Mississippi Valley Division,
Regional Planning and Environment Division South

Amite River and Tributaries East of the Mississippi River, Louisiana

Supplemental Second Draft Integrated Feasibility Report with Environmental Assessment #600

December 2023

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Cover Page

Amite River and Tributaries, East of the Mississippi River, Louisiana

Supplemental Second Draft Integrated Feasibility Report and Environmental Assessment #600

Counties/Parishes:	Amite, Lincoln, Franklin, and Wilkinson Mississippi; Counties East Feliciana, St. Helena, East Baton Rouge, Livingston, Iberville, St. James, St. John the Baptist, and Ascension Louisiana Parishes
Lead Agency:	U.S. Army Corps of Engineers, New Orleans District
Cooperating Agencies:	U.S. Fish and Wildlife Service; U.S. Environmental Protection Agency; U.S. Geological Survey; U.S. Department of Agriculture-National Resource Conservation Agency

Abstract: The Amite River and Tributaries, East of the Mississippi River, Louisiana Feasibility Study (study) for flood damage reduction is authorized by the Resolution of the Committee on Public Works of the United States Senate, adopted on April 14, 1967. The study was funded by the Bipartisan Budget Act of 2018 (P.L. 115-123), Division B, Subdivision 1, Title IV. The study area includes l portions of Amite, Lincoln, Franklin, and Wilkinson Counties in Mississippi, as well as East Feliciana, St. Helena, East Baton Rouge, Livingston, Iberville, St. James, St. John the Baptist, and Ascension Parishes in Louisiana. The Supplemental Second 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 (proposed action). The proposed action includes 3,298 nonstructural residential elevations and nonresidential floodproofing for eligible structures East Feliciana, St. Helena, East Baton Rouge, Livingston, Iberville, and Ascension Parishes in Louisiana.

Date Comments must be Received by: 29 January 2024

Estimated Total Cost of EA Preparation: To be provided in the final report.

For further Information, please visit the study website at: https://www.mvn.usace.army.mil/Amite-River-and-Tributaries/ or contact:

U.S. Army Corps of Engineers
Attention: Chief, Environmental Branch
CEMVN–PDS, Room 136,
7400 Leake Avenue New Orleans, LA 70118
Email: AmiteFS@usace.army.mil

Executive Summary

The United States Army Corps of Engineers (USACE), Mississippi Valley Division (MVD), New Orleans District (CEMVN), Regional Planning and Environment Division South (RPEDS), prepared this Supplemental Second Draft Integrated Feasibility Report and Environmental Assessment #600 (SSDIFR/EA). The SSDIFR/EA reflects the collaboration of the Non-Federal Sponsor (NFS), cooperating agencies, stakeholders, and members of the public. The Tentatively Selected Plan (TSP), or Proposed Action, is supported by the NFS.

The purpose of the Amite River and Tributaries, East of the Mississippi River, Louisiana, Feasibility Study (study) is to investigate flood risk reduction solutions to reduce flood damages caused by rainfall in the Amite River Basin (ARB). The NFS is the State of Louisiana, acting by and through, the Louisiana Department of Transportation and Development (LADOTD). A Feasibility Cost Share Agreement (FCSA) was executed between the Department of the Army and the NFS on October 3, 2018. The study is authorized by the Resolution of the Committee on Public Works of the United States Senate, adopted on April 14, 1967. The study is funded through the Bipartisan Budget Act of 2018 (BBA-18) (P.L. 115-123), Division B, Subdivision 1, Title IV, and is 100 percent federally funded.

Draft Integrated Feasibility Report and Environmental Impact Statement (DIFR/EIS)

The USACE conducted concurrent review of the DIFR/EIS, including public, technical, legal, and policy reviews, as well as Independent External Peer Review (IEPR) upon its public release on November 26, 2019. The TSP of the 2019 DIFR/EIS was an estimated $2.3 billion-dollar new large-scale dry dam with a nonstructural component to address residual risk over a 2200 mi^2 study area. During review, the TSP was identified to have extensive technical and policy concerns, which found the dam was constrained by site conditions that made it in-feasible as designed and potentially increased life safety risk. The 2020 Battelle IEPR report is located on the USACE Amite project website. https://www.mvn.usace.army.mil/Amite-River-and-Tributaries/

Supplemental Second Draft Integrated Feasibility Report and Environmental Assessment (SSDIFR/EA)

Additional resources were approved by the Assistant Secretary of the Army for Civil Works ASA(CW) in November 2022 in order to complete the complex feasibility study due to the size of the study area, differing stakeholder viewpoints, compliance with Engineering Regulations (ERs) and the complexities of addressing social vulnerability which includes environmental justice (EJ). An additional $1.91M and 20 months, to the original $3M and 136 months, was allocated to complete critical tasks to inform the decision on the TSP. The SSDIFR/EA documents the critical tasks to inform the decision on the revised TSP.

Study Area - The study area is the ARB. The ARB begins in southwest Mississippi and flows southward, crossing the state line into southeastern Louisiana. The ARB includes 2,200 square miles consisting of portions of Amite, Lincoln, Franklin, and Wilkinson Counties in Mississippi, as well as East Feliciana, St. Helena, East Baton Rouge, Livingston, Iberville, St.

James, St. John the Baptist, and Ascension Parishes in Louisiana. The study area is similar to the 1984 Amite Rivers and Tributaries Flood Control Initial Evaluation Study by USACE; however, it has been expanded to include areas that are impacted by backwater and coastal flooding to the southeast and east because they are hydraulically connected to the ARB and its tributaries.

No significant flood risks associated with the ARB and its tributaries were identified within Mississippi; therefore, no structures have been identified as eligible for the TSP. The Mississippi Soil and Water Conservation Commission preliminary confirmed on November 19, 2018, that there are "no major flood risk problems in Mississippi from the ARB but may be some minor ones associated with bank carving/sloughing from periodic heavy rains."

Problems and Opportunities (Purpose and Need) -

The primary problem identified in the study area is the risk of flood damages from the Amite River and its tributaries to human life and flood damages of residential and nonresidential structures. Critical infrastructure throughout the region is also at risk of flood damages, including the I-10 and I-12 transportation corridors, government facilities, and schools. The ARB primarily has flooding from two different sources. The upper basin flooding is caused from headwater flooding from rainfall events. The lower basin flooding is caused by a combination of drainage from headwaters and backwater flooding from tides, wind setup as well as flooding from storm surge events. Opportunities to address the identified problems include:

- Risk reduction to life, land, property, and infrastructure from flooding.
- Work with local communities to manage flood risk.
- Increase the resiliency of the vitally important I-10/I-12 transportation corridor.
- Prevent degradation to fish and wildlife habitat.
- Afford access to recreation (boating, bike trails, camping, swimming, and sightseeing facilities).

Planning Objectives/Constraints – *Planning objectives* represent desired positive changes to future conditions. All of the objectives focus on alternatives within the study area and within the 50-year period of analysis from 2026 to 2076. The planning objectives are as follows:

- reduce risk to human life from flooding;
- reduce rainfall flood damages in the ARB to industrial, commercial, and agricultural facilities and to residential and nonresidential structures;
- reduce interruption to the nation's transportation corridors, particularly the I-10/I-12 infrastructure;
- reduce risk to critical infrastructure (e.g. medical centers, schools, transportation, etc.).

Planning Process and Alternatives Considered - The USACE's planning process was followed, which included identifying problems and opportunities, inventorying, and forecasting conditions, identifying measures, creating alternatives and continually reevaluating the management measures within the alternatives and screening measures through the selection of the Final Array of Alternatives and the TSP.

Thirty-four nonstructural and structural management measures of a variety of scales were identified for evaluation to reduce the risk of flood damages within the ARB. The range of management measures were refined to 19 based on preliminary analyses of effectiveness, efficiency, acceptability, and completeness, which is detailed in Appendix F: Plan Formulation, based on the planning objectives, existing data, professional judgment, avoiding constraints, and addressing the opportunities and problems within the study area. See Table 4-1 in Section 4.

The initial array of alternatives were identified using one or more of the 19 management measures that were carried forward after the screening evaluation. Fifteen alternatives were assembled for the initial array of alternatives through the plan formulation process, which include alternatives for no action and nonstructural. Two additional alternatives were identified through public scoping.

Most alternatives assessed had very little reduction in flood risk and thus limited benefits. The less frequent annual exceedance probability (AEP) events (0.04 AEP up) cause the majority of flooding issues in the ARB. The rainfall events, combined with a steep hydraulic gradient from the headlands of the basin to the flat middle and lower basins, provide for a significant backwater effect at the lower end of the system at Lake Maurepas. Once the water accumulates and backs up, it can no longer exit the basin and the basin begins to fill. This unique hydrology was evaluated with numerous measures and alternatives that resulted in primarily shifting water from one place to another within the damage areas while not reducing the backwater effect and thus not allowing water to drain from the basin. The parishes in the study area have a combined population of about 900,000 with more than half of the population living in East Baton Rouge Parish. The study area has over 260,000 structures and of those, about 80 percent are in the central portion of the ARB north of Bayou Manchac. Many of the alternatives, such as channel improvements and diversions, were located where there were not many structures, so there were limited benefits. The remaining structural alternatives that were not screened were those that provided storage of water to attenuate flooding downstream in heavily developed areas. Those structural alternatives are included in the focused array of alternatives.

The focused array of alternatives are the same alternatives as previously identified in the final array in the publicly released 2019 DIFR/EIS. Three alternatives were screened due to negative net benefits: the nonstructural plan for a 0.02 AEP floodplain, large scale 0.04 AEP wet Darlington Dam, and the three 0.01 AEP dry dams on the Darlington, Lilley, and Bluff Creeks. The remaining alternatives were, Alternative 10 for an 0.01 AEP dry dam on Sandy Creek, Alternative 12 .04 AEP dry Darlington Dam, and Alternative 13 nonstructural for 0.4 AEP. The alternative carried forward and chosen to be the TSP based on the 2019 economic evaluation was Alternative 12, an 0.04 AEP dry Darlington Dam because it had the highest net economic benefit.

The TSP in the publicly released 2019 DIFR/EIS, Alternative 12 of the SSDIFR/EA focused array, was a $2.3 billion dry dam and nonstructural measures to address residual risk. This plan, while preliminarily determined to be feasible, revealed technical and policy concerns that were raised during its public, policy, and technical reviews. Based on the concerns and available information, the Dry Dam alternative does not meet USACE tolerable risk guidelines due to economic risk/cost effectiveness, potential societal life risk, and environmental acceptability. For these reasons, the Dry Dam alternative (including Alternative 10: Sandy Creek Dry Dam) has been removed from further consideration consistent with USACE policy of acceptability and implementability in accordance with Engineering Regulation (ER) 1105-2-100.

With removal of the Dry Dam alternative from further consideration, the next highest NED alternative and likely the only economically justified one, is the 0.04 AEP nonstructural plan. To further assess the 0.04 AEP nonstructural only plan, three plans were developed as well as revisions to existing conditions to account for projects that alter the hydrology H&H models for inclusion of storm surge downstream boundary conditions. The first developed plan identified was the Nonstructural NED Plan using a new USACE method of logical aggregation. Two additional plans were identified to increase benefits in the Other Social Effects (OSE) account, which is one of the four accounts USACE uses to identify benefits of plans in accordance with the USACE 2014 Principles, Requirements and Interagency Guidelines (PRG). This comprehensive assessment of the four accounts is used to identify the Total Benefits Plan. Expanding the NED plan to include socially vulnerable (SV) areas, increased the OSE benefits.

Plan 2: Nonstructural NED Plan- Floodproofing or elevation of 3,117 structures located in the 0.1 (46 aggregates), 0.2 (5 aggregates), or 0.4 (6 aggregates) floodplain to 0.01 AEP Base Flood Elevation (BFE). Plan 2 would include the elevation of 2,748 residential structures and floodproofing of 369 nonresidential structures.

Plan 3: Nonstructural NED Plan + OSE Increment 1- Floodproofing or elevation of 3,189 structures located in the 0.1 (54 aggregates), 0.2 (8 aggregates), or 0.4 (6 aggregates) floodplain to 0.01 AEP BFE. Plan 3 would include the elevation of 2,815 residential structures and floodproofing of 374 nonresidential structures.

Plan 4: Nonstructural NED Plan + OSE Increment 2- Floodproofing or elevation of 3,298 structures located in the 0.1 (59 aggregates), 0.2 (13 aggregates) or 0.4 (7 aggregates) floodplain to 0.01 AEP BFE. Plan 4 would include the elevation of 2,918 residential structures and floodproofing of 380 nonresidential structures.

Risk Reduction- The term 0.01 AEP level of risk reduction, refers to a level of reduced risk of rainfall, riverine, or storm surge driven flooding that the project has a 1 percent chance of experiencing each year. Different combinations of size, intensity, and track of rainfall and coastal storm could result in a 0.01 probability of a surge and/or rainfall event.

For evaluation purposes, the cost of raising and flood proofing 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 on a grouping of aggregations using the USACE logical aggregation method.

The measures in the Final Array of Alternative Plans were evaluated for economics 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). They were subsequentially compared to the four Federal accounts (Table ES-1) that are used to assess the effects of the final array of alternatives. This evaluation and screening informs the decision in selecting the TSP.

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

Four Accounts	Plan 2: NED Plan	Plan 3: NED + OSE Increment 1	Plan 4: NED + OSE Increment 2
National Economic Development (NED)	Avg. Annual Benefits $ 59.8 M Avg. Annual Costs $54.6 through 58.0 M Net Annual Benefits $5.1 through 1.8 M BCR- 1.09 through 1.03	Avg. Annual Benefits $60.6 M Avg. Annual Costs $56.1 through 59.6 M Net Annual Benefits $4.4 M through 942 K BCR- 1.08 through 1.02	Avg. Annual Benefits $61.4 M Avg. Annual Costs $58.0 through 61.6 M Net Annual Benefits $3.4 M through (178) K BCR- 1.06 through 0.997
Environmental Quality (EQ)	No significant impacts to the environment.	No significant impacts to the environment.	No significant impacts to the environment.
Regional Economic Development (RED)	Value Added: $1,391,463,000 FTE Jobs: 14,521	Value Added: $1,429,854,000 FTE Jobs: 14,925	Value Added: $1,478,086,040 FTE Jobs: 14,429
OSE	Overall minor positive benefits associated with the NED nonstructural plan. These benefits are realized via the Social Vulnerability & Resiliency, Health & Life Safety, Economic Vitality, Social Connectedness, Participation, and Environmental Justice as it relates to Justice 40 themes.	Both Minor & Moderate positive benefits are associated with Plan 2. These benefits are realized via the Social Vulnerability & Resiliency, Health & Life Safety, Economic Vitality, Social Connectedness, Participation, and Environmental Justice as it relates to Justice 40 themes.	Both Minor & Moderate positive benefits are associated with Plan 2. These benefits are realized via the Social Vulnerability & Resiliency, Health & Life Safety, Economic Vitality, Social Connectedness, Participation, and Environmental Justice as it relates to Justice 40 themes.

Ranges are 10-18% Preconstruction Engineering & Design (PED) costs
Fiscal Year (FY) 24 Interest 2.75% and 2024 Price Level
Cost Share 35% NFS and 65% Federal

Identifying the TSP - CEMVN is presently pursuing a policy exception for the following USACE Policy: ER 1105-2-100 2-3(f)(1) stating: “The National Economic Development (NED) Plan. For all project purposes except ecosystem restoration, the alternative plan that reasonably maximizes net economic benefits consistent with protecting the Nation’s environment, the NED plan, shall be selected. The Assistant Secretary of the Army for Civil Works (ASA (CW)) may grant an exception when there are overriding reasons for selecting another plan based upon comprehensive benefits or other Federal, State, local and international concerns."

Currently, the TSP is Plan 4: Nonstructural Plan with additive for OSE for positive and negative economic benefits because it provides flood risk reduction in terms of national economic development along with the added benefit of flood risk reduction to vulnerable and disadvantaged communities, maximizing the OSE account (Table ES-2). While this plan is not the NED Plan, it provides the best level comprehensively assessed benefits for flood risk reduction to the ARB study area and is the Total Benefits Plan for this study. If the policy exception is not granted, the TSP will default to Plan 2: Nonstructural NED Plan.

Table ES-2. Summary of Costs and Benefits of the TSP (Plan 4: Total Benefits Plan) and the NED Plan

Item	NED: Plan 2	TSP: Plan 4
Total Annual Benefits: Damage Category: Structure, Contents, Vehicles, and Debris Removal	$59.8 M	$61.4 M
Total First Costs	$1.47 through 1.56 B	$1.56 through 1.66 B
Interest During Construction	$5.0 through 5.3 M	$5.3 through 5.6 M
Annual Operation & Maintenance Costs	TBD	TBD
Total Annual Costs	$54.6 through 58.0 M	$58.0 through 61.6 M
B/C Ratio	1.09 through 1.03	1.06 through 0.9997
Expected Annual Net Benefits	$5.1 through 1.8 M	$3.4 M through (178) K

Ranges are 10-18% PED costs
FY 24 Interest 2.75% and 2024 Price Level
Cost Share 35% NFS and 65% Federal

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 2026. The schedule assumes that implementation of the Nonstructural Plan will occur over an approximate 10-year period with approximately 500 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.

In order to be preliminarily eligible for inclusion in the Plan, 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 0.1, 0.04, 0.02 AEP year floodplain depending on the location of the structure), based on hydrologic conditions predicted to occur in 2026 (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 2026-2076) unless they have been identified eligible based on SV criteria and included in the next highest aggregation regardless of economic justification.
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.

The following work tasks were assumed for cost estimation purposes. No USACE Federal funds will be used to restore, replace, or repair a structure or bring a structure into compliance with applicable building and other codes. All work will require the issuance of state and local government permits prior to the commencement of any onsite construction. Elements of structure work that are deemed to be potentially eligible costs include, but are not limited to: design costs; costs of obtaining all required permits (i.e., zoning or land use approvals, environmental permits or required certifications, historic preservation approvals and Section 106 NHPA consultation in accordance with the PA; including any required mitigation measures, building permits, etc.): costs for title searches and the review of title documents; survey and inspection costs.

Elevation of Residential Structures

No additions to the habitable spaces of a structure (including but not limited to, outbuildings, detached garages, sheds, etc.) will be permitted in the performance of the elevation work. Elements of structure elevation work that are potentially eligible project costs include the following tasks:

- Raising the roof and extending the walls of a side structure attached to the main structure (i.e., garage);
- Raising mechanical equipment (e.g., air conditioner, furnace, water heater, electrical panel, fuel storage, valves, or meters);
- Connecting, disconnecting, and extending utility connections for electrical power, fuel, incoming potable water, wastewater discharge;

- Meeting access requirements of applicable building and other codes (e.g., stairs with landings, guardrails) and/or the Americans with Disabilities Act;
- Creating large vent openings in the foundation and walls to meet requirements for floodwater entry and exit;
- Special access improvements (e.g., elevators, lifts, ramps, etc.) when a satisfactory written medical opinion is provided by a medical doctor who is active, in good standing and licensed by the State of Louisiana, stating that special handicapped access is required for a handicapped or mobility challenged property owner and/or the property owner's family member and/or other person currently residing in the structure, and/or by a tenant currently occupying the structure. Multiple access points may also be eligible where necessary to meet state and/or local building and other code requirements;
- Removal of any trees and other vegetation which restrict the elevation work;
- Debris removal (all demolition debris (hazardous and non-hazardous) shall be removed and taken to an approved landfill;
- Site grading and site restoration including grading landscaping to it preconstruction condition but it cannot adversely affect drainage of adjacent properties;
- Temporary site protection measures during the elevation work such as temporary construction fencing;
- Allowable relocation assistance funds for displaced tenants who are unable to occupy the structure during the elevation process in accordance with the Uniform Relocation Assistance (URA) and Real Property Acquisition Policies for Federal and Federally Assisted Programs of 1970, Public Law 91-646, 84 Stat. 1984 (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. Relocation assistance for tenants who cannot live in the structure during the elevation process, may include, among other thing, advisory services, eligible reasonable out-of-pocket expenses incurred during temporary displacement (e.g., moving and storage of household goods required to be removed during construction, temporary quarters, meals, etc.);
- If additional work is required as a condition of building permit issuance, and if such work is not listed as eligible herein, the property owner will be required to fund and conduct such additional work. In no event shall the structure be elevated if USACE determines that the structure is not physically sound and/or capable of being raised safely.

Dry Floodproofing of Nonresidential Structures

Elements of structure work that are deemed to be potentially eligible dry floodproofing costs include, the following tasks:

- Installation of backflow valves;
- Closures on doors, windows, stairwells and vents-- temporary or permanent;
- Rearranging or protecting damageable real property components--e.g., relocate or raise utilities;

- Sump pumps and sub-drains;
- Water resistant material; water resistant window coverings, doors and jambs; waterproof adhesives; sealants and compounds, and floor drains;
- Plastic sheeting around the walls;
- Connecting, disconnecting, and extending utility connections for electrical power, fuel, incoming potable water, wastewater discharge;
- Removal of any trees that restrict the dry floodproofing of a structure;
- Temporary site protection measures during site work.

Wet Floodproofing of Nonresidential Structures

Elements of structure work that are deemed to be potentially eligible wet floodproofing costs include the following tasks:

- Wet floodproofing of the structure;
- Engineered flood vents;
- Flood-resistant construction materials such as rigid foam board wall insulation or cement board and molding within the interior of the building,
- Elevation and wet floodproofing of electric outlets,
- Concrete floor treatment and interior wall and floor sealer/stains;
- Exterior paint coatings;
- Sand/water blasting or other manual removal of rusted coatings and application of epoxy coatings;
- Elevation and wet floodproofing of mechanical and electrical equipment;
- Connecting, disconnecting, and extending utility connections for electrical power, fuel, incoming potable water, wastewater discharge;
- Removal of any trees which restrict the elevation of a structure;
- Temporary site protection measures during site work.

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. EJ outreach will be performed prior to USACE selection of the Recommended Plan and concurrently with public meetings. The nonstructural plan will be optimized to present alternatives based on consideration of EJ benefits as part of OSE, as well as the other 3 P&G accounts.

Residual Risk and Damages
The TSP will greatly reduce, but not eliminate all future flood risk damages and residual risk would remain in the study area. Additionally, the structures eligible for inclusion in the nonstructural plans were based only on rainfall flood risk. This leaves a large number of structures, approximately 50 percent of the structures with residual flood risk within the study area (See Appendix G Table G:5-3) not included in the TSP that would have been if the plan formulation used coastal hydraulic conditions in addition to rainfall to develop alternatives. This would require additional authorization and is outside of the study purpose.

The residual risk, along with the potential consequences, will be communicated to the NFS and will become a requirement of any communication and evacuation plan when this plan is implemented.

Environmental Summary: A NOI to prepare an EIS was published in the Federal Register (Volume 84, No. 63) on April 2, 2019. The scoping period ended on July 8, 2019. Three public scoping meetings were conducted within the study area on April 24 and 25, 2019 with Facebook live streaming. Comments were accepted via written correspondence and emails. Approximately 80 non–USACE people attended the meetings in person and the Facebook live streaming had over 6,000 views. Scoping identified four areas of concern: flooding, dredging opportunities, levee opportunities, and nature-based engineering. People are concerned about inducement of flooding into other areas and proposed further investigation in alternative formulation and specific areas of concern. Feedback from the public scoping meeting resulted in the identification of one additional measure, which was proposed by the Healthy Gulf Collaborative, regarding conversion of sand and gravel mines to bottomland hardwoods habitat for flood control.

A meeting was conducted on June 18, 2019, with collaborative stakeholders, the NFS, resource agencies, and Federally-Recognized Tribes to present the preliminary final array of alternatives and the screening rationale of the alternatives that were screened. As a result, three agencies, (The U.S. Fish and Wildlife Service (USFWS), Louisiana Department of Environmental Quality (LDEQ), and Louisiana Department of Wildlife and Fisheries (LDWF) requested an evaluation of river restoration, which resulted in the addition of another alternative, restoration of river meanders.

After the additional resources were approved to reassess the dry dam and further evaluate nonstructural alternatives, EJ outreach meetings were conducted on February 28, 2023, and March 1, 2023, to inform and engage residents about the flood risk reduction measures.

A Public notice of availability of the ART draft IFR and DEIS was published in the Baton Rouge and New Orleans Advocate for the 45-day comment period beginning November 29, 2019 and ending January 13, 2019. A total of 139 public comments were received during the comment period and covered a variety of themes. These include:

- Five Cultural – comments all pertaining to cemeteries in the Darlington Dam project footprint.
- Two Environmental Justice – A comment regarding the impact on children in the study area (60 percent) coming from low-income families and one chain letter from EPA, Region 6 five individuals recommending an update to the environmental justice impact assessment and mitigation plan.
- Thirty-five Project Features – General comments involving support/opposition for project features. These were focused on the structures associated with the conceptual design of the Darlington Dry Dam.
- Eighteen No General Response – Specialized comments that would require further evaluation in design of the project features.

Consultation and coordination with resource agencies is on-going and would be concluded prior to signature of the Finding of No Significant Impact.

Timeline: This SSDIFR/EA is available for a 30-day public review and comment beginning 15 December 2023. The official closing date for comments is 29 January 2024, 30 days from the public review start date. be mailed or emailed to:

U.S. Army Corps of Engineers
Attention: Chief, Environmental Branch
CEMVN–PDS, Room 136,
7400 Leake Avenue
New Orleans, LA 70118
Email: AmiteFS@usace.army.mil

CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

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Section 1
Introduction

The United States Army Corps of Engineers (USACE), Mississippi Valley Division (MVD), New Orleans District (CEMVN), Regional Planning and Environment Division South (RPEDS), prepared this Supplemental Second Draft Integrated Feasibility Report and Environmental Assessment (SSDIFR/EA). It includes input from the Non-Federal Sponsor (NFS), agencies, and the public. The SSDIFR/EA reflects the collaboration of the NFS, cooperating agencies, stakeholders, and members of the public. The Tentatively Selected Plan (TSP), or Proposed Action, is supported by the NFS.

The purpose of the ART study is to investigate flood risk solutions to reduce the risk of flood damages caused bey rainfall in the ARB.

1.1 STUDY SCOPE

The ART SSDIFR/EA is an interim response to the study authority to investigate and determine the extent of Federal interest in plans that reduce flood risk along the ARB. The effect of flooding from the Amite River and its tributaries was studied, but localized flooding in adjacent communities was not studied. The study investigated alternatives for flood risk management (FRM) and identified and evaluated a full range of reasonable alternatives, including the no action alternative. The results of the study are presented in this decision document, which is an integrated Feasibility Report and National Environmental Policy Act of 1969 (NEPA) Environmental Assessment document, in accordance with the USACE's Planning Guidance Notebook, ER 1105-2-100.

1.2 STUDY AUTHORITY

The study is funded using appropriations from the Bipartisan Budget Act of 2018 (Public Law 115-123) ("BBA-18"), H. R. 1892—13, Title IV, Corps of Engineers—Civil, Department of the Army, Investigations, where funds for are being made available for the expenses related to the completion, or initiation and completion, of flood and storm damage risk reduction, including shore protection studies, which are currently authorized or which are authorized after the date of enactment of this the act, to reduce risk from future floods and hurricanes. The funds are at full Federal expense and funds made available for high-priority studies of projects in states and insular areas with more than one flood related major disaster declared pursuant to the Robert T. Stafford Disaster Relief and Emergency Assistance Act (42 U.S. Code [U.S.C.] 5121 et seq.) in calendar years 2014, 2015, 2016, or 2017.

The ART study area is included based on the August 2016 flooding over southeast and south-central Louisiana and is a continuing investigation under the authorization provided by the Resolution of the Committee on Public Works of the United States Senate, adopted on April 14, 1967.

> "RESOLVED BY THE COMMITTEE ON PUBLIC WORKS OF THE UNITED STATES SENATE, That the Board of Engineers for Rivers and Harbors, created under Section 3 of the River and Harbor Act approved June 13, 1902, be, and is hereby requested to review the report of the chief of Engineers on Amite River and Tributaries, Louisiana, published as House Document Numbered 419, Eighty-fourth Congress. And other pertinent reports, with a view to determining whether the existing project should be modified in any way at this time with particular reference to additional improvements for flood control and related purposes on Amite River, Bayou Manchac, and Comite River and their tributaries." Committee on Public Works, 1967."

1.3 NON-FEDERAL SPONSOR

The NFS is the Louisiana Department of Transportation and Development (LADOTD). This supplemental feasibility study, funded through the BBA-18, is 100 percent federally funded. A feasibility cost sharing agreement was executed on October 3, 2018.

1.4 STUDY AREA AND MAP

The study area is the ARB and its tributaries. The ARB begins in southwest Mississippi and flows southward, crossing the state line into southeastern Louisiana. The ARB includes 2,200 square miles flowing into the Amite River and its tributaries (Figure 1-1). It includes portions of Amite, Lincoln, Franklin, and Wilkinson Counties in Mississippi, as well as East Feliciana, St. Helena, East Baton Rouge, Livingston, Iberville, St. James, St. John the Baptist, and Ascension Parishes in Louisiana.

The study area is similar to the 1984 Amite Rivers and Tributaries Flood Control Initial Evaluation Study by USACE; however, it has been expanded to include areas that are impacted by backwater flooding to the southeast and east because they are hydraulically connected to the ARB and its tributaries. Also, structures located within St. John the Baptist and St. James Parish were removed from the study assessment after the final array of alternatives were identified. This was due to one USACE project and study that are currently active within those parishes that are also addressing flood risk.

No significant flood risks associated with the ARB and its tributaries were identified within Mississippi. The Mississippi Soil and Water Conservation Commission preliminary confirmed on November 19, 2018, that there are "no major flood risk problems in Mississippi from the ARB but may be some minor ones associated with bank carving/sloughing from periodic heavy rains." Therefore, the development of alternatives was focused on Louisiana.

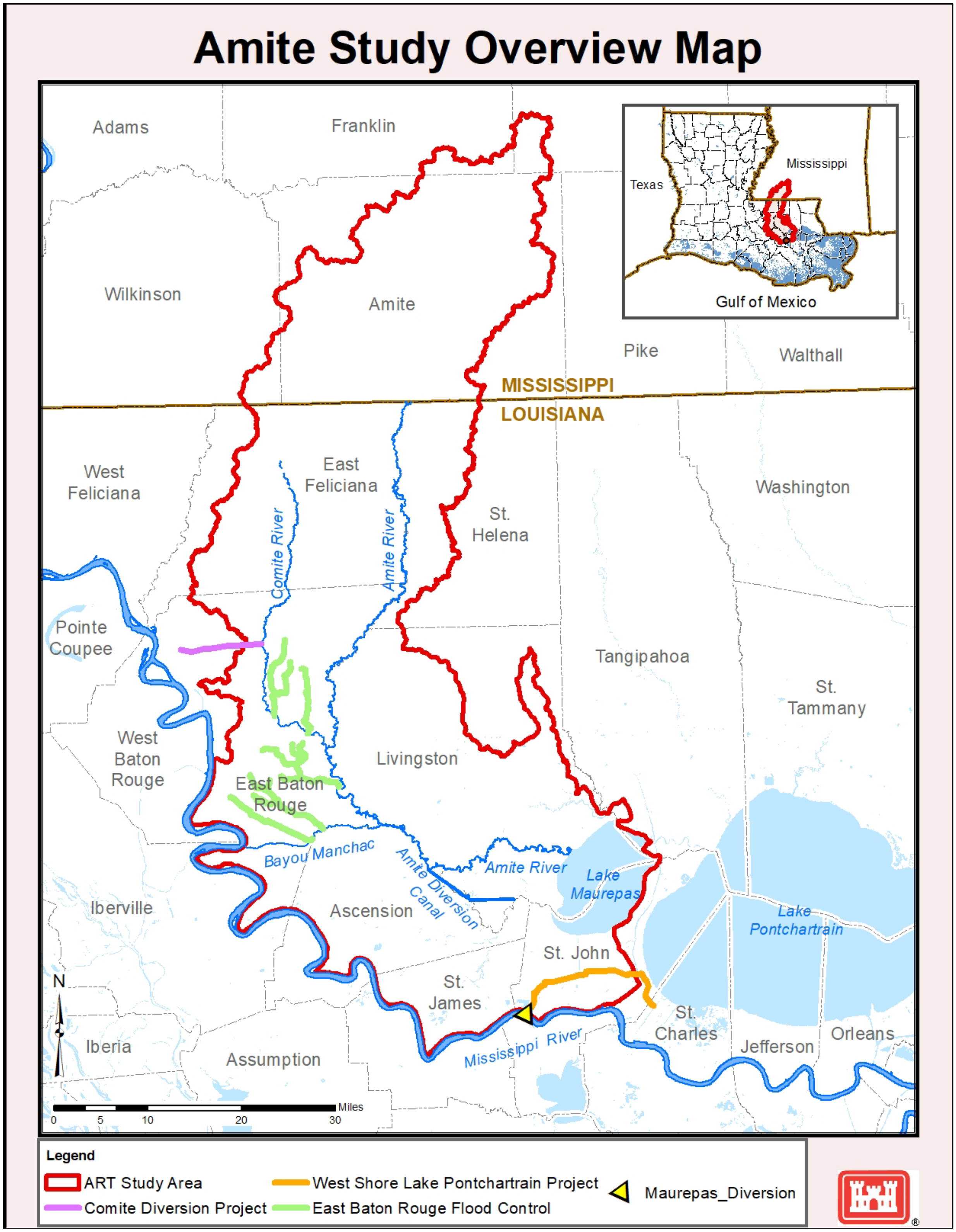

Figure 1-1. ART Study Area

1.5 PRIOR REPORTS, EXISTING WATER PROJECTS, AND ONGOING PROGRAMS

A number of prior reports and studies by USACE, as well as other agencies, were reviewed and used in writing of the SSDIFR/EA. Information from the documents in Table 1-1 was deemed the most significant to problem identification and plan formulation.

USACE FRM Constructed Projects

There is one existing FRM USACE constructed project in the study area that was authorized on August 9, 1955 (construction was completed in 1964). Pursuant to the 1955 authorization, the NFSs for that project are responsible for its operation and maintenance (O&M). The 1955 authorization states:

> "Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That improvements in the interest of flood control and drainage be undertaken in the Amite River, Bayou Manchac and the Comite River, such work to be prosecuted under the direction of the Secretary of the Army and the supervision of the Chief of Engineers, substantially in accordance with a survey report entitled "Survey Report of Amite River and Tributaries La.," of the district engineer, Corps of Engineers, New Orleans District, dated June 8, 1955, approved by the division engineer, Corps of Engineers, Lower Mississippi Valley Division, and submitted to the Board of Engineers for Rivers and Harbors on July 5, 1955 at an estimated first cost to the United States of $3,008,000: Provided, That local interest comply with the provisions in the district engineer's recommendations, including the contribution of 24.7 per centum of actual cost in cash or equivalent work as approved by the Chief of Engineers, for Comite River, presently estimated at $67,000." House of Representatives, 1956.

The 1955 authorized constructed features include the following:

- Bayou Manchac-Clearing and snagging on bayou from the mouth to below Ward Creek at mile 7.81.
- Comite River-Channel enlargement and realignment on Comite River from its mouth to Cypress Bayou at mile 10
- Blind River-Intermittent Clearing/snagging on Blind River below Lake Maurepas
- Amite River-Enlargement/realignment between Bayou Manchac (mile 35.75) to control weir at (mile 25.3); intermittent clearing/snagging from mouth Comite (mile 54) to Bayou Manchac (mile 35.75)
- Amite Diversion Channel-Construct weir and diversion 19 miles long from mile 25.3 on the Amite to mile 4.8 on the Blind River. Weir original design 1,500' at sea level divided into 1,000 & 500' sections and then modified to include 5x20' boat way.

USACE FRM Studies and In Construction Projects

There are several authorized USACE studies and construction projects, which may impact the hydrology of the ARB when construction is completed. They include the following:

- Comite River Diversion Project-The Amite H&H model has the authorized project in place (Appendix H). The project is located in East Baton Rouge Parish, LA in the southern portion of the Comite River Basin and currently in construction. The features will provide urban flood damage reduction to reduce risks from rainfall events/headwater flooding for residents in the area. The primary project features include a control structure at the Comite River, a control structure at Lilly Bayou, three control drop structures at the intersections of the diversion channel with White, Cypress and Baton Rouge Bayous, a drop control structure in the vicinity of McHugh Road, two railroad bridges, four highway bridges and one parish road bridge (USACE, 2023a).
- Comite Resiliency Study- The study recommendations will be completed after this study effort. If a project is authorized and appropriated from the Comite Resiliency Study during the implementation of a project associated with the ARB study effort, it will be assessed at that time.
- East Baton Rouge (EBR) Flood Risk Reduction Project- The authorized project is intended to reduce flooding along 5 sub-basins throughout the EBR Parish, including Jones Creek, Ward Creek, Bayou Fountain, Blackwater Bayou, and Beaver Bayou. The project is in construction consisting of improvements to 50 miles of channels, including clearing and snagging, channel enlargement, and placement of riprap to reduce the risk of flood damages during heavy rainfall events (USACE,2023b). Sensitivity tests were run to see how adjusting these 5 inflow hydrographs would impact water surface elevations (WSE) throughout ARB. These tests showed that even right next to the inflow locations, WSE increases were less than 0.02 feet for the 25-year event. Therefore, the EBR project was not incorporated into H&H model (Appendix H).
- Westshore Lake Pontchartrain (WSLP) Project - The project is located in southeast Louisiana on the east-bank of the Mississippi River in St. Charles, St. John the Baptist, and St. James parishes in southeast Louisiana. The project is currently in construction and includes a 100-year level risk reduction system extending from the Bonnet Carre spillway to Garyville (USACE,2023c). The project was not included in the ARB H&H model geometry (Appendix H). The impact of the levee project on water levels in the study area was determined based on ADCIRC modeling that WSE increase due to the WSLP project will be less than 0.1 feet in the ARB project area.
- WSLP Resiliency Study- The study assessment and recommendations, which includes locally focused flood risk assessment of this subarea that includes St John the Baptist and St. James Parishes will be completed after this study effort. It is not anticipated any recommendations from the WSLP resiliency study will impact this one since the structural inventory for St. John the Baptist and St. James Parish were removed from the nonstructural plan assessment.

- Maurepas Diversion-This is a mitigation feature of the WSLP project and is not included in the ART H&H model since it was determined to not have an effect on USACE plan selection for this study due to the location and minimal hydraulic influence. The Maurepas Diversion is a 2,000 cubic foot per second (cfs) freshwater diversion to be constructed by Louisiana Coastal Protection and Restoration Authority (CPRA) that will reconnect the Mississippi River to the Maurepas Swamp, strategically delivering nutrient-laden river water to restore a degraded Cypress-Tupelo swamp (CPRA, 2023).

The State of Louisiana is in the process of developing a comprehensive State Watershed Plan. Per the 2018 Phase 1 Investigation Report for the Louisiana Statewide Comprehensive Water Based Floodplain Management Program (LWFMP) that informed the creation of the Louisiana Watershed Initiative (LWI):

> “Currently, Louisiana various different jurisdictions, including city/parish planning, perform Floodplain Management activities in a largely uncoordinated fashion. Additionally, various jurisdictions, including city/parish planning and zoning departments or public works, regulate or undertake activities that affect floodplains independently, even when they affect the same watersheds. Floodplain issues are managed within political jurisdictions, often without mechanism to consider the effects on other jurisdictions or the watershed on a whole.” LWFMP, 2018

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.

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 of Development (OCD) coordinates funds from the Community Development Block Grant (CDBG). Statewide support (CAPP-SSSE) funds are coordinated by the Analysis Team of LA Watershed Initiative, GOSHEP and LADOTD.

Based on communication with the GOSHEP, LADOTD, and OCD, the current programs and projects with funding that may have an impact on the hydrology of the ARB are presented in Table 1-3. Additionally, the Louisiana Watershed Resiliency Study is currently ongoing by the Federal Emergency Management Agency (FEMA) and the state has applied to FEMA for a Housing and Urban Development grant.

Table 1-1. Relevant Prior Reports and Studies

Year	Study/Report/Environmental Document Title	Data Source	Consistency	Structural Measures	Non-Structural Measures	FWOP Conditions
Comprehensive Planning Studies						
1980	LA Coastal Resources Program	X	X	X	X	X
1999	Coast 2050: Toward a Sustainable Coastal LA	X	X	X	X	X
2004	LA Coastal Area (LCA), LA Ecosystem Restoration Study	X	X	X	X	X
2017	Louisiana State Master Plan by Coastal Protection and Restoration Authority	X	X	X	X	X
2017	Louisiana Watershed Resiliency Study: Developed Following the March and August 2016 Floods by Federal Emergency Management Agency, Mitigation Branch, Hazard Performance Analysis Group	X	X	X	X	X
2017	Characterization of Peak Streamflows and Flood Inundation of Selected Areas in Louisiana from the August 2016 Flood by United States Geological Survey (USGS) for FEMA	X	X			X
Flood Damage Risk Reduction Projects and Reports						
1888	Preliminary Examination of Bayou Manchac, Louisiana by USACE	X				
1907	Pass Manchac, Louisiana House Doc 882, 60th Congress, 1st Session	X				
1912	Completed Pass Manchac Project by USACE via the River and Harbor Act of 6/24/1910	X				X
1927	Amite River and Bayou Manchac, Louisiana Navigation Project was authorized. (7'X60' navigation canal)	X				X
1928	USACE completes navigation channel improvements in the ARB from Denham Springs to Lake Maurepas.	X				X
1930	Amite River and Bayou Manchac, Louisiana Feasibility Report by USACE	X	X			X
1953-1967	LA DPW and East Baton Rouge improvements to Wards Creek, Clay Cut Bayou, Jacks Bayou, Bayou Duplantier and White Bayou.	X				
1955	ARB and Tributaries Flood Control Study by USACE	X	X	X	X	X
1956	USACE Chief of Engineers Report: Amite River and Tributaries	X	X	X	X	X
1964	USACE completes channel improvements to upstream portions of Amite River, and to lower portions of Comite River, Blind River, and Bayou Manchac; including construction of the Amite River Diversion Canal and weir	X	X	X	X	X
1971	Bayou Fountain: Floodplain Information Report for East Baton Rouge Parish by USACE	X	X			X
1972	Amite Rivers and Tributaries: Preliminary Evaluation Report by USACE	X	X			X
1972	Ward Creek and Tribes: Floodplain Information Report for East Baton Rouge Parish by USACE	X	X			X

1974	Clay Cut Bayou, Jones Creek and Tributaries: Flood plain Information Report For East Baton Rouge Parish by USACE	X	X			X
1976	Hurricane Creek, Monte Sano Bayou and Tribes: Floodplain Information Report for East Baton Rouge Parish by USACE	X	X			X
1976	Cypress Bayou and Tributaries: Floodplain Information Report for East Baton Rouge Parish by USACE	X	X	X	X	X
1979	Bayou Manchac and Amite River Louisiana Feasibility Report by USACE	X	X	X	X	X
1984	Amite Rivers and Tribes: Flood Control Initial Evaluation Study by USACE	X	X	X	X	X
1989	Amite River Flood Control Study Report for LADOTD	X	X	X		X
1990	Amite River and Tributaries, Louisiana, Comite River Basin Feasibility Study by USACE	X	X	X	X	X
1990	Land Use and Development Plan (Horizon Plan) for the City of Baton Rouge	X	X			X
1991	Comite River Final EIS by USACE	X	X			X
1991	Amite River And Tributaries Study - Feasibility Report on Comite River Basin by USACE	X	X	X	X	X
1992	Amite River and Tributaries Darlington Reservoir Feasibility Study by USACE	X	X	X	X	X
1995	Comite River Design Memorandum No. 1 by USACE	X	X	X	X	X
1995	Final Environmental Assessment (EA #222) Amite River and Tributaries Louisiana, Comite River Basin, Revision Of Diversion Channel Alignment And Other Changes by USACE	X	X			X
1995	Amite Rivers and Tributaries East Baton Rouge Flood Control Projects by USACE	X	X	X	X	X
1995	Study to Lower Stages along the Amite River (3 Low Impact Dry Dams) by C.E. Matrailer P.E. & Cecil E. Soileau P.E.	X	X	X		
1995	ARB Flood Control Program for LADOTD	X	X	X		
1996	Post Authorization Change Report for the Comite River Diversion Plan by USACE	X	X	X	X	X
1997	Livingston Parish Feasibility Study for channel improvement for Flood Control by USACE	X	X	X	X	X
1997	Darlington Reservoir Re-evaluation Study by USACE	X		X		
1998	ARBC in conjunction with USGS, LADOTD and LOEP and USACE establish a Flood Warning System for the ARB	X	X		X	X
1999	Comite River Diversion Construction Authority WRDA August 17, 1999	X				X
1999	Amite River Sand & Gravel Mine Reclamation Demonstration Project for LADOTD	X	X			

Year	Study/Report/Environmental Document Title	Data Source	Consistency	Structural Measures	Non-Structural Measures	FWOP Conditions
2000	Amite River and Tributaries Ecosystem Restoration Reconnaissance Study by USACE	X	X			
2002	Environmental Assessment, Lilly Bayou Control Structure, Phase 1 EA# 222-A by USACE	X	X	X	X	X
2005	City of Baton Rouge and East Baton Rouge Parish Bridge Location Index Map by City of Baton Rouge & East Baton Rouge Parish	X	X			X
2005	Frog Bayou and Alligator Bayou Comprehensive Flood Risk Reduction Plan for the Pontchartrain Levee District	X	X			X
2007	Fluvial Instability and Channel Degradation of Amite River and its Tributaries, Southwest Mississippi and Southeast Louisiana by ERDC Geotechnical and Structures Lab	X	X	X	X	X
2007	East Baton Rouge Flood Control Project Authority WRDA 2007	X				X
2011	Amite River Field Investigation and Geomorphic Assessment by ERDC Coastal & Hydraulics Laboratory	X	X		X	X
2014	West Shore Lake Pontchartrain Hurricane and Storm Damage Risk Reduction Study by USACE	X	X	X	X	X
2015	ARB Floodplain Management Plan by Gulf Engineers and Consultants for ARB Drainage and Water Conservation District	X	X	X	X	X
2016	August 2016 Flood Preliminary Report ARB	X	X	X	X	X
2017	Hydrologic and Hydraulic Numerical Model of the ARB-Detailed Work Plan, Detailed Cost Estimate and Schedule Proposal	X	X			X
2018	West Shore Lake Pontchartrain Hurricane and Storm Damage Risk Reduction Study by USACE	X	X	X	X	X
2018	St. James/Ascension Storm Surge Flood Protection Project by The Pontchartrain Levee District	X	X	X	X	X
2018	Bayou Conway & Panama Canal Drainage Improvement Project by The Pontchartrain Levee District	X	X	X		X
2018	Laurel Ridge Levee Extension Project Ascension Parish by The Pontchartrain Levee District	X	X	X	X	X
2019	Investigation into the Potential Hydraulic Impacts of Dredging the Lower Amite River for LADOTD	X	X	X		
2019	ARB Numerical Model Project Report for LADOTD	X	X			X
2019	Investigation into the Impacts of the Darlington Reservoir Concept for LADOTD	X	X	X		X
2019	Draft Integrated Feasibility Report and Environmental for Impact Statement Amite River and Tributaries, East of the Mississippi River, Louisiana	X	X	X	X	X
2019	Amite River and Tributaries-Comprehensive Study East of the Mississippi River, Louisiana. Environmental Impact Statement Final Scoping Report	X	X	X	X	X

Year	Study/Report/Environmental Document Title	Data Source	Consistency	Structural Measures	Non-Structural Measures	FWOP Conditions
2020	Final Independent External Peer Review Report (IEPR) Amite River and Tributaries – East of the Mississippi River, Louisiana, Feasibility Study	X	X	X	X	X
2020	Comment Response Record for the IEPR of the Amite River and Tributaries – East of the Mississippi River, Louisiana, Feasibility Study USACE Final Evaluator Responses and Panel Final Back Checks	X	X	X	X	X

Table 1-2. Funding Sources for Floodplain Related Activities within the Study Area

Funding Source	Type	Grantor	Funding Range ($ Millions)
Federal Emergency Management Agency (FEMA) Public Assistance (PA)	Post disaster (Non-recurring)	Federal	Varies based on eligible recovery and mitigation scopes of work following a major presidential disaster declaration.
HMGP	Post disaster (Non-recurring)	Federal	Varies based on amount of total federal assistance
FMA	Non-disaster (recurring)	Federal	Varies based on amount appropriated annually by congress, from the NFIP
PDM	Non-disaster (recurring)	Federal	Varies based on amount appropriated annually by congress
CDBG	Post-disaster (Non-recurring)	Federal	$65 to $13,400
Gulf of Mexico Energy Security Act (GOMESA)	Recurring	Federal	$0.1 to $8 (previous) $70 predicted
Statewide Flood Control Program	Recurring	State	$10 to $20

Source: LWFMP, 2018.

Table 1-3. Current Funded Programs/Projects within the Study Area

Program	Project Title	Parish
FMA	FMA-PJ-06-LA-2017-024	East Baton Rouge
FMA	EBR Acquisition/Demolition & Elevation	East Baton Rouge
FMA	Livingston FMA 2016 Acquisition & Elevation	Livingston Parish Council
FMA	FY 17 Flood Mitigation Assistance	Livingston Parish Council
HMGP	Livingston Parish 4263 Elevation Project	Livingston Parish Council
HMGP	St. Helena Parish Home Acquisition	St. Helena Parish
FMA	St. John the Baptist Parish Elevation Project	St. John The Baptist
HMGP	Drainage Improvements	St. John The Baptist

Section 2

Problems and Opportunities (Purpose and Need)

2.1 SPECIFIC PROBLEMS AND OPPORTUNITIES

The study area has previously experienced riverine flooding from excessive rainfall events, in addition to residual flood damages associated with hurricanes and tropical storms. Since 1851, the paths of 52 tropical events have crossed the study area. The paths and intensities of these storms are shown in Figure 2-1. The FEMA flood claims for the most recent events to impact the area are shown in Table 2-1. Table 2-2 shows the flood claims paid between 1978 and September 2018 for all counties and parishes in the study area. The table includes the number of claims, number of paid losses, and the total amount paid in the dollar value at the time of the payment. The table excludes losses that were not covered by flood insurance.

The most recent event to affect the study area was the 2016 Louisiana flood resulting from rainfall. This event brought catastrophic flooding damage to Baton Rouge and the surrounding areas with both localized flooding and riverine flooding from the Amite and Comite Rivers and their tributaries. In August 2016, the President issued disaster declarations for parishes in the ARB 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). The study area experienced historic flooding to thousands of homes and businesses and impacts to the Nation's critical infrastructure because both the I-10 and I-12 transportation systems were shut down for days. Major urban centers in the ARB saw significant flooding, well outside of normal flood stages.

The study will provide FRM alternatives to reduce the risks to public, commercial, and residential property, real estate, infrastructure, and human life; increase the reliability of the Nation’s transportation corridor (I-10-I-12); and enhance public education and awareness of flood risks.

Problems

The primary problem identified in the study area is the risk of flood damages from the Amite River and its tributaries to human life and flood damages of residential and nonresidential structures. Critical infrastructure throughout the regions includes the I-10 and I-12 transportation corridors, government facilities, and schools. This critical infrastructure is expected to have increased risk of damage from rainfall events. Problems are based on the need of evaluating flood risk management in the ARB and depend on addressing the planning goal and objectives (See Section 2.2).

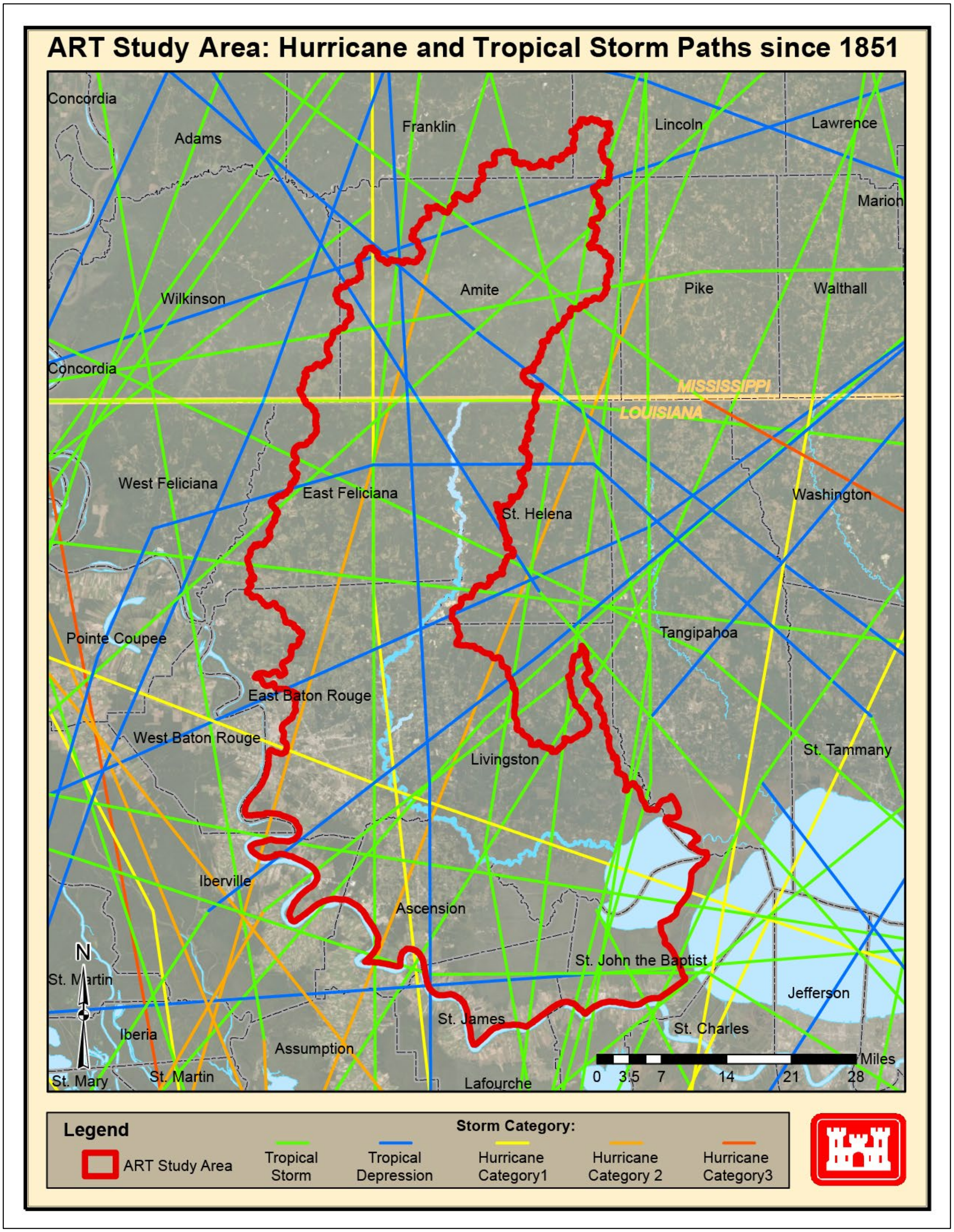

Figure 2-1. Hurricane and Tropical Storm Paths Since 1851

Table 2-1. Top Tropical Storms by Amount Paid by FEMA in the Study Area

Event	Month & Year	Number of Paid Claims	Total Amount Paid (millions)
2016 Louisiana Floods	August 2016	20,641	$1,689.2
Tropical Storm Lee	September 2011	9,725	$377.6
Hurricane Ike	September 2008	45,374	$2,074.1
Hurricane Gustav	September 2008	4,396	$88.9
Hurricane Rita	September 2005	8,921	$348.7
Hurricane Andrew	August 1992	5,242	$128.9
Hurricane Ida	September 2021	21,637	$1,112.0
Hurricane Zeta	October 2020	1,041	$17.3
Tropical Storm Nicholas	September 2021	254	$5.6

Source: Federal Emergency Management Agency (FEMA)

Note 1: Total amount paid is at price level at time of the event.
Note 2: Claims and amount paid are for entire event, which may include areas outside of the study area.

Table 2-2. FEMA Flood Claims in the Study Area by Parish/County from January 1978 through September 2023

Parish/County	Total Number of Claims	Number of Paid Claims	Total Payments (millions)
Ascension	6,005	5,141	$285.7
East Baton Rouge	18,958	15,792	$948.5
East Feliciana	14	12	$0.6
Iberville	544	439	$7.3
Livingston	10,270	8,829	$477.2
St. Helena	51	36	$1.7
St. James	206	144	$3.4
St. John the Baptist	8,725	7,209	$483.4
Total	44,773	37,602	$2,207.8

Source: Federal Emergency Management Agency (FEMA)

Opportunities

Opportunities to address the identified problems include:

- Risk Reduction to life, land, property, and infrastructure from flooding.
- Work with local communities to manage flood risk by leveraging the following efforts:
  - enhance public education and awareness of floodplain management;
  - improve flood warnings for preparation and evacuation;
  - recommend future modifications to the roadway systems to maintain emergency response vehicles access during hurricane and tropical storm events.
- Increase the resiliency of the vitally important I-10/I-12 transportation corridor
- Prevent degradation to fish and wildlife habitat by:
  - improving water quality;
  - increasing habitat or slowing down the trend of habitat quality reduction;
  - encouraging best management practices for land use management.
- Afford access to recreation (boating, bike trails, camping, swimming, and sightseeing facilities)

2.2 PLANNING GOAL AND OBJECTIVES

The primary goal is to reduce the severity of flood risk, damages and risk to human life along the ART to residents, businesses, and critical infrastructure. The federal objective of water and related land resources project planning is to contribute to 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. All of the objectives focus on alternatives within the study area and within the 50-year period of analysis from 2026 to 2076. The planning objectives are:

- reduce risk to human life from flooding;
- reduce flood damages from rainfall in the ARB to industrial, commercial, and agricultural facilities and residential and nonresidential structures;
- reduce interruption to the nation's transportation corridors, particularly the I-10/I-12 infrastructure;
- reduce risks to critical infrastructure (e.g. medical centers, schools, transportation etc.).

2.3 PLANNING CONSTRAINTS AND CONSIDERATIONS

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. One planning constraint was identified in this study:

- Avoid promoting development within the floodplain (in accordance with E.O. 11988) to the maximum extent practicable, which contributes to increased life safety risk.

Additionally, several planning considerations identified for plan formulation that would not require the removal of an alternative plan, but need to be assessed as part of the plan formulation process:

- Avoid or minimize negative impacts to:
  - threatened and endangered (T&E) species and protected species;
  - critical habitat, e.g., T&E;
  - water quality;
  - cultural, historic, and Tribal-trust resources;
  - recreation use in the ARB.
- Recognition/awareness that reaches of the Amite and Comite Rivers are Scenic Rivers, which may require legislative changes to implement alternatives.
- Consistency with local floodplain management plans by not inducing flooding in other areas.

2.4 PUBLIC SCOPING

Early NEPA coordination with the NFS, stakeholders, Federal and State agencies, and Federally-Recognized Tribes was performed prior to the notice of intent (NOI) and afterward through public meetings, social media, and the CEMVN website. USACE hosted general scoping meetings within 90 days of the start of the study, per Water Resources Reform and Development Act (WRRDA) 2014. As part of the early coordination, general scoping was initiated prior to the NEPA NOI, in conformity with 40 CFR 1500-1508. A public website page with the study information and request for feedback was established in mid-December 2018.

The collaborative stakeholders associated with this study are USACE, ARB Commission (ARBC), CPRA, and the following parishes: Livingston, Ascension, St. Helena, East Feliciana, East Baton Rouge, Iberville, St. John the Baptist, and St. James. 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), U.S. Geological Survey (USGS), and 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 (ACTT), Chickasaw Nation, Chitimacha Tribe of Louisiana (CTL), Choctaw Nation of Oklahoma (CNO), Coushatta Tribe of Louisiana (CT), Jena Band of Choctaw Indians (JBCI), Mississippi Band of Choctaw Indians (MBCI), Muscogee (Creek) Nation (MCN), Seminole Nation of Oklahoma (SNO), Seminole Tribe of Florida (STF), and Tunica-Biloxi Tribe of Louisiana (TBTL) on December 4, 2018.

A NEPA stakeholder meeting was conducted by USACE on December 3, 2018 at the USGS Baton Rouge, Louisiana office that included an option to participate by video conference. A subsequent reconnaissance meeting was conducted on December 10, 2018 with the NFS, and resource agencies at the at CPRA's Baton Rouge, Louisiana office which also included an option to participate by video conference. Federally-Recognized Tribes were invited, but were unable to attend. However, a follow up meeting was held on January 7, 2019, during which the MBCI participated. Additionally, a public scoping meeting was conducted on January 10, 2019, at CEMVN with Facebook live streaming, where feedback was requested as well. Feedback from the public scoping meeting resulted in the identification of three additional measures.

In accordance with NEPA, a NOI to prepare an EIS was published in the Federal Register (Volume 84, No. 63) on April 2, 2019. The scoping period ended on July 8, 2019. Three public scoping meetings were conducted within the study area on April 24 and 25, 2019 with Facebook live streaming. Comments were accepted via written correspondence and emails. Approximately 80 non–USACE people attended the meetings in person and the Facebook live streaming had over 6,000 views. Scoping identified four areas of concern: flooding, dredging opportunities, levee opportunities, and nature-based engineering. People are concerned about inducement of flooding into other area and proposed further investigation in alternative formulation and specific areas of concern. Feedback from the public scoping meeting resulted in the identification of one additional measure, which was proposed by the Healthy Gulf Collaborative, regarding conversion of sand and gravel mines to bottomland hardwoods habitat for flood control.

A meeting was conducted on June 18, 2019, with collaborative stakeholders, the NFS, resource agencies, and Federally-Recognized Tribes to present the preliminary final array of alternatives and the screening rationale of the alternatives that were screened. As a result, three agencies, (FWS, LDEQ, and LDWF) requested an evaluation of river restoration, which resulted in the addition of another alternative, restoration of river meanders.

The scoping report can be found on the project website: https://www.mvn.usace.army.mil/Amite-River-and-Tributaries/. It is called Appendix C-2 EIS Final Scoping Report and is found under the 2019 Draft Report and Appendices header. The scoping report has copies of all written feedback received prior to the additional resources approval in 2022.

After the additional resources were approved to reassess the dry dam and further evaluate nonstructural alternatives, EJ outreach meetings were conducted on February 28, 2023, and March 1, 2023, to inform and engage residents about the flood risk reduction measures. Outreach efforts focused on civic and faith-based organizations that serve residents in areas of EJ concern, including local churches, libraries, non-profits, and community centers. Initial and follow-up calls were made to 29 churches, four community centers, three non-profits, and three academic institutions. Of those contacted, six churches, two community centers, two non-profits, and two academic institutions agreed to disseminate our one-page summary of the outreach effort to the residents they serve.

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

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

NEPA Sections		Location in this Document
Cover Sheet		Cover Page
Abstract		Cover Page
Table of Contents		Table of Contents
Purpose of 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 Laws and Regulations		Section 8
Mitigation		Section 7
List of Report Recipients		Section 9
Index		Listed in References
Appendices		Listed in the Table of Contents

Section 3
Inventory and Forecast Conditions

3.1 ENVIRONMENTAL SETTINGS

Land Use

The Pre-Contact settlement of the ARB extends as far back as the Paleoindian period (11,500-8000 B.C.), although few sites of this age have been identified within the study area. However, archaeological evidence supports that during the period from 8000 B.C. to 800 B.C., the region was well inhabited by Native American peoples who often settled along ridges overlooking streams with gravel outcroppings. It is noteworthy to mention that during the subsequent Pre-Contact period, from approximately 800 B.C. and leading up until the time of Native American-European contact, settlement strategies shift away from the uplands of the ARB towards alluvial valleys, giving rise to some of the earliest agricultural-based settlements in the region. Upon the arrival of Europeans to the ARB, there were multiple groups of Native Americans occupying the ARB. The effects of contact between these cultures are understudied at the present time and can be refined as additional investigations are conducted in the future. European Settlements from the 1800s in the ARB primarily consisted of farming, fishing, hunting, and trapping communities near the Prairie Terraces and natural levees, often at or near floodplains. More densely populated communities began to form in response to the need for government administration and trade centers, resulting in the slow degradation of nearly 100 percent of the natural forested landscape. Road and rail networks further contributed to urbanization near high-ground water routes, and the establishment of multiple universities, a large petrochemical industry, and the Second World War prompted continuous population growth into the 1900s (GEC, Inc., 2015).

As of 2015, the study area predominantly consisted of undeveloped acreage. About 28 percent of the land was developed for commercial, residential, agricultural, recreation, and industrial purposes. The remaining 72 percent of the land was comprised of wetlands, new-growth forest, barren land, and other undeveloped land. Refer to Appendix D-2 for the land use classification table and map of the study area.

Climate, Weather Patterns, and Climate Change

The 2014 USACE Climate and Resiliency Policy Statement states the “USACE shall continue to consider potential climate change impacts when undertaking long-term planning, setting priorities, and making decisions affecting its resources, programs, policies, and operations.” The ART Study evaluates the feasibility of nonstructural flood risk measures from 2026 to 2076. The most significant impact on coastal wetlands resulting from climate change is sea level change (SLC).

Climate in the region is humid subtropical, being heavily influenced by the movements of warm moist air off of the Gulf of Mexico. Average monthly temperatures vary from approximately 51.2 °F in January to 82.0 °F in July. Winter nighttime lows below freezing are common, as are summer daytime highs in the mid-90s. See Appendix D-2, Table D:1-2 for the monthly temperature normals recorded from the Baton Rouge Metro Airport, LA monitoring station by the National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center (NCDC).

Normal annual precipitation for the ARB is 60.5 inches, although for the period 1980 through 1991, rainfall averaged 64 inches a year. The ARB experienced drought conditions (-2 or less on the Palmer Drought Severity Index) during the modern era years of 1952, 1963, 1981, 1999, and 2000. Southerly, maritime winds prevail for much of the year, resulting in the potential for highly variable rainfall over the ARB. Daily variations are frequently measured in inches. Even for a 30-year averaging period, annual precipitation at various weather stations throughout the ARB ranged from 56 to 67 inches. The wettest month is December, with an average monthly normal rainfall of 6.14 inches. October is the driest month, averaging 3.50 inches of rainfall.

High cumulative rainfall events (e.g., 6 inches or more in less than 72 hours) over large areas of the ARB are caused under two typical scenarios: slow moving cold fronts encountering warm moist coastal air in late winter or early spring; and slow-moving tropical storms in summer or early fall. High short-term localized rainfall intensities (e.g., over one inch in an hour) can occur under these two scenarios and are also experienced in a third scenario—heavy summer-time thunderstorms. Severe riverine flooding in the lower ARB has occurred under extreme examples of all three scenarios, with minor localized flood events typically occurring at least once per year in small, poorly drained catchments. Record floods often result when significant rainfall events occur in the context of above-average seasonal rainfall patterns, which sustain high soil moisture saturation and floodplain water levels. In addition to rainfall-riverine flood events, the lower ARB is also subject to wind-driven coastal flooding associated with slow-moving tropical storms. Prolonged, heavy, southerly winds cause high water levels along the southeastern Louisiana coast (e.g., Breton and Mississippi Sounds), causing back-step rises in Lakes Borgne, Pontchartrain, and Maurepas. Lake Maurepas levels above 3 feet mean sea level (MSL) typically impact the lower ARB at least once per year. Tropical storms have pushed levels above 6 feet MSL. Increasing levels of relative sea level change (RSLC) are also associated with climate change (See Section 3.1.4).

Current projections of storm frequencies from the CPRA Coastal Master Plan Report (2017) anticipates increased frequencies for hurricanes and decreased frequencies for tropical storms. See Table 3-1a for the average annual number of North Atlantic Basin tropical storms and major hurricanes (CPRA 2017). https://coastal.la.gov/our-plan/2023-coastal-master-plan/

Table 3-1a. North Atlantic Basin Tropical Storms and Major Hurricanes based on the Plausible Range of Future Tropical Storm Frequency

	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%

See Appendix D-1, Table D1-2 for the temperature normals from Baton Rouge Metro Airport.

Flood Events

The August 2016 Flood Preliminary Report for ARB (Jacobsen, B.J. 2017) provides findings on prior flooding, as well as the 2016 Flood Event. See Appendix D-2, Section 1.1.3 for Table D:1-3, which presents the top 10 pre-2016 crests based on USGS gauges for the Amite River at Denham Springs and Comite River at Joor Road (with peak stage data as far back as 1921 and 1943, respectively) and the peak discharge for five of the Amite River floods at Denham Springs. Three significant pre-2016 flood events are:

- The April 1983 Flood. A slow-moving system produced 6 to 13 inches of rain over a broad portion of the ARB, with high totals in the Upland Hills. This flood established the pre-2016 record flood for the lower Amite River and backwater in associated tributaries in the Middle and Lower Prairie zones. It was the second highest flood recorded on the Comite River at Joor Road. About 5,300 homes and 200 businesses were flooded and an estimated $172 million of damages incurred (1983 dollars). Flood damages in the Comite River Sub-basin were estimated to be $48 million.
- Hurricane Juan in October 1985. Hurricane Juan became stalled along the Louisiana coast for several days, producing extremely high wind-driven water levels in Lake Maurepas, reportedly above 6 feet NAVD 88, and 6-day rainfall totals of five to eleven inches throughout the ARB. Record flooding occurred in the Coastal Wetlands and Margins. Upstream portions of the ARB were largely unaffected.
- Tropical Storm Allison in June 2001. Tropical Storm Allison stalled over the region, with 7-day measured rainfall totals of 19.66 inches in Baton Rouge; 14.07 inches in Denham Springs; and 23.29 inches in Ascension Parish. The seven-day rainfall totals in parts of the lower ARB were considered a 0.01 AEP precipitation event. Due to a significant drought and very low soil moisture conditions present prior to the event, flood conditions in the upper and middle ARB were not as extreme.

The top tropical storms by amount paid by FEMA in the study area are presented in Table 2-1.

The August 2016 flood over southeast and south-central Louisiana was caused by a slow-moving low-pressure system that had its origins as an Atlantic tropical wave. Beginning on Monday, August 8, 2016, the low traversed east-to-west across northern Florida and lower

Alabama/Mississippi and approached the ARB late on Thursday, 11 August 2016. The low was not considered an area of interest for development by the National Hurricane Center. The U.S. National Weather Service (NWS) issued a flash flood watch for the region on Tuesday, August 9. Flash flood and river flood warnings were issued beginning Wednesday, August 10 and continued through the event. The majority of the ARB received in excess of 10 inches, with a large portion of the northern half of the ARB experiencing over 15 inches. Parts of the Middle Prairie zone in northern East Baton Rouge and northwestern Livingston Parishes had over 20 inches of rainfall.

A report commissioned by Louisiana Economic Development (2016) estimates damages under lost economic activity, property damages to residences, autos and businesses, and damage to government infrastructure. Operations at approximately 19,900 Louisiana businesses were disrupted by the flooding event, impacting approximately 278,500 workers (14 percent of the Louisiana workforce). Table 3-1b provides a summary of damages by category (Terrell 2016).

Table 3-1b. Summary of Damages by Category

Damages Category	Loss in Millions
Residential Housing Structures	$3,844.2
Residential Housing Contents	$1,279.8
Automobiles	$378.8
Agriculture	$110.2
Business Structures	$595.6
Business Equipment	$262.8
Business Inventories	$1,425.5
Business Interruption Loss	$836.4
Total $8,733.3	

Sea Level Change

ER 1100-2-8162 (USACE 2019) provides guidance for incorporating direct and indirect physical effects of projected future SLC 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.

Research by climate science experts predict continued or accelerated climate change for the 21st century and possibly beyond, which would cause a continued or accelerated rise in global MSL. The resulting local RSLC will likely impact USACE coastal project and system performance. As a result, managing, planning, engineering, designing, operating, and maintaining for SLC must consider how sensitive and adaptable natural and managed ecosystems and human and engineered systems are to climate change and other related global changes. Planning studies and engineering designs over the project life cycle, for both existing and proposed projects, will consider alternatives that are formulated and evaluated for the entire range of possible future rates of SLC, represented here by three scenarios of “low,” “intermediate,” and “high” SLC. These alternatives will include nonstructural alternatives. In compliance with USACE policy (ER 1100-2-8162), the performance of all projects under all three SLC scenarios will be analyzed for the final array of alternatives in the final report.

Using USACE-predicted future water levels under the SLC scenarios, those water levels were converted into RSLC rates, incorporating sea level rise (SLR) effects measured at the gauges and land loss experienced in the extended project area for each project. No operations and maintenance activities were planned for any of the projects in relation to future elevation changes. Long-term sustainability (percent land left at the end of the period of analysis) was used to analyze the impact that different SLC scenarios had on the project areas.

3.2 RELEVANT RESOURCES

This section contains a description of relevant resources in the study area that could be impacted by the proposed project. The significant 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. Significance 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, Tribes, or private groups. Significance based on public recognition means that some segment of the general public recognizes the importance of an environmental resource. Significance 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 3-2 provides summary information of the institutional, technical, and public importance of these resources.

Table 3-2. Relevant Resources in the Study Area

Resource	Institutionally Important	Technically Important	Publicly Important
Cultural and Historic Resources	National Historic Preservation Act (NHPA), as amended, and Section 106 and 110 of the NHPA; the Native American Graves Protection and Repatriation Act of 1990; the Archeological Resources Protection Act of 1979; and USACE's Tribal Consultation Policy (2012).	Federal, State, and Tribal stakeholders document and protect cultural resources including archaeological sites, districts, buildings, structures, and objects that are significant in American history, architecture, archaeology, engineering, and/or sites of religious and cultural significance based on their association or linkage to past events, to historically important persons, to design and construction values, and for their ability to yield important information about prehistory and history.	Preservation groups and private individuals support protection and enhancement of historical resources.
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.
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.
Wetlands	Clean Water Act of 1977, 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., E.O. 11988, and Fish and Wildlife Coordination Act.	They provide necessary 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.	The high value the public places on the functions and values that wetlands provide. Environmental organizations and the public support the preservation of marshes.

Uplands	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.
Aquatic Resources/ Fisheries	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 Act of 1968.	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.	The high priority that the public places on their esthetic, recreational, and commercial value.
Soils and Water Bottoms	Fish and Wildlife Coordination Act, Marine Protection, Research, and Sanctuaries Act of 1990	State and Federal agencies recognize the value of water bottoms for the production of benthic organisms.	Environmental organizations and the public support the preservation of water quality and fishery resources.
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, Endangered, and Protected 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, FWS, NMFS, NRCS, EPA, LDWF, and Louisiana Department of Natural Resources 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.
Prime and Unique Farmland	Farmland Protection Policy Act	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.
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.
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, FWS, NMFS, NRCS, EPA, and State DNR and wildlife/fishery offices recognize value of fisheries and 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 fishery resources and the desire for clean drinking water.

Resource	Institutionally Important	Technically Important	Publicly Important
Environmental Justice	Executive Order 12898 of 1994 (E.O. 12898) and the Department of Defense's Strategy on Environmental Justice of 1995	State and Federal agencies recognize social and economic welfare of minority and low-income populations	Public concerns about the fair and equitable treatment (fair treatment and meaningful involvement) of all people with respect to environmental and human health consequences of Federal laws, regulations, policies, and actions.
Socioeconomics	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.

Resources not impacted in this study include Navigation, Noise and Vibration, and Essential Fish Habitat.

Natural Environment

3.2.1.1 Wetland Resources

Bottomland hardwood forests (BLH) in the study area are dominated by water oak, nuttall oak, green ash, red maple, and pignut hickory. Swamps in the Lower ARB are dominated by bald cypress and water tupelo, which have regenerated following extensive logging of virgin forest more than 70 years ago. The Louisiana swamps generally lack a mature canopy, as was present in the forests before logging occurred, and have lower productivity where isolated from riverine influences (Shaffer et al., 2003). Economically important natural resources associated with these swamps include fisheries of crawfish, blue catfish, and channel catfish, as well as logging. The classification of wetlands habitat from the U.S. Fish and Wildlife National Wetlands Inventory (https://www.fws.gov/wetlands/) is located in Appendix C-1.

3.2.1.2 Upland Resources

Forested Wetlands (From LDWF Natural Communities of Louisiana)

<u>Hardwood Slope Forest</u>

These forests mostly occur on slopes, or sometimes on stream and river terraces that are only rarely subject to flooding. This natural community occurs along slopes rising out of the floodplains in the Upper ARB and is dominated by hardwood trees with a sparse herbaceous layer. The hardwood slope forest community historically occupied approximately 100,000 to 500,000 acres and an estimated 25 to 50 percent of this acreage remains. Habitat conversion to pine plantations or residential uses, invasive and exotic species (including

Chinese tallow (*Triadica sebifera*), Chinese privet (*Ligustrum sinense*), and cogon grass (*Imperata cylindrica*)) construction of roads, utilities and pipelines, and use of off-road vehicles currently threatens the long-term viability of these forests.

<u>Small Stream Forest</u>

Small stream forests are relatively narrow wetland forests occurring along small rivers and large creeks in central, western, southeastern, and northern Louisiana. They are seasonally flooded for brief periods. The percentage of sand, silt, calcareous clay, acidic clay, and organic material in the soil is highly variable (depending on local geology) and has a significant effect on species composition. Soils are typically classified as silt-loams. At times, the community is quite similar in species composition to hardwood slope forests (beech-magnolia forests). These forested wetlands are critical components of the landscape filtering surface and subsurface flows, improving water quality, and storing sediment and nutrients (Rummer 2004). See Appendix D-1, Table D:2-3 for a vegetative species list for this natural community.

Nuisance Species (from LDWF Waterbody Management Plan 2017)

Common salvinia and water hyacinth have been the main source of access and habitat issues and complaints over the past several years. Common salvinia is scattered throughout the ARB and is constantly being restocked by draining swamps and bayous. Within the river system, the desire to own/sell waterfront property has led to the construction of numerous man-made canals over the past four decades. These canals are typically 50 to 200 feet wide, dead-end offshoots of the main river channel. The canals are lined with houses, camps, boat slips, docks, and an occasional boat ramp. The canal systems are rarely designed so that river water can flow through unimpeded (i.e. horseshoe in shape, etc.). Consequently, these dead-end canals have no inherent “flushing” mechanism to remove floating vegetation. Invariably, some form of aquatic vegetation makes its way into these canals each year and remains stranded due to the stagnant water conditions and thrives. When the suspect vegetation in these canals reaches unacceptable levels, shoreline property owners call LDWF to complain.

Estimates of vegetation coverage are:

Problematic Species:

- Common Salvinia (*Salvinia minima)* – 25 acres
- Water Hyacinth (*Eichhornia crassipes)* – 15 acres
- Duckweed (*Lemna spp.)* – 15 acres
- Duck Lettuce (*Ottelia alismoides*) – 50 acres
- Crested Floating Heart (*Nymphoides cristata*) – 6 acres

Beneficial Species:

- Yellow Water Lily (*Nymphaea mexicana)* – 100 acres
- Coontail (*Ceratophyllum demersum)* – 100 acres

3.2.1.3 Aquatic Resources and Fisheries

For a list of fish species in the study area, see Appendix D-2, Table D:2-4 (LDWF Amite River Waterbody Management Plan).

The Alabama Hickorynut (*Obovaria unicolor*) is an at-risk species, a 1.2 - 2 inch-long freshwater mussel, with round or elliptical shape. The outer shell (periostracum) is smooth and brown to yellow-brown, with rays. This species is a long-term brooder that is gravid 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 (glochial host) in order to transform into a juvenile mussel. Once the glochidia are ready, they release from the host to find a suitable substrate. Suitable glochidial host fishes for this species include the naked sand darter (*Ammocrypta beani*), southern sand darter (*Ammocrypta meridiana*), Johnny darter (*Etheostoma nigrum*), Gulf darter (*Etheostoma swaini*), blackbanded darter (*Percina nigrofasciata*), dusky darter (*Percina sciera*), and redspot darter (*Etheostoma artesiae*).

The Alabama Hickorynut inhabits sand and gravel substrates in moderate currents in large streams. However, the presence of moderate gradient pool and riffle habitats in a variety of stream and river sizes may contain this species. In Louisiana, the Alabama Hickorynut is known to occur in the Pearl and Amite River systems. Habitat modification and destruction due to siltation (i.e. from flooding events) and impoundment threaten this species. It is also negatively affected by the pollution of streams and rivers.

The rare Broadstripe topminnow *(Fundulus euryzonus)* is endemic to the Amite and Tangipahoa River Basins. The Broadstripe topminnow is listed as Vulnerable at the global and national level and Imperiled at the state level. This fish prefers smaller channel widths, with riparian vegetation canopy; features of upstream reaches of rivers. Current and historical mining operations in the ARB have led to channelization, which changes the upstream reaches of the river to behave more like downstream reaches by widening the channel and increasing water flow; thus, diminishing suitable habitat for the topminnow.

3.2.1.4 Wildlife

The study-area wetland and non-wetland forests provide valuable habitat for a variety of migratory game and non-game birds, mammals, amphibians, and reptiles. For a listing of associated species, see Appendix D-2, Table D:2-5 through Table D:2-8.

The coastal marshes and forested wetlands of the Lake Pontchartrain Basin have been identified by the North American Waterfowl Management Plan (NAWMP), Gulf Coast Joint Venture (GCJV): Mississippi River Coastal Wetlands Initiative as a key waterfowl wintering area. The Gulf Coast is the terminus of the Central and Mississippi Flyways and is therefore one of the most important waterfowl areas in North America, providing both wintering and migration habitat for significant numbers of the continental duck and goose populations that use both flyways.

The Mississippi River Coastal Wetlands Initiative area is dominated by coastal marsh, forested swamps, and seasonally flooded bottomland hardwoods that provide habitat for several species of wintering waterfowl. Wood ducks are the primary waterfowl species in forested wetlands, while other ducks, and use those forested habitats to a lesser degree. Other game birds are present in or adjacent to the study area including rails (Family: *Rallidae*). Non-game bird species also utilize the study area marshes, including various species of gulls and terns. Birds of prey in the study area include resident and transient hawks. Some neo-tropical migrants, currently experiencing population decline, are dependent on large forested areas to successfully reproduce. Also present are cuckoos, swifts, hummingbirds, woodpeckers, and the belted kingfisher (*Megaceryle alcyon*). See Appendix D-2, Table D2-5 for a list of bird species in the study area.

3.2.1.5 Threatened, Endangered, and Protected Species

Factors regarding the existing conditions for threatened and endangered species in the study area principally stem from the alteration, degradation, and loss of habitats; and human disturbance. The continued high rate of commercial development throughout the study area continues to reduce available wetland habitat to threatened and endangered species. This creates increased intra- and interspecific competition for rapidly depleting resources between not only the various threatened and endangered species, but also other more numerous fauna.

On November 15, 2023 CEMVN obtained a draft Coordination Act Report (CAR) from the FWS that provides a list of threatened and endangered species that may occur in the proposed project location, and/or may be affected by the proposed project. Table D:2-9 in Appendix D-2 a summary of findings from the draft CAR .

West Indian Manatee

Federally listed as a threatened species, *Trichechus manatus* (West Indian manatees) occasionally enter Lakes Pontchartrain and Maurepas and associated coastal waters and streams during the summer months (i.e., June through September). Manatee occurrences appear to be increasing, and they have been regularly reported in the Amite, Blind, Tchefuncte, and Tickfaw Rivers, and in canals within the adjacent coastal marshes of Louisiana. The manatee has declined in numbers due to collisions with boats and barges, entrapment in flood control structures, poaching, habitat loss, and pollution. Cold weather and outbreaks of red tide may also adversely affect these animals. All contract personnel associated with the project should be informed of the potential presence of manatees and the need to avoid collisions with manatees, which are protected under the Marine Mammal Protection Act of 1972 and the Endangered Species Act of 1973. All construction personnel are responsible for observing water-related activities for the presence of manatee(s). Temporary signs should be posted prior to and during all construction/dredging activities to remind personnel to be observant for manatees during active construction/dredging operations or within vessel movement zones (i.e., work area), and at least one sign should be placed where it is visible to the vessel operator. Siltation barriers, if used, should be made of material in which manatees could not become entangled, and should be properly secured and monitored. If a manatee is sighted within 100 yards of the active work zone, special operating conditions should be implemented, including: no operation of moving equipment within 50 feet of a manatee; all vessels should operate at no wake/idle speeds within 100 yards of the work area; and siltation barriers, if used, should be re-secured and monitored. Once the manatee has left the 100-yard buffer zone around the work area on its own accord, special operating conditions are no longer necessary, but careful observations would be resumed. Any manatee sighting should be immediately reported to the Service's Lafayette, Louisiana Field Office (337/291-3100) and the Louisiana Department of Wildlife and Fisheries, Natural Heritage Program (225/765-2821).

Public data on manatee sightings have provided benefits for conservation efforts, according to Hieb et al. (2017). Ongoing manatee population growth, future climate change, or other large-scale environmental perturbations are likely to continue altering the timing, duration, and location of manatee visits to the northern Gulf of Mexico. Although publicly sourced data and citizen-science efforts have inherent biases, on a decadal timescale these datasets could provide comprehensive information on manatee habitat use than is possible by direct observations.

Gulf Sturgeon

Acipenser oxyrhynchus desotoi (the Gulf sturgeon), federally listed as a threatened species, is an anadromous fish that occurs in many rivers, streams, and estuarine waters along the northern Gulf Coast between the Mississippi River and the Suwannee River, Florida. In Louisiana, Gulf sturgeon have been reported at Rigolets Pass, rivers and lakes of the Lake Pontchartrain Basin, and adjacent estuarine areas. Spawning occurs in coastal rivers between late winter and early spring (i.e., March to May). Adults and sub-adults may be found in those rivers and streams until November, and in estuarine or marine waters during the remainder of the year. Sturgeon less than 2 years old appear to remain in riverine habitats and estuarine areas throughout the year, rather than migrate to marine waters. Habitat alterations, such as those caused by water control structures that limit and prevent spawning, poor water quality, and over-fishing have negatively affected this species.

On March 19, 2003, the FWS and the National Marine Fisheries Service (NMFS) published a final rule in the Federal Register (Volume 68, No. 53) designating critical habitat for the Gulf sturgeon in Louisiana, Mississippi, Alabama, and Florida. The proposed project; however, does not occur within, nor would it impact designated Gulf sturgeon critical habitat.

USACE is responsible for determining whether the selected alternative is likely (or not likely) to adversely affect any listed species and/or critical habitat, and for requesting the FWS' concurrence with that determination. If USACE determines, and the FWS concurs, that the selected alternative is likely to adversely affect listed species and/or critical habitat, a request for formal consultation in accordance with Section 7 of the Endangered Species Act (ESA) should be submitted to the FWS. That request should also include USACE's rationale supporting their determination.

Inflated Heelsplitter Mussel

Federally listed as a threatened species, the Alabama heelsplitter mussel (*Potamilus inflatus*) was historically found in Louisiana in the Amite, Tangipahoa, and Pearl Rivers. Many life history aspects of the species are poorly understood but are likely similar to that of other members of the Unionidae family. Although the primary host fish for the species is not certain, investigation by K. Roe et al. (1997) indicates that the freshwater drum (*Aplodinotus grunniens)* is a suitable glochidial host for the species.

Based on the most recent survey data, the currently known range for the Alabama heelsplitter in Louisiana occurs only in the lower third of the Amite River, along the East Baton Rouge/Livingston Parish line from Spiller's Creek, which is in the vicinity of Denham Springs, downstream to the vicinity of Port Vincent. Because it has not been used widely for past or present gravel mining operations, the lower third of the Amite River (between Louisiana Highway 37 and Louisiana Highway 42) is more typical of a coastal plain river, being characterized by a silt substratum, less channelization, and slower water flow, all of which are characteristic of Heelsplitter habitat. This freshwater mussel is typically found in soft, stable substrates such as sand, mud, silt, and sandy gravel, in slow to moderate currents. Heelsplitter mussels are usually found in depositional pools below sand point bars and in shallow pools between sandbars and riverbanks.

Major threats to this species in Louisiana are the loss of habitat resulting from sand and gravel dredging and channel modifications for flood control, as shown by the apparent removal of the species in the extensively modified upper portions of the Amite River.

Northern Long-Eared Bat

The northern long-eared bat (*Myotis septentrionalis*), federally listed as an endangered species, is a medium sized bat about 3 to 3.7 inches in length but with a wingspan of 9 to 10 inches and is distinguished by its long ears. Its fur color can range from medium to dark brown on the back and tawny to pale brown on the underside. The northern long-eared bat can be found in much of the eastern and north central United States and all Canadian provinces from the Atlantic Ocean west to the southern Yukon Territory and eastern British Columbia. In Louisiana, there have been confirmed reports of sightings in West Feliciana, Winn, and Grant parishes, although they can possibly be found in other parishes in the state. Some individuals were documented during mist net and bridge surveys on the Winn District of the Kisatchie National Forest and observed under bridges on the Winn District in Grant Parish.

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 motionless insects from vegetation and water surfaces.

The most prominent threat to this species is white-nose syndrome, a disease known to cause high mortality in bats that hibernate in caves. Other sources of mortality for northern long-eared bats are wind energy development, habitat destruction or disturbance, climate change and contaminants. If implementation of the proposed action has the potential to directly or indirectly affect the northern long-eared bat or its habitat, further consultation with this office will be necessary.

The USACE is responsible for determining whether the selected alternative is likely (or not likely) to adversely affect any listed species and/or critical habitat, and for requesting the Service's concurrence with that determination. If the USACE determines, and the Service concurs, that the selected alternative is likely to adversely affect listed species and/or critical habitat, a request for formal consultation in accordance with Section 7 of the Endangered Species Act should be submitted to the Service. That request should also include the USACE's rationale supporting their determination.

Protected Species

Bald Eagle

The project-area forested wetlands provide nesting habitat for *Haliaeetus leucocephalus* (the bald eagle), which was officially removed from the List of Endangered and Threatened Species on August 8, 2007. There is one active bald eagle nest that is known to exist within the proposed project area; however, other nests may be present that are not currently listed in the database maintained by LDWF.

Bald eagles' nest in Louisiana from October through mid-May. They typically nest in mature trees (e.g., bald cypress, sycamore, willow, etc.) near fresh to intermediate marshes or open water in the southeastern parishes. Areas with high numbers of nests include the north shore of Lake Pontchartrain and the Lake Salvador area. Major threats to this species include habitat alteration, human disturbance, and environmental contaminants (i.e., organochlorine pesticides and lead).

Breeding bald eagles occupy "territories" that they will typically defend against intrusion by other eagles and that they likely return to each year. A territory may include one or more alternate nests that are built and maintained by the eagles, but which may not be used for nesting in a given year. Potential nest trees within a nesting territory may, therefore, provide important alternative bald eagle nest sites. Bald eagles are vulnerable to disturbance during courtship, nest building, egg laying, incubation, and brooding. Disturbance during this critical period 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.

Colonial Nesting Birds

In accordance with the Migratory Bird Treaty Act and draft CAR from FWS (dated November 15, 2023, see Appendix D-1 Agency Coordination), the study area includes habitats that are commonly inhabited by colonial nesting waterbirds, which include herons, egrets, night-herons, ibis, and roseate spoonbills. Recommendations to address compliance with the Migratory Bird Treaty Act is included in Section 8.5.

3.2.1.6 Geology, Soils and Water Bottoms, and Prime Farmland

The study area can be roughly divided into three regions with distinctive landforms, topographies, and associated floodplain characteristics. For a map of the geographic and physiographic setting, see Appendix D-2, Figure D:2-2.

1. The High Terraces includes the Mississippi counties, East Feliciana Parish, St. Helena Parish, and northern East Baton Rouge Parish. The area, with sediment dated to the Pleistocene era, consists of narrow floodplains with rolling hills at elevations typically ranging from approximately 80 to 500 feet above MSL.

2. The Intermediate and Prairie Terraces includes most of East Baton Rouge and Livingston Parishes and upland portions of Iberville and Ascension Parishes. This landscape transitions from rural hilly older Plio-Pleistocene Terraces to flatter, mid-elevation (approximately 20 to 80 feet MSL) recent Intermediate and Prairie Pleistocene Terraces.

3. The Recent Alluvial Floodplain includes lower Livingston Parish, the remainder of Iberville and Ascension Parishes, as well as St. James Parish. This area is dominated by expansive, low-lying (approximately 1 to 5 feet MSL), alluvial floodplains filled during the recent Holocene.

Soils and Water Bottoms

Soil textures present in the study area are found in Appendix D-2, Section 2.11.

Prime and Unique Farmland

The Farmland Protection Policy Act of 1981 (FPPA) was enacted to minimize the extent that Federal programs contribute to the 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 the State, local government, and private programs and policies to protect farmland.

Under this policy, soil associations are used to classify areas according to their ability to support different types of land uses, including urban development, agriculture, and silviculture. The USDA Natural Resource Conservation Service (NRCS) designates areas with particular soil characteristics as either “Farmland of Unique Importance,” “Prime Farmland,” “Prime Farmland if Irrigated,” or variations on these designations. Prime farmland, as defined by the FPPA, is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. Farmland of unique importance is land other than prime farmland that is used for the production of specific high-value food and fiber crops, such as citrus, tree nuts, olives, cranberries, and other fruits and vegetables. A recent trend in land use in some areas has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, drought-prone, and less productive, and cannot be easily cultivated as compared to prime farmland (NRCS 2016).

No unique farmlands are located within the study area, but approximately 503,703 acres of prime farmlands are located within the study area. For land classification and acreage of prime and unique farmlands in the study area, see Appendix D-2, Section 2.11.

3.2.1.7 Water Quality

The dominant bodies of water in the ARB are the Amite River, Blind River, and Comite River. Numerous rivers and streams cross through the ARB and its hydrology is greatly affected in the lower basin because the elevation is around sea level, plus or minus a foot.

Water quality in the main channels of the ARB is influenced by non-point source agricultural runoff and by residential and commercial point sources. Water quality in the Upper ARB; however, is often quite different because of hydrological modifications from the sand and gravel mines and berms. Louisiana Department of Environmental Quality has a general permit for the Louisiana Pollutant Discharge Elimination System, which requires that "impoundments of process or mine dewatering wastewater must be surrounded by a levee of sufficient size and construction to prevent a discharge of pollutants into waters of the state." The berms must have a height of 2 feet freeboard.

Nineteen water bodies in the Amite watershed are listed as impaired for one or more designated uses in the 2016 Integrated Report of Water Quality in Louisiana. (See Appendix D-2, Table D:2-11 for the Final 2016 Integrated Report of Water Quality in Louisiana).

Most of the segments are impaired for fish and wildlife propagation and swimming. In the Amite watershed, the top five suspected causes of impairment are 1) dissolved oxygen, 2) nitrate/nitrite (nitrite plus nitrate as N), 3) fecal coliform, 4) phosphorus (Total), and 5) turbidity.

3.2.1.8 Air Quality

The U.S. Environmental Protection Agency (EPA), Office of Air Quality Planning and Standards has set National Ambient Air Quality Standards for six principal pollutants, called “criteria” pollutants. They are carbon monoxide, nitrogen dioxide, ozone, lead, particulates of 10 microns or less in size (PM-10 and PM-2.5), and sulfur dioxide. Ozone is the only parameter not directly emitted into the air, but forms in the atmosphere when three atoms of oxygen (03) are combined by a chemical reaction between oxides of nitrogen and volatile organic compounds in the presence of sunlight. Motor vehicle exhaust and industrial emissions, gasoline vapors, and chemical solvents are some of the major sources of nitrogen and volatile organic compounds, also known as ozone precursors. Strong sunlight and hot weather can cause ground-level ozone to form in harmful concentrations in the air. The Clean Air Act General Conformity Rule (58 FR 63214, November 30, 1993, Final Rule, Determining Conformity of General Federal Actions to State or Federal Implementation Plans) dictates that a conformity review be performed when a federal action generates air pollutants in a region that has been designated a non-attainment or maintenance area for one or more National Ambient Air Quality Standards. A conformity assessment would require quantifying the direct and indirect emissions of criteria pollutants caused by the Federal action to determine whether the proposed action conforms to Clean Air Act requirements and any state implementation plan.

The general conformity rule was designed to ensure that Federal actions do not impede local efforts to control air pollution. It is called a conformity rule because Federal agencies are required to demonstrate that their actions “conform with” (i.e., do not undermine) the approved State Implementation Plan for their geographic area. The purpose of conformity is to (1) ensure Federal activities do not interfere with the air quality budgets in the state implementation plans; (2) ensure actions do not cause or contribute to new violations, and (3) ensure attainment and maintenance of the National Ambient Air Quality Standards.

The ART Study Area includes several parishes in Louisiana and several counties in southwest Mississippi. Four of the Louisiana parishes are located in the Baton Rouge metropolitan area, which has been designated by the EPA as a maintenance area for ozone under the 8-hour standard effective December 27, 2016. This classification is the result of area-wide air quality modeling studies, and the information is readily available from the LDEQ, Office of Environmental Assessment and Environmental Services.

Federal activities proposed in the ozone-maintenance area may be subject to the state’s general conformity regulations as stated under LAC 33:III.14.A, Determining Conformity of General Federal Actions to State or Federal Implementation Plans. A general conformity applicability determination is made by estimating the total of direct and indirect volatile organic compound (VOC) and nitrogen oxide (NOX) emissions caused by the construction of the project. Prescribed de minimis levels of 100 tons per year per pollutant are applicable in Ascension Parish. Projects that would result in discharges below the de minimis level are exempt from further consultation and development of mitigation plans for reducing emissions.

Human Environment

Cultural and Historical Resources

Federal regulations require USACE, as an agency responsible for funds appropriated by Congress, to identify if properties are historic (listed or eligible for listing in the National Register of Historic Places (NRHP)); to assess the effects the work will have on historic properties; to seek ways to avoid, minimize, or mitigate any adverse effects to historic properties; and to evaluate the proposed action’s potential for significant impacts to the human and natural environment. The consideration of impacts to historic and cultural resources is mandated under Section 101(b)(4) of the NEPA as implemented by 40 CFR, Parts 1501-1508. Additionally, Section 106 of the National Historic Preservation Act (NHPA), as amended (54 U.S.C. § 300101 et seq.), requires Federal agencies to take into account their effects on historic properties (i.e., historic and cultural resources) and allow the Advisory Council on Historic Preservation (ACHP) an opportunity to comment. Section 106 lays out four (4) basic steps that must be carried out sequentially (i.e., “Standard” Section 106): 1) establish the undertaking; 2) identify and evaluate historic properties; 3) assess effects to historic properties; and 4) resolve any adverse effects (avoid, minimize, or mitigate). An agency cannot assess the effects of the undertaking on historic properties until it has identified and evaluated historic properties within the Area of Potential Effects (APE). The Federal agency must consult with the appropriate State Historic Preservation Officer(s) (SHPO), Tribal Historic Preservation Officer/s (THPO) and/or tribal officials, state and local governments, NFS/applicants, and other Consulting Parties in identifying historic properties, assessing effects, and resolving adverse effects, and provide for public involvement. Additionally, it is the policy of the Federal government to consult with Indian Tribal Governments on a Government-to-Government basis as required in E.O. 13175 (U.S. President 2000).

Existing Conditions

The cultural prehistory and history of southeast Louisiana and southwest Mississippi is shared with much of the southeast. The generalized Pre-Contact cultural chronology for the region according to Rees (2010:12) is divided into 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). Regionally, these periods have been further divided into sub-periods based on material culture, settlement patterns, subsistence practices, and sociopolitical organization. Specific sub-periods identified within the study area include Poverty Point, Tchefuncte, Marksville, Baytown, Troyville, Coles Creek, Plaquemine, and Mississippian. Post-Contact Period (*ca.* 1650 A.D.-present) cultural affiliations within the study area follow the thematic approach set forth in the Louisiana Division of Archaeology’s (LDOA) State of Louisiana Site Record Form (August 29, 2018) and are divided into the following temporal groups: *Historic Exploration* (1541-1803 A.D.), *Antebellum Louisiana* (1803-1860 A.D.), *War and Aftermath* (1860-1890 A.D.), *Industrial and Modern* (1890-1945 A.D.), and *Post-WWII* (1945 A.D.-present).

Archaeological Sites

Table 3-3. Historic Properties within the Study Area.

County/Parish	Building	Site	Structure	District	NHL	Archaeological Sites
Mississippi:						
Amite	18	1	—	—	—	29
Franklin	3	—	2	—	—	—
Lincoln	14	—	—	1	—	—
Wilkinson	11	3	—	2	—	1
Louisiana:						
Ascension	17	1	—	1	—	78
East Baton Rouge	67	7	2	13	2	20
East Feliciana	28	1	—	2	1	104

Iberville	21	—	1	1	—	22
Livingston	13	—	—	1	—	87
St. Helena	3	—	—	—	—	72
St. James	19	—	1	2	1	41
St. John the Baptist	14	1	—	2	1	14

Based on a review of the LDOA, *Louisiana Cultural Resources Map* (web-resource), the Mississippi Department of Archives and History (MDAH) Historic Resources Inventory Map (web-resource), and pertinent site and survey reports regarding previous investigations, CEMVN determined that approximately 468 archaeological sites (Table 3-3) are recorded within the current study area that collectively span the entire spectrum of Pre-Contact and Post-Contact archaeological components referenced above; encompassing some 10,000 years or more. It is also important to stress that many of the known sites in the study area have occupation spans encompassing more than one of the aforementioned cultural/ temporal periods, attesting to the long-ranging cultural importance of the region. Presently, no comprehensive systematic archaeological survey has been conducted throughout the entire study area and the distribution of recorded archaeological sites is largely indicative 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 region, project alternatives must also be assessed for archaeological site potential.

Archaeological Site Potential

Louisiana’s Comprehensive Archaeological Plan (Girard, et al. 2018) and research conducted by Earth Search, Inc. (Lee et al. 2009) for the *Proposed Amite River and Tributaries, Bayou Manchac Water Shed Feasibility Study, Ascension, East Baton Rouge & Iberville Parishes, Louisiana*, can be used for baseline planning purposes. To a great extent, the unique geomorphology and ecology of the study area has influenced site type and location. To examine how the physical landscape impacts the archaeological record, the LDOA divides the study area into a series of regions that follow the ecoregions classification of the Western Ecology Division of the U.S. Environmental Protection Agency (Daigle et al. 2006). There are six Regions at Level III, three of which fall within the present study area (Southern Coastal Plain, Mississippi Valley Loess Plain and Mississippi Alluvial Plain). All three Level III Regions are then further divided into sub-regions (Level IV: Southern Rolling Plains, Baton Rouge Terrace, Gulf Coast Flatwoods, Inland Swamps, and Southern Holocene Meander Belts). Girard, et al. (2018: 24-31) define how the unique environmental, biological, and physiological characteristics of each region influenced cultural development in order to provide context to the distribution of where sites are likely or unlikely to occur. Complimentary to Girard, et al.’s (2018) ecosystem-based model (above), Lee et al. recommend:

> *It is essential that investigations be conducted in the fullest consideration and effective integration of available knowledge of landscape dynamics. In doing so,*

> *surveys can be designed to provide adequate assessment of all areas, but with greater attention and effort focused on areas that would have been relatively more favorable for prehistoric occupation. Of greater importance, it avoids the expenditure of resources in areas where existing knowledge of geomorphic processes and landscape evolution indicates with confidence that prehistoric activities were precluded or where subsequent natural processes have destroyed the evidence…Geomorphologic data, previous archaeological investigations, and previously recorded sites will constitute the primary data sets utilized in the predictive model. Landform type, elevation, and soils will also be utilized to construct the predictive model. These data will be integrated to determine high probability areas within the riverine and upland portions of the project area*.

Geospatial modeling of cultural landscapes for predictive scientific research is an important and rapidly developing approach in archaeology. Depending on the scale of the final array of project alternatives, it may be advantageous to develop a geospatial predictive model based upon the work of Girard, et al. (2018) and Lee et al. (2009) that incorporates the accumulated environmental and archaeological information specified above as a means to forecast the probability of significant archaeological sites occurring in any particular location that can further be used to guide efficient identification and evaluation strategies.

U.S. Civil War

The study area is also the setting of at least 11 terrestrial and naval Civil War battles ranging from small skirmishes to major decisive battles. The NPS's American Battlefield Protection Program (ABPP; 54 U.S.C. 380101-380103), Civil War Sites Advisory Commission (Public Law 101-628) has assigned Preservation Priorities ((http://npshistory.com/publications/battlefield/cwsac/report.pdf) to five individual battlefields located within the Study Area: Magnolia Cemetery (East Baton Rouge: Priority IV.1), Donaldsonville 1862 (Ascension Parish; Priority IV.2), Donaldsonville 1863 (Ascension Parish; Priority IV.2), Cox's Plantation (Ascension Parish; Priority IV.1), and Port Hudson (East Baton Rouge Parish and East Feliciana Parish: Priority I.1).

Louisiana Scenic Rivers Act

The LDWF is the lead state agency in the State Scenic River Program. Archaeological resources within scenic river corridors are protected by law under the Louisiana Scenic Rivers Act of 1988 (LSRA). The current Study Area includes the following Louisiana Natural and Scenic Rivers: the Amite River, Comite River, Blind River, and Bayou Manchac. In addition to the extra protections afforded to cultural resources under the LSRA, Bayou Manchac from the Amite River to the Mississippi River is designated as a "Historic and Scenic River," which requires that "full consideration shall be given to the detrimental effect of any proposed action upon the historic and scenic character thereof, as well as the benefits of the prosed use."

Next Steps

No determination of effect under the NHPA pursuant to 36 CFR 800.4(d) is being made at this time. As an alternate to the “Standard Section 106” process described above, in partial fulfillment of its Section 106 responsibilities, CEMVN has initiated consultation to negotiate a Programmatic Agreement (PA) that sets out the measures CEMVN will implement to resolve adverse effects through avoidance, minimization, and/or mitigation (36 CFR § 800.14(b)). A PA is appropriate when the undertaking is complex; the undertaking will adversely affect a significant historic property; the extent of effects is unknown; there is public controversy; and/or the parties involved overwhelmingly prefer it. The goal of this Section 106 consultation is to provide a framework for addressing this undertaking and establish protocols for continuing consultation with SHPO(s), Federally-Recognized Tribal governments, and other stakeholders. The PA would identify Consulting Parties, define applicability, establish review timeframes, stipulate roles and responsibilities of stakeholders, include procedures for consultation with Federally-Recognized Tribes, consider the views of the SHPO/THPO(s) and any other Consulting Parties, afford for public participation, develop programmatic allowances to exempt certain actions from Section 106 review, outline a standard review process, determine an appropriate level of field investigation to identify and evaluate historic and determine the potential to affect historic properties and/or sites of religious and cultural significance, streamline the assessment and resolution of adverse effects to historic properties through avoidance, minimization, and programmatic treatment approaches for mitigation, establish reporting frequency and schedule, provide provisions for post-review unexpected discoveries and unmarked burials, and incorporate the procedures for amendments, duration, termination, dispute resolution, and implementation. The PA would then govern CEMVN’s subsequent NHPA compliance efforts. Following the execution of a PA, the Chief of Engineers may then proceed with making a final decision on the project and issuing a Finding of No Significant Impact (FONSI) in compliance with NHPA and NEPA.

3.2.1.9 Aesthetics

The majority of the study area is within the ARB, which constitutes a mosaic of forest, pine plantations, pasture, and cropland. The primary land-use in the area is agriculture. The Amite River flows South from the Mississippi Valley Loess Plains Ecoregion and into the Mississippi Alluvial Ecoregion. The dominant natural vegetation in the northeast consists of upland forests dominated by oak, hickory, and both loblolly and shortleaf pine. The dominant natural vegetation in the northwest consists of forests characterized by beech, southern magnolia, and American holly. The dominant natural vegetation in the south consists of inland swamps and ridges (according to the State of Louisiana Eco-Region Map, ref. "Louisiana Speaks" and “USGS Eco-Region Map,” Daigle, J.J., Griffith, G.E. Omernik, J.M., Faulker, P.L., McCulloh, R.P., Handley, L.R., Smith, L.M., and Chapman, S.S., 2006, Ecoregions of Louisiana color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey (map scale 1:1,000,00).”

From an aesthetic perspective, the inland swamps in the south have a fairly dense canopy constituted by bald cypress and water tupelo trees. The majority of the bald cypress are rarely the mature and majestic specimens as they once were due to logging operations in the early 1900s. The heavily shaded swamp understory is composed primarily of red maple and green ash. The ground is hard bottom. The tranquil swamps are perennially wet and the water is clear. These swamp areas are often difficult to access and are generally viewed into from roadway edges, waterways, and natural ridges. The ridges are small rises in the inland swamp and are typically occupied by Water Oak, Diamond Oak, Sweetgum, Ash, Wax Myrtle, Black Willow, Chinese Tallow, and Privet. The ridges provide a dryer and slightly more accessible setting in contrast to the surrounding darkness and wetness of the inland swamps for hunters, nature observers, bird watchers, and ecologists.

Numerous efforts have been made to protect and promote visual resources within the ARB that are known for their unique culture and natural identity. One of these efforts, made by the Louisiana Department of Culture, Recreation & Tourism, is for marketing scenic byways thru rural landscape and culturally significant communities. There is a Scenic Byway bordering the study area on the south and east, which includes the Great River Road. This is but one segment to an overall scenic byway that stretches on multiple thoroughfares from Canada to the Gulf of Mexico. It is state and federally designated and has an “All American Road” status, making it significant in culture, history, recreation, archeology, aesthetics, and tourism.

In 1970, the Louisiana Legislature created the Louisiana Natural and Scenic Rivers System. The System was developed for the purpose of preserving, protecting, developing, reclaiming, and enhancing the wilderness qualities, scenic beauties, and ecological regimes of certain free-flowing Louisiana streams. These rivers, streams and bayous, and segments thereof, are located throughout the state and offer a unique opportunity for individuals and communities to become involved in the protection, conservation and preservation of two of Louisiana's greatest natural resources: its wilderness and its water. Within the study area, there are four designated Louisiana Natural and Scenic Rivers (RS 56:1857). The Amite River from the Louisiana-Mississippi state line to La. Hwy. 37 in East Feliciana Parish; the Blind River from its origin in St. James Parish to its entrance into Lake Maurepas; the Comite River from the Wilson-Clinton Hwy. in East Feliciana Parish to the entrance of White Bayou in East Baton Rouge Parish; and Bayou Manchac from the Amite River to the Mississippi River is designated as a Louisiana Historic and Scenic River (RS 56:1856).

“The general purpose of the Louisiana Scenic Rivers Act as it applies to the Amite River is to protect this section of river from channel modifications, protect water quality and habitats, and preserve recreational and scenic aspects of this river. Many of the Amite River reaches upstream and downstream of Grangeville have experienced significant mining activity and are neither natural nor scenic.” (ERDC/GSL TR-07-26, 2007, Page 12) Since 2007, LDWF has made efforts to halt in-stream mining and relocate mining sites further off the channel. While not pristine, the river remains natural and scenic in many of those reaches.

3.2.1.10 Recreation

Opportunities for both consumptive and non-consumptive recreational activities in the study area are centered on natural resources. Consumptive recreational activities in the area include hunting and fishing. Non-consumptive recreational activities include hiking, canoeing, boating, biking, ATV riding, camping, outdoor photography, wildlife observation, and environmental education/interpretation.

The following public recreation areas, both within and near the study area, provide high quality recreational opportunities: Homochitto National Forest, Caston Creek Wildlife Management Area (WMA), Maurepas Swamp WMA, Waddill Outdoor Education Center, and multiple county-wide park and recreation systems. Table 3-4 highlights the extensive network of recreation resources within the study area currently established at the public level.

Table 3.4. Recreational Resources within the Study Area

Public Area	Size (acres)	Parish / County	Managing Agency	Recreation		Boat Launch	Recreational Highlights
				Consumptive	Non-consumptive		
				National Forest			
Homochito National Forest	191,846	Amite, Franklin, Lincoln, Wilkinson	United States Department of Agriculture Forest Service	fishing, hunting	Horseback riding, hiking, picnicking, mountain biking, birding, photography, camping, shooting range	Yes	This National Forest is just outside the project area border to the northwest and includes 5.5 mile Bushy Creek Horse Trail, Clear Springs Recreation Area, Okhissa Lake Recreation Area with boat ramps, Woodman Springs Shooting Range
				State Wildlife Refuge			
Caston Creek WMA	28,286	Amite, Franklin	Mississippi Department of Wildlife, Fisheries& Parks	Fishing, hunting	Horseback riding, hiking, picnicking, mountain biking, birding, photography, camping	No	This WMA is just outside the project area border to the northwest and within Homochito National Forest. It offers scenic horseback trails as well as various hiking and biking trails for the avid outdoorsmen or the novice adventurer.
Maurepas Swamp WMA	124,567	Ascension, Livingston, St. James, St. John the Baptist	Louisiana Department of Wildlife and Fisheries	fishing, hunting, trapping	Boating, camping, birding, wildlife viewing	No	Bald eagles and osprey nest in and around the WMA. Numerous species of neotropical migrant birds use this coastal forest habitat during fall and spring migrations. Resident birds, including wood ducks, black-bellied whistling ducks, egrets, and herons can be found on the WMA year-round.
Waddill Outdoor Education Center	237	East Baton Rouge	Louisiana Department of Wildlife and Fisheries	fishing,	Nature trails, birding, shooting range, archery range, picnic facilities	No	Accessible via North Flannery Road or by boat from the Comite River. LDWF initiated a Summer Day Camp for children ages 12 to 16 in the summer of 2011. The camp is free and open for 5 days allowing participants to receive official boater and hunter education certifications. The camp also offers a fish identification class, fishing and canoeing, skeet shooting, and other outdoor related activities.
				Parish/County Park System			
Ascension Parish Parks	N/A	Ascension	Ascension	N/A	Ballfields, courts, playgrounds, leisure paths, swimming pools, picnic areas	Yes	The parish has 13 parks within the study area in communities including St. Amant, Gonzales, Prairieville, and Geismar

Recreation and Park Commission for the Parish of East Baton Rouge (BREC)	N/A	East Baton Rouge	BREC	N/A	Horseback riding, hiking, picnicking, mountain biking, birding, photography, camping, shooting range	Yes	BREC has more than 180 parks including a unique mix of facilities, which mirror the history and rich natural resources in the region; including a state-of-the-art observatory, a swamp nature center and conservation areas, a performing arts theatre, an equestrian park, an art gallery, an arboretum, an accredited zoo, seven golf courses and an extreme sports park with a 30,000-foot concrete skate park, rock-climbing wall, BMX track, and velodrome.
Livingston Parish Parks	N/A	Livingston	Livingston	N/A	Ball field, courts, pools, leisure paths, picnic areas	No	The parish has parks within the study area in communities including Greenwell Springs, Walker, Parks and Recreation of Denham Springs (PARDS), and Livingston Parks and Recreation (LPR).
St. James Parish Parks	N/A	St. James	St. James Parish Parks and Recreation	N/A	Ball fields, courts, playgrounds, leisure paths, swimming pools	No	The parish has 4 parks within the study area including Gramercy Park, Lutcher Park, Paulina Park, and Romeville Park,
St. John Parish Parks	N/A	St. John the Baptist	St. John the Baptist	N/A	Ball fields, courts, playgrounds, leisure paths, swimming pools, picnic areas	No	The parish has 8 parks within the study area: Ezekiel Jackson, Regala, Belle Pointe, Emily C. Watkins, Greenwood, Cambridge, Stephanie Wilking, and Hwy. 51 Park

According to the United States Department of the Interior National Park Service Land & Water Conservation Fund (L&WCF), 100 recreation projects within the study area have been supported since 1965. 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. Table 3-5 illustrates funding from the L&WCF within the study area.

Table 3-5. L&WCF Grant Funding within the Project Area

Grants	Parish/County	Amount
2	Amite	$73,181.00
1	Wilkinson	$20,000.00
20	Ascension	$1,542,343.00
51	East Baton Rouge	$2,694,127.00
2	Iberville	$349,295.00
19	Livingston	$2,208,956.00
4	St. James	$367,093.00

1	St. John the Baptist	$128,027.00
100	**Total**	**$7,383,022.00**

Source: https://lwcf.tplgis.org/mappast/

3.2.1.11 Environmental Justice

An Environmental Justice (EJ) analysis focuses on the potential for disproportionately high and adverse impacts to minority and low-income populations during the construction and normal operation of the Federal action, in this case, the proposed flood risk-reduction system alternatives: the Non-Structural plan. The EJ assessment identifies environmental and demographic indicators for the project alternatives, using the NHGIS Tool which is a U.S. Census data mapping tool providing similar demographic data as EJSCREEN. Low-income and minority data are the criteria used to identify areas of EJ concern. EJSCREEN and CEQ's Climate and Economic Justice Screening Tool (CEJST) area also used to identify areas of EJ concern.

If an alternative impact is appreciably more severe or greater in magnitude on areas of EJ concern (minority or low-income populations) than the adverse effect suffered by the non-minority or non-low-income populations after taking offsetting benefits into account, then there may be a disproportionate finding. Avoidance or mitigation are then required. The following subsections provide information on the low-income and minority population in Ascension, East Baton Rouge, East Feliciana, Iberville, Livingston, St. Helena, St. James, and St. John the Baptist Parishes in Louisiana and the Mississippi Counties of Amite, Franklin, Lincoln, and Wilkinson.

Methodology

EJ is the fair treatment and meaningful involvement of all people regardless of race, color, national origin or income regarding the development, implementation and enforcement of environmental laws, regulations, and policies, with no group bearing a disproportionate burden of environmental harm, and risks. Executive Order (EO) 12898 directs federal agencies to identify and address any disproportionately high adverse human health or environmental effects of Federal actions to minority and/or low-income populations. Areas of EJ concern are identified to help inform planners as to the location of those areas needing a particular focus and attention when determining the impacts of the federal action, as described in EO 12898. Federal agencies should assess the effects of their projects on communities with Environmental Justice concerns in accordance with EO 12898: Environmental Justice, 1994 and EO 14008, Tackling the Climate Crisis at Home and Abroad, 2021. For USACE, compliance with these Executive Orders is mandatory pursuant to Section 112(b)(1) of WRDA 2020 (Public Law 116-260). ("In the formulation of water development resources projects, the Secretary shall comply with any existing Executive Order regarding environmental justice . . . to address any disproportionate and adverse human health or environmental effects on minority communities, low-income communities, and Indian Tribes."). For purposes of consistency with EO 12898, Federal Actions to

Address Environmental Justice in Minority Populations and Low-Income Populations, the terms “minority populations” and low-income populations” are used in this document.

For a detailed description of the methodology used to identify low-income and minority areas that comprise the areas of EJ concern and the focus of the EJ analysis, refer to the EJ Appendix D-4.

Existing Conditions

Justice40 Initiative

The Council on Environmental Quality (CEQ) developed the Climate and Economic Justice Screening Tool (CEJST) to assist in identifying economically-disadvantaged communities. The CEJST utilizes several burdens that qualify a census tract as disadvantaged. Burden categories in CEJST include housing, health, climate change, energy, legacy pollution, transportation, water/wastewater infrastructure, and workplace development. In order for a tract to be considered disadvantaged, it must be at or above the 90th percentile in one or more burdens and be at or above the 65th percentile for low income. Detailed methodology can be found on the CEJST website.

Out of 146 census tracts in the ART study area, 57 are historically burdened by a CEJST burden category. These identified communities would be impacted disproportionately by inundation events as they may not have the resources to recover from the impacts or be able to properly mitigate prior to the event. Refer to Appendix G, Economic and Social Considerations, Section 7.2.6 for more information on Justice40.

For the EJ assessment, two different geographies are presented and both identify areas of EJ concern, based upon minority and low-income criteria. The first presents data for Parishes and Counties which gives a broad-brush overview of the study area’s minority and low-income demographics. Twelve parishes and counties in Louisiana and Mississippi, respectively comprise the ART study area, including Ascension, East Baton Rouge, East Feliciana, Iberville, Livingston, St. Helena, St. James and St. John the Baptist Parishes in Louisiana and in Mississippi, Amite, Franklin, Lincoln and Wilkinson Counties. Table D4-1 in Appendix D-4 shows the racial composition for the Louisiana parishes and Mississippi counties, respectively in the study area. Seven of the twelve parishes or counties in the study area including East Baton Rouge, East Feliciana, Iberville, St. Helena, St. James and St. John the Baptist Parishes as well as Wilkinson County, MS, meet or exceed the minority thresholds and are identified as EJ areas of concern. The minority threshold for Louisiana is 48.5 percent and for Mississippi is 50 percent.

For more information on minority populations, refer to the EJ Appendix D-4.

Six of the 12 Parishes/Counties in the study area, including Iberville and St. Helena Parishes in Louisiana and Amite, Franklin, Lincoln and Wilkinson Counties in Mississippi exceed the poverty threshold of individuals living below poverty relative to each State’s poverty percentage, 18.8 percent and 19.4 percent respectively (Appendix D-4, Table D4-3). These six parishes/counties are identified as areas of EJ concern based upon meeting the poverty criteria.

The Parishes and Counties exceeding the minority OR poverty thresholds are identified as areas of EJ concern from a large-scale perspective. In total, 10 of the 12 parishes/counties in the study area meet or exceed the minority OR poverty criteria and are identified as areas of EJ concern.

For more information on low-income populations, refer to Appendix D-4.

However, the second geographic approach provides a more zoomed in geographic scale, at the Census Block Group level, which shows the areas of EJ concern based upon minority and poverty thresholds being exceeded--at this smaller geographic scale. A more zoomed in perspective provides an opportunity to identify impacts from the proposed action to smaller communities. U.S. Census Block Groups are much smaller geographic areas compared to parishes or counties. Census Block Groups are smaller geographic areas made up of Census Blocks (the smallest geographic area for which U.S. Census data is available).

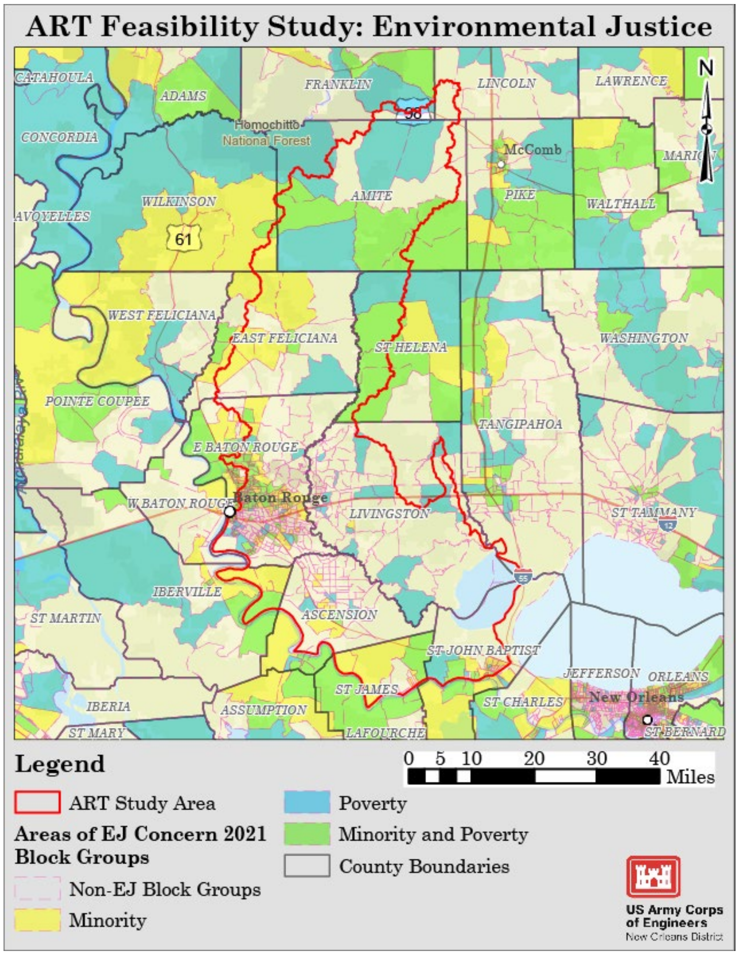

Figure 3-1. Areas of EJ Concern, ART Study Area

Polygon shapefiles shown on the maps in the EJ sections of the main report and attribute data used in the EJ analysis are from Steven Manson, Jonathan Schroeder, David Van Riper, Tracy Kugler, and Steven Ruggles. IPUMS National Historical Geographic Information System: Version 16.0 [dataset]. Minneapolis, MN: IPUMS. 2021. http://doi.org/10.18128/D050.V16.0

A closer look at the study area reveals pockets of neighborhoods with EJ concerns located in Census Block Groups within the parishes and counties. The colored polygons in Figure 3-1 depict the U.S. Census Block Groups in the study area that are identified as areas of EJ concern because they meet or exceed the criteria for minority (yellow), low-income or poverty (blue) or both low-income and minority (green) criteria.

Just under 800,00 people live in the ATR study area, defined as the population in Louisiana and Mississippi block groups within or intersecting the ATR study area. The vast majority are in Louisiana. Just over 380,000 of the ART study area population live in areas of EJ concern.

About 150,000 residents live in EJ areas identified as meeting both minority and poverty criteria, roughly 160,000 are in EJ areas identified as meeting just the minority threshold while the remainder, about 73,000 people, live in EJ areas identified using the poverty criteria.

The Census Block Groups shown on Figure 3-1 represent the areas of EJ concern in the ART study area and are the focus of the EJ impacts assessment which will identify adverse and beneficial effects from the federal action, described in Chapter 5.

EJSCREEN uses environmental and demographic indicators to help identify EJ areas of concern. If an EJ area's exposure to the environmental indicators is above the 80th percentile in the state or the nation and the Federal action exacerbates any of those environmental risks, a potential disproportionate impact may occur. The EJ Environmental Indexes are presented in Table D4-4 in Appendix D-4. Five of the indexes are at or above the 80th percentile as compared to Louisiana or the USA and include Particulate Matter, Ozone, Air Toxics Cancer Risk, Toxic Releases to Air, and Wastewater Discharge

EJ outreach meetings

Meetings took place for the Amite River and Tributaries Feasibility Report Environmental Impact Statement on February 28, 2023, and March 1, 2023 to inform and engage residents about the flood risk reduction measures, which included the Nonstructural Plan.

Outreach efforts focused on civic and faith-based organizations that serve residents in areas of EJ concern, including local churches, libraries, non-profits, and community center. Initial and follow-up calls were made to 29 churches, four community center, three non-profits, and three academic institutions. Of those contacted, six churches, two community centers and two non-profits agreed to disseminate our one-page project summary to the residents they serve. More information on the EJ meetings is provided in Appendix D-4.

3.2.1.12 Socioeconomics

Table 3-6, 3-7, and 3-8 display the population, number of households, and the employment (number of jobs) for each of the parishes and counties for the years 2000, 2010, and 2017 as well as projections for the years 2025 and 2045. The 2000 and 2010 population, number of households, and employment is based on estimates from the 2010 U.S. Census and the projections were developed by Moody's Analytics (ECCA) Forecast, which has projections to the year 2045.

Table 3-6 Historical and Projected Population by Parish/County

Parish/County	2000	2010	2017	2025	2045
Ascension	76,627	107,215	122,948	136,988	161,973
East Baton Rouge	412,852	440,171	446,268	441,495	415,720
East Feliciana	21,360	20,267	19,412	18,140	15,910
Iberville	33,320	33,387	33,027	31,166	27,428
Livingston	91,814	128,026	138,228	150,306	166,260
St. Helena	10,525	11,203	10,363	9,681	8,592
St. James	21,201	22,006	21,790	22,599	23,727
St. John the Baptist	43,248	45,621	44,078	45,713	47,995
Amite	13,599	13,131	12,447	11,992	11,680
Franklin	8,448	8,118	7,765	7,517	7,476
Lincoln	33,166	34,869	34,347	35,400	36,479
Wilkinson	10,312	9,878	8,804	8,335	7,823
Total	776,472	873,893	899,477	919,332	931,063

Sources: 2000, 2010, 2017 from U.S. Census Bureau; 2025, 2045 from Moody's Analytics (ECCA) Forecast

Table 3-7. Projected Households by Parish/County

Parish/County	2000	2010	2017	2025	2045
Ascension	26,995	38,050	44,890	51,815	66,244
East Baton Rouge	156,740	172,440	179,910	184,008	186,082
East Feliciana	6,694	6,996	6,922	6,752	6,411
Iberville	10,697	11,075	11,229	11,137	10,643
Livingston	32,997	46,297	52,184	57,891	69,149
St. Helena	3,890	4,323	4,116	3,995	3,810
St. James	7,002	7,691	7,945	8,561	9,727
St. John the Baptist	14,381	15,875	16,005	17,249	19,602
Amite	5,261	5,349	5,213	5,149	5,252
Franklin	3,205	3,214	3,118	3,138	3,272
Lincoln	12,563	13,313	13,682	14,272	15,446
Wilkinson	3,584	3,452	3,236	3,097	3,065
Total	284,008	328,074	348,450	367,063	398,703

Sources: 2000, 2010 from U.S. Census Bureau; 2017, 2025, 2045 from Moody's Analytics (ECCA) Forecast

Table 3-8. Projected Employment by Parish/County

Parish/County	2000	2010	2017	2025	2045
Ascension	36,431	49,414	59,670	65,803	82,614
East Baton Rouge	197,789	205,112	227,301	222,833	222,810
East Feliciana	7,811	7,427	7,866	7,321	6,820
Iberville	11,745	12,622	13,661	12,892	12,054
Livingston	42,326	56,675	66,010	70,000	82,219
St. Helena	3,830	4,097	4,171	3,868	3,649
St. James	8,102	8,949	8,940	9,257	10,448
St. John the Baptist	18,702	19,252	18,794	19,479	21,968
Amite	5,274	4,385	4,206	4,023	4,082
Franklin	3,234	2,866	2,721	2,650	2,747
Lincoln	13,981	12,940	13,614	13,749	14,784
Wilkinson	3,239	2,968	2,610	2,404	2,343
Total	352,463	386,704	429,564	434,280	466,538

Sources: 2000, 2010 from U.S. Bureau of Labor Statistics; 2017, 2025, 2045 from Moody's Analytics (ECCA) Forecast

Table 3-9 shows the per capita personal income levels for the 12 parishes and counties for the years 2000, 2010, 2017, and 2025, with projections provided by Moody's Analytics Forecast.

Table 3-9. Per Capita Income ($) by Parish/County

Parish/County	2000	2010	2017	2025
Ascension	24,052	39,416	47,628	60,180
East Baton Rouge	27,228	39,651	48,120	60,048
East Feliciana	20,049	33,122	39,908	53,331
Iberville	18,681	32,342	38,960	50,288
Livingston	21,521	32,621	39,883	51,341
St. Helena	16,821	34,136	41,273	55,046
St. James	18,722	38,421	45,219	60,576
St. John the Baptist	20,002	33,894	41,505	57,423
Amite	17,923	25,620	32,225	41,711
Franklin	15,844	27,175	33,133	42,441
Lincoln	20,257	30,468	36,895	44,607
Wilkinson	14,667	24,322	28,745	37,916

Sources: 2000, 2010 from U.S. Census Bureau; 2017, 2025 from Moody's Analytics (ECCA) Forecast

3.2.1.13 Other Social Effects

In accordance with the USACE Institute for Water Resources (IWR) handbook in Applying OSE in Alternatives Analysis (USACE, 2013), the CEMVN identified six themes to describe the social impact in the study area. The six social factors include:

- Social Vulnerability & Resiliency
- Health & Safety
- Economic Vitality
- Social Connectedness
- Participation
- Environmental Justice – Justice 40 Initiative

3.3 FUTURE WITHOUT PROJECT CONDITIONS

NEPA requires that, in analyzing alternatives to a proposed action, a federal agency must consider an alternative of "no action." The future-without-project (FWOP) conditions apply to when the proposed action would not be implemented and the predicted additional environmental gains (e.g. flood risk reduction) would not be achieved. The FWOP conditions would include lower tax revenues as property values decline due to higher risk of damage from flooding events over time. Higher risk of damage from flooding could manifest itself in higher premiums for flood insurance under FEMA's National Flood Insurance Program.

Higher premiums are expected to increase the cost of property ownership and result in correspondingly lower market values.

Without implementation of the proposed action, other federal, state, local, and private restoration efforts may still occur within or near the proposed project area. Section 1.5 of the SSDIFR/EA discusses ongoing programs and potential projects in the study area for floodplain related activities. None of the proposed projects are currently in construction and if they were implemented, would have only localized flood risk reduction within the study area. The projects/programs would have the potential to reduce the number of eligible structures for the nonstructural portion of the TSP.

Section 1.5.1 details current projects in and around study area. The Comite River Diversion, which is currently under construction, will be located approximately 20 river miles upstream of the confluence of the Comite and Amite Rivers (Figure 1-1). The project will divert water from the Comite River west to the Mississippi River, between the cities of Zachary and Baker, providing urban flood damage risk reduction.

Section 4
Formulation of Alternatives

Plan formulation supports the USACE water resources development mission. A systematic and repeatable planning approach is used to ensure that sound decisions are made. The Principles and Guidelines describe the process for Federal water resource studies. It requires formulating alternative plans that contribute to Federal objectives. Alternative plans are a set of one or more management measures functioning together to address one or more planning objectives. A management measure is a feature or activity that can be implemented at a specific geographic site to address one or more planning objectives.

The initial plan formulation strategy was to focus on regional solutions (e.g., dams, detention basin, and diversion) followed by formulation based on economics damage centers (e.g., where the greatest consequences are) minimizing life loss, and/or more local protection. These measures/alternatives were developed based on previous reports and studies, NFS information, stakeholder/public input, new hydrology and hydraulics, geotechnical assessments, and professional judgment. This section also describes the plan formulation process to identify the TSP, which includes development of cost estimates and economic analysis.

4.1 MANAGEMENT MEASURES AND SCREENING

The ARB primarily has flooding from two different sources. The upper basin flooding is caused from headwater flooding from rainfall events. The lower basin flooding is caused by a combination of drainage from headwaters and backwater flooding from tides, wind setup as well as flooding from tropical coastal storm events. Thirty-four nonstructural and structural management measures of a variety of scales were identified for evaluation to reduce the risk of flood damages within the ARB (Table 4-1). The measures were evaluated by the screening process based on the planning objectives, constraints, as well as the opportunities and problems of the study/project area.

Nineteen measures were carried forward to develop the alternative plans. Section 2 of Appendix F provides a description of the evaluation.

Table 4-1. Management Measures

Measure ID	Description
RW-1	Dredging of Outfall @ Amite River
RW-2	Dredging of Lower Amite River
RW-3	Dredging of Upper Amite River
RW-4	Dredging of Bayou Manchac
RW-5	Bridge Restrictions/ Improvements for I-12
RW-6	Amite River Channel Bank Gapping
RW-7	Storage Area at Spanish Lake, Ascension/Iberville Parish
RW-8	Hwy 22 and Port Vincent Bridge Drainage Improvements
RW-9	Upper Amite Bridge Restrictions/ Improvements
RW-10	Bayou Conway Pump to Mississippi River
RW-11	Diversion Gravity Fed (Manchac)
RW-12	Diversion Pump Station (Manchac)
RW-13	Diversion Gravity Fed (Union)
RW-14	Diversion Pump Station (Union) with conveyance channel
RW-15	Diversion Gravity Fed (Romeville)
RW-16	Diversion Pump Station (Romeville) with conveyance channel
RW-17	Modifications to Comite Diversion
RW-18	Dredging of Outfall @ Blind River
RW-19	Dredging of Lower Blind River
RW-20	Dredging of Colyell Creek
RW-21	Amite River Diversion Channel Bank Gapping
RW-22	Dredging of Lake Maurepas
HW-1	0.01 AEP Dry Dams-Upper Amite Tributaries
HW-2	Small Dry Dams on Amite River -Upper Amite
HW-3	Reservoirs along Bayou Manchac
HW-4	Flood Gate at Blind River Hwy 61
HW-5	Dry Retention Ponds- Lower Amite
HW-6	Closures at Tidal Passes
HW-7	University Lakes as Reservoir
UL-1	Large Scale Dam -Upper Amite (i.e. Darlington 0.04 AEP)
NS-1	Flood warning/Monitoring systems
UL-2	Dredging of Amite River Tributaries
NS-2	Nonstructural Improvements for high frequency events
FS-1	Ring Levees around Critical Facilities

Note: Shaded cells are measures that were not carried forward during the screening process.

4.2 DEVELOPMENT OF INITIAL ARRAY OF ALTERNATIVE AND SCREENING

Fifteen alternatives were assembled through the plan formulation process, which include alternatives for no action and nonstructural (Table 4-2). The alternative plans were initially identified using one or more of the 19 management measures that were carried forward after the screening evaluation. Two additional alternatives were identified through public scoping, as discussed in Section 2.4.

The alternatives comprised of the FRM concepts are:

- Remove Water (RW) = removing water more quickly out of the ARB
- Hold Water (HW) = during heavy rainfall events, water would be held back from flowing down the ARB until water levels drop to reduce the flood risk
- Nonstructural (NS) = does not modify or restrict the natural flood
- Upper and Lower Basin (UL) = alternative that likely results in reduced flood risk for the entire ARB.
- Focused Structural (FS) = measures to protect critical facilities.

Most alternatives assessed had very little reduction in flood risk and limited benefits. The less frequent AEP events (25 years and up) cause the majority of flooding issues in the ARB. The rainfall events, combined with a steep hydraulic gradient from the headlands of the basin to the flat middle and lower basins (Figure 4-1), provide for a significant backwater effect at the lower end of the system at Lake Maurepas. Once the water accumulates and backs up, it can no longer exit the basin and the basin begins to fill. This unique hydrology was evaluated with numerous measures and alternatives that resulted in primarily shifting water from one place to another within the damage areas while not reducing the backwater effect and thus not allowing water to drain from the basin. In essence, other alternatives could not get to the core of the issues because they were not removing water from the hydraulic budget. Because water backs up into the watershed, water surface elevations did not lower in specific areas or overall. This, in turn, did not allow for significant lowering of water surface elevation in damage areas. The parishes in the study area have a combined population of about 900,000 with more than half of the population living in East Baton Rouge Parish. The study area has over 260,000 structures and of those, about 80 percent are in the central portion of the ARB, north of Bayou Manchac. Many of the alternatives, such as channel improvements and diversions, were located where there were not many structures, so there were limited benefits. The remaining alternatives that were not screened, were those that provided storage of water to attenuate flooding downstream in heavily developed areas. Those alternatives are the focused array of alternatives.

In compliance with the Water Resources Development Act of 2016 (WRDA, 2016) Section 1184, engineering with nature was considered. Alternatives 14 and 15 are nature-based features; however, they were screened due to limited flood risk reduction benefits as discussed in Appendix F.

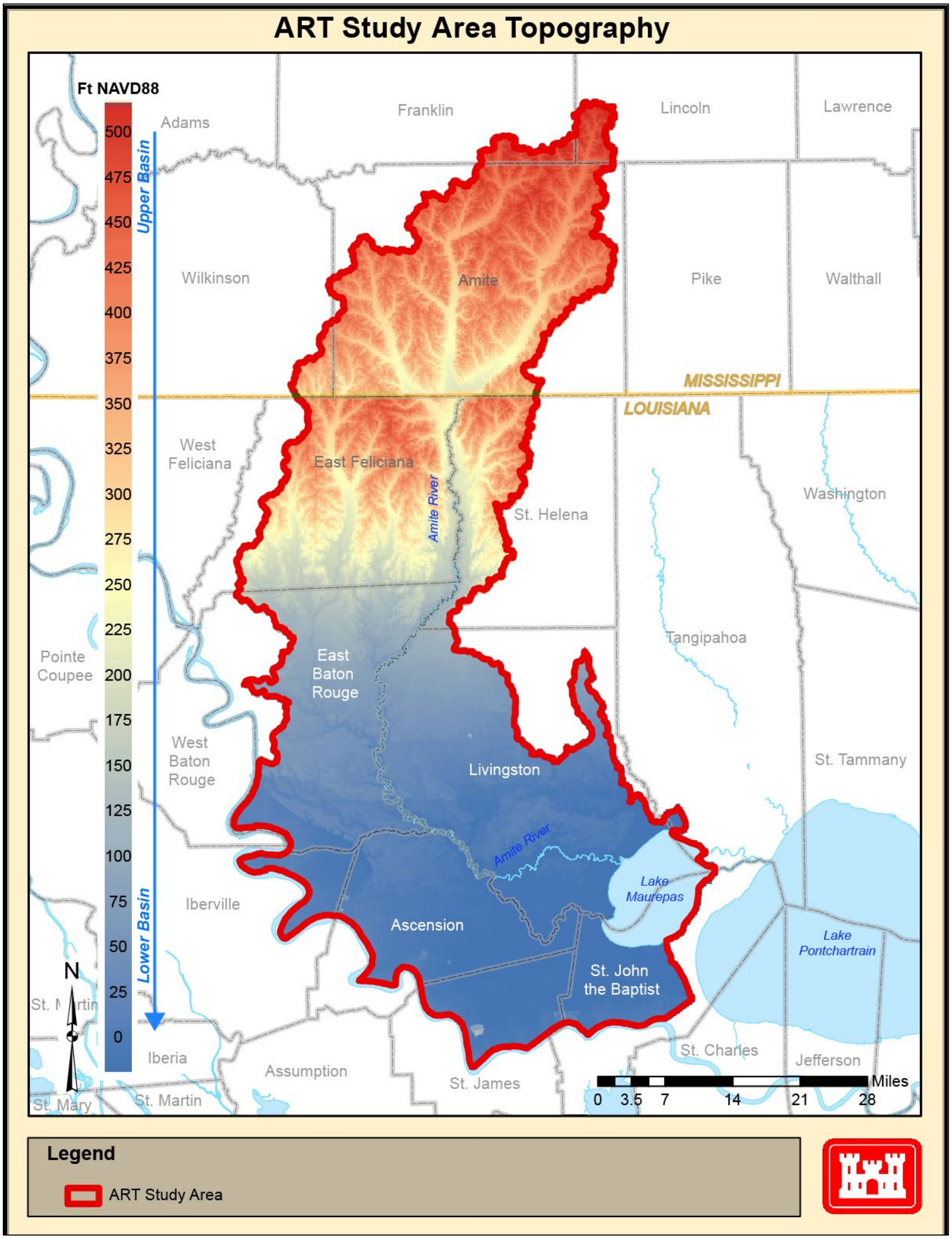

Figure 4-1. ARB Topographic Digital Elevation Model (Source: Louisiana Oil Spill Coordinators Office 2001)

Table 4-2. Alternatives

Alt ID	Measures Included	Alternative Description
Alt 1	No Action	No action would be taken under this plan. Damages would continue into the future.
Alt 2	RW-1+RW-2	Dredging of the Amite River outfall (RW-1) and in the lower reaches of the Amite River (RW-2)
Alt 3	RW-6	Lower Amite River Channel Bank Gapping (RW-6)
Alt 4	RW-8	Hwy 22 and Port Vincent Bridge drainage improvements (RW-8)
Alt 5	HW-3+ RW-4	Dredging (RW-4) and storage along Bayou Manchac in multiple small reservoirs (HW-3)
Alt 6	RW-7+NS-2+FS-1	Flood gate at Airline Hwy, Pump to MS River, open flood gates at Turtle and Alligator Bayous (RW-7) with the addition of nonstructural measures (NS-2) and ring levees for residential communities and critical infrastructure (FS-1)
Alt 7	RW-5+RW-9	Reduction of flow restrictions from bridges at I-12 (RW-5) and above I-12 (RW-9)
Alt 8	RW-3	Dredging of the Upper and Central Amite Basin, above I-12 (RW-3)
Alt 9	HW-7	University Lakes as reservoirs (HW-7)
Alt 10	HW-1	0.01 AEP Dry Dams along tributaries (HW-1)
Alt 11	HW-2	Small dry dams on the Amite River (HW-2)
Alt 12	UL-1	Large scale 0.04 AEP dam (UL-1) (wet or dry)
Alt 13	NS-1+ NS-2	Nonstructural (NS-1 and NS-2) (0.04 and .02 AEP floodplains)
Alt 14	None	Conversion of sand and gravel mines in the Amite Riverine to bottomland hardwood forest and swamp forest
Alt 15	None	Restoration of River Meanders

Note: Shaded cells are alternatives that were not carried forward during the screening process.

4.3 FOCUSED ARRAY OF ALTERNATIVES

The focused array of alternatives, which is the same alternatives as previously identified in the final array in the publicly released 2019 DIFR/EIS, are presented in Table 4-3. Descriptions of the alternatives are presented in the Plan Formulation Appendix F and designs are presented in Engineering Appendix B.

Table 4-3. Focused Array of Alternatives

Alt ID	Management Measures	Alternative Description
Alt 1	No Action	No action would be taken under this plan. Damages would continue into the future.
Alt 10	HW-1	0.01 AEP Dry Dams along tributaries (HW-1)
Alt 12	UL-1	Large scale 0.04 AEP dam (UL-1) (wet and dry)
Alt 13	NS-1+ NS-2	Nonstructural (NS-1 and NS-2) (0.04 and .02 AEP floodplains)

Three alternatives were screened due to negative net benefits: the nonstructural plan for a 0.02 AEP floodplain, large scale 0.04 AEP wet Darlington Dam and the three 0.01 AEP dry dams on the Darlington, Lilley, and Bluff Creeks (Appendix F). The remaining alternatives were, Alternative 10 for an 0.01 AEP dry dam on Sandy Creek, Alternative 12 .04 AEP dry Darlington Dam and Alternative 13 nonstructural for 0.4 AEP. The alternative carried forward and chosen to be the TSP based on the 2019 economic evaluation was Alternative 12, an 0.04 AEP dry Darlington Dam since it had the highest net economic benefits.

2019 TSP Public, Policy and Technical Reviews and Additional Detailed Evaluation

In the TSP of the publicly released 2019 DIFR/EIS, a $2.3 billion dry dam and nonstructural measures to address residual risk was identified. This plan, while preliminarily determined to be feasible, revealed technical and policy concerns that were raised during its public, policy and technical reviews.

Per ER 1105-2-100, acceptability is the workability and viability of the alternative plan with respect to acceptance by Federal and non-Federal entities and the public and compatibility with existing laws, regulations, and public policies. Two primary dimensions to acceptability are implementability and satisfaction. Implementability means that the alternative is feasible from technical, environmental, economic, financial, political, legal, institutional, and social perspectives. If it is not feasible due to any of these factors, then it cannot be implemented, and therefore is not acceptable. An infeasible plan should not be carried forward for further consideration. However, just because a plan is not the preferred plan of a NFS does not make it infeasible or unacceptable ipso facto. The non-Federal partner’s willingness or unwillingness to sign a Project Cooperation Agreement should not be the test of whether a plan is acceptable or not. The second dimension to acceptability is the satisfaction that a particular plan brings to government entities and the public. Obviously, the extent to which a plan is welcome or satisfactory is a qualitative judgement. Nevertheless, discussions as to the degree of support (or lack thereof) enjoyed by particular alternatives from a community, state Department of Natural Resources, Ducks Unlimited, or other national or regional organizations, for example, are additional pieces of information that can help planners evaluate whether to carry forward or screen out alternative plans.

4.3.1.1 Implementability

Implementability means that the alternative is feasible from technical, environmental, economic, financial, political, legal, institutional, and social perspectives. If it is not feasible due to any of these factors, then it cannot be implemented, and therefore is not acceptable. The level of the dam design, due in part to a lack of soil data, was insufficient to ensure constructability. Constructing the dam would introduce significant incremental risk to the communities downstream. A semi quantitative risk analysis was not conducted to identify how severe the incremental risk would be.

For a dam to be effective to reduce flood risk, it needs to be located in the upper Amite River watershed, an area where sand and gravel mining is extensive. There is a high likelihood that there would be presence of these high porosity soils throughout the upper Amite River area which would result in weaker soil strengths that require a much larger dam base and section. Without the increased level of design evaluation, the available information regarding the embankment (settlement, seepage, abutments) and structures (spillway and controlled outlet) were insufficient to inform the dam safety process and constructability. In consideration of the technical and policy concerns raised during public, policy and technical review and in accordance with USACE policies ER 1110-2-1302 Civil Works Cost estimating, the overall contingency for dam increased from 30 percent used for the 2019 DIFR-EIS to be around 110-130 percent.. This level of increase in cost contingency would also be applied to the other dam alternative (Alternative 10) of the 0.01 AEP dry dam on Sandy Creek.

As a result, a USACE policy compliant, technically implementable, and constructable dam design and cost, including addressing incremental life risk, would likely exceed the benefits resulting in no federal interest. Because of the previously outlined social impacts and acceptability, the cost will not be reevaluated. The best available Geotech data was used to screen the dam from a technical standpoint and economic standpoint.

4.3.1.2 Social Impacts and Acceptability

Again, the two components of acceptability are implementability and satisfaction. In light of the acceptability policy criteria outlined previously, there are substantial social impacts that would have resulted from the dam and more specifically the unsupportable EJ impacts that would occur. In February 2021, the Governor of Louisiana expressed concerns regarding the potential impacts to EJ communities within the footprint of the Darlington Dry Dam. EJ is an institutionally important factor consistent with Executive Order 12898 of 1994 (EO. 12898) and the Department of Defense’s Strategy on Environmental Justice of 1995, which direct Federal agencies to identify and address any disproportionately high adverse human health or environmental effects of Federal actions to minority and/or low-income populations and to those populations challenged with environmental hazards. The area where the Darlington Dam would be located is identified as an area of EJ concern based upon EPA’s EJSCREEN 2020 data for minority and low-income residents and based upon two environmental indicators. There is the potential for high, adverse, disproportionate, direct impacts to historically disadvantaged communities from construction of the Darlington Dam. A disproportionately high and adverse effect means the adverse impact is appreciably more severe or greater in magnitude on minority or low-income populations than the adverse effect suffered by the non-minority or non-low-income populations after considering offsetting benefits. The high adverse impact is the relocation of households that currently are within the footprint of the proposed dam. The benefits of the dam would be flood risk reduction. A vast majority of structures benefiting (damages prevented) are located well south of the dam. The area of the dam footprint is feeling the high burden of the project (relocations) while only receiving a small share of the flood risk reduction benefits. The community would likely relocate to housing in an area outside of a floodplain. All structures within the footprint of the proposed dam would have been acquired. This concern was critical to the Governor and his concerns were expressed to the CEMVN Commander in a letter.

Additionally, there was significant public dispute as to the nature or effects of the dam project (See Appendix D-4). East Feliciana and St. Helena Parishes, Louisiana, and Amite

County, Mississippi, have passed public resolutions against USACE construction of the dam due to concerns about community impacts to the parishes. Finally, there is significant public dispute as to the economic or environmental costs or benefits of the dam project. St. Helena and East Feliciana Parishes also have concerns regarding the loss of tax base due to large land acquisitions.

The misalignment between the Darlington Dam and USACE EJ policies and initiatives along with the lack of support and satisfaction from both state and local governments and a sector of the public gives rise to the dam alternative not being acceptable. Based on acceptability criteria, the Darlington Dam alternative is screened as an alternative.

4.3.1.3 Conclusion

Based on the concerns and available information the Dry Dam alternative does not meet USACE tolerable risk guidelines due to economic risk/cost effectiveness, potential societal life risk, and environmental acceptability. For these reasons the Dry Dam alternative (including Alternative 10: Sandy Creek Dry Dam) has been removed from further consideration consistent with USACE policy of acceptability and implementability in accordance with ER 1105-2-100.

4.4 FINAL ARRAY OF ALTERNATIVES PLAN DEVELOPMENT

With removal of the Dry Dam alternative from further consideration, the next highest NED alternative and likely the only economically justified one is the 0.04 AEP nonstructural plan. To further assess the 0.04 AEP nonstructural only plan, three plans were developed as well as revisions to existing conditions to account for projects that alter the hydrology as described in Section 1.5 of the SSDIFR/EA and H&H models for inclusion of residual risk from storm surge downstream boundary conditions (See Appendix H). The first developed plan identified was the Nonstructural NED Plan using a new USACE method of aggregation and an additional two alternatives that increased OSE benefits for SV areas. Plan 1 is the no action alternative.

All nonstructural plans employed the USACE “logical aggregation method” which according to USACE Planning Bulletin 2019-03, nonstructural analyses are to be conducted using the method. Rather than the individual structure, selected groups of structures known as “aggregates” are the unit of analysis and each such aggregate is a separable element that must be incrementally justified. Aggregates were arranged based on several factors (See Appendix G: Economic and Social Consideration). Since the study area is subject to riverine, rainfall, and residual flood damages associated with hurricanes and coastal storm flood events, aggregates were primarily grouped according to the source (type of flood event) of the flooding. Using this method, 57 floodplain aggregates (groups of structures) were identified. An assessment of all structures located in the 0.1, 0.04, and 0.2 AEP floodplains was performed. The net benefits of each aggregate were analyzed based on the damages they would incur at the 0.1, 0.04, and 0.2 AEP. For evaluation purposes, the cost of raising and flood proofing was used to determine the cost of the nonstructural plans.

Acquisition and buyouts were not carried forward to the final array for assessment of nonstructural plans using the USACE logical aggregation method. The USACE team completed an economic analysis to assess the cost of acquisition and relocation of structures based on the eligible structures in Plan 4. The estimate of the cost of acquiring structures was computed once model execution was completed. Acquisition costs are based on the cost of acquiring the parcel of land, the structure(s) built on the land, an architectural survey, and miscellaneous costs associated with the acquisition process. The depreciated replacement value of the structure (excluding any contents) was used to represent the cost of the structure, which was previously described as being sourced from RS Means square foot cost data. The acquisition cost was the cost of performing an architectural survey, which is associated with cultural resources concerns. Finally, the cost of demolition, deed changes, legal fees, and re-grading the surface were estimated and included as miscellaneous costs. These miscellaneous costs associated with acquisition were sourced from the 2010 USACE Cedar Rapids, Iowa Feasibility Report. The prices derived from the 2010 report were price indexed to 2023 price levels. Acquisition costs by structure were summed to yield an estimate of total structure acquisition cost.

Relocation costs were based on the cost of relocating a tenant residential occupant, as required per Uniform Relocation Assistance and Real Property Acquisition Act of 1970 (URA), that has been removed from the acquired parcel. Relocation costs include purchasing a suitably located piece of property commensurate with the acquired parcel and the costs associated with the URA. Costs associated with URA include assisting the occupant with moving costs and incidentals for residential structures and moving costs, searching expenses, and re-establishing costs for non-residential structures. The URA costs amount to $53,800 per residential structure and $269,000 per non-residential structure. Relocation costs by structure were summed to yield an estimate of total structure relocation cost. The total acquisition and relocation costs were added together and applied on a per structure basis to estimate a cost of acquisition and relocation. The acquisition and relocation first costs is $2,216,403,800 versus the elevation and floodproofing measures of $1,657,970,000.

Additionally, since the interior of the study area is most often receiving damages resulting from widespread, low-level flooding; no individual reaches were identified during the logical aggregation method for relocation and buyouts.

Plan 2: Nonstructural NED Plan Identification

The initial Nonstructural NED plan was identified to be the plan strictly for the study purpose of rainfall flood risk (See Appendix G). When adding an increment of residual risk for storm surge, the HEC-FDA economic model uses aggregations based on the rainfall WSE only and calculates the flood damages based on the predominate condition since the relative WSE at a given probability changes, the expected annual damage changes (Table 4-4 and Figure 4-2). The predominant condition WSE takes the higher of the WSEs generated by two hydrologic boundary condition scenarios: one condition accounts for basin-wide extreme rainfall events with normal highwater downstream boundary condition, and a secondary condition that has negligible basin rainfall with storm surge downstream boundary conditions. The details of these models will be available in the H&H Appendix H. Eight flooding events were used (0.5, 0.2, 0.1, 0.04, and 0.02, 0.01 and 0.002) for the HEC-FDA analysis the assignment of stages relative to the probabilities change.

Table 4-4. Nonstructural Aggregation Plans

	Rainfall Risk Only Plan (Average Elevation of 4 feet)	**Nonstructural NED PLAN: Rainfall Risk and inclusion of benefits from reduced damages from residual risk of coastal storm surge (Average Elevation of 6 feet)**
Structures Eligible	1,777	3,177

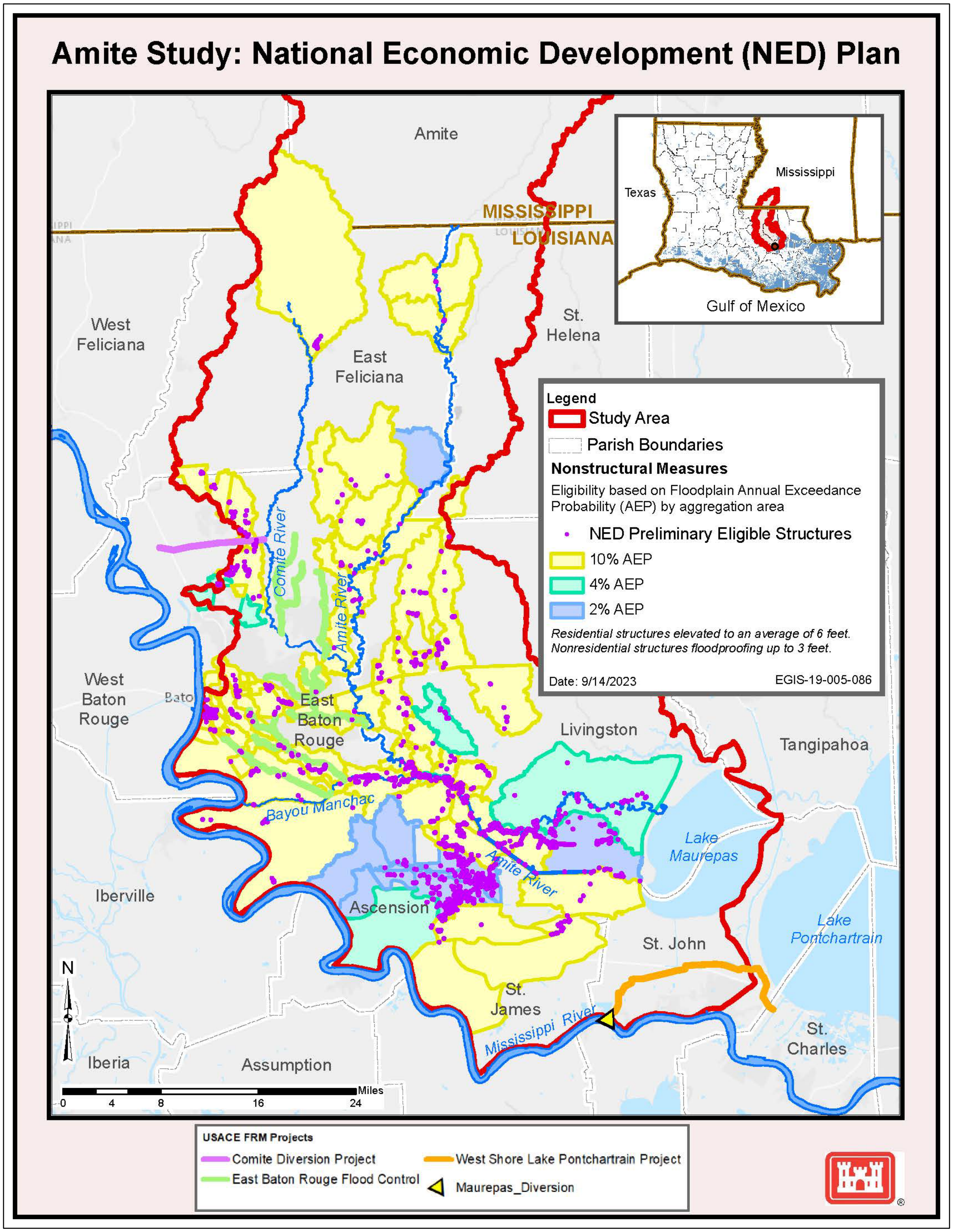

Figure 4-2. Nonstructural NED Plan

Total Benefits Plan Development

Two additional plans were identified to increase benefits in the OSE account, which is one of the four account USACE uses to identify benefits of plans in accordance with the USACE 2014 PRG. This comprehensive assessment of the four accounts is used to identify the Total Benefits Plan. Expanding the NED plan to include SV areas, increased the OSE benefits account.

The primary database used to represent social vulnerability data was the CDC's Social Vulnerability Index (CDC-SVI). CDC-SVI data included representation for socioeconomic status, age, disabilities, language, minority status, housing, and transportation (Figure 4-3). Areas in the 90th percentile or higher were flagged as having high social vulnerability. The aggregates used to identify the NED Plan were further subdivided into 19 SV sub aggregates allowing the team to evaluate impacts and formulate alternatives specific to areas experiencing high social vulnerability. Eligibility for incremental total benefits plans relied on a comparison of the benefits at the 10 percent, 5 percent, and 2 percent AEP floodplain aggregations and parametric construction costs at the sub aggregate level. Plan 3 and Plan 4 include all structures eligible within Plan 2 and they expand eligibility to include additional structures in areas experiencing social vulnerability. See Appendix G: Economic and Social Consideration for additional information regarding the process used.

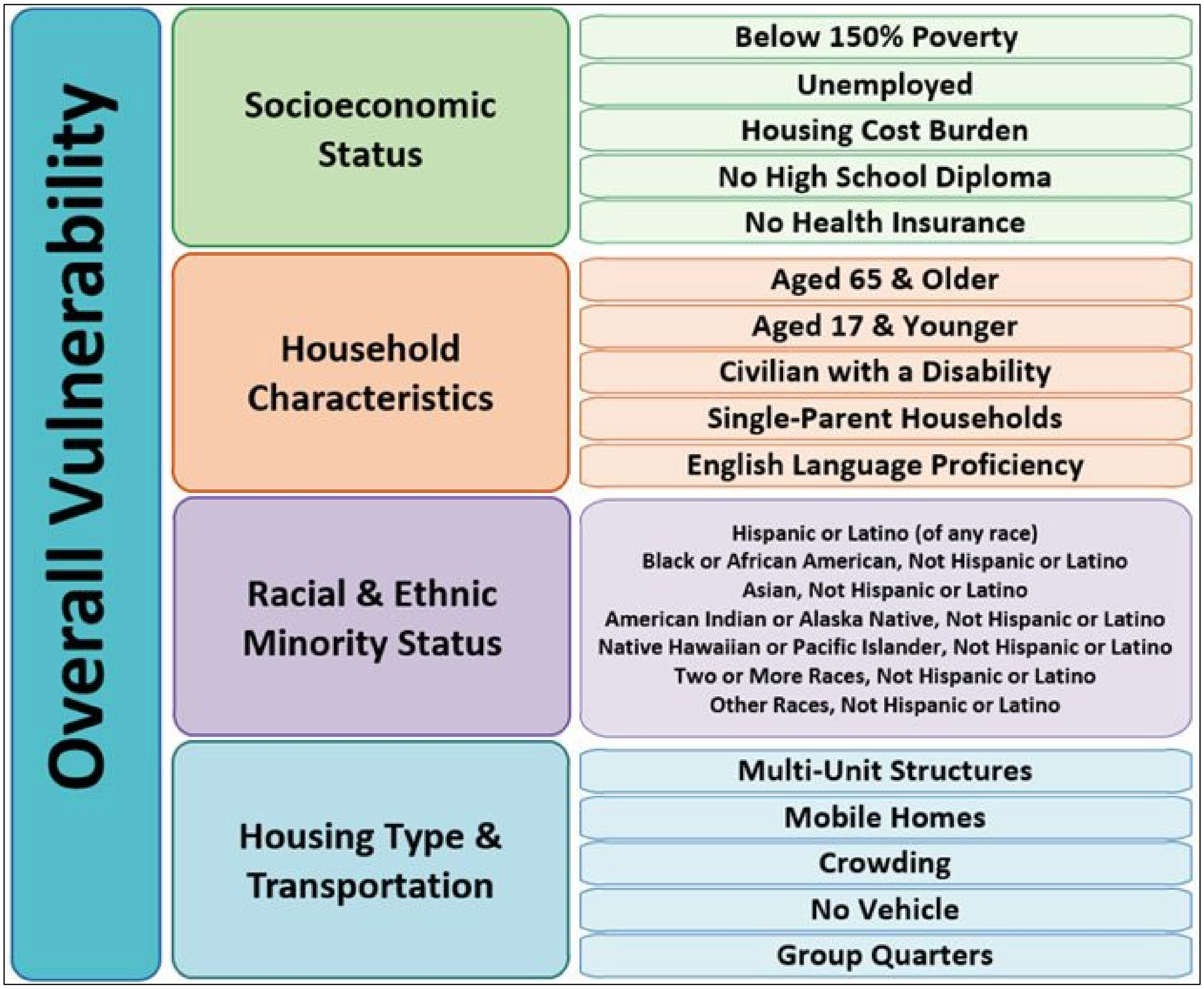

Figure 4-3. CDC's Social Vulnerability Index

Plan 3: Nonstructural NED Plan + OSE Increment 1

Plan 3 expanded eligibility to include all structures within SV sub aggregates that had positive net benefits when to compared to the parametric constructions.

Plan 4: Nonstructural NED Plan + OSE Increment 2

Plan 4 expanded eligibility to include all structures within SV sub aggregates at the next highest floodplain aggregation even if the sub aggregation did not have positive net benefits (Figure 4-4).

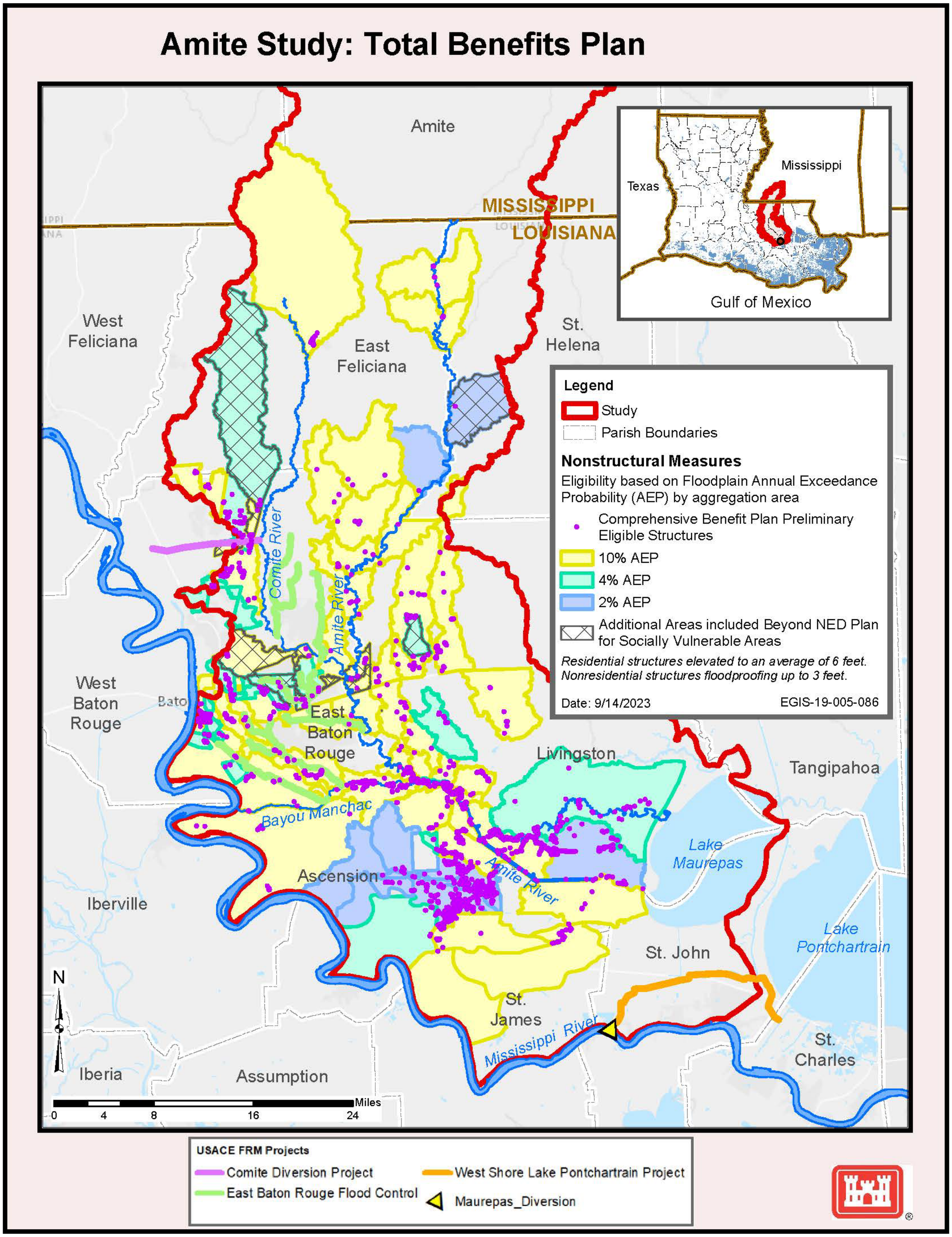

Figure 4-4. Plan 4: Nonstructural Plan + OSE Increment 2

Section 5
Evaluate Alternative Plans

5.1 ENVIRONMENTAL CONSEQUENCES

In accordance with NEPA, this chapter 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), Environmental Justice (Section 5.3.1.12), and Socioeconomics (Section 5.3.1.13) are addressed in the SSDIFR/EA .

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, decision-makers 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.

This chapter compares the effects of the proposed final array of alternative plans:

- Plan 1: No Action Alternative
- Plan 2: Nonstructural NED Plan
- Plan 3: Nonstructural NED Plan + OSE Increment 1
- Plan 4: Nonstructural NED Plan + OSE Increment 2

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 OSE Plans.

Initially, a wide selection of resources were 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. Wetlands, Uplands, aquatic resources/fisheries, prime and unique farmland, and essential fish habitat would not be affected by the proposed project. 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 Impacts in and near the Project Area

Relevant Resource	Negative Impact	Positive Impact	Not Impacted
Wetland Resources	Temporary and permanent for No Action		Nonstructural TSP
Upland Resources	Temporary and permanent No Action		Nonstructural TSP
Aquatic Resources/Fisheries			No Action Alternative and nonstructural
Wildlife			No Action Alternative and Nonstructural TSP
Threatened, Endangered, and Protected Species			No Action Alternative and Nonstructural TSP
Geology, Soils, and Prime and Unique Farmland			No Action Alternative and Nonstructural TSP
Water Quality			No Action Alternative and Nonstructural TSP
Air Quality			None for No Action Alternative and Nonstructural TSP
Cultural	Potential Adverse Effect for Nonstructural	Potential positive indirect impacts towards preserving at-risk unique architectural and design characteristics that the communities and historic districts in the 0.04 AEP floodplain strive to maintain and enhance.	No Action Alternative
Recreation		Potential	No Action Alternative and Nonstructural TSP
Aesthetics		potential for Nonstructural	No Action Alternative and Nonstructural TSP
Socioeconomic Resources		Potential for Nonstructural with Acquisitions	
Environmental Justice	Adverse Impact for No Action;	Permanent for reduced flood risk for structural and nonstructural measures	
HTRW			No Action Alternativeand Nonstructural TSP

While there may be marginal effects to land-use from each of the alternatives, no major changes to land-use are expected from any of the projects being considered. Wetland and Upland resources would potentially have temporary negative impacts due to SLR, continued habitat degradation and anthropogenic development.

5.3.1.1 Wildlife

Impacts of Considered Alternatives

Plan 1: 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 (See Appendix C-1).

Plan 2: 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.

Plan 3: Nonstructural NED Plan + OSE Increment 1

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.

Plan 4: Nonstructural NED Plan + OSE Increment 2

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.

5.3.1.2 Threatened, Endangered, and Protected Species

Impacts of Considered Alternatives

Plan 1: 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, including the inflated heelsplitter mussel.

Table 5-2. Threatened (T), Endangered (E), & Protected (P) Species in Study Area

Scientific name	Common name and status (T, E, or P)	Listing	Found in Study Area	Determination of Effects
Potamilus inflatus	Alabama Heelsplitter Mussel (T)	Federal	Yes	No effect
Acipenser oxyrhynchus desotoi	Atlantic Sturgeon (T)	Federal	Yes	No effect
Trichechus manatus	West Indian Manatee (TT)	Federal	Yes	No effect
Myotis septentrionalis	Northern long-eared bat (E)	Federal	Yes	No effect
Haliaeetus leucocephalus	Bald Eagle (P)	State	Yes	No effect

Plan 2: Nonstructural NED Plan

Direct, Indirect, and Cumulative Impacts: This alternative would not result in impacts to threatened, endangered, and protected species.

Plan 3: Nonstructural NED Plan + OSE Increment 1

Direct, Indirect, and Cumulative Impacts: This alternative would not result in impacts to threatened, endangered, and protected species.

Plan 4: Nonstructural NED Plan + OSE Increment 2

Direct, Indirect, and Cumulative Impacts: This alternative would not result in impacts to threatened, endangered, and protected species.

5.3.1.6 Geology, Soils and Water Bottoms, and Prime Farmland

Impacts of Considered Alternatives

Plan 1: No Action Alternative

Direct, Indirect, and Cumulative Impacts: This alternative would not have an effect on prime farmland. Soil and water bottoms could continue to experience both anthropogenic and natural impacts within the ARB, including the sand and gravel operations and erosional forces that alter the river channel.

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

Plan 2: Nonstructural NED Plan

Direct, Indirect, and Cumulative Impacts: Structures elevated or purchased in the floodplain could contain but not affect prime farmland, soils, or water bottoms.

Plan 3: Nonstructural NED Plan + OSE Increment 1

Direct, Indirect, and Cumulative Impacts: Structures elevated or purchased in the floodplain could contain but not affect prime farmland, soils, or water bottoms.

Plan 4: Nonstructural NED Plan + OSE Increment 2

Direct, Indirect, and Cumulative Impacts: Structures elevated or purchased in the floodplain could contain but not affect prime farmland, soils, or water bottoms.

5.3.1.7 Water Quality

Impacts of Considered Alternatives

Plan 1: No Action Alternative

Direct, Indirect, and Cumulative Impacts: Without implementation of the proposed action, no direct impacts to water quality would occur. Indirect impacts as a result of not implementing the proposed action would be the continued degradation of water quality as the area continues to erode as a result of flood events and human development in the ARB.

Plane 2: Nonstructural NED Plan

Direct, Indirect, and Cumulative Impacts: This alternative would not directly impact water quality. When combined with other past, present, and reasonably foreseeable future projects in the ARB, this alternative would not impact water quality.

Plan 3: Nonstructural NED Plan + OSE Increment 1

Direct, Indirect, and Cumulative Impacts: This alternative would not directly impact water quality. When combined with other past, present, and reasonably foreseeable future projects in the ARB, this alternative would not impact water quality.

Plan 4: Nonstructural NED Plan + OSE Increment 2

Direct, Indirect, and Cumulative Impacts: This alternative would not directly impact water quality. When combined with other past, present, and reasonably foreseeable future projects in the ARB, this alternative would not impact water quality.

Direct, Indirect, and Cumulative Impacts: This alternative would not directly impact water quality. When combined with other past, present, and reasonably foreseeable future projects in the ARB, this alternative would not impact water quality.

5.3.1.9 Cultural and Historic Resources

Plan 1: 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, commercial gravel mining, 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. 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 that are expected to occur to some built-environment resources include non-compatible 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 2: Nonstructural NED Plan

Direct:

A review of Plan 2 indicates that the considered action includes ground disturbing activities (e.g., access, staging, foundation work and hardening, demolition, site cleanup, and other associated site work) within the project footprint that may directly affect archeological resources in a manner that may diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Plan 2 also has potential for significant 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, flood proofing, 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 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.

Indirect:

In addition to individual historic properties where Nonstructural measures are implemented, Plan 2 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 2 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 2 may have positive indirect impacts towards preserving at-risk unique architectural and design characteristics that the communities and historic districts in the 0.04 AEP 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 (see above). 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.

<u>Cumulative</u>:

Cumulative impacts to cultural resources would be the additive combination of the direct and indirect impacts of Plan 2 and other Federal, state, local, and private, flood risk projects existing and/or authorized for construction along the Amite River Basin (see: Table 1-1a in the Relevant Prior Reports and Studies Section). 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 2 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 2 may have long-term positive net impacts to cultural resources within communities in the 0.04 AEP floodplain. USACE acknowledges that the implementation of Plan 2 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 the Amite River Basin, thus; potentially protecting the architectural qualities of communities within the 0.04 AEP floodplain as a whole. Therefore, Plan 2 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 0.04 AEP floodplain and its surrounding communities. This is important because the cultural resources within many portions of the 0.04 AEP 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 2 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 3: Nonstructural NED Plan + OSE Increment 1

<u>Direct, Indirect, and Cumulative Impacts</u>:

The direct, indirect, and cumulative impacts to cultural resources for the considered action would be proportionally similar to the impacts specified for Plan 2 described above.

Plan 4: Nonstructural NED Plan + OSE Increment 2

<u>Direct, Indirect, and Cumulative Impacts</u>:

The direct, indirect, and cumulative impacts to cultural resources for the considered action would be proportionally similar to the impacts specified for Plan 2 described above.

5.3.1.10 Aesthetics

Plan 1: No Action Alternative

<u>Direct and Indirect Impacts</u>: The harmonious natural landscape combination of rivers and creeks slowly meandering southward is contrasted by unnaturally straight roadways and spoil banks, cutting through the mosaic of forest, pine plantations, pasture, and cropland. 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.

<u>Cumulative Impacts</u>: Cumulative impacts to visual resources would be the additive combination of impacts by this and other Federal, State, local, and private flood risk reduction efforts, including but not limited to the CRD and the EPR Flood Control Project.

Plan 2: 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. Houses being raised are currently present; their elevation would change, but the site is still occupied either way..

Plan 3: Nonstructural NED Plan + OSE Increment 1

The direct, indirect, and cumulative impacts to aesthetics for the considered action would be proportionally similar to the impacts specified for Plan 2 described above.

Plan 4: Nonstructural NED Plan + OSE Increment 2

The direct, indirect, and cumulative impacts to aesthetics resources for the considered action would be proportionally similar to the impacts specified for Plan 2 described above.

5.3.1.11 Recreation

Alternative 1: 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 both land use trends and natural processes over the course of time.

Plan 2: Nonstructural NED Plan

Direct, Indirect, and Cumulative Impacts: The nonstructural features could have no impact to recreational resources, depending on the methods used.

Plan 3: Nonstructural NED Plan + OSE Increment 1

Direct, Indirect, and Cumulative Impacts: The nonstructural features could have no impact to recreational resources, depending on the methods used.

Plan 4: Nonstructural NED Plan + OSE Increment 2

Direct, Indirect, and Cumulative Impacts: The nonstructural features could have no impact to recreational resources, depending on the methods used.

5.3.1.12 Environmental Justice

Alternative 1: No Action Alternative

Direct, Indirect, and Cumulative Impacts: 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 minority and/or low-income population groups under this alternative. However, because this alternative fails to provide flood risk reduction, the actual and perceived risks to minority and/or low-income population groups under this alternative would be higher than under the alternatives.

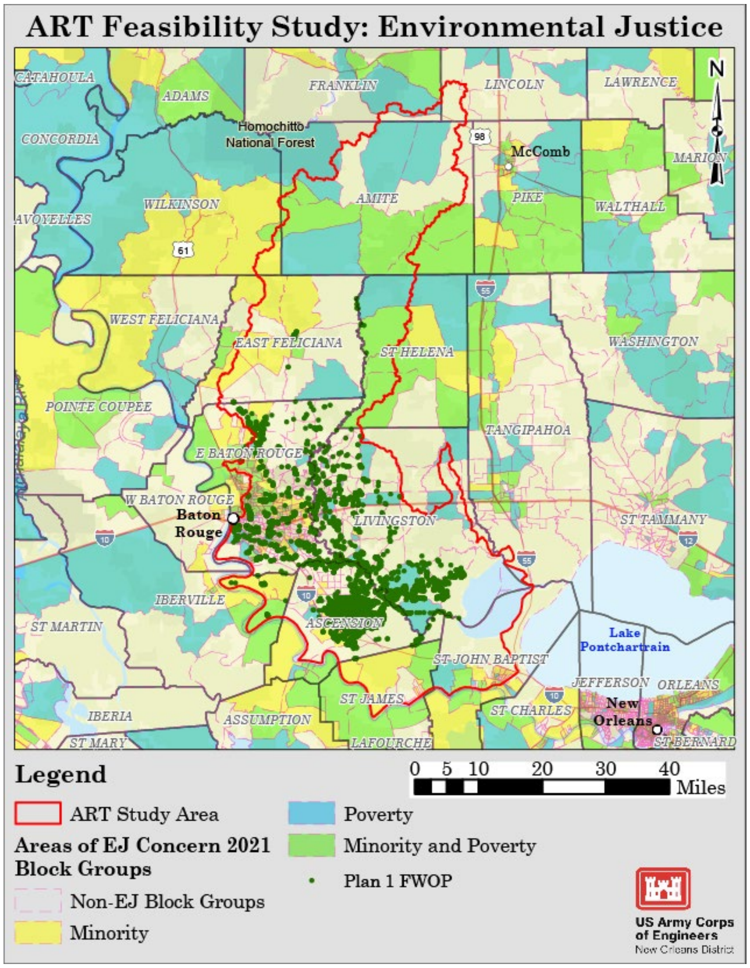

Figure 5-1: Plan 1, Future Without-Project Condition, Structures at Risk for Flooding

Polygon shapefiles shown on the maps in the EJ sections of the main report and attribute data used in the EJ analysis are from Steven Manson, Jonathan Schroeder, David Van Riper, Tracy Kugler, and Steven Ruggles. IPUMS National Historical Geographic Information System: Version 16.0 [dataset]. Minneapolis, MN: IPUMS. 2021. http://doi.org/10.18128/D050.V16.0

Figure 5-1 shows the structures in the ART study area at risk for flooding under the no action plan, and which are in areas of EJ concern. Of the 14,309 structures identified in the future without-project condition that are at risk for flooding, 5,269 are in areas of EJ concern or about 37 percent of structures. In this case, at risk for flooding means there is a risk for flooding at the first-floor elevation of the structure.

Indirect impacts under the no action alternative include a higher potential for permanent displacement of minority and/or low-income population groups as compared to the with-project alternatives as residents relocate to areas with higher levels of flood protection.

Cumulative impacts under the no action alternative include the potential for a steady decline in minority and/or low-income population groups and other groups as residents move to areas with lower flood risks, as well as continued financial and emotional strain placed on these groups as they prepare for and recover from flood events. Other Federal, State, local, and private flood risk reduction efforts, including but not limited to, the CRD and the EBR Flood Control Project, would also influence these populations.

Plan 2: Nonstructural NED Plan

<u>Direct Impacts:</u> The voluntary nonstructural plan involving structure elevation may directly impact EJ communities and these impacts are not disproportionate. All residents, regardless of race and income, will have the choice of elevation. Direct impacts include temporary disruption of use of homes during elevation. At this time, there are 3,117 structures (the vast majority are residential structures) located in the 0.1, 0.04, and 0.2 AEP floodplains and it is uncertain who may participate in the non-structural 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.

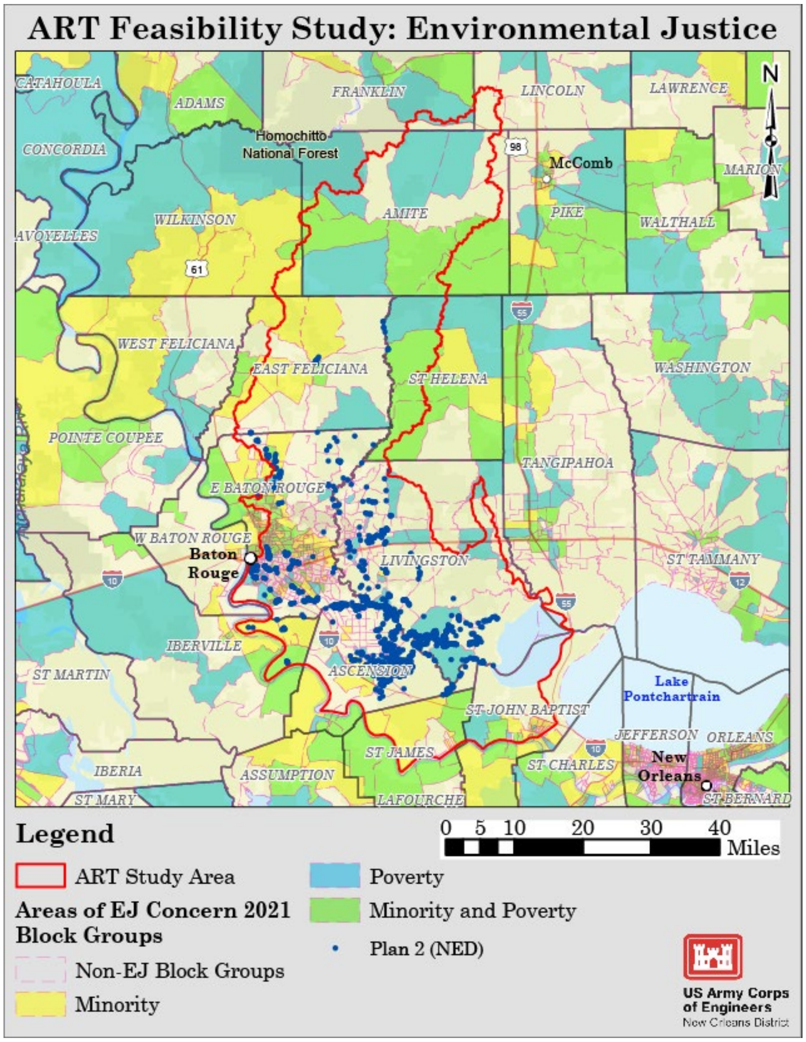

Figure 5-2: Plan 2, NED, Eligible Structures and Areas of EJ Concern

Polygon shapefiles shown on the maps in the EJ sections of the main report and attribute data used in the EJ analysis are from Steven Manson, Jonathan Schroeder, David Van Riper, Tracy Kugler, and Steven Ruggles. IPUMS National Historical Geographic Information System: Version 16.0 [dataset]. Minneapolis, MN: IPUMS. 2021. http://doi.org/10.18128/D050.V16.0

Figure 5-2 shows the location of 3,117 structures eligible for elevation or floodproofing (blue dots). Of the 3,117 structures eligible for home elevation or non-residential floodproofing, 1,163 are in areas of EJ concern or about 37 percent of total eligible structures. Homeowners living in areas of EJ concern would be eligible to participate in the elevation program which is a direct positive benefit to those choosing to participate. The 1,163 eligible structures in areas of EJ concern under Plan 2 represent about 22 percent of the structures in areas of EJ concern that are at risk for flooding under the future without-project condition (1,163/5,269).

The nonstructural measures may provide those choosing home elevation in this low-density area of minority and low-income populations with flood risk reduction. Despite existing base floor elevations differing among individual structures, elevations would provide the same level of risk reduction benefits per structure at year 2076 (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.

Indirect Impacts: 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 Section 1.1.4 of the Economic Appendix.

Cumulative Impacts: Positive cumulative impacts to minority and/or low-income populations associated with providing risk reduction 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 low-income and minority communities. 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 3: Nonstructural NED Plan + OSE Increment 1

Direct, Indirect, and Cumulative Impacts:

Plan 3 beneficial impacts are similar to Plan 2 and include flood risk reduction but to 3,189 structures or 72 more structures than are in the NED Plan 1. The additional 72 structures included in Plan 3 are all residential located in SV areas as defined by the CDC.

About 1,200 structures are in areas of EJ concern or about 38 percent of the eligible structures that comprise Plan 3. Figure 5-3 shows the location of the eligible structures under Plan 3 with the dark blue dots representing NED Plan 2 carried forward into Plan 3 and light blue dots as the additional SV structures or about 72. Direct impacts for homeowner 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. Businesses in areas of EJ concern, 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 EJ areas of concern much more quickly than if they choose not to participate in the floodproofing program.

Indirect impacts for eligible participants in Plan 3 include OSE and comprehensive benefits such as over-arching social themes including social vulnerability & resiliency, health & safety, economic vitality and social connectedness. Impacts to these social themes are prevalent in flood risk management projects and Plan 3 improves these social themes by offering a housing elevation program or business floodproofing option. Both eligible homes and businesses, could be elevated or floodproofed which adds to the areas resiliency to recover after a disaster. Out of 191 Louisiana Census Tracts within the ART study area, there were 46 Tracts that were identified as experiencing social vulnerability and include 72 additional structures that are not in Plan 2 and are shown in Figure 5-3 as light blue dots.

Potential adverse indirect impacts from Plan 3 are similar to those discussed for the NED Plan 2 and include the possibility that low-income homeowners may not be able to afford the out-of-pocket costs to have their home elevated.

Additionally, areas of EJ concern may benefit from regional economic development spurred by the implementation of the NS Plan. An increase in jobs, labor income, value-added and sales are economic impacts that EJ areas could experience to varying degrees. These project-related economic impacts are considered regional impacts. For more information on regional economic development, see Section 6 in the Economic Appendix.

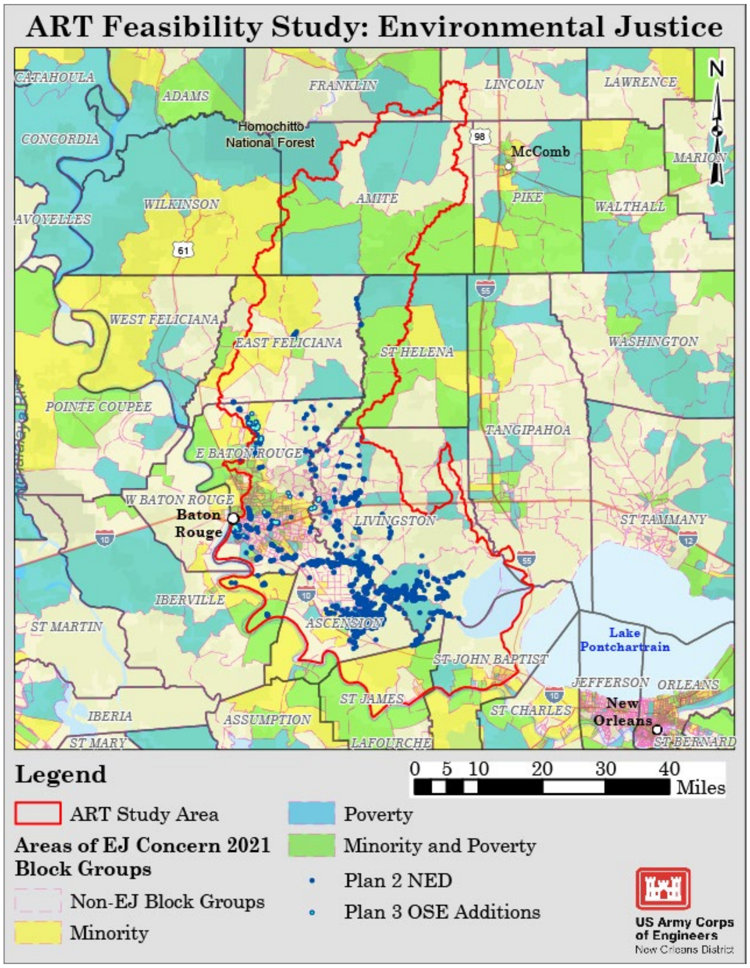

Figure 5-3: Plan 3, NED/OSE1, Eligible Structures and Areas of EJ Concern

Polygon shapefiles shown on the maps in the EJ sections of the main report and attribute data used in the EJ analysis are from Steven Manson, Jonathan Schroeder, David Van Riper, Tracy Kugler, and Steven Ruggles. IPUMS National Historical Geographic Information System: Version 16.0 [dataset]. Minneapolis, MN: IPUMS. 2021. http://doi.org/10.18128/D050.V16.0

Plan 4: Nonstructural NED Plan + OSE Increment 2

Direct, Indirect, and Cumulative Impacts:

Plan 4 is similar to Plan 3 except Plan 4 includes 109 more eligible residential structures that are in SV areas that are not in Plan 3. A total of 3,298 structures are eligible under Plan 4 and about 40 percent of these structures (1,322) are in areas of EJ concern. Figure 5-3 shows the location of Plan 4 eligible structures and structures in areas of EJ concern with the dark blue dots representing the OSE Plan 3 eligible structures and the light blue dots representing the additional 109 structures added that are added from SV areas. Positive direct benefits will accrue to residents and businesses in areas of EJ concern who chose to participate in the plan and include a lower flood risk.

Adverse indirect impacts include the homeowner having to pay for temporary housing and costs associated with preparing their home for elevation. 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 of not being able afford costs to volunteer for elevation are discussed in the section below, Mitigation of Potential Direct Impacts.

Positive indirect impacts also accrue to areas of EJ Concern by reducing social vulnerability and OSE, as is described for Plan 3. These affects are similar to Plan 3 but slightly larger since more structures would be eligible for elevation and floodproofing, based in part on Social Vulnerability.

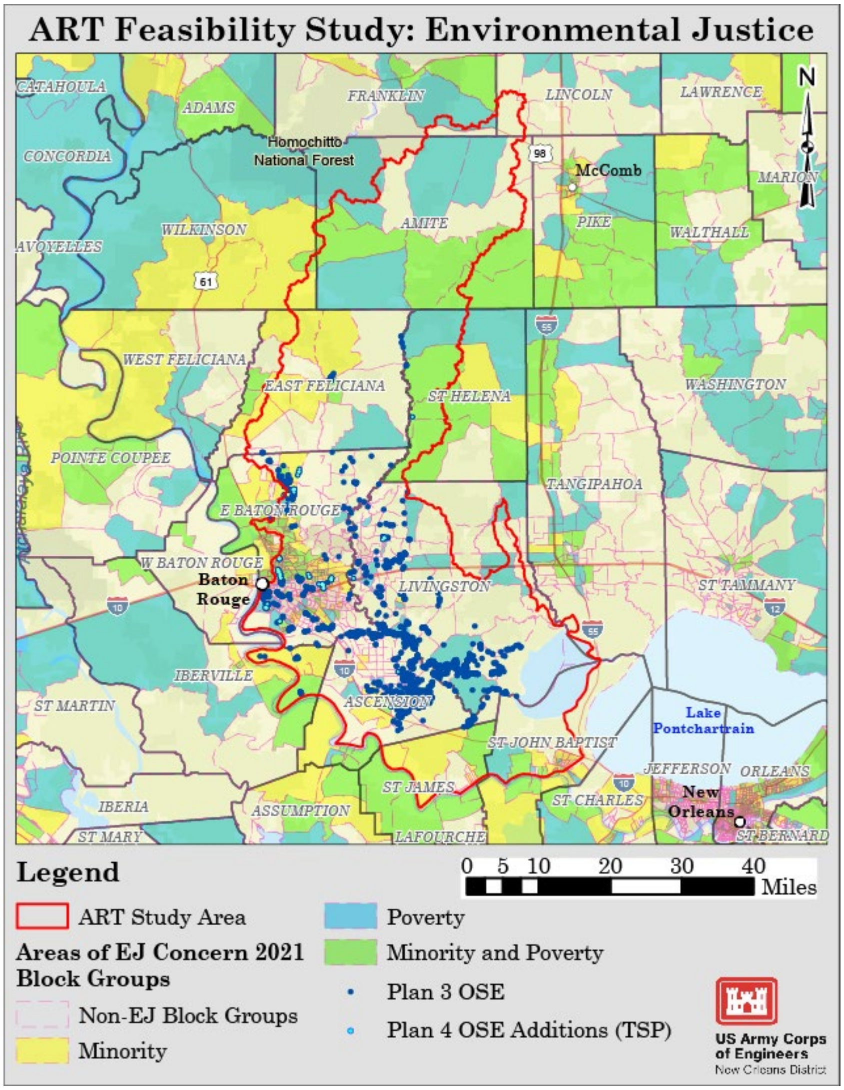

Figure 5-4: Plan 4, NED/OSE2 Eligible Structures and Areas of EJ Concern

Polygon shapefiles shown on the maps in the EJ sections of the main report and attribute data used in the EJ analysis are from Steven Manson, Jonathan Schroeder, David Van Riper, Tracy Kugler, and Steven Ruggles. IPUMS National Historical Geographic Information System: Version 16.0 [dataset]. Minneapolis, MN: IPUMS. 2021. http://doi.org/10.18128/D050.V16.0

5.3.1.2.1 Justice 40

The Federal Government has made it a goal that 40 percent of the overall benefits of certain Federal investments flow to disadvantaged communities that are marginalized, underserved, and overburdened by pollution. This goal has been designated the Justice 40 Initiative. There are nine census tracks in the study area that have been identified as disadvantaged communities according to the Justice 40 criteria. Each of these communities qualify due to their low-income designation and the economic loss to building value resulting from natural hazards each year. Additionally, categories shared by some but not all these communities include barriers to transportation, unemployment, percent of adults with less than a high school diploma, high rates of heart disease, and projected flood risk. The factors considered included Social Vulnerability & Resiliency, Health & Safety, Economic Vitality, and Social Connectedness.

Approximately 40% of eligible structures in each of the three plans (Plans 2, 3 and 4) are in disadvantaged communities. For more information on the Justice40 Initiative, refer to Section 6.4.4.

5.3.1.2.2 Mitigation of Potential Indirect Impacts:

For those residents in areas of EJ concern 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.

5.3.1.2.3 Other Benefits to Areas of EJ Concern: Clustering Based on Socially Vulnerable Communities

During implementation of the NS Plan, a clustering methodology would identify populations in areas of social vulnerability using Center for Disease Control and Prevention (CDC) Socially Vulnerable Index (SVI) most recent data. For this effort US percentile ranking may be chosen over Louisiana percentile ranking to ensure that all census tracts with potential SVI are captured. Detailed documentation of the SVI percentile ranking, and data dictionary can be found on the CDC’s website. A vast majority of the CDC’s SV areas are also areas of EJ concern, as identified in the SSDIFR/EA.

According to CDC’s SVI documentation, census tracts at the 90th percentile or higher indicate high vulnerability. SVI includes four themes: Socioeconomic Status; Household Characteristics; Racial & Ethnic Minority Status; and Housing Type/Transportation (Figure 1-2). To capture all SV, census tracts with 90th percentile or higher in any of the four themes may be classified as highly vulnerable which are areas where the population is exposed to high levels of environmental stressors and are low-income who reside in disadvantage communities as identified by CEQ's Climate and Economic Justice Screening Tool using the most recent race demographic statistics from the U.S. Census Bureau. This approach would rank environmental and demographic data as the main factor in determining which eligible properties should be prioritized. Homeowners in disadvantaged communities or those living at or below the poverty level would be given priority.

5.3.1.13 Socioeconomics

Plan 1: No Action Alternative

<u>Direct, Indirect, and Cumulative Impacts</u>: The no action alternative would maintain the current without-project condition of the study area. There are no expected cumulative impacts due to the Comite River Diversion and East Baton Rouge Flood Control projects or other Federal, State, local, or private flood risk reduction efforts. Cumulative impacts to socioeconomic resources would be the additive combination of impacts by this study and other studies, including, but not limited to the two aforementioned projects.

Plan 2: Nonstructural NED Plan

<u>Direct, Indirect, and Cumulative Impacts</u>:

The non-structural alternative would rely upon the voluntary participation of residents of the 3,117 structures within the 0.02 AEP floodplain to have their structures flood-proofed, or elevated. The voluntary nature of this alternative makes it impossible to determine which residents would participate without surveys. With the construction of this project, there will be a small, direct impacts to employment in the construction industry during duration of construction. There are no expected cumulative socioeconomic impacts due to this alternative; socioeconomic impacts due to this alternative are independent of the socioeconomic impacts of the CRD and EBR Flood Control projects or other Federal, State, local, or private flood risk reduction efforts.

Plan 3: Nonstructural NED Plan + OSE Increment 1

<u>Direct, Indirect, and Cumulative Impacts</u>: The non-structural alternative would rely upon the voluntary participation of residents of the 3,189 structures within the 0.02 AEP floodplain to have their structures flood-proofed, or elevated. The voluntary nature of this alternative makes it impossible to determine which residents would participate without surveys. With the construction of this project, there will be a small, direct impacts to employment in the construction industry during duration of construction. There are no expected cumulative socioeconomic impacts due to this alternative; socioeconomic impacts due to this alternative are independent of the socioeconomic impacts of the CRD and EBR Flood Control projects or other Federal, State, local, or private flood risk reduction efforts.

Plan 4: Nonstructural NED Plan + OSE Increment 2

Direct, Indirect, and Cumulative Impacts: The non-structural alternative would rely upon the voluntary participation of residents of the 3,298 structures within the 0.02 AEP floodplain to have their structures flood-proofed, or elevated. The voluntary nature of this alternative makes it impossible to determine which residents would participate without surveys. With the construction of this project, there will be a small, direct impacts to employment in the construction industry during duration of construction. There are no expected cumulative socioeconomic impacts due to this alternative; socioeconomic impacts due to this alternative are independent of the socioeconomic impacts of the CRD and EBR Flood Control projects or other Federal, State, local, or private flood risk reduction efforts.

Section 6

Evaluation and Comparison of Final Array of Alternative Plans

The USACE evaluated measures described in Section 4 and screened them based on their ability to meet the project objectives, avoid constraints, and to maximize benefits provided over the 50-year period of analysis from 2026 - 2076. Plans were developed with incrementally justified measures in accordance with ER 1105-2-100 and WRDA 1986. Three plans, in addition to no action, were progressed for further evaluation in selecting the TSP which included:

Plan 2: Nonstructural NED Plan- Floodproofing or elevation of 3,117 structures located in the 0.1 (46 aggregates), 0.2 (5 aggregates) or 0.4 (6 aggregates) floodplain to 0.01 AEP BFE. Plan 2 would include the elevation of 2,748 residential structures and floodproofing of 369 nonresidential structures.

Plan 3: Nonstructural NED Plan + OSE Increment 1- Floodproofing or elevation of 3,189 structures located in the 0.1 (54 aggregates), 0.2 (8 aggregates) or 0.4 (6 aggregates) floodplain to 0.01 AEP BFE. Plan 3 would include the elevation of 2,815 residential structures and floodproofing of 374 nonresidential structures.

Plan 4: Nonstructural NED Plan + OSE Increment 2- Floodproofing or elevation of 3,298 structures located in the 0.1 (59 aggregates), 0.2 (13 aggregates) or 0.4 (7 aggregates) floodplain to 0.01 AEP BFE. Plan 4 would include the elevation of 2,918 residential structures and floodproofing of 380 nonresidential structures.

Risk Reduction- The term 0.01 AEP level of risk reduction, refers to a level of reduced risk of rainfall, riverine or storm surge driven flooding that the project has a 1 percent chance of experiencing each year. Different combinations of size, intensity and track of rainfall and coastal storm could result in a 0.01 probability of a surge and/or rainfall event.

The measures in the Final Array of Alternative Plans were evaluated for economics (Section 6.1) and then to the planning objectives (Section 6.2) and the formulation criteria (Section 6.3) as given and defined in the Principles and Guidelines (P&G) Section VI.1.6.2(c). They were subsequentially compared to the four Federal accounts (Section 6.4) that are used to assess the effects of the final array of alternatives. This evaluation and screening informs the decision in selecting the TSP.

6.1 ECONOMIC EVALUATION OF FINAL ARRAY OF ALTERNATIVE PLANS

The following assumptions were applied when evaluating floodproofing and elevations of structures within the 0.1, 0.04, and 0.02 AEP floodplains:

- Elevation of residential structures to predicted 2076, 0.01 AEP BFE to a maximum of 13 feet above ground level*.
- Dry Floodproofing of non-residential structures for flood depths not greater than 3 feet above the adjacent ground.

*Raising structures greater than 13 feet above ground level introduces damage risk from winds during tropical events as a new condition. This height generally serves as a differentiator for insurance rates for wind/hail coverage as well and is therefore used as the upper limit for elevating structures. If the BFE elevation is greater than 13 feet above ground level, the structure would still be eligible for elevation up to that height with the residual risk present. It is estimated more than 99 percent of the structures' BFE, based on 2076 hydrology, is below 13 feet.

As shown on Table 6-1, Plan 2 has the greatest annual net benefits and was identified as the preliminary NED plan.

Table 6-1. Economic Analysis of Final Array of Alternatives

Costs	Plan 2: NED Plan	Plan 3: NED + OSE Increment 1	Plan 4: NED + OSE Increment 2
Total Project Costs			
First Cost	$1.47 through 1.56 B	$1.51 through 1.60 B	$1.56 through 1.66 B
Interest During Construction	$5.0 through 5.3 M	$5.1 through 5.4 M	$5.3 through 5.6 M
Total Investment Cost	$1.47 through 1.57 B	$1.52 through 1.61 B	$1.57 through 1.66 B
Estimated Annual Costs			
Annualized Project Costs	$54.6 through 58.0 M	$56.1 through 59.6 M	$58.2 through 61.8 M
Annual OMRR&R	TBD	TBD	TBD
Total Annual Costs	$54.6 through 58.0 M	$56.1 through 59.6 M	$ 8.2 through 61.8 M
Average Annual Benefits			
Total Annual Benefits	$59.8 M	$60.6 M	$61.4 M
Net Annual Benefits	$5.1 through 1.8 M	$4.4 M through 942 K	$3.4 M through (178) K
Benefit to Cost Ratio	1.09 through 1.03	1.08 through 1.02	1.06 through 0.997

Table 6-2. Nonstructural Plans Floodplain Aggregation by Reach

Floodplain AEP	Plan 2: NED Plan	Plan 3: NED + OSE Increment 1	Plan 4: NED + OSE Increment 2
0.1	46	54	59
0.04	5	8	13
0.02	6	6	7

6.2 EVALUATION OF STUDY PLANNING OBJECTIVES

Plans 1 through 4 were compared to the study objectives, presented, and discussed in Section 2.2 of the SSDIFR/EA, to validate the selection of the TSP based on net benefit calculations (Table 6-3).

Objective 1 (reduce the risk to human life from flooding) and Objective 2 (reduce flood damages from rainfall in the ARB to industrial, commercial, and agricultural facilities and residential and nonresidential structures) were evaluated through the performance analysis described in Section 6.1 of the SSDIFR/EA. The analysis quantitively measured the reductions in WSEs which informed the subsequent economic analysis to determine the change in the number and frequency of flooded structures compared to the No Action Alternative. Public infrastructure such as hospitals are included in the nonstructural analysis. All the Final Array of Alternatives decreased the risk to public health and safety by reducing the number of structures impacted by flooding and reducing the annual flood damages when compared with the No Action Alternative. The No Action Alternative does not decrease the risk to public safety. Specifically, regarding life safety risk reduction for all nonstructural plans it is a minor positive impact because of structure elevation. Life safety risk reduction is specific to residents who shelter in place and during events not requiring evacuation.

Objective 3 is to reduce interruption to the nation's transportation corridors, particularly the I-10/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. Interstate 10 and Interstate 12 are the major transportation corridor within the study area. Objective 3 did not end up being a distinguishing factor in the Final Array of Alternatives.

Objective 4 is to reduce risks to critical infrastructure (e.g. medical centers, schools, transportation etc.). Objective 4 did not end up being a distinguishing factor in the Final Array of Alternatives between nonstructural plans; however, some critical infrastructure are preliminary eligible as part of the nonstructural plans vs. the no action.

Table 6-3. Final Array Evaluation to Study Objectives

Alternative	Reduce flood damages from rainfall events	Reduce risk to human life from flooding	Reduce interruption to the nation's transportation corridors	Reduce risks to critical infrastructure (e.g. medical centers, schools, transportation etc.);
Plan 1: No Action	Low	Low	Low	Low
Plan2: Nonstructural NED Plan	Medium	Medium	Low	Low
Plan 3: NED + OSE Increment 1	Medium	Medium	Low	Low
Plan 4: NED + OSE Increment 2	Medium	Medium	Low	Low

High-Signifies the metric was met considerably.

Medium-Signifies the metric was met moderately.

Low-Signifies the metric was minimally met if all.

6.3 PRINCIPLE AND GUIDANCE CRITERIA EVALUATION

The four formulation criteria suggested 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. Table 6-4 presents the P&G criteria evaluation.

- *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 or not 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 6-4. Final Array Evaluation to P&G Criteria

Alternative	Acceptability	Completeness	Effectiveness	Efficiency
Plan 1: No Action	Partially. Viable and in accordance with state and local entities and with existing laws. Provides no solution to the identified problems.	No. Does not meet objectives to reduce flood risk.	No. The alternative does not alleviate the problems identified and does not meet the objectives of the project.	Yes. No money is expended, no benefits are gained, problems are not alleviated, and objectives are not met. No flooding risk would be reduced.
Plan 2: Nonstructural NED Plan	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.	Yes. Is the most cost-effective means of providing a reduction of damages to eligible structures.
Plan 3: 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. It does not achieve Objective 3 of the study.	Partially. It is cost effective but does have a slightly lower net benefits and increased cost but provides some potential to reduce flooding for SV areas.
Plan 4: Plan 4: 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. It does not achieve Objective 3 of the study.	Partially. It is cost effective but does have a lower net benefits and increased cost but provides the highest potential to reduce flooding for SV areas.

6.4 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 2014 PRG which are NED, Environmental Quality (EQ), Regional Economic Development (RED), and OSE. Table 6-5 compares the four Federal accounts against the three nonstructural alternatives in the final array. This is a summary of the highest-ranking alternatives by account.

Table 6-5. P&G Four Federal Accounts Assessment

Four Accounts	Plan 2: NED Plan	Plan 3: NED + OSE Increment 1	Plan 4: NED + OSE Increment 2
National Economic Development (NED)	Avg. Annual Benefits $ 59.8 M Avg. Annual Costs $54.6 through 58.0 M Net Annual Benefits $5.1 through 1.8 M BCR- 1.09 through 1.03	Avg. Annual Benefits $60.6 M Avg. Annual Costs $56.1 through 59.6 M Net Annual Benefits $4.4 M through 942 K BCR- 1.08 through 1.02	Avg. Annual Benefits $61.4 M Avg. Annual Costs $58.0 through 61.6 M Net Annual Benefits $3.4 M through (178) K BCR- 1.06 through 0.997
Environmental Quality (EQ)	No significant impacts to the environment.	No significant impacts to the environment.	No significant impacts to the environment.
Regional Economic Development (RED)	Value Added: $1,391,463,000 FTE Jobs: 14,521	Value Added: $1,429,854,000 FTE Jobs: 14,925	Value Added: $1,478,086,040 FTE Jobs: 14,429
OSE	Overall minor positive benefits associated with the NED nonstructural plan. These benefits are realized via the Social Vulnerability & Resiliency, Health & Life Safety, Economic Vitality, Social Connectedness, Participation, and Environmental Justice as it relates to Justice 40 themes. For a detailed explanation of OSE criteria, reference table 6-7.	Both Minor & Moderate positive benefits are associated with Plan 2. These benefits are realized via the Social Vulnerability & Resiliency, Health & Life Safety, Economic Vitality, Social Connectedness, Participation, and Environmental Justice as it relates to Justice 40 themes. For a detailed explanation of OSE criteria, reference table 6-7.	Both Minor & Moderate positive benefits are associated with Plan 2. These benefits are realized via the Social Vulnerability & Resiliency, Health & Life Safety, Economic Vitality, Social Connectedness, Participation, and Environmental Justice as it relates to Justice 40 themes. For a detailed explanation of OSE criteria, reference table 6-7.

Ranges are 10-18% PED costs

FY 24 Interest 2.75% and 2024 Price Level

Cost Share 35% NFS and 65% Federal

6.4.1 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.

6.4.2 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 TSP 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.

6.4.3 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. The USACE Institute for Water Resources, Louis Berger, and Michigan State University developed the regional economic impact modeling tool, RECONS (Regional Economic System), that provides estimates of jobs and other economic measures such as labor income, value added, and sales that are supported by USACE programs, projects, and activities. 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. RECONS allows the USACE to evaluate the regional economic impact and contribution associated with USACE expenditures, activities, and infrastructure. Table 6-6 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 6-6. RED Impacts from RECONS

Plan	Expenditures	Gross Regional Product	Full-time Equivalent Jobs
1: No action	$0	$0	0

2: NED Plan	$1,560,788,000	$1,391,463,000	14,521
3: NED + OSE Increment 1	$1,603,850,000	$1,429,854,000	14,925
4: NED + OSE Increment 2	$1,657,950,000	$1,478,086,000	15,429

6.4.4 OTHER SOCIAL EFFECTS

The OSE account includes impacts to over-arching social themes including social vulnerability & resiliency, health & safety, economic vitality, social connectedness, participation, and environmental justice as it relates to the justice 40 initiative. Impacts to these social themes are prevalent in flood risk management projects and are evaluated and discussed in the OSE account (Table 6-7).

Evaluation of the outcomes of the various alternatives on SV populations using the Center for Disease Control, Agency for Toxic Substances and Disease Registry's Social Vulnerability and US. Census Bureau statistics, United States Geological Survey Food Atlas, and the Council on Environmental Quality's Climate and Economic Justice Screening Tool. Additionally, the life safety risk to the study area utilizing submergence criteria from the LifeSim technical manual was evaluated.

Table 6-7. Summary of OSE Benefit Themes

OSE Theme	Indicator	Plan 2: NED Plan	Plan 3: NED + OSE Increment 1	Plan 4: NED + OSE Increment 2
Social Vulnerability & Resiliency	Structures included in SV Areas	+	++	++
Health & Safety	Life Safety	+	+	+
	Critical Infrastructure	+	+	+
	Food Insecurity	+	++	++
Economic Vitality	Employment Activity	+	+	+
Social Connectedness	Civic Infrastructure	+	+	+
Participation	Public Involvement	*Evaluated Post-Draft Report Outreach*		
Environmental Justice	Structures included in Areas of EJ concern	+	++	++

Legend:
+: Minor Positive Benefits
++: Moderate Positive Benefits
+++: Significant Positive Benefits

Social Vulnerability & Resiliency:

Plan 2 provides minor benefits to individuals experiencing social vulnerability in the study area. Under this plan, $6.4 Million, 11.07 percent of total benefits are provided to these identified areas. Plan 3, NED + OSE Increment 1 provides moderate benefits to individuals experiencing social vulnerability within the ART study area. This plan was formulated with specific considerations of Social Vulnerability. Under this plan, incremental benefits in communities experiencing social vulnerability were increased to $7.2 Million, or 12.8 percent of overall benefits. Plan 4, NED + OSE Increment 2 provides moderate benefits to communities experiencing social vulnerability, increasing the total benefits to these identified areas to $7.9 Million, for an overall 14 percent of total benefits of the plan. Additional information on the incorporation of social vulnerability into the final array and their impacts can be found in the Economic & Social Consideration Appendix, Appendix G, in sections 1.2.2, 7.2.1, and 7.3.1.

Health & Safety

Life Safety:

Life safety concerns were addressed for the ART study via a simplified method utilizing the submergence criteria established by the Risk Management Center's (RMC) LifeSim technical manual. This approach does not include warning and evacuation and assumes that all residents within the structures are trapped in the structure at the time the max depth arrives.

All proposed nonstructural plans do not mitigate life safety risk on roadways; however, mitigation of proposed elevations and floodproofing does reduce the number of structures experiencing high hazard conditions according to the submergence criteria thresholds in the LifeSim technical manual. The decreased life safety concern is consistent among all of the plans in the final array. Reference Appendix G, section 7.3.3 for additional information relating to life safety.

Critical Infrastructure:

Critical infrastructure was assessed by surveying the physical critical infrastructure that is mitigated under the final array. Under each of the plans, there are 5 facilities that will be wet floodproofed. This mitigation will allow these services and their assistance to return to operation sooner than under the existing flood conditions. See Appendix G, section 7.3.3 for additional information relating to critical infrastructure.

Food Insecurity:

Food Insecurity impacts were determined through the USGS Food Access Atlas, where tracts are identified as experiencing food insecurity if they are both low income and have low access to fresh grocers. Plan 2 mitigates 14 total grocery stores, two of which are included in areas experiencing food insecurity. Plan 3 includes mitigation of 15 grocery stores in total, with the additional grocer not being in an area that experiences food insecurity. Plan 4 presents the same level of mitigation for areas experiencing food insecurity as Plan 3. Reference Appendix G, section 7.3.3 for additional information related to food insecurity.

<u>Economic Vitality</u>

Economic vitality was assessed via employment by industry and the number of commercial structures mitigated under each of the plans. Plan 2 floodproofs 369 commercial structures, Plan 3 floodproofs 374 commercial structures, and Plan 4 floodproofs 380 commercial structures. The difference between the 3 plans is insignificant when compared. The mitigation of these structures will decrease the duration of employment and consumption pauses.

<u>Social Connectedness</u>

Impacts to social connectedness was measured via inclusion of civic infrastructure in each of the plans. Civic infrastructure includes community centers and places of worship. Each of the plans in the final array mitigates eight physically located facilities, three of them being community centers and five of them being places of worship.

Environmental Justice – Justice 40 Initiative

Environmental Justice as it relates to the Justice 40 initiative according to Executive Order 14008, was evaluated by determining how many structures are included in the plans within areas of Environmental Justice concern according to the Council on Environmental Quality's Climate and Economic Justice Screening Tool. Plan 2 included 1,262, or 40 percent of total structures in areas of Environmental Justice Concern. Plan 3 included an additional 22 structures in areas of Environmental Justice Concern for a total of 1,284, or 40 percent of the total eligible structures in the plan. Of the increase in total structures from Plan 2, 31 percent of the increased structures are in areas of Environmental Justice concern. Plan 4 included an additional 172 structures in areas of Environmental Justice Concern for a total of 1,324, or 40 percent of the total eligible structures in the plan. Of the increase in total structures from Plan 2, 36 percent of the increased structures are in areas of Environmental Justice concern (Table 6-8).

Table 6-8. Disadvantaged Communities (Justice 40)

	***Plan 2**: NED Plan*	***Plan 3**: NED + OSE Increment 1*	***Plan 4**: NED + OSE Increment 2*
Structures Included	1,262	1,284	1,324
% of Benefits to Disadvantaged Communities	40%	40%	40%

6.5 IDENTIFYING THE TSP

The CEMVN is presently pursuing a policy exception for the following USACE Policy: ER 1105-2-100 2-3(f)(1) stating: "The National Economic Development (NED)Plan. For all project purposes except ecosystem restoration, the alternative plan that reasonably maximizes net economic benefits consistent with protecting the Nation's environment, the NED plan, shall be selected. The Assistant Secretary of the Army for Civil Works (ASA (CW)) may grant an exception when there are overriding reasons for selecting another plan based upon comprehensive benefits or other Federal, State, local and international concerns."

Currently, the TSP is the Plan 4: Nonstructural Plan with additive for OSE for positive and negative benefits because it provides flood risk reduction in terms of national economic development along with the added benefit of flood risk reduction to vulnerable and disadvantaged communities, maximizing the OSE account (Table 6-9). While this plan is not the NED Plan, it provides the best level of comprehensive benefits for flood risk reduction to the ARB study area and is the Total Benefits Plan for this study. If the policy exception is not granted, the TSP will default to Plan 2: Nonstructural NED Plan. As part of feasibility level design activities, the costs and benefits will continue to be refined and will be updated within the final report.

Table 6-9. Summary of Costs and Benefits of the TSP (Plan 4: Total Benefits Plan) and the NED Plan

Item	NED Plan	TSP: Plan 4
Total Annual Benefits:	$59.8 M	$61.4 M
Damage Category: Structure, Contents, Vehicles, and Debris Removal		
Total First Costs	$1.47 through 1.56 B	$1.56 through 1.66 B
Interest During Construction	$5.0 through 5.3 M	$5.3 through 5.6 M
Annual Operation & Maintenance Costs	TBD	TBD
Total Annual Costs	$54.6 through 58.0 M	$58.0 through 61.6 M
B/C Ratio	1.09 through 1.03	1.06 through 0.997
Expected Annual Net Benefits	$5.1 through 1.8 M	$3.4 M through (178) K

Ranges are 10-18% PED costs
FY 24 Interest 2.75% and 2024 Price Level
Cost Share 35% NFS and 65% Federal

Section 7
Tentatively Selected Plan

The federal TSP is Plan 4, the Total Benefits Plan, which includes nonstructural elevation, dry floodproofing, and wet floodproofing measures on a total of 3,298 structures, located in the 0.1 (59 aggregates), 0.2 (13 aggregates), or 0.4 (7 aggregates) AEP floodplain to 0.01 AEP BFE in the ARB study area. Flood risk and residual risk from coastal storm surge were estimated to be reduced to:

- 2,918 residential structures,
- 380 nonresidential structures.

The reduction in damages would be achieved by elevating residential structures up to 13 feet above ground surface and floodproofing 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 $58 through $61.6 million (total project cost of 1.56 through 1.66 Billion including interest during construction), a BCR range of 1.06 through 0.997, and net benefits range of $3.4 million through -$178 K at the current Federal discount rate (FDR) of 2.75 percent and 2024 Price Level.

No significant flood risks associated with the ARB and its tributaries were identified within Mississippi; therefore, no structures have been identified as eligible as part of this plan.

7.1 NATIONAL ECONOMIC DEVELOPMENT PLAN

The intent of comparing alternative flood risk reduction plans in terms of NED is to identify the beneficial and adverse effects that the plans may have on the national economy. Beneficial effects were considered to be 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 NED plan reasonably maximizes net benefits. The NED costs and benefits for the final array are described in Table 6-1. The NED Plan includes floodproofing or elevation of 3,117 structures located in the 0.1 (46 aggregates), 0.2 (5 aggregates) or 0.4 (6 aggregates) floodplain to 0.01 AEP BFE.

Flood and costal storm risk were estimated to be reduced to:

- 2,748 residential structures,
- 369 nonresidential structures.

The CEMVN is presently pursuing a policy exception for the following USACE Policy: ER 1105-2-100 2-3(f)(1) stating: "The National Economic Development (NED)Plan. For all project purposes except ecosystem restoration, the alternative plan that reasonably maximizes net economic benefits consistent with protecting the Nation's environment, the NED plan, shall be selected. The ASA CW may grant an exception when there are overriding reasons for selecting another plan based upon comprehensive benefits or other Federal, State, local and international concerns." If the policy exception is not granted, the Recommended Plan will default to Plan 2: Nonstructural NED Plan.

7.2 IMPLEMENTING THE PLAN

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 2026 (Appendix I: Implementation Plan). The schedule assumes that implementation of the Nonstructural Plan will occur over an approximate 10-year period with approximately 500 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.

In order to be preliminarily eligible for inclusion in the Plan, 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 0.1, 0.04, 0.02 AEP year floodplain depending on the location of the structure), based on hydrologic conditions predicted to occur in 2026 (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 2026-2076) unless they have been identified eligible based on SV criteria and included in the next highest aggregation regardless of economic justification.
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.

Once construction funds are appropriated for this project, the LADOTD, as the NFS, and the Department of the Army will enter into a project partnership agreement (PPA). After the signing of a PPA, the NFS will acquire the necessary land, easements and rights of way to construct the project. Because project features cannot be advertised for construction until the appropriate real estate interests have been acquired, obtaining the necessary real estate in a timely fashion is critical to meeting the project schedule. At the completion of construction, or functional portions thereof, the NFS would be fully responsible for OMRR&R, as the functional portions of the project are completed.

The following work tasks were assumed for cost estimation purposes. No USACE Federal funds will be used to restore, replace, or repair a structure or bring a structure into compliance with applicable building and other codes. All work will require the issuance of state and local government permits prior to the commencement of any onsite construction. Elements of structure work that are deemed to be potentially eligible costs include, but are not limited to: design costs; costs of obtaining all required permits (i.e., zoning or land use approvals, environmental permits or required certifications, historic preservation approvals and Section 106 NHPA consultation in accordance with the PA; including any required mitigation measures, building permits, etc.): costs for title searches and the review of title documents; survey and inspection costs.

<u>Elevation of Residential Structures</u>

No additions to the habitable spaces of a structure (including but not limited to, outbuildings, detached garages, sheds, etc.) will be permitted in the performance of the elevation work. Elements of structure elevation work that are potentially eligible project costs include the following tasks:

- Raising the roof and extending the walls of a side structure attached to the main structure (i.e., garage);
- Raising mechanical equipment (e.g., air conditioner, furnace, water heater, electrical panel, fuel storage, valves, or meters);
- Connecting, disconnecting, and extending utility connections for electrical power, fuel, incoming potable water, wastewater discharge;
- Meeting access requirements of applicable building and other codes (e.g., stairs with landings, guardrails) and/or the Americans with Disabilities Act;
- Creating large vent openings in the foundation and walls to meet requirements for floodwater entry and exit;
- Special access improvements (e.g., elevators, lifts, ramps, etc.) when a satisfactory written medical opinion is provided by a medical doctor who is active, in good standing and licensed by the State of Louisiana, stating that special handicapped access is required for a handicapped or mobility challenged property owner and/or the property owner's family member and/or other person currently residing in the structure, and/or by a tenant currently occupying the structure. Multiple access points may also be eligible where necessary to meet state and/or local building and other code requirements;
- Removal of any trees and other vegetation which restrict the elevation work;
- Debris removal (all demolition debris (hazardous and non-hazardous) shall be removed and taken to an approved landfill;

- Site grading and site restoration including grading landscaping to it preconstruction condition but it cannot adversely affect drainage of adjacent properties;
- Temporary site protection measures during the elevation work such as temporary construction fencing;
- Allowable relocation assistance funds for displaced tenants who are unable to occupy the structure during the elevation process in accordance with the URA and Real Property Acquisition Policies for Federal and Federally Assisted Programs of 1970, Public Law 91-646, 84 Stat. 1984 (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. Relocation assistance for tenants who cannot live in the structure during the elevation process, may include, among other thing, advisory services, eligible reasonable out-of-pocket expenses incurred during temporary displacement (e.g., moving and storage of household goods required to be removed during construction, temporary quarters, meals, etc.);
- If additional work is required as a condition of building permit issuance, and if such work is not listed as eligible herein, the property owner will be required to fund and conduct such additional work. In no event shall the structure be elevated if USACE determines that the structure is not physically sound and/or capable of being raised safely.

<u>Dry Floodproofing of Nonresidential Structures</u>

Elements of structure work that are deemed to be potentially eligible dry floodproofing costs include, the following tasks:

- Installation of backflow valves;
- Closures on doors, windows, stairwells and vents-- temporary or permanent;
- Rearranging or protecting damageable real property components--e.g., relocate or raise utilities;
- Sump pumps and sub-drains;
- Water resistant material; water resistant window coverings, doors and jambs; waterproof adhesives; sealants and compounds, and floor drains;
- Plastic sheeting around the walls;
- Connecting, disconnecting, and extending utility connections for electrical power, fuel, incoming potable water, wastewater discharge;
- Removal of any trees that restrict the dry floodproofing of a structure;
- Temporary site protection measures during site work.

<u>Wet Floodproofing of Nonresidential Structures</u>

Elements of structure work that are deemed to be potentially eligible wet floodproofing costs include the following tasks:

- Wet floodproofing of the structure;
- Engineered flood vents;

- Flood-resistant construction materials such as rigid foam board wall insulation or cement board and molding within the interior of the building,
- Elevation and wet floodproofing of electric outlets,
- Concrete floor treatment and interior wall and floor sealer/stains;
- Exterior paint coatings;
- Sand/water blasting or other manual removal of rusted coatings and application of epoxy coatings;
- Elevation and wet floodproofing of mechanical and electrical equipment;
- Connecting, disconnecting, and extending utility connections for electrical power, fuel, incoming potable water, wastewater discharge;
- Removal of any trees which restrict the elevation of a structure;
- Temporary site protection measures during site work.

7.2.1 REAL ESTATE

The TSP consists of implementing nonstructural measures to reduce the risk of damages from flooding to residential and non-residential structures in the study area. The TSP involves elevations of residential structures and flood proofing of nonresidential structures.

The TSP is presently Plan 4: Nonstructural Plan with additive for OSE for positive and negative benefits because it provides flood risk reduction in terms of national economic development along with the added benefit of flood risk reduction to vulnerable and disadvantaged communities, maximizing the OSE account. While this plan is not the NED Plan, it provides the best level of comprehensive flood risk reduction to the ARB study area and is the Total Benefit Plan for this study. If the policy exception is not granted, the TSP will default to Plan 2: Nonstructural NED Plan.

Plan 4: Nonstructural Plan with additive for OSE for positive and negative net benefits

A total of approximately 3,298 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 4 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 2,918 structures) and floodproofing (approximately 380 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 2: Nonstructural NED Plan

The initial Nonstructural NED plan involves the floodproofing or elevation of 3,117 structures located in the floodplain. The estimated total cost for Real Estate for Plan 2, if a waiver is not obtained, is $105.6 M This plan would involve elevating approximately 2,748 structures and floodproofing approximately 369 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. 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 2076 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 based on individual structure but is to be documented and with reference to associated 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. For all structure types (residential and nonresidential) OMRR&R costs are expected to be '*de minimus*.' Costs for these efforts have not yet been calculated but will be included in the final report.

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. Feasibility study costs are typically shared 50 percent Federal and 50 percent non-Federal, but this study is 100 percent federally funded. 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 $1.56 through 1.66 B. The total fully funded cost of the project, with escalation through the mid-point of construction, is approximately $1.92 through 2.04 B (Table 7-1). As part of feasibility level design activities, the costs will continue to be refined and will be updated within the final report.

Table 7-1. Project First and Total Apportionments

Project First Costs	
Construction	$ 915.1 M
PED	$ 91.5 M through $164.7 M
Construction Management	$ 91.5 M
Real Estate	$ 89.4 M
Contingency	$ 374 M through $ 397 M
Total Project First Cost (constant dollar basis) Apportionment	**$ 1.56 through 1.66 B**
Federal Share (65%)	$ 1.01 through $1.08 B
Non-Federal Share (35%)	$ 550 through 580 M
Total Project Cost (Fully Funded)	**$1.92 through 2.04 B**
Federal Share (65%)	$ 1.25 through $1.33 B
Non-Federal Share (35%)	$ 671 through 714 M

Ranges are 10-18% PED costs
FY 24 Interest 2.75% and 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:

a. Provide 35 percent of construction costs, as further specified below:
    1. 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;
    2. 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;
    3. Provide, during construction, any additional contribution necessary to make its total contribution equal to at least 35 percent of construction costs;
b. 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;
c. 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;
d. 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;
e. 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;
f. 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;

g. 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;
h. 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;
i. Agree, as between the Federal government and the non-Federal sponsor, that the non-Federal 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
j. 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. 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.

For nonstructural measures, the level of risk reduction is variable, as every structure in the aggregation has a unique ground surface elevation and structural attributes such as foundation height, value, and condition. Each of these factors led to each individual structure, in the project area, having a different level of risk reduction relative to its neighbors and other structures in the inventory. The result is that the TSP does not have a single level of risk reduction, but rather 3,298 different levels. The level of risk reduction can be summarized by how many structures see risk reduction for each of the eight flood frequencies ran through HEC-FDA, see Appendix G Economics and Social Vulnerability for additional discussion on the risk reduction.

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 $1.56 through 1.66 B 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 construction design;
- Modeling analysis and assumptions;
- Existing or future projects cause unexpected effects on the TSP.

As the project moves into the next phases, USACE will focus risk management and mitigation on the primary cost and other significant risk drivers to the extent within USACE control. 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.

Because natural systems are complex and consist of an intricate web of variables that influence the existence and condition of other variables within the system, all projects (e.g., flood risk management, restoration, etc.) contain inherent uncertainties. The effects of tropical storms, increased SLR, and climate change on each project's performance are uncertain and are addressed through future projections based on existing information.

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.

- Potential climate change issues, such as SLR, in addition to regional subsidence rates are significant scientific uncertainties. These issues have been incorporated in the alternative evaluation process. SLR is discussed further in Section 7.2.6.2.1.
- Future climate change trajectories or projections affect habitat conditions (e.g., subsidence, SLR, flood events, drought, growing season lengths, etc.).
- River conditions could change.

7.2.6.3 Participation Rate

An analysis will be performed, as part of feasibility level design and included within the final report to determine a triangular distribution regarding what participation rate could be expected within the Amite study area. It is likely that this uncertainty distribution will be around 25 percent, 50 percent, and 75 percent sensitivities to provide the range of net benefits that non-participation would expect to yield. The economics team will rely on the best practice guides provided by the National Nonstructural Committee to assist with this effort.

7.2.6.4 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 SLC: low, intermediate, and high. 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 SLR should be used in this study for future conditions model runs in the analysis of alternatives. This topic is discussed further in Section 6.3 of Appendix H: Hydrologic & Hydraulics.

In recognition of the uncertainty presented by SLR, the TSP is based on the 2076, 0.01 AEP BFE predominate condition WSE, which uses the higher of the WSEs created by riverine flooding due to extreme precipitation or storm surge flooding. This results in an increase structure elevation heights and likely floodproofing for many of the structures, that will help ensure adaptation capacity. CEMVN will continue to monitor local conditions and determine if the intermediate scenario of sea level change is reasonably representative of observed conditions. If observed conditions significantly exceeding the intermediate projection are identified during design or construction, reevaluation of the TSP plan will be required.

7.2.6.5 Residual Risk and Damages

The TSP will greatly reduce, but not eliminate all future flood risk damages and residual risk would remain in the study area. Additionally, the structures eligible for inclusion in the nonstructural plans were based only on rainfall flood risk. This leaves a large number of structures, approximately 50 percent of the structures with residual flood risk within the study area (See Appendix G Table G:5-3), not included in the TSP that would have been if the plan formulation used coastal hydraulic conditions in addition to rainfall to develop alternatives. This would require additional authorization and is outside of the study purpose.

The residual risk, along with the potential consequences, will be communicated to the NFS and will become a requirement of any communication and evacuation plan when this plan is implemented.

7.2.6.6 Potential Induced Flooding

No potential induced flooding is anticipated with nonstructural plans.

Section 8
Environmental Laws and Regulations

8.1 EXECUTIVE ORDER (E.O.) 11988 FLOODPLAIN MANAGEMENT

Executive Order 11988 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 flood plains. Agencies must consider alternatives to avoid adverse and incompatible development in the flood plain. If the only practical alternative requires action in the flood plain, agencies must design or modify their action to minimize adverse impacts. 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.

8.2 EXECUTIVE ORDER 11990 PROTECTION OF WETLANDS

The purpose of Executive Order (E.O.) 11990 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. If impacts to wetlands are determined, a wetlands assessment must be prepared that describes the alternatives considered. The procedures include a requirement for public review of assessments. The proposed action would not result in impacts to wetlands and therefore is in compliance with E.O. 11990.

8.3 COASTAL ZONE MANAGEMENT ACT

The Coastal Zone Management Act (CZMA) 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 complete before finalization of the FONSI.

8.4 ENDANGERED SPECIES ACT OF 1973

The Endangered Species Act (ESA) is designed to protect and recover threatened and endangered (T&E) species of fish, wildlife and plants. No plants were identified as being threatened or endangered in the project area. If a manatee(s) is sighted within 100 yards of the project area, moving equipment must be kept at least 50 feet away from the manatee or shut down. There would be restrictions on vessel operation, restrictions on the use of siltation barriers, and mandatory signage designed to avoid any harm to manatees in the project area as stated in the draft FWCAR. Based on review of existing data and in coordination with the FWS guidelines, the CEMVN finds that there would be no effect on threatened and endangered species with implementation of this project.

8.5 MIGRATORY BIRD TREATY ACT

The project area is known to support colonial nesting wading/water birds (e.g., herons, egrets, ibis, night-herons and roseate spoonbills) and shorebirds (terns and gulls). Based on review of existing data, and with the use of FWS guidelines, the CEMVN finds that implementation of the proposed actions would have no effect on colonial nesting water/wading birds or shorebirds. FWS and USACE biologists would survey the proposed project area before project implementation to confirm no nesting activity as suitable habitat and the potential for nesting exist within the project area. If active nesting exists within 1,000 feet (water birds) or 1,300 feet (shorebirds) of construction activities then USACE, in coordination with FWS, would develop specific measures to avoid potential adverse impacts to those species. A detailed nesting prevention plan may be necessary in order to deter birds from nesting within the aforementioned buffer zones in order to avoid potential adverse impacts. If a nesting prevention plan is necessary, it would be prepared in coordination with FWS.

The bald eagle was removed from the List of Endangered and Threatened Species in August 2007, but continues to be protected under the Bald and Golden Eagle Protection Act (BGEPA) and the Migratory Bird Treaty Act of 1918, as amended (MBTA). During nesting season, construction must take place outside of FWS/LDWF buffer zones. A USACE Biologist and a FWS Biologist would survey for nesting birds. This would be done prior to the start of project implementation.

8.6 FISH AND WILDLIFE COORDINATION ACT OF 1934

The Fish and Wildlife Coordination Act (FWCA) provides authority for the FWS involvement in evaluating impacts to fish and wildlife from proposed water resource development projects. It requires that fish and wildlife resources receive equal consideration to other project features. It requires Federal agencies that construct, license or permit water resource development projects to first consult with the FWS, NMFS and State resource agencies regarding the impacts on fish and wildlife resources and measures to mitigate these impacts. Section 2(b) requires the FWS to produce a Coordination Act Report (FWCAR) that details existing fish and wildlife resources in a project area, potential impacts due to a proposed project and recommendations for a project. The FWS reviewed the proposed action project described in this SSDIFR/EA. The draft FWCAR is pending and can be found in Appendix D-1 . Responses to draft comments would be included in the final report.

1. If ring levees are proposed as part of the “non-structural” component of the TSP, the levee alignments should be located to avoid and minimize impacts to both herbaceous wetlands and forested communities (wet and non-wet) as much as possible. The acreage of wetlands and forested habitat enclosed within ring levees also should be minimized to the maximum extent practicable.

USACE RESPONSE: Ring levees are not a part of the proposed nonstructural TSP. Should this change in the future, USACE would re-coordinate with the FWS and avoid and minimize impacts to habitat to the maximum extent practicable.

2. Avoid adverse impacts to bald eagle nesting locations and wading bird colonies through careful design of project features and timing of construction. During project construction, a qualified biologist should inspect the proposed construction site for the presence of documented and undocumented wading bird nesting colonies and bald eagles.

    a. All construction activity during the wading bird nesting season (February through October 31 for wading bird nesting colonies, exact dates may vary) should be restricted within 1,000 feet of a wading bird colony. If restricting construction activity within 1,000 feet of a wading bird colony is not feasible, the CPRA should coordinate with the Service to identify and implement alternative best management practices to protect wading bird nesting colonies.
    b. During construction activities, if a bald eagle nest is within or adjacent to the proposed project area, the applicant should follow the bald and golden eagle guidelines found on-line here to determine whether disturbance will occur and/or an incidental take permit is needed.

USACE RESPONSE: Concur. During project implementation a qualified biologist would be on site to ensure activities would not affect colonial wading birds during the nesting season. USACE would also be in compliance with the Bald and Golden Eagle Protection Act if activities are within 660 feet of a bald eagle nest.

3. If implementation of the proposed action has the potential to directly or indirectly affect Inflated heelsplitter mussel, Gulf sturgeon, West Indian Manatee, or the Northern long-eared bat, then consultation with this office should be initiated.

USACE RESPONSE: Concur. The nonstructural TSP would not effect Inflated heelsplitter mussel, Gulf sturgeon, West Indian manatee, or the Northern long- bat. Should this change in the future, USACE would re-coordinate with the FWS and avoid and minimize impacts to habitat to the maximum extent practicable.

4. West Indian manatees occasionally enter Louisiana coastal waters and streams during the warmer months (i.e., June through September). During in-water work in areas that potentially support manatees all personnel associated with the project should be instructed about the potential presence of manatees, manatee speed zones, and the need to avoid collisions with and injury to manatees. All personnel should be advised that there are civil and criminal penalties for harming, harassing, or killing manatees, which are protected under the Marine Mammal Protection Act of 1972, the Endangered Species Act of 1973, and state law. Additionally, personnel should be instructed not to attempt to feed or otherwise interact with manatees, although passively taking pictures or video would be acceptable. For more detail on avoiding contact with manatees refer to the Endangered and Threatened Species section of this document, contact this office.

USACE RESPONSE: Concur. There is no in-water work anticipated with the proposed nonstructural TSP. Should this change in the future, USACE would re-coordinate with the FWS and avoid and minimize impacts to the maximum extent practicable.

5. The Service recommends that the USACE contact the Service for additional ESA section 7 consultation if: 1) the scope or location of the proposed project is changed significantly, 2) new information reveals that the action may affect listed species or designated critical habitat, 3) the action is modified in a manner that causes effects to listed species or designated critical habitat, or 4) a new species is listed or critical habitat designated.

USACE RESPONSE: Concur.

The final SSIFR/EA will include responses to the final FWCAR.

8.7 HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE

A phase I environmental site assessment is required for all USACE civil works projects to facilitate early identification and appropriate consideration of potential hazardous, toxic, and radioactive waste (HTRW) problems. HTRW includes any material listed as a “Hazardous Substance” under CERCLA. Other regulated contaminants include those substances that are not included under CERCLA but pose a potential health or safety hazard. Examples include, but are not limited to, many industrial wastes, naturally occurring radioactive materials, many products and wastes associated with the oil and gas industry, herbicides, and pesticides. ER 1165-2-132 and Division Regulation 1165-2-9 established policies for conducting HTRW review for USACE civil works projects.

A preliminary HTRW phase 1 environmental site assessment was conducted for the current draft SSDIFR/EA, and no HTRW concerns were identified. The ART study area was surveyed via aerial photography and environmental database searches in the study area’s respective zip codes, and no HTRW concerns were identified. The proposed action would include an individual HTRW assessment per structure, should that structure go through the process of being elevated. If during the individual HTRW assessment, a recognized environmental condition (REC) is identified, it would be incumbent upon the property owner to address the REC in order to be considered a part of the program.

8.8 E.O. 12898 ENVIRONMENTAL JUSTICE

USACE is obligated under E.O. 12898 of 1994 and the Department of Defense’s Strategy on Environmental Justice of 1995, which direct Federal agencies to identify and address any disproportionately high adverse human health or environmental effects of Federal actions to minority and/or low-income populations. Minority populations are those persons who identify themselves as Black, Hispanic, Asian American, American Indian/Alaskan Native, Pacific Islander, or some other race or a combination of two or more races.

A minority population exists where the percentage of minorities in an affected area either exceeds 50 percent or is meaningfully greater than in the general population. Low-income populations are those whose income is the Census Bureau’s statistical poverty threshold for a family of four. The Census Bureau defines a "poverty area" as a census tract or block numbering area with 20 percent or more of its residents below the poverty threshold level and an "extreme poverty area" as one with 40 percent or more below the poverty threshold level.

8.9 NATIONAL HISTORIC PRESERVATION ACT OF 1966

USACE is continuing to follow its NHPA Section 106 procedures described in Section 3 and 5 to develop a project-specific PA in furtherance of USACE's Section 106 responsibilities for this Undertaking. Due to the unknowns associated with implementing the TSP, and the inability to determine effects on historic properties, CEMVN has decided to negotiate a PA in accordance 36 CFR 800.14(b). The PA would then govern USACE's subsequent NHPA compliance efforts. Following the execution of the PA, USACE may proceed with issuing a FONSI in compliance with Section 106 and NEPA.

8.10 TRIBAL CONSULTATION

It is the policy of the Federal Government to consult with Federally-Recognized Tribal Governments on a Government-to-Government basis as required in E.O. 13175 ("Consultation and Coordination with Indian Tribal Governments;" U.S. President 2000). The requirement to conduct coordination and consultation with Federally-Recognized Tribes on and off of Tribal land finds its basis in the constitution, Supreme Court cases, and is clarified in later planning laws, such as the National Environmental Policy Act. 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. These principles emphasize Tribal sovereignty, the Federal Government's trust responsibility, Government-to-Government consultation, early and pre-decisional consultation, recognition of Tribal self-reliance, focusing USACE on efforts at Tribal capacity building, and requiring USACE to protect natural and cultural resources during project development and implementation. Moreover, the USACE Planning and Guidance Notebook (ER 1105-2-100), including Smart Planning, gives guidance in Appendix B, Public Involvement, Collaboration and Coordination (B-8) and Appendix D, Environmental Evaluation and Compliance (D-3), reinforcing the same authorities and processes. The most explicit and accessible guidance regarding USACE and Tribal interaction can be found in USACE's Tribal Consultation Policy (November 01, 2012).

In addition to consulting with Tribes under the NHPA as described above (NHPA 1966 Section), USACE is consulting in accordance with E.O. 13175, NEPA, and its 2012 Tribal Policy. The 2012 Tribal Consultation Policy directs that consultation should begin at the earliest planning stages before decisions are made and actions are taken (paragraph 3b); provides guidance that USACE should contact "[T]ribes whose aboriginal territories extend to the lands where an activity would occur…sufficiently early to allow a timely review of the proposed action" (paragraph 5.d.(1); and goes on to state that the USACE official interacting with Federally-Recognized Tribes should maintain open lines of communication through consultation with Tribes during the decision making process for matters that have the potential to significantly affect protected Tribal resources, Tribal rights (including treat rights), and Indian lands (paragraph 6. d.). In sum, all of this guidance directs the agency to start early and to coordinate often.

USACE started the Tribal consultation process by inviting Tribes to participate in the early scoping process via letter on December 4, 2018, (also see Public Scoping Section 2.4). The letters were directed to the leadership of each of the Tribal governments whose aboriginal and historic territories or historic removal routes extended to the lands where the proposed activities would occur (i.e., the ACTT, CTL, CNO, CT, MBCI, JBCI, STF, SNO, and TBTL). Two responses were received that did not address the substance of the request. The MBCI participated in a scoping meeting and raised the issue of effects to pre-contact archaeological sites from any of the then-proposed alternatives. Next, on April 10, 2019, USACE provided an email distribution of the April 2, 2019, Notice of Intent to produce an EIS as well as the advertisement of public meetings for this project. No responses were received regarding this distribution. USACE also invited each of the Tribes to participate as a cooperating agency in the development of the EIS at a meeting on June 18, 2019. Only the MCN responded to this correspondence, indicating that the Tribe was choosing to consult under the NHPA, rather than participate as a cooperating agency. USACE intends to keep the lines of communication open throughout the study, relying on the Section 106 Process to capture significant Tribal concerns regarding historic properties, but remains open to the need to undertake Government-to-Government consultation, as necessary.

Section 9
Public Involvement

Project Delivery Team (PDT) meets every other Thursday with team members and the NFS to discuss progress and pitfalls of the study.

Early NEPA coordination with the NFS, stakeholders, Federal and State agencies, and Federally-Recognized Tribes was performed prior to the 2019 notice of intent (NOI) and afterward through public meetings, social media, and the CEMVN website. USACE hosted general scoping meetings within 90 days of the start of the study, per Water Resources Reform and Development Act (WRRDA) 2014. As part of the early coordination, general scoping was initiated prior to the NEPA NOI, in conformity with 40 CFR 1500-1508. A public website page with the study information and request for feedback was established in mid-December 2018.

The collaborative stakeholders associated with this study are USACE, ARB Commission (ARBC), CPRA, and the following parishes: Livingston, Ascension, St. Helena, East Feliciana, East Baton Rouge, Iberville, St. John the Baptist, and St. James. 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), U.S. Geological Survey (USGS), 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 (ACTT), Chickasaw Nation, Chitimacha Tribe of Louisiana (CTL), Choctaw Nation of Oklahoma (CNO), Coushatta Tribe of Louisiana (CT), Jena Band of Choctaw Indians (JBCI), Mississippi Band of Choctaw Indians (MBCI), Muscogee (Creek) Nation (MCN), Seminole Nation of Oklahoma (SNO), Seminole Tribe of Florida (STF), and Tunica-Biloxi Tribe of Louisiana (TBTL) on December 4, 2018.

A NEPA stakeholder meeting was conducted by USACE on December 3, 2018 at the USGS Baton Rouge, Louisiana office that included an option to participate by video conference. A subsequent reconnaissance meeting was conducted on December 10, 2018 with the NFS, and resource agencies at the at CPRA's Baton Rouge, Louisiana office which also included an option to participate by video conference. Federally-Recognized Tribes were invited, but were unable to attend. However, a follow up meeting was held on January 7, 2019, during which the MBCI participated. Additionally, a public scoping meeting was conducted on January 10, 2019, at CEMVN with Facebook live streaming, where feedback was requested as well. Feedback from the public scoping meeting resulted in the identification of three additional measures.

In accordance with NEPA, a NOI to prepare an EIS was published in the Federal Register (Volume 84, No. 63) on April 2, 2019. The scoping period ended on July 8, 2019. Three public scoping meetings were conducted within the study area on April 24 and 25, with Facebook live streaming. Comments were accepted via written correspondence and emails.

Approximately 80 non–USACE people attended the meetings in person and the Facebook live streaming had over 6,000 views. Scoping identified four areas of concern: flooding, dredging opportunities, levee opportunities, and nature-based engineering. People are concerned about inducement of flooding into other area and proposed further investigation in alternative formulation and specific areas of concern. Feedback from the public scoping meeting resulted in the identification of one additional measure, which was proposed by the Healthy Gulf Collaborative, regarding conversion of sand and gravel mines to bottomland hardwoods habitat for flood control.

A meeting was conducted on June 18, 2019, with collaborative stakeholders, the NFS, resource agencies, and Federally-Recognized Tribes to present the preliminary final array of alternatives and the screening rationale of the alternatives that were screened. As a result, three agencies, (FWS, Louisiana Department of Environmental Quality (LDEQ), and LDWF) requested an evaluation of river restoration, which resulted in the addition of another alternative, restoration of river meanders.

The scoping report was included in the 2019 DIFR/EIS, Environmental Appendix C-2, which has copies of all written feedback received prior to the additional resources approval in 2022. It can be found at https://www.mvn.usace.army.mil/Amite-River-and-Tributaries/.

After the additional resources were approved to reassess the dry dam and further evaluate nonstructural alternatives, EJ outreach meetings were conducted on February 28, 2023, and March 1, 2023, to inform and engage residents about the flood risk reduction measures. Outreach efforts focused on civic and faith-based organizations that serve residents in areas of EJ concern, including local churches, libraries, non-profits, and community centers. Initial and follow-up calls were made to 29 churches, four community centers, three non-profits, and three academic institutions. Of those contacted, six churches, two community centers, two non-profits, and two academic institutions agreed to disseminate our one-page summary of the outreach effort to the residents they serve.

A Public Notice of this SSDIFR/EA will be available for a 45-day comment period beginning December 15, 2023, and end on January 29, 2024 along with a redaction of the 2019 NOI.

Environmental Justice (EJ) Meetings took place for the Amite River and Tributaries Feasibility Report Environmental Impact Statement on February 28, 2023, and March 1, 2023 to inform and engage residents about the flood risk reduction measures, which included the Nonstructural Plan.

Outreach efforts focused on civic and faith-based organizations that serve residents in areas of EJ concern, including local churches, libraries, non-profits, and community center. Initial and follow-up calls were made to 29 churches, four community center, three non-profits, and three academic institutions. Of those contacted, six churches, two community centers and two non-profits agreed to disseminate our one-page project summary to the residents they serve. More information on the EJ meetings is provided in Appendix D-4.

A Public Notice of this draft SSDIFR/EA will be available for a 45-day comment period beginning December 15, 2023, and end on January 29, 2024.

Preparation of this SSDIFR/EA was coordinated with appropriate congressional, 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 of the:

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 Natural Resources, Coastal Restoration Division
Louisiana Department of Environmental Quality
Louisiana State Historic Preservation Officer
Louisiana Departments of Transportation and Development

Section 10
Conclusion

The recommendations contained herein reflect the information available at this time and current USACE 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 Congress as proposals for authorization and implementation funding. However, prior to transmittal to Congress, the non-federal sponsor, interested federal agencies, and the public will be advised of any significant modifications and will be afforded an opportunity to comment further.

10.1 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 SSDIFR/EA has been identified by CEMVN for future recommendation for authorization as a Federal project, with such modifications thereof as in the discretion of the Commander, Headquarters, U.S. Army Corps of Engineers, may be advisable. The USACE recognizes that the NFS, supports the current identification of the TSP, but the NFS will also concurrently review the SSDIFR/EA.

The Draft Report for this study was first released for review in November 2019 and has since undergone additional analysis. This SSDIFR/EA includes additional concurrent ATR, public and policy reviews. The PDT, CEMVN management, and USACE vertical team representatives throughout the agency will consider 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, policy and IEPR 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 2024 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 Office of the Assistant Secretary of the Army for Civil Works for review by the Administration.

The SSDIFR/EA fully describes flood risk to structures and life safety associated with riverine, rainfall, 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. The residual risk, along with the potential consequences, has been communicated to the Non-federal Sponsor and will become a requirement of any communication and evacuation plan.

10.2 PARTICIPATION IN NONSTRUCTURAL ALTERNATIVES.

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 in order 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.

10.3 RECOMMENDED ACTION 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.

10.3.1 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.

10.3.2 ADOPTION OF MORE STRINGENT LOCAL FLOODPLAIN REGULATIONS

Although communities within the study area cannot change the minimum National Flood Insurance Program (NFIP) standards. The NFS should work with the local governments to adopt local standards that achieve higher levels of flood risk reduction. Examples of potential actions may include replacing elevation requirements based on the 0.01 AEP to the 0.2 AEP level of risk reduction; implementing a zero-rise floodway; and adopting cumulative damages as the trigger for substantial damage determination.

10.3.3 ADOPTION OF MORE RESTRICTIVE PARISH AND MUNICIPAL BUILDING CODES, LAND USE AND ZONING REGULATIONS, AND OTHER DEVELOPMENTAL CONTROLS

Local governments within the floodplain should be encouraged to adopt, implement, and enforce stricter building and housing code requirements, land use and zoning regulations, and other developmental controls aimed at reducing flood risk and flood damage.

10.4 PATH FORWARD

This draft report available for public review beginning December 15, 2023. The official closing date for the receipt of comments is January 29, 2024, which is 45 days from the date on which the notice of availability of the SSDIFR/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
Environmental Branch
CEMVN–PDS, Room 136,
7400 Leake Avenue
New Orleans, LA 70118
Email: AmiteFS@usace.army.mil

Public meetings are tentatively scheduled for the week of January 15, 2024. The meetings dates and locations will be provided on the CEMVN project website at: www. mvn.usace.army.mil/Amite-River-and-Tributaries.

List of Preparers

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References and Resources

Battelle Memorial Institute.2020. *Final Independent External Peer Review Report Amite River and Tributaries – East of the Mississippi River, Louisiana, Feasibility Study*. February

Brown and Butler, Inc. 1984. *Conceptual Stage Engineering and Economic Feasibility Report. Preface, Introduction, Summary, Proposed Darlington Reservoir*. Prepared for the Louisiana Department of Transportation and Development, Office of Public Works, Baton Rouge.

Brown & Daniel. 2014. The Population Ecology of the Threatened Inflated Heelsplitter, Potamilus inflatus, in the Amite River, Louisiana. *The American Midland Naturalist* 171(2), 328-339, (1 February 2014) https://bioone.org/journals/The-American-Midland-Naturalist/volume-171/issue-2/0003-0031-171.2.328/The-Population-Ecology-of-the-Threatened-Inflated-Heelsplitter-iPotamilus-inflatus/10.1674/0003-0031-171.2.328.full

East Baton Rouge Parish (EBR) Recreation and Park Commission, 2003. *Economic Impact Study Report*. http://www.brec.org/assets/PlanningandEngineering/IYP1_Final/iyp1_chapter4.pdf.

Coastal Protection and Restoration Authority (CPRA). 2023. River Reintroduction Into Maurepas Swamp (Transferred) (PO-29). https://lacoast.gov/new/Projects/Info.aspx?num=po-29

Coastal Protection and Restoration Authority (CPRA). 2017. *Attachment C2-4: Tropical Storm Intensity and Frequency*." http://coastal.la.gov/wp-content/uploads/2017/04/Attachment-C2-4_FINAL_5.15.2017.pdf)

Committee on Public Works of the United States Senate. Resolution adopted on April 14, 1967. Flood control and related purposes on Amite River, Bayou Manchac, and Comite River and their tributaries Authorization.

Daigle, J.J., Griffith, G.E. Omernik, J.M., Faulker, P.L., McCulloh, R.P., Handley, L.R., Smith, L.M., and Chapman, S.S., 2006. State of Louisiana Eco-Region Map, ref. "Louisiana Speaks" and "USGS Eco-Region Map", *Ecoregions of Louisiana* color poster with map, descriptive text, summary tables, and photographs.

EPA EJ Screen: https://ejscreen.epa.gov/mapper

Engineer Research and Development Center (ERDC)/Geotechnical and Structural Laboratory (GSL). 2007.TR-07-26, *Fluvial Instability and Channel Degradation of Amite River and its Tributaries, Southwest Mississippi and Southeast Louisiana*, September.

Espey, Huston & Associates, Inc. 1989. *Cultural Resources Survey Of The Proposed Darlington Reservoir (Amite River Alternative R-La*) East Feliciana And St. Helena Parishes, Louisiana State Project Number 575-99-30. Report prepared for the Louisiana Department of Transportation and Development and the ARB Drainage and Water Conservation District (LA DOA Report No. 22-1382).

Executive Order 13175. *Consultation and Coordination with Indian Tribal Governments*. Federal Register 65 (9 November): 67249; available from https://www.gpo.gov/fdsys/pkg/FR-2000-11-09/pdf/00-29003.pdf; Internet; accessed 11/16/2017.

Girard, Jeff, Chip McGimsey, and Dennis Jones, 2018. *Louisiana's Comprehensive Archaeological Plan*. State of Louisiana Department of Culture, Recreation and Tourism, Office of Cultural Development, Division of Archaeology, Baton Rouge.

Gulf Coast Joint Venture (GCJV): *Mississippi River Coastal Wetlands*. Electronic resource: http://www.gcjv.org/docs/MSRcoastpub.pdf

Hieb EE, Carmichael RH, Aven A, Nelson-Seely C, Taylor N .2017. *Sighting demographics of the West Indian manatee Trichechus manatus in the north-central Gulf of Mexico supported by citizen-sourced data*. Endang Species Res 32:321-332.

House of Representatives Document No. 419. 84th Congress 2nd Session. Chief of Engineers Report: Survey Report of Amite River and Tributaries, Louisiana.

Lee, Aubra, Christa Clements, Dayna B. Lee, Angele Montana, John Rawls & Rhonda L. Smith, 2009. Background Research for the Proposed Amite River and Tributaries, Bayou Manchac Watershed Feasibility Study, Ascension, East Baton Rouge & Iberville Parishes, Louisiana. Report prepared by Earth Search, Inc. on behalf of the Shaw Group for the U.S. Army Corps of Engineers, New Orleans District. New Orleans, Louisiana (LA DOA Report No. 22-3427).

Louisiana Department of Health. Emergency Preparedness. 2016 Flood Confirmed Storm-Related Deaths. Electronic Resource: http://ldh.la.gov/index.cfm/page/2553; Internet accessed 10/11/2023.

Louisiana Statewide Comprehensive Water Based Floodplain Management Program (LWFMP).2018. *Phase 1 Investigation Report*. May

Louisiana Department of Environmental Quality, Louisiana Digital Elevation Dataset source, UTM Zone 15 NAD83, LOSCO (2004) [24KDEM_LDEQ_2004]": Louisiana Oil Spill Coordinators Office 2001. Electronic resource: https://catalog.data.gov/dataset/louisiana-digital-elevation-dataset-from-ldeq-source-data-utm-zone-15-nad83-losco-2004-24k-2004

Louisiana Department of Wildlife and Fisheries. 2009. Louisiana Natural Heritage Program. *The Natural Communities of Louisiana*. August.

Louisiana National Guard Public Affairs Office. 2016. National Guard rescues 19,000 in flood-affected areas. August.www.army.mil/article/173589/national_guard_rescues_19000_in_flood_affected_areas. Internet accessed 10/11/2023.

Moody's Analytics. 2017. *Economic and Consumer Credit Analytics Forecast.* Retrieved from https://www.moodysanalytics.com/solutions-overview/economic/economic-forecasts.

National Environmental Policy Act of 1969. 1970. Vol. 83, secs. 1-207, 852; available from http://www.gpo.gov/fdsys/pkg/STATUTE-83/pdf/STATUTE-83-Pg852.pdf. Amended 1975. Statutes at large, Vol. 89, sec. 102, 424; http://www.gpo.gov/fdsys/pkg/STATUTE-89/pdf/STATUTE-89-Pg424.pdf; Internet; accessed 11/16/2017.

National Park Service, 1995. How to Apply the National Register Criteria for Evaluation. National

Register Bulletin No. 15. U.S. Dept. of the Interior, National Park Service, Cultural Resources, Washington, D.C. Electronic resource: https://www.nps.gov/nr/publications/bulletins/pdfs/nrb15.pdf

Rees, Mark A., 2010. *Archaeology of Louisiana*. Louisiana State University, Baton Rouge.

Terrell, Dek. Lewis Terrell and Associates. 2016. *The Economic Impact of the August 2016 Floods on the State of Louisiana*. Report Commissioned by Louisiana Economic Development. Electronic resource: http://gov.louisiana.gov/assets/docs/RestoreLA/SupportingDocs/Meeting-9-28-16/2016-August-Flood-Economic-Impact-Report_09-01-16.pdf.

USACE. 1992. Amite River and Tributaries Darlington Reservoir Feasibility Study, September

USACE.1995. EM 1110-2-1911, 1995. *Construction Control for Earth and Rock-Fill Dams*. Electronic resource: https://www.publications.usace.army.mil/Portals/76/Publications/EngineerManuals/EM_1110-2-1911.pdf?ver=2013-09-04-161128-287

USACE. 2004. EM 1110-2-2300. *General Design and Construction Considerations for Earth and Rock-Fill Dams*. Electronic resource: https://www.publications.usace.army.mil/Portals/76/Publications/EngineerManuals/EM_1110-2-2300.pdf?ver=2014-04-07-145941-947

USACE. 2014. Principles, Requirements and Interagency Guidelines, March 2013/ December 2014.

USACE. 2015.Planning Bulletin 2016-01, *Clarification of Existing Policy for USACE Participation in Nonstructural Flood Risk Management and Coastal Storm Damage Reduction Measures*. Electronic resource: https://planning.erdc.dren.mil/toolbox/library/pb/PB2016_01.pdf

USACE.2018. Implementation Guidance for Section 1005 of the Water Resource Reform and Development Act of 2014 (WRRDA 2014), Project Acceleration. March 20.

USACE. 2019a.Amite River and Tributaries East of the Mississippi River, Louisiana Draft Integrated Feasibility Study Report and Environmental Impact Statement, November.

USACE. 2019b. ER 1100-2-8162, 2019. *Global Changes. Incorporating Sea Level Change in Civil Works Programs*. Electronic resource: https://www.publications.usace.army.mil/Portals/76/Users/182/86/2486/ER_1100-2-8162.pdf?ver=2019-07-02-124841-933

USACE. 2020.*Comment Response Record for the Independent External Peer Review of the Amite River and Tributaries – East of the Mississippi River, Louisiana, Feasibility Study USACE Final Evaluator Responses and Panel Final Back Checks*, April.

USACE. 2023a. Comite River Diversion. https://www.mvn.usace.army.mil/About/Projects/BBA-2018/Comite-River-Diversion/

USACE. 2023b. East Baton Rouge Flood Reduction Project. https://www.mvn.usace.army.mil/About/Projects/BBA-2018/East-Baton-Rouge/

USACE.2023c. West Shore Lake Pontchartrain Project. https://www.mvn.usace.army.mil/About/Projects/BBA-2018/West-Shore-Lake-Pontchartrain/

USACE.2023d. Hydrologic Engineering Center-Flood Damage Reduction Analysis (HEC-FDA). https://www.hec.usace.army.mil/software/hec-fda/

U.S. Census Bureau. 2019. *Population and Housing Unit Estimates Datasets.* Retrieved from https://www.census.gov/programs-surveys/popest/data/data-sets.html.

U.S. Census Bureau. 2019. *Income.* Retrieved from https://www.census.gov/topics/income-poverty/income.html.

U.S. Bureau of Labor Statistics. 2019. *State and County Employment and Wages.* Retrieved from https://www.bls.gov/data/#employment.

U.S. Fish and Wildlife Service. 2007.*National Bald Eagle Management Guidelines*. May. Electronic Resource: https://ecos.fws.gov/ServCat/DownloadFile/36458?Reference=36436

U.S. Fish and Wildlife Service. 2017. *Eagle Technical Assistance.* Last updated April 2017. https://www.fws.gov/southeast/our-services/eagle-technical-assistance/

Williams et al. 2017.*A Revised list of the Freshwater Mussels (Mollusca: Bivalvia: Unionida) of the United States and Canada*. Freshwater Mollusk Biology and Conservation. 20:22-58, 2017.Electronic resource:

https://molluskconservation.org/PUBLICATIONS/FMBC/FMBC_Vol20/20-2-articles/20-2-33-58-Williams%20et%20al-frmc.pdf

40 CFR 1500-1508, Council on Environmental Quality Regulations for Implementing the Procedural Provisions of NEPA.

2013-2017 American Community Survey (ACS) 5-year estimates. Website: https://www.census.gov/programs-surveys/acs/technical-documentation/table-and-geography-changes/2017/5-year.html

List of Acronyms and Abbreviations

AAHU	Average Annual Habitat Units
ACHP	Advisory Council on Historic Preservation
ACS	American Community Survey
ACTT	Alabama-Coushatta Tribe of Texas
AEP	Annual Exceedance Probability
APE	Area of Potential Effects
ARB	Amite River Basin
ARBC	Amite River Basin Commission
ART	Amite River and Tributaries East of the Mississippi River, Louisiana.
BCR	Benefit to Cost Ratio
BGEPA	Bald and Golden Eagle Protection Act
BMP	Best Management Practices
BREC	Recreation and Park Commission for the Parish of East Baton Rouge
CDBG	Community Development Block Grant
CEMVN	USACE New Orleans District
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CNO	Choctaw Nation of Oklahoma
CPRA	Coastal Protection and Restoration Authority
CRD	Comite River Diversion
CT	Coushatta Tribe of Louisiana
CTL	Chitimacha Tribe of Louisiana
CWA	Clean Water Act
DEA	Draft Environmental Assessment

DEIS	Draft Integrated Feasibility Report and Environmental Impact Statement
EA	Environmental Assessment
EBR	East Baton Rouge
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EJ	Environmental Justice
EO	Executive Order
EPA	Environmental Protection Agency
EQ	Environmental Quality
ER	Engineer Regulation
ESA	Endangered Species Act
FDR	Federal Discount Rate
FEIS	Integrated Feasibility Report and Environmental Impact Statement
FEMA	Federal Emergency Management Agency
FMA	Flood Mitigation Assistance
FONSI	Finding of No Significant Impact
FPPA	Farmland Protection Policy Act of 1981
FRM	Flood Risk Management
FS	Focused Structural
FWCA	Fish and Wildlife Coordination Act
FWCAR	Coordination Act Report
FWS	Fish and Wildlife Services
FY	Fiscal Year
FWOP	Future With Out Project
GCJV	Gulf Coast Joint Venture
GOMESA	Gulf of Mexico Energy Security Act

GOSHEP	Louisiana Governor's Office of Homeland Security and Emergency Preparedness
H&H	Hydraulics and Hydrology
HMGP	Hazard Mitigation Grant Program
HTRW	Hazardous, Toxic, and Radioactive Waste
HW	Hold Water
IFR	Integrated Feasibility Report
JBCI	Jena Band of Choctaw Indians
LCA	LA Coastal Area
LDEQ	Louisiana Department of Environmental Quality
LDOA	Louisiana Division of Archaeology
LADOTD	Louisiana Department of Transportation and Development
LDWF	Louisiana Department of Wildlife and Fisheries
LPR	Livingston Parks and Recreation
LWCF	Land and Water Conservation Fund
LWFMP	Louisiana Statewide Comprehensive Water Based Floodplain Management Program
LWI	Louisiana Watershed Initiative
MBCI	Mississippi Band of Choctaw Indians
MBTA	Migratory Bird Treaty Act
MCACES MII	Micro-Computer Aided Cost Estimating System, 2nd Generation
MCN	Muscogee (Creek) Nation
MSL	Mean Sea Level
NAAQS	National Ambient Air Quality Standards
NAWMP	North American Waterfowl Management Plan
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
NRHD	National Register Historic District
NHL	National Historic Landmarks
NHPA	National Historic Preservation Act
NLAA	Not Likely to Adversely Affect
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NOX	Nitrogen Oxide
NPS	National Park Service
NRC	National Research Council
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
NS	Nonstructural
NSI	National Structure Inventory
NWI	National Wetlands Inventory
NWS	US National Weather Service
O&M	Operation and Maintenance
OCD	Office of Community of Development
OMRR&R	Operations, Maintenance, Repair, Rehabilitation, and Replacement
OSE	Other Social Effects
PA	Programmatic Agreement
PARDS	Parks and Recreation of Denham Springs

PDM	Pre-Disaster Mitigation Program
PDT	Professional Development Team
PED	Planning, Engineering and Design
PPA	Project Partnership Agreement
REC	Recognized Environmental Condition
RED	Regional Economic Development
ROD	Record of Decision
ROE	Right of Entry
RPDES	Regional Planning and Environment Division South
RSLC	Relative Sea Level Change
RW	Remove Water
SHPO	State Historic Preservation Officer
SLC	Sea Level Change
SLR	Sea Level Rise
SNO	Seminole Nation of Oklahoma
SSDIFR	Supplemental Second Draft Integrated Feasibility Report
STF	Seminole Tribe of Florida
SWPP	Stormwater Pollution Prevention Plan
T&E	Threatened and Endangered
TBTL	Tunica-Biloxi Tribe of Louisiana
THPO	Tribal Historic Preservation Officers
TSP	Tentatively Selected Plan
UL	Upper and Lower Basin
URA	Uniform Relocation Assistance Act
USACE	United States Army Corps of Engineers
USDA	US Department of Agriculture

USGS	United States Geological Survey
VOC	Volatile Organic Compound
WMA	Wildlife Management Area
WQC	Water Quality Certification
WRRDA	Water Resources Reform and Development Act
WVA	Wetland Value Assessment

Mississippi Valley Division,
Regional Planning and Environment Division South

Amite River and Tributaries East of the Mississippi River, Louisiana

Appendix A: Authorized Documents

December 2023

STUDY AUTHORITY

The ART study area is included based on the August 2016 flooding over southeast and south-central Louisiana, and is continuing investigation under the authorization provided by the Resolution of the Committee on Public Works of the United States Senate, adopted on April 14, 1967.

> "RESOLVED BY THE COMMITTEE ON PUBLIC WORKS OF THE UNITED STATES SENATE, That the Board of Engineers for Rivers and Harbors, created under Section 3 of the River and Harbor Act approved June 13, 1902, be, and is hereby requested to review the report of the chief of Engineers on Amite River and Tributaries, Louisiana, published as House Document Numbered 419, Eighty-fourth Congress. And other pertinent reports, with a view to determining whether the existing project should be modified in any way at this time with particular reference to additional improvements for flood control and related purposes on Amite River, Bayou Manchac, and Comite River and their tributaries." Committee on Public Works, 1967."

The study is funded by the Bipartisan Budget Act of 2018, H. R. 1892—13, Title IV, Corps of Engineers—Civil, Department of the Army, Investigations, where funds for are being made available for the expenses related to the completion, or initiation and completion, of flood and storm damage reduction, including shore protection studies, which are currently authorized or which are authorized after the date of enactment of this the act, to reduce risk from future floods and hurricanes. The funds are at full Federal expense and funds made available for high-priority studies of projects in states and insular areas with more than one flood related major disaster declared pursuant to the Robert T. Stafford Disaster Relief and Emergency Assistance Act (42 U.S. Code [U.S.C.] 5121 et seq.) in calendar years 2014, 2015, 2016, or 2017.

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
CIVIL WORKS
108 ARMY PENTAGON
WASHINGTON DC 20310-0108

AUG - 9 2018

MEMORANDUM FOR Deputy Commanding General for Civil and Emergency Operations

SUBJECT: Policy Guidance on Implementation of Supplemental Appropriations in the Bipartisan Budget Act of 2018

1. References:

a. Bipartisan Budget Act of 2018 (Public Law 115-123), Division 8, Subdivision 1, Title IV (Enclosure 1).

b. Balanced Budget and Emergency Deficit Control Act of 1985 (Public Law 99-177), as amended.

2. General.

a. This document provides implementation guidance for supplemental appropriations in the Investigations, Construction, Mississippi River and Tributaries (MR&T), Operation and Maintenance, and Expenses appropriations. Implementation guidance for the Flood Control and Coastal Emergencies appropriation is provided separately, dated 11 May 2018. It is my expressed intent that the USACE act as expeditiously as possible to initiate and complete the projects and studies identified in the Long-term Disaster Recovery Investment Plans (LDRIPs).

b. Funds appropriated in Public Law 115-123 are designated by the Congress as being for an emergency requirement pursuant to section 251(b)(2)(A)(i) of the Balanced Budget and Emergency Deficit Control Act of 1985.

c. In accordance with Public Law 115-123, my office will provide a monthly report to the Committees on Appropriations of the House of Representatives and the Senate reflecting the allocation and obligation of all funding provided by Public Law 115-123. In accordance with standard practice, your office will consolidate this monthly report with the monthly reports on other supplemental appropriations using data as of the end of each month and furnish each monthly report to my office for transmittal. In addition, your office will provide, at least quarterly, in-person execution updates to Office of the Assistant Secretary of the Amy (Civil Works) (ASA (CW)) and Office of Management and Budget (0MB) leadership and will also provide similar relevant information to the appropriations committees.

d. In accordance with Section 20401 of Public Law 115-123, in Fiscal Year (FY) 2018, and each FY thereafter, the Chief of Engineers of the U.S. Army Corps of Engineers shall transmit to the Congress, after reasonable opportunity for comment, but without change, by the Assistant Secretary of the Army for Civil Works, a monthly report, the first of which shall be transmitted to Congress not later than two days after the date of enactment of this subdivision and monthly thereafter, which includes detailed estimates of damages to each Corps of Engineers project, caused by natural disasters or otherwise. Please have your staff prepare the monthly reports based on data as of the end of each month and furnish the draft reports to my office for comment not later than the 7*th* day of each month.

3. Long-term Disaster Recovery Investment Plans.

a. Long-term Disaster Recovery Investment Plans (LDRIPs) have been approved for each of the following accounts for Public law 115-123: Investigations; Construction (other than the $55,000,000 for short-term repairs); and Mississippi River and Tributaries (MR&T) work. The approved LDRIPs will be updated over time as additional information is developed on other studies and projects; however, it is not necessary to update LDRIPs for changes in the costs of already-included studies and projects. Coordination with this office and clearance by 0MB (as conducted for the initially approved LDRIPs) are required for updates to the LDRIPs, and, while changes in costs for approved projects are not required to be coordinated or cleared, these changes will be provided to my office as they are identified. As was done for the initial LDRIPs, this office will continue to transmit updates to the LDRIPs to the Appropriations Committees of the House of Representatives and Senate as a courtesy. The approved LDRIPs, as well as updates to the LDRIPs, for each appropriation should be posted on the Corps web site, which is available to the general public. In addition, the Corps should consider the use of various authorities (such as WRRDA 2014, Section 1043) that encourage expanded non-Federal participation in studies and projects.

b. The LDRIP for Construction will include $50,000,000 in reserve for the Continuing Authorities Program (CAP). This amount may be reduced in future updates to the plan as additional information is developed. Headquarters, U.S. Army Corps of Engineers (HQUSACE), will determine the allocation of CAP funding among CAP projects based on performance. Allocation of CAP funds should be reported to this office along with the monthly allocation and obligation report.

c. The Investment Plan for the $400,000,000 amount for MR&T will follow the guidance on Investigations and Construction, except that for mega-projects such as Channel Improvement and Mississippi River Levees, useful increments of work instead of entire projects may be included for completion.

4. Investigations.

a. Public Law 115-123 appropriates $135,000,000 in Investigations funds (Supplemental Investigations funds), to remain available until expended, for necessary expenses related to the completion, or initiation and completion, of authorized flood and storm damage reduction studies, including shore protection. It further provides that the funds are for high-priority studies of projects in States and insular areas (territories) with more than one flood-related major disaster declared pursuant to the Robert T. Stafford Disaster Relief and Emergency Assistance Act (42 U.S.C. 5121 et seq.) in calendar years 2014, 2015, 2016, or 2017. Thirty-three states and three territories meet the criteria and are listed in Enclosure 2. Of that lump sum amount, not less than $75,000,000 is available for studies in such States and insular areas (territories) that were impacted by Hurricanes Harvey, Irma, and Maria (HHIM). The States and territories that were also impacted by HHIM are listed in Enclosure 3.

b. Studies must be Federally authorized in order to be eligible to be undertaken using Supplemental Investigations funds. Public Law 115-123 did not provide authority for the Corps of Engineers to undertake a study that is not otherwise authorized.

c. Feasibility studies that are predominantly for flood and storm damage reduction are eligible to be considered for Supplemental Investigations funds. In addition, comprehensive and watershed studies that are predominantly for flood and storm damage reduction, even if there are other ancillary purposes, are eligible for consideration. Both structural and non-structural measures will be considered. Studies may address long-range measures to reduce exposure to risks from floods and coastal storms. In addition, studies of projects located partially in a State identified in Enclosure 2 or 3, and primarily benefitting such State, are eligible to be considered for this funding.

d. In addition to comprehensive studies and watershed studies, feasibility studies (including General Reevaluation Studies) as well as work needed to reach a document supporting a construction decision and inclusion of the project in the Construction Investment Plan will be funded in Investigations. Types of studies are as follows:

(1) Study new starts, leading to preparation of a Chiefs Report or a Director's Report or a watershed assessment or a comprehensive report. New study starts are studies that have never been funded in the Investigations appropriation, including former Continuing Authorities Program projects migrating to the Investigations account for the first time.

(2) Active studies that are currently proceeding in accordance with a vertical *team* aligned scope, schedule and budget, and leading to preparation of a Chiefs Report for new authorization or a Director's Report, if additional authorization is not required.

(3) Study resumptions, leading to preparation of a Chiefs Report for new authorization or a Director's Report, if additional authorization is not required. Study resumptions are formerly Inactive studies that become Active once the Division Commander signs a memorandum reactivating the study.

(4) Public Law 115-123 provides that a project that is studied using Supplemental Investigations funds is eligible for implementation using Construction funds provided in that Act if the Secretary determines that the project is technically feasible, economically justified, and environmentally acceptable. For the Rio Grande de Loiza, Rio Guanajibo at Mayaguez, and Rio Nigua at Salina projects, Investigations funds will be provided to verify that the scope of each project as identified in its Chief Report is the project that is being proposed for implementation using Construction funds provided in Public Law 115-123. The verification and Chiefs Report for each project will be provided to the ASA(CW) for the required determination of technical feasibility, economic justification, and environmental acceptability, after which implementation of the project may be undertaken using Supplemental Construction funds.

e. Enclosure 4, dated July 5, 2018, identifies the studies that will be funded with Supplemental Investigations funds as part of the LDRIP. In accordance with paragraph 3, this list may be updated as necessary. Before Supplemental Investigations may be used, any Federal funds previously provided for a study, including funds carried into FY 2018 as well as funds provided in the FY 2018 workplan, will be used first, with such funds remaining subject to cost sharing. In addition, for the Coastal Texas Protection and Restoration Study, the amount of Supplemental Investigations funds that will be made available for the study will be reduced by the amount provided in the FY 2019 President's Budget, with such amount subject to cost sharing. An interim accounting and cost share balancing will be undertaken to ensure that any regular funding, i.e., any funding other than Supplemental Investigations funds provided for the study, is appropriately cost shared.

f. Cost Sharing Agreement. No cost sharing agreement is required for the South Atlantic Coastal Comprehensive Study and the Houston Regional Watershed Assessment. For feasibility studies (including General Reevaluation Studies), a new feasibility cost sharing agreement (FCSA) or an amendment to the existing FCSA is required to address use of Supplemental Investigations funds at 100 percent federal expense.

(1) HQUSACE is authorized to develop and approve FCSAs, and amendments to existing FCSAs, for studies in the LDRIP and to delegate to the Division Commander authority to approve use of such FCSAs and amendments. In addition, authority to execute a FCSA or amendment, once approved, may be delegated to the District Commander.

(2) To ensure studies are being expedited, the FCSA or amendment to the FCSA, as applicable, should be executed as soon as possible. A significant delay in agreement execution may result in de-selection from the LDRIP.

g. Initial Funding of New Studies and Resumptions. To enable success for new and resuming studies approved for Supplemental Investigations funds, the Division Chief of Planning & Policy may approve the use of up to $100,000 to establish the project delivery team, hold a scoping meeting, develop a draft Project Management Plan, and negotiate the FCSA or amendment. For resumptions, the $100,000 includes any regular funding currently unobligated on the study, with the remainder, if any, being Supplemental Investigations funds. All Supplemental funding used on a study is included inthe calculation of the total study cost.

h. Applicable Policies and Guidance. Except as otherwise noted, studies funded by Public Law 115-123 will be undertaken in accordance with existing Civil Works policies and guidance and incorporate SMART Planning principles. Consistent with current procedures, divisions will coordinate with HQUSACE to identify, document, and pursue opportunities to expedite completion of these studies and associated review and approval procedures in compliance with, but not limited to, Section 1001 of WRRDA 2014 and, for feasibility studies, the "3x3x3" rule and Section 1002 of WRRDA 2014.

i. Generally, feasibility studies funded by Public Law 115-123 will be conducted for not more than $3 million and will be 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. However, if available remaining Supplemental Investigations funds are exhausted, then the additional costs will be cost shared and the Federal portion of those remaining costs will compete for funding from annual Investigations funding. If additional cost sharing is required, the FCSA will need to be amended.

5. Construction.

a. Public Law 115-123 provides $15,055,000,000 in Construction funding (Supplemental Construction funds) to address emergency situations at Corps of Engineers projects, and to construct, and to rehabilitate and repair damages caused by natural disasters to, Corps projects. Of that amount, $15,000,000,000 is available to construct flood and storm damage reduction projects in States and insular areas (territories) with more than one flood-related major disaster declared pursuant to the Robert T. Stafford Disaster Relief and Emergency Assistance Act (42 U.S.C. 5121 et seq.) in calendar years 2014, 2015, 2016, or 2017. Thirty-three states and three territories meet the criteria and are listed in Enclosure 2. Additionally, not less than $10,425,000,000 of the $15,000,000,000 is available for projects within such States and insular areas (territories) that were also impacted by HHIM. The States and territories that meet the criteria and also were also impacted by HHIM are listed in Enclosure 3. Further, Public Law 115-123 provides that all repair, rehabilitation, study, design, and construction of Corps of Engineers projects in Puerto Rico and the United States Virgin Islands (USVI), using the Supplemental Construction funds, shall be conducted at full federal expense.

b. Within the lump sum Construction appropriation, $55,000,000 is available to repair to pre-storm condition Corps projects nation-wide that are under construction and that were damaged by natural disasters. This amount will be used only for damage repairs on projects not listed in the LDRIP for Construction (see paragraph 5.c.). Damage repairs include emergency dredging of shoaled material resulting from floods and storms. Projects receiving these repair funds are not limited to flood and coastal storm damage reduction projects. Funding will be distributed for the highest priority dredging and repairs based on risks and consequences. Repairs to damages not resulting from natural events are not eligible for this funding. Repairs funded from this amount in Puerto Rico and USVI will be undertaken at full federal expense. Other repairs funded from this amount will be cost shared normally. For projects included in LDRIP for Construction, repairs will be undertaken as part of construction of the project in accordance with paragraph 5.c., with cost sharing depending on whether construction of the project will be undertaken using Public Law 115-123 funds as "ongoing construction" or not "ongoing construction".

c. Long-term Flood and Storm Damage Reduction

(1) $15,000,000,000 of the Construction funds is for flood and storm damage reduction projects, including shore protection projects, in the States and territories listed in Enclosure 2. Of that amount, not less than $10,425,000,000 is for such projects in the HHIM-impacted States and territories listed in Enclosure 3. Only projects that are predominantly for flood and storm damage reduction are eligible for this funding; in addition, separable elements of such projects that are not for flood and storm damage reduction are not eligible for this funding.

(a) The flood and storm damage reduction projects eligible for the funding include: 1) currently authorized projects; 2) projects that are authorized in the future; 3) projects that have signed Chiefs Reports as of February 9, 2018, but have not yet been authorized; and 4) projects that are not yet authorized, but that were studied using funds provided in Public Law 115-123 under the "Investigations" heading. For the last two categories of projects (not yet authorized projects), the ASA(CW) must also find that the project is technically feasible, economically justified, and environmentally acceptable. For t is purpose, the Chiefs Report or the verification required under paragraph 4.d(4),will be submitted to this office to support such a determination. A project partially located in a State identified in Enclosure 2 or 3 and primarily benefitting that State is eligible to be considered for inclusion in the LDRIP for Construction.

(b) Enclosure 5, dated July 5, 2018, identifies the projects that will be funded with Supplemental Construction funds as part of the LORIP. In accordance with paragraph 3, this list may be updated as necessary. Before Supplemental Construction funds may be used, any Federal Construction funds previously provided for the project, including funds carried into FY 2018, as well as funds provided in the FY 2018 workplan, will be used first, with work funded with non-Supplemental Construction funds remaining subject to cost sharing. In addition, the amount of Supplemental Construction funds that will be made available for each of the following projects will be reduced by the amount provided in the FY 2019 President's Budget for that project, with such amount subject to cost sharing: Herbert Hoover Dike, Fl; Buffalo Bayou and Tributaries, TX; Lewisville Dam, TX; Isabella Lake, CA; Santa Anna River Mainstem, CA; Yuba River Basin, CA; and Bluestone Lake, WV. In the case of construction being performed by a non-Federal sponsor under an executed reimbursement PPA, costs eligible for reimbursement using Supplemental Construction funds are those costs incurred after February 9, 2018, i.e., when the obligation takes place, such as the date of award of a construction contract.

(c) Any costs of a locally preferred plan that are in excess of the cost of the National Economic Development Plan for a project remain the responsibility of the non-Federal sponsor, which must pay such costs during construction of the project.

(2) The LDRIP for Construction for long-term flood and coastal storm damage reduction will fund projects of the following types, leading to completion of the projects:

(a) New construction starts, with a commitment to the completion of the projects. New construction starts are projects that have never been funded in the Construction appropriation. Documentation supporting a new start decision includes the Chiefs Report and the determination, if required, by the ASA(CW) that the project is technically feasible, economically justified, and environmentally acceptable. All work needed to complete that project, including engineering and design, will be funded in Construction.

(b) "Ongoing construction projects," with a commitment to the completion of the projects. An "ongoing construction project" includes all separable elements of that project.

(i) "Ongoing construction projects" include authorized Corps projects that have received Construction account appropriations (an initial work allowance from a Statement of Managers, work plan, or supplemental appropriation) in any of the previous three fiscal years (FY 2015, 2016, or 2017). A shore protection project that has received funding for initial construction, or for a cycle of periodic renourishment, in one of these fiscal years, is eligible for funding to complete that initial construction, or that particular cycle of periodic renourishment, respectively, as an "ongoing construction project".

(ii) "Ongoing construction projects" also include authorized projects with an executed agreement providing for non-Federal sponsor construction, with potential reimbLKsement (such as section 211 for flood damage reduction or section 206 for shore protection), if the project was under construction during FY 2015, 2016, or 2017, even if no reimbursements have been provided previously for the project. It also includes a cycle of periodic renourishment to be completed prior to the end of calendar year 2020 for a project that is under construction by the non-federal sponsor during one of these fiscal years as eligible for reimbursement as an "ongoing construction project".

(iii) "Construction account appropriations for monitoring of the performance of renourishments do not count as appropriations for physical construction.

(iv) Of the projects listed in the LDRIP for Construction, Enclosure 5 identifies those projects that meet the requirements to be considered an "ongoing construction project". This list will be revised or updated as needed.

(c) Other projects that were funded in the Construction appropriation previously but that are not "ongoing construction projects," with a commitment to completion of the projects. If the latest economic update was not within five years, the district with responsibility should use available or reprogrammed funds to perform an economic update, then submit the project for consideration for Supplemental Construction funding. Existing policy on cost certification also should be followed.

(3) Cost Sharing and Real Estate Requirements - Ongoing Construction Projects, and Projects in Puerto Rico and USVI. Public Law 115-123 provides that the completion of "ongoing construction projects" and all repair, rehabilitation, study, design, and construction of Corps of Engineers projects in Puerto Rico and USVI, using Construction funding provided in Public Law 115-123, shall be conducted at full Federal expense.

(a) The non-Federal sponsors remain responsible for the provision of lands, easements, and rights-of-way (LER). Subject to the availability of Public Law 115-123 funds and the following conditions, the value of LER acquired by the non-Federal sponsors for work that will be performed at full Federal expense will be eligible for reimbursement by the Government. For a project with an existing Project Partnership Agreement (PPA), the Corps will reimburse non-Federal sponsors for the value of LER acquired from private owners after the date of execution of an amendment to the PPA providing for completion of construction at full Federal expense. For a project for which no PPA has been executed, the Corps will reimburse non-federal sponsors for the value of required LER acquired from private owners after the date of execution of the PPA.

(b) As discussed in paragraph 5c3(a), the non-Federal sponsors remain responsible for the provision of LER. If any acquisition assistance is requested by the non-Federal sponsor, the District will promptly notify HQUSACE (including the RIT and CEMP-CR) of the request. Acceptance of requests will be at the sole discretion of the Corps and reviewed and processed in accordance with the procedure outlined in ER 405-1-12, para.,12-34. A non-Federal sponsor must formally request assistance in writing no later than 30 calendar days after the Corps provides the non-Federal sponsor with written descriptions of the real property interests required for a project. Under no circumstances will the Corps agree to acquire any real property interest on behalf of a non-Federal sponsor if the non-Federal sponsor has initiated negotiations with the owner of the real property interest.

(c) Among other requirements of Sections 210 and 305 of the Unifonn Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended (42 U.S.C. 4630 and 4655), non-Federal sponsors must observe the land acquisition policies in Section 4651 of Title 42 of the U.S. Code when acquiring real property interests. These policies include, but are not limited to, appraising real property interests before initiating negotiations with landowners, offering an amount no less than the appraised value as just compensation, not requiring landowners to surrender possession of real property interests before paying the agreed upon purchase price or depositing with the court an amount not less than the approved appraised value, not taking any coercive actions to compel an agreement on the price to be paid for real property interests, and instituting fonnal condemnation proceedings in the event real property interests are to be acquired by exercise of the power of eminent domain.

(4) Cost Sharing and Real Estate Requirements - Projects Outside of Puerto Rico and USVI That Are Not "Ongoing Construction Projects," including new starts and projects that had previously received Construction funds but did not receive Federal funds in FY 2015, 2016, or 2017.

(a) For projects that are neither "ongoing construction projects" nor located in Puerto Rico or the USVI, nonnal cost sharing applies, except that the non-Federal sponsor may, but is not required to, finance its cash contribution, including the 5 percent cash contribution for flood damage reduction projects, for costs funded by Public Law 115-123 for up to 30 years after completion of the project in accordance with Section 103(k) of WRDA 1986. The financing provisions apply only to the work that is undertaken with Supplemental Construction funds, and do not apply, for instance, to future periodic renourishments that are not funded with these funds.

(b) For such projects, the non-Federal sponsors remain responsible for the provision of LER and utility/facility relocations. The value of the LER acquired from private owners after the date of PPA execution and utility/facility relocations provided by the non-Federal sponsor will be credited towards the non-Federal share of project costs in accordance with the terms of the PPA.

(c) As discussed in paragraph 5c4(b), the non-Federal sponsors remain responsible for the provision of LER and performance of utility/facility relocations. If any acquisition assistance is requested by the non-Federal sponsor, the District will promptly notify HQUSACE (including the RIT and CEMP-CR) of the request. Acceptance of requests will be at the sole discretion of the Corps and reviewed and processed in accordance with the procedure outlined in ER 405-1-12, para.,12-34. A non-Federal sponsor must formally request assistance in writing no later than 30 calendar days after the Corps provides the non-Federal sponsor with written descriptions of the real property interests required for a project. Under no circumstances will the Corps agree to acquire any real property interest on behalf of a non-Federal sponsor if the non-Federal sponsor has initiated negotiations with the owner of the real property interest.

(d) Among other requirements of Sections 210 and 305 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), non-federal sponsors must observe the land acquisition policies in Section 4651 of Title 42 of the U.S. Code when acquiring real property interests. These policies include, but are not limited to, appraising real property interests before initiating negotiations with landowners, offering an amount no less than the appraised value as just compensation, not requiring landowners to surrender possession of real property interests before paying the agreed upon purchase price or depositing with the court an amount not less than the approved appraised value, not taking any coercive actions to compel an agreement on the price to be paid for real property interests, and instituting formal condemnation proceedings in the event real property interests are to be acquired by exercise of the power of eminent domain.

(5) The non-Federal sponsor is responsible for the costs of cleanup and response to hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (42 U.S.C. 9601-9675), that exist in, on, or under any of the real property interests required for construction, operation, maintenance, repair, replacement, and rehabilitation of a project. Such costs shall be paid solely by the non-Federal sponsor without reimbursement or credit by the Government.

(6) Public Law 115-123 did not change the responsibilities for operation, maintenance, repair, replacement, and rehabilitation **(OMRR&R).** Non-Federal sponsors remain responsible for all costs of **OMRR&R.**

(7) The provisions of section 902 of the Water Resources Development Act of 1986 do not apply to the Public Law 115-123 funding, and therefore: these funds are not included in calculating the total project cost to be compared to the section 902 limit for a project.

(8) Project Partnership Agreements and Amendments.

(a) No separate design agreement is required for projects included in the approved LDRIP for Construction. Once a project is included in the approved Construction Investment Plan, except as provided in paragraph 5.c.(1)(b) regarding use of previously provided Federal funds, Supplemental Construction funding may be used, at full Federal financing, for engineering and design, as well as for negotiation and processing of the PPA or PPA amendment, as applicable. However, the PPA or PPA amendment should be executed as soon as possible and in all cases must be executed prior to solicitation of the first construction contract using Public Law 115-123 Construction funds. All costs funded with Supplemental Construction funds will be included in total project costs and cost shared and / or financed in accordance with the applicable PPA or PPA amendment.

(b) For a project or separable element with an existing PPA, an interim accounting and cost share balancing will be undertaken to ensure that any regular funding, i.e., any funding other than Supplemental Construction funding provided for the project, is appropriately cost shared.

(c) HQUSACE will work with my office to develop basic model PPAs and PPA

Amendments. Once these basic models are approved, HQUSACE may approve non-substantial variations to such models based on experience as well as specific requirements associated with projects. In addition, HQUSACE may delegate to the Division Commander authority to approve use of a model PPA or PPA amendment, or a PPA or PPA Amendment with variations approved by HQUSACE. In addition, authority to execute a PPA or PPA amendment, once approved, may be delegated to the District Commander.

(9) Separate guidance will be developed to address a non-Federal sponsor request for Supplemental Construction funds to implement a project utilizing Section 1043 of the Water Resources Development Act of 2014.

(10) Continuing Authorities Program (CAP) Projects. Up to $50,000,000 of the $15,000,000,000 in Construction funds is available for Continuing Authority Program (CAP) projects for flood and storm damage reduction. Consistent with delegation of the CAP, HQUSACE is authorized to determine which CAP projects will be funded by Public Law 115-123 in accordance with the following guidance.

(a) In general, an individual CAP project will be considered for completion as an "ongoing construction project" at full federal expense if the project received funding in FY 2015, 2016, or 2017 for the Design and Implementation (D&I) phase. In addition, study, design and construction of CAP projects in Puerto Rico and USVI using Public Law 115-123 funds will be undertaken at full Federal expense. For CAP projects in the Feasibility phase and CAP projects in the D&I phase that are neither "ongoing construction projects" nor located in Puerto Rico or USVI, the non-federal cash contribution may be financed in accordance with Section 103(k) of WRDA 1986.

(b) Public Law 115-123 funding is included in calculating the Federal per-project limit for a project. Public Law 115-123 did not modify or waive the Federal per-project limits. D&I agreements will include the normal requirement that the non-Federal sponsor is responsible for any costs over the Federal per-project limit.

(c) For a discussion of converting a CAP project to an Investigations study, see paragraph 4.d.1.

6. Mississippi River and Tributaries.

a. Public Law 115-123 provided $770,000,000 to address emergency situations at Corps of Engineers projects, and to construct, and rehabilitate and repair damages to Corps of Engineers projects, caused by natural disasters. Normal cost sharing, if any, and non-federal sponsor responsibilities apply.

b. $400,000,000 is available to construct flood and storm damage reduction projects that were authorized as of the date of enactment of Public Law 115-123, and such projects that are authorized subsequently, once authorized. This funding may be used for feasibility studies leading to authorization and a construction decision, in which case Investigations guidance in paragraph 3 will be followed, as well as for engineering and design and construction, including rehabilitation costs normally funded from the Construction subdivision of the appropriation, in which case the Construction guidance in paragraph 4 will be followed. Channel improvement revetments and Mississippi River levee construction was cleared on July 5, 2018 for multiple authorized states.

c. $370,000,000 is available to address emergency situations at Corps of Engineers projects, and to construct, and rehabilitate and repair damages to Corps of Engineers projects, caused by natural disasters. Based on estimates provided to Appropriations Subcommittee staff, this amount is intended to be used for damage repairs only, including emergency dredging of shoaled material resulting from floods and storms. Funding will be distributed for the highest priority dredging and repairs based on risks and consequences. Dredging and repairs to damages not caused by natural events are not eligible for this funding.

7. Operation and Maintenance.

a. $608,000,000 is provided to dredge Federal navigation projects in response to, and repair damages to Corps of Engineers federal projects caused by, natural disasters. Dredging and repairs to damages not caused by natural events are not eligible for this funding. Funding will be distributed for the highest priority dredging and repairs based on risks and consequences.

b. This appropriation provides that such sums as are necessary to cover the Federal share of eligible operation and maintenance costs for coastal harbors and channels, and for inland harbors shall be derived from the Harbor Maintenance Trust Fund (HMTF). Care should be taken that the proper accounting codes are used to identify funding for costs eligible to be derived from the HMTF.

8. Expenses. $20,000,000 is provided to administer and oversee the obligation and expenditure of amounts provided in Public Law 115-123 for the Corps of Engineers. HQUSACE will distribute the funding based on Public Law 115-123 workload.

8. Funding of Studies and Projects.

a. Although the LDRIP reflects a commitment to complete all work leading to a construction decision and the LDRIP for Construction reflects a commitment to complete construction projects, funding will be provided to approved projects in increments based on need. This will help to avoid reprogramming difficulties in the event of cost savings, changes in non-Federal participation, or termination of project studies found to be no longer justified. Funding for CAP projects will also be incremental.

b. Repair and emergency dredging work funded in the Construction, Operation and Maintenance, and MR&T appropriations will be funded in increments, for instance, once for plans and specifications and once for the contract. This will help to avoid reprogramming difficulties in the event of cost savings or if higher priority repair and dredging work arises.

c. Expenses funding will be distributed based on the underlying Public Law 115-123 workload.

R. D. James
Assist Secretary of the Army
(Civil Works)

Ends

TITLE IV

CORPS OF ENGINEERS--CIVIL

DEPARTMENT OF THE ARMY

Investigations

For an additional amount for "Investigations" for necessary expenses related to the completion, or initiation and completion, of flood and storm damage reduction, including shore protection, studies which are currently authorized or which are authorized after the date of enactment of this subdivision, to reduce risk from future floods and hurricanes, at full Federal expense, $135,000,000, to remain available until expended: Provided, That of such amount, not less than $75,000,000 is available for such studies in States and insular areas that were impacted by Hurricanes Harvey, Irma, and Maria: Provided further, That funds made available under this heading shall be for high-priority studies of projects in States and insular areas with more than one flood-related major disaster declared pursuant to the Robert T. Stafford Disaster Relief and Emergency Assistance Act (42 U.S.C. 5121 et seq.) in calendar years 2014, 2015, 2016, or 2017: Provided further, That such amount is designated by the Congress as being for an emergency requirement pursuant to section 251(b)(2)(A)(i) of the Balanced Budget and Emergency Deficit Control Act of 1985: Provided further, That the Assistant Secretary of the Army for Civil Works shall provide a monthly report to the Committees on Appropriations of the House of Representatives and the Senate detailing the allocation and obligation of these funds, including new studies selected to be initiated using funds provided under this heading, beginning not later than 60 days after the enactment of this subdivision.

Construction

For an additional amount for "Construction" for necessary expenses to address emergency situations at Corps of Engineers projects, and to construct, and rehabilitate and repair damages caused by natural disasters, to Corps of Engineers projects, $15,055,000,000, to remain available until expended: Provided, That of such amount, $15,000,000,000 is available to construct flood and storm damage reduction, including shore protection, projects which are currently authorized or which are authorized after the date of enactment of this subdivision, and flood and storm damage reduction, including shore protection, projects which have signed Chiefs Reports as of the date of enactment of this subdivision or which are studied using funds provided under the heading "Investigations" if the Secretary determines such projects to be technically feasible, economically justified, and environmentally acceptable, in States and insular areas with more than one flood-related major disaster declared pursuant to the Robert T. Stafford Disaster Relief and Emergency Assistance Act (42 U.S.C. 5121et seq.} in calendar years 2014, 2015, 2016, or 2017: Provided further, That of the amounts in the preceding proviso, not less than $10,425,000,000 shall be available for such projects within States and insular areas that were impacted by Hurricanes Harvey, Irma, and Maria: Provided further, That all repair, rehabilitation, study, design, and construction of Corps of Engineers projects in Puerto Rico and the United States Virgin Islands, using funds provided under this heading, shall be conducted at full Federal expense: Provided further, That for projects receiving funding under this heading, the provisions of section 902 of the Water Resources Development Act of 1986 shall not apply to these funds: Provided further, That the completion of ongoing construction projects receiving funds provided under this heading shall be at full Federal expense with respect to such funds: Provided further, That using funds provided under this heading, the non-Federal cash contribution for projects eligible for funding pursuant to the first proviso shall be financed in accordance with the provisions of section 103{k) of Public Law 99-662 over a period of 30 years from the date of completion of the project or separable element: Provided further, That up to $50,000,000 of the funds made available under this heading shall be used for continuing authorities projects to reduce the risk of flooding and storm damage: Provided further, That any projects using funds appropriated under this heading shall be initiated only after non-Federal interests have entered into binding agreements with the Secretary requiring, where applicable, the non-Federal interests to pay 100 percent of the operation, maintenance, repair, replacement, and rehabilitation costs of the project and to hold and save the United States free from damages due to the construction or operation and maintenance of the project, except for damages due to the fault or negligence of the United States or its contractors: Provided further, That such amount is designated by the Congress as being for an emergency requirement pursuant to section 251(b)(2)(A)(i) of the Balanced Budget and Emergency Deficit Control Act of 1985: Provided further, That the Assistant Secretary of the Army for Civil Works shall provide a monthly report to the Committees on Appropriations of the House of Representatives and the Senate detailing the allocation and obligation of these funds, beginning not later than 60 days after the enactment of this subdivision.

Mississippi River and Tributaries

For an additional amount for "Mississippi River and Tributaries" for necessary expenses to address emergency situations at Corps of Engineers projects, and to construct, and rehabilitate and repair damages to Corps of Engineers projects, caused by natural disasters, $770,000,000, to remain available until expended: Provided, That of such amount, $400,000,000 is available to construct flood and storm damage reduction projects which are currently authorized or which are authorized after the date of enactment of this subdivision: Provided further, That such amount is designated by the Congress as being for an emergency requirement pursuant to section 251(b)(2)(A)(i) of the Balanced Budget and Emergency Deficit Control Act of 1985: Provided further, That the Assistant Secretary of the Army for Civil Works shall provide a monthly report to the Committees on Appropriations of the House of Representatives and the Senate detailing the allocation and obligation of these funds, beginning not later than 60 days after the enactment of this subdivision.

Operation and Maintenance

For an additional amount for "Operation and Maintenance" for necessary expenses to dredge Federal navigation projects in response to, and repair damages to Corps of Engineers Federal projects caused by, natural disasters, $608,000,000, to remain available until expended, of which such sums as are necessary to cover the Federal share of eligible operation and maintenance costs for coastal harbors and channels, and for inland harbors shall be derived from the Harbor Maintenance Trust Fund: Provided, That such amount is designated by the Congress as being for an emergency requirement pursuant to section 251(b)(2)(A)(i) of the Balanced Budget and Emergency Deficit Control Act of 1985: Provided further, That the Assistant Secretary of the Army for Civil Works shall provide a monthly report to the Committees on Appropriations of the House of Representatives and the Senate detailing the allocation and obligation of these funds, beginning not later than 60 days after the enactment of this subdivision.

Flood Control and Coastal Emergencies

For an additional amount for "Flood Control and Coastal Emergencies", as authorized by section 5 of the Act of August 18, 1941 (33 U.S.C. 701), for necessary expenses to prepare for flood, hurricane and other natural disasters and support emergency operations, repairs, and other activities in response to such disasters, as authorized by law, $810,000,000, to remain available until expended: Provided, That funding utilized for authorized shore protection projects shall restore such projects to the full project profile at full Federal expense: Provided further, That such amount is designated by the Congress as being for an emergency requirement pursuant to section 251(b)(2)(A)(i) of the Balanced Budget and Emergency Deficit Control Act of 1985: Provided further, That the Assistant Secretary of the Army for Civil Works shall provide a monthly report to the Committees on Appropriations of the House of Representatives and the Senate detailing the allocation and obligation of these funds, beginning not later than 60 days after the enactment of this subdivision.

Expenses

For an additional amount for "Expenses" for necessary expenses to administer and oversee the obligation and expenditure of amounts provided in this title for the Corps of Engineers, $20,000,000, to remain available until expended: Provided, That such amount is designated by the Congress as being for an emergency requirement pursuant to section 251(b)(2)(A}(i) of the Balanced Budget and Emergency Deficit Control Act of 1985: Provided further, That the Assistant Secretary of the Army for Civil Works shall provide a monthly report to the Committees on Appropriations of the House of Representatives and the Senate detailing the allocation and obligation of these funds, beginning not later than 60 days after enactment of this subdivision.

GENERAL PROVISIONS--THIS TITLE

Sec. 20401. In fiscal year 2018, and each fiscal year thereafter, the Chief of Engineers of the U.S. Army Corps of Engineers shall transmit to the Congress, after reasonable opportunity for comment, but without change, by the Assistant Secretary of the Army for Civil Works, a monthly report, the first of which shall be transmitted to Congress not later than 2 days after the date of enactment of this subdivision and monthly thereafter, which includes detailed estimates of damages to each Corps of Engineers project, caused by natural disasters or otherwise.

Sec. 20402. From the unobligated balances of amounts made available to the U.S. Army Corps of Engineers, $518,900,000 under the heading "Corps of Engineers--Civil, Flood Control and Coastal Emergencies" and $210,000,000 under the heading "Corps of Engineers--Civil, Operations and Maintenance" in title X of the Disaster Relief Appropriations Act, 2013 (Public Law 113-2; 127 Stat. 25) shall be transferred to "Corps of Engineers--Civil, Construction", to remain available until expended, to rehabilitate, repair and construct Corps of Engineers projects: Provided, That those projects may only include construction expenses, including cost sharing, as described under the heading "Corps of Engineers--Civil, Construction" in title X of that Act or other construction expenses related to the consequences of Hurricane Sandy: Provided further, That amounts transferred pursuant to this section that were previously designated by the Congress as an emergency requirement pursuant to the Balanced Budget and Emergency Deficit Control Act are designated by the Congress as an emergency requirement pursuant to section 251(b)(2)(A)(i) of the Balanced Budget and Emergency Deficit Control Act of 1985: Provided further, That the Assistant Secretary of the Army for Civil Works shall provide a monthly report to the Committees on Appropriations of the House of Representatives and the Senate detailing the allocation and obligation of these funds, beginning not later than 60 days after the enactment of this subdivision.

States and Territories with More than One Flood-Related Major Disaster Declaration in Calendar Years 2014, 2015, 2016, or 2017

Alabama
Alaska
Arkansas
California
Florida
Georgia
Guam
Hawaii
Idaho
Iowa
Kansas
Kentucky
Louisiana
Michigan
Minnesota
Mississippi
Missouri
Montana
Nebraska
New Mexico
Nevada
New York
North Dakota
Oklahoma
Oregon
Puerto Rico
South Carolina
South Dakota
Tennessee
Texas
U.S. Virgin Islands
Vermont
Washington
Wisconsin
West Virginia
Wyoming

States and Territories with More than One Flood-Related Major Disaster Declaration in Calendar Years 2014, 2015, 2016, or 2017 That Were Impacted by Hurricanes Harvey, Irma, and Maria

Florida
Georgia
Louisiana
Puerto Rico
South Carolina
Texas
U.S. Virgin Islands

Bipartisan Budget Act of 2018 (Public Law 115-123)	
Long Term Disaster Recovery Investment Plan	
Investigations Account	
As of July 5, 2018	
STUDY NAME	**STATE**
Selma, AL	AL
Valley Creek, AL	AL
LA County Flood Control System, CA	CA
Westminster (East Garden Grove) Watershed, CA	CA
Collier Countv Beach Erosion Control, FL	FL
Dade County, FL	FL
Miami Back Bay, FL	FL
Monroe County, FL	FL
Okaloosa County, FL	FL
Pinellas Countv, FL	FL
South Atlantic Coastal Study, FL, PR & USVI	FL, PR, USVI
Proctor, Fulton Countv, GA	GA
Metro Louisville Flood Protection Svstem, KY	KY
Amite River & Tributaries East of the Mississippi River, LA	LA
Lake Pontchartrain and Vicinity, LA {General Reevaluation Report)	LA
South Central Coast, LA	LA
Upper Barataria Basin, LA	LA
West Bank and Vicinity, New Orleans. LA (General Reevaluation Report}	LA
Nassau County Back Bays, NY	NY
Tulsa West Tulsa Levees, OK	OK
Portland Metro Levee System, OR	OR
Puerto Rico Study, PR	PR
Rio Culebrinas, PR	PR
Rio Grande de Manati, PR (Ciales)	PR
Rio Guavanilla, PR	PR
San Juan Metro Area Study, PR	PR
Charleston Peninsula, SC	SC
Folly Beach, SC	SC
Memphis Wolf River Backwater Levee System, TN	TN
Brazos River, Fort Bend County, TX	TX
Buffalo Bayou and Tributaries Resiliency Study, TX	TX
Coastal Texas Protection and Restoration Study, TX	TX
Houston Regional Watershed Assessment, TX	TX
Guadalupe and San Antonio River Basins, TX	TX
Savan Gut Phase 11, St. Thomas, USVI	USVI
Turpentine Run, St. Thomas, USVI	USVI
Upper Connecticut River, VT	VT
Mill Creek, Walla Walla Countv, WA	WA

Enclosure 4

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
CIVIL WORKS
108 ARMY PENTAGON
WASHINGTON DC 20310-0108

SACW 4 November 2022

MEMORANDUM FOR COMMANDING GENERAL, U.S. ARMY CORPS OF ENGINEERS

SUBJECT: Amite River and Tributaries East of the Mississippi River, Louisiana Feasibility Study, 3x3x3 Rule Exemption

1. Reference HQ, USACE, CECW-MVD memorandum (3x3x3 Exception Request for the Amite River and Tributaries East of the Mississippi Feasibility Study, Louisiana), 28 July 2022.

2. I am responding to the memorandum request for an exemption to the requirement identified in Section 1001(a) of the Water Resources Reform and Development Act of 2014 that feasibility reports are, to the extent practicable, to be completed in three years and have a maximum Federal cost of $3 million.

3. My staff has reviewed the request with background information and determined that an additional twenty months to complete the study is warranted. As the feasibility study is currently at full Federal expense, the justification in the referenced documentation supports the request for an additional $1.91 million in Federal funding. I hereby grant an exemption to increase the total study time for the Amite River and Tributaries East of the Mississippi River, Louisiana Feasibility Study by 20 months at a total Federal cost of $4.91 million. The feasibility study shall be completed within twenty months of the date of this memorandum.

4. I request your diligent attention on actively managing the study cost and schedule. If there are any questions, please contact Mr. Mark Kramer, Project Planning and Review at (202) 761-0038.

MICHAEL L. CONNOR
Assistant Secretary of the Army
(Civil Works)

CF:
DCG-CEO, USACE
DCW, USACE
CECW-MVD

Mississippi Valley Division,
Regional Planning and Environment Division South

Amite River and Tributaries East of the Mississippi River, Louisiana

Appendix B: Revised Draft Engineering

December 2023

CONTENTS

LIST OF TABLES

LIST OF FIGURES

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SECTION 1
General

This Engineering Appendix documents the feasibility level engineering and design for the structural alternatives. Nonstructural alternatives are reflected in Appendix I. Development of this appendix was in accordance with Engineering Regulation (ER) 1110-2-1150, "Engineering and Design for Civil Works Projects," dated 31 August 1999.

The study area is the Amite River Basin and tributaries. The Amite River Basin begins in southwest Mississippi and flows southward, crossing the state line into southeastern Louisiana. The Amite River Basin includes 2,200 square miles flowing into the Amite River and its tributaries. It includes portions of Amite, Lincoln, Franklin, and Wilkinson Counties in Mississippi as well as East Feliciana, St. Helena, East Baton Rouge, Livingston, Iberville, St. James, St. John the Baptist, and Ascension Parishes in Louisiana.

The study area is similar to the US Army Corps of Engineers' (USACE)1984 Amite Rivers and Tributaries Flood Control Initial Evaluation Study; however, it was expanded to include areas that are impacted by backwater flooding to the southeast and east because they are hydraulically connected to the Amite River Basin and tributaries. The alternatives discussed in the sections that follow were analyzed by the Civil, Geotechnical, and Structures Branches of USACE, Mississippi Valley Division, New Orleans District (MVN), Engineering Division.

SECTION 2
Structural Alternatives

2.1 DARLINGTON DRY DAM/DARLINGTON REDUCED WET DAM

Darlington Dry Dam/Darlington Reduced Wet Dam, the Darlington Dam alternative, consists of an earthen dam on the Amite River with the option of being a wet or dry dam. (A dry dam only holds water during flood events. After the flood waters recede, the storage area drains completely dry again. This is opposed to a “wet” dam, where at least some water is permanently stored in what is typically called a full-sized conservation pool.) The dam would include an outlet feature (currently, three 10 feet by 10 feet box culverts) and a large spillway. The spillway would require a concrete base and walls. Because it is on an earthen base, the spillway would likely require anchor piles and a seepage cutoff. Structural components would also require flip bucket or baffle field and there is the possibility that gate control towers would be needed. Other structures could include debris booms, trash racks, etc. Because this alternative was previously studied, data for analyzing it is available in the “Amite River and Tributaries, Darlington Reservoir Re-evaluation Study (Reconnaissance Scope),” dated September 1997. A Reduced “wet” dam would function as a “wet” dam but would include a smaller sized conservation pool and spillway.

2.2 DRY DAM ON SANDY CREEK

The Dry Dam on the Sandy Creek alternative consists of an earthen dam on Sandy Creek, a tributary of the Amite River. Limited data is available during the feasibility phase due to funding constraints; therefore, many assumptions were made such as the geology of the area, the dam theoretical section, the outlet and spillway structure design, and borrow material and quantities.

2.3 DRY DAM ON DARLINGTON, LILLEY, AND BLUFF CREEKS

The dry dams for the Darlington, Lilley, and Bluff Creek alternative consists of three earthen dams on Darlington Creek, Lilley Creek, and Bluff Creek, all tributaries of the Amite River.

Limited data is available during the feasibility phase due to funding constraints; therefore, many assumptions were made such as the geology of the area, the dam theoretical section, the outlet and spillway structure design, and borrow material and quantities.

A map showing the locations of all four dry retention dams is provided in Figure B:2-1

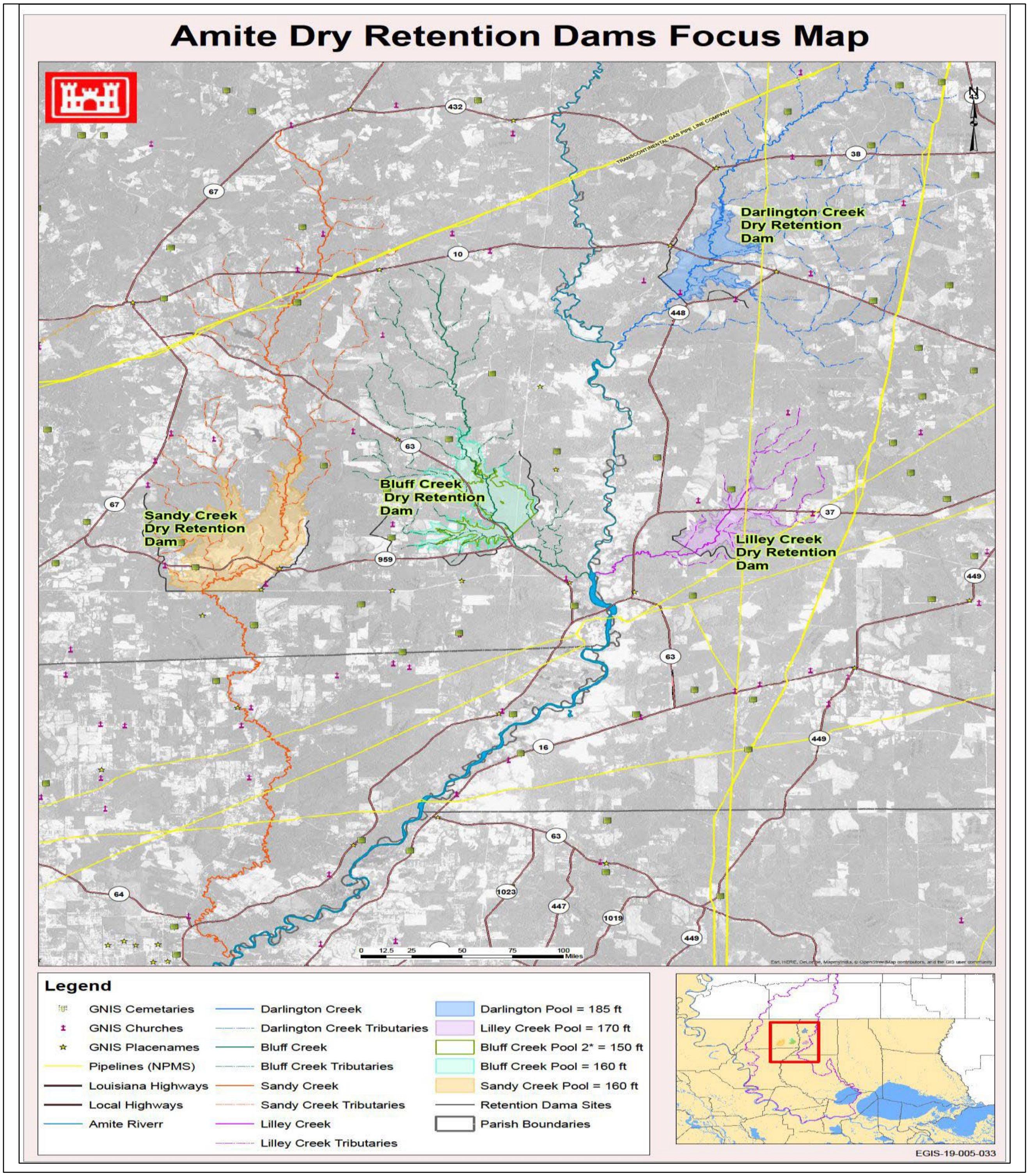


Figure B:2-1. Amite River Dry Retention Dams Focus Maps

SECTION 3

Geotechnical Investigations and Design

This portion of the report contains the initial feasibility level geotechnical review performed for the Amite River and Tributaries Study. Alternatives assessed within this study include:

- Darlington Dry Dam/Darlington Reduced Wet Dam alternative.
- Dry Dam on Sandy Creek alternative.
- Dry Dams on Darlington Creek, Lilley Creek, and Bluff Creek alternative.

3.1 DARLINGTON DRY DAM/DARLINGTON REDUCED WET DAM

This section presents the results of the geotechnical design assessment of the proposed Darlington Dam. An initial feasibility level study for the Darlington Dam was conducted in 1992 and revised in 1997. Findings from these studies are documented in the “Amite River and Tributaries, Darlington Reservoir Feasibility Study,” dated September 1992 (1992 study) and in the “Amite River and Tributaries, Darlington Reservoir Re-evaluation Study (Reconnaissance Scope),” dated September 1997 (1997 study).

No new borings or other subsurface investigations were conducted for this project and no additional geotechnical designs were performed as part of this study. To assess technical feasibility and update cost estimation, existing geotechnical investigations and analyses were re-evaluated to compare to the current design requirements as per USACE manuals, specifications, and criteria.

The Darlington Dry Dam/Darlington Reduced Wet Dam alternative was analyzed using the same design section as taken from the 1997 report. The dry dam would have a crown elevation 1 foot lower than the reduced wet dam alternative. The dam would consist of a clay core with a random fill outer layer. The design section would consist of a reservoir with a 24 feet wide crown at elevation 202.8 feet North American Vertical Datum of 1988 (NAVD 88) (2009.55) and side slopes of 1 vertical on 3 horizontal from the crown to elevation 172.8 feet NAVD 88 (2009.55), the elevation of the flood control pool. On the floodside, from the flood control pool elevation to the conservation pool elevation, the slope would be 1 vertical on 6 horizontal. The flatter slope is to reduce the chances of sudden drawdown failures that tend to occur in this zone. Below the conservation pool elevation, the slope would be 1 vertical on 4 horizontal. On the protected side, the slope would be 1 vertical on 5 horizontal from the flood control pool elevation to the conservation pool. The flatter slope in this area would increase stability and would resist seepage forces that may concentrate in the lower portion of the dam. Below the conservation pool, the slope would be 1 vertical on 3 horizontal. The outlet structure for the dam consists of three 10 feet by 10 feet box culverts with an emergency spillway.

3.1.1 Geology

The 1992 study describes the geology in the project area as:

> "The study area is in the Southern Pine Hills of the Eastern Gulf Coastal Plain. Topography in the northern portion of the basin is dominated by plateaus and ridgetops underlain by the Citronelle Formation. The southern portion is dominated by gently sloping Pleistocene terrace surfaces.
>
> The maximum elevation within the basin is approximately 500 feet MSL. Elevations are between 35 feet and 40 feet MSL near the junction of the Comite River and Amite River near Denham Springs. Minimum elevations are between 0 and 5 feet in the lower part of the basin near Lake Maurepas.
>
> Although older sediments are found at depth in the study area, only the Plio-Pleistocene and Holocene sediments exposed at the surface and found near the surface are discussed. Four distinct geologic units are found within the basin: the Citronelle Formation, the Pleistocene terraces, the loess deposits, and Holocene alluvium. The Citronelle Formation, which varies in age from late Pliocene to Pleistocene, generally consists of a gradational sequence of fluvial gravels, cross bedded sands, silts, and clays with the coarser grained material occurring at the base of this sequence. On the southside of the outcrop of the Citronelle Formation, are found the relatively flat Pleistocene terraces of less variable lithology than that of the Citronelle Formation. Generally, these terraces are comprised of sediments consisting of silt and sandy clay which grade downward into a fine to coarse grained sand with some gravel.
>
> The study area is in a stable area of low seismicity. Earthquake activity is relatively rare and is usually less severe than average. Resulting damage to structures and levees (dikes) in the project area would be expected to be minor." (USACE, 1992)

Seismic effects continue to be required considerations in current structure design regulations including:

- EM 1110-2-2300, "General Design and Construction Considerations for Earth and Rock-Fill Dam", dated 30 July 2004
- ER 1110-2-1156, "Safety of Dams – Policy and Procedures", dated 31 March 2014
- ER 1110-2-1806, "Earthquake Design and Evaluation for Civil Works Projects", dated 31 May 2016

However, a great portion of Louisiana is considered to have "Low" seismic hazard (Appendix C, ER 1110-2-1156). While Louisiana has had several quakes, they were minor as the local faults are not the type to typically produce earthquakes, especially not deep and forceful ones.

3.1.2 Geotechnical Data Available for Assessment

No soil borings were collected, and no soil testing was performed for this study. The assessment was based on borings and soil testing performed in the 1992 and 1997 studies. Seven undisturbed borings (DD-1U to DD-7U) were taken for the 1992 study, one on each dam abutment and five along the center of the dam. Four additional undisturbed borings (DD-8U, DD-9U, DD-10U, and DD-11U) were taken during the 1997 study (see Figure B:3-1), as well as two exploratory trench excavations. The earth core material data obtained from two exploratory trench excavations is considered adequate for embankment fill construction. There are gaps where no boring information is available along the east and west terraces. In addition, consolidation test data was limited to two borings (DD-9U and DD-10U) located at the center of the dam. It is recommended that additional boring data be taken to supplement existing borings used during the feasibility study.

Figure B:3-1. Boring Locations

3.1.3 Sheer Strength Data

Shear strength tests, including unconsolidated undrained, consolidated undrained, direct shear, and consolidation, were performed on selected samples to obtain design values at MVN during the 1997 study. The shear strength values selected for design (i.e., clay core, embankment soils, and foundation clays, and granular foundation soils) are consistent with current design criteria requirements.

3.1.4 Stability Analyses

In the 1992 and 1997 studies, stability analyses were performed for the dam section, as per USACE EM 1110-2-1902, *Engineering and Design Stability of Earth and Rock-Fill Dams*, dated 1 April 1970. As part of the 1992 study, stability analyses were performed for seven separate reaches along the length of the dam: the east abutment terrace, east abutment, river closure, east river terrace, west abutment terrace, west river terrace, and west abutment. Stability analyses for these runs included end of construction analyses (required Factor of Safety [FOS] of 1.3, long-term analysis (required FOS of 1.5), and a sudden draw-down analysis (required FOS of 1.0). In all cases analyzed in 1992, the construction case (short-term) governed the design cross-section of the dam. The scope of the 1997 study's stability analyses was limited to using new boring and strength data to determine if a reduced dam cross section is feasible to reduce cost of the structure. Analysis in the 1997 study was limited to the East River Terrace reach, which was chosen because it has clay strata closer to the ground surface and is more critical from a stability viewpoint. The 1997 study analyzed the critical end of construction analysis (both upstream and downstream) for this reach, but did not look at long-term, maximum surcharge pool, or sudden draw-down cases. The end of construction analyses resulted in a safety factor greater than 1.4. Several additional end of construction analyses were assessed using modified parameters to simulate a direct shear value for the core and strain softening of the foundation clay.

The current EM 1110-2-1902, *Slope Stability,* dated 31 October 2003, specifies a minimum FOS 1.3 (for end-of-construction including stage construction for both upstream and downstream), 1.5 (Long-term for steady seepage, maximum storage pool, spillway crest or top of gates at downstream), 1.4 (maximum surcharge pool at downstream), and 1.1-1.3 (Rapid drawdown from maximum surcharge pool and storage pool, respectively at upstream). The analyses run for the 1997 study are adequate for cost estimation purposes for the Darlington Dam alternative. To comply with the current EM 1110-2-1902, the full range of stability analyses are required for final design and construction. USACE Method of Planes using the Stability with Uplift program and Spencer's method using the Slope/W program are recommended for stability analyses.

3.1.5 Seepage Analysis

Seepage analyses were not performed in the 1997 study due to lack of information. However, the following seepage control methods were recommended for embankment, foundation, abutments, and spillway section areas. A clay core with a 4-foot crest width at elevation 192, and 30-foot width at the ground surface was proposed to control seepage through the embankment. A 70-foot-deep slurry trench was proposed to control seepage through the foundation. An upstream drainage control blanket was recommended to control seepage at abutment areas. The spillway section (i.e., see in the Plate 12 in 1997 study report) with sheet pile at upstream and downstream were proposed to control the seepage. Boring DD-11U, taken near the location of the spillway, shows a clay layer of approximately 20-foot thick. The 20 foot clay layer, in combination with the clay core of the dam, were assumed to reduce seepage in spillway areas. To comply with EM 1110-2-1901, Seepage Analysis and Control for Dams, a thorough seepage analysis to include mitigation features, including proposed cutoffs and upstream blanket, is recommended to adequately assess and design seepage control measures for embankment, foundation, abutments, and spillway section areas.

3.1.6 Foundation Settlement

Settlement analyses were not performed in the 1997 study due to a limited scope and funding constraints. Consolidation tests revealed a stiff clay deposit with high pre-consolidation values; thus, it was assumed that only 1 percent foundation settlement would occur. However, consolidation testing was only available in two of the 11 borings taken through the length of the dam. For this current assessment, an additional 15 percent of embankment fill, and 25 percent of compacted clay core fill was included in cost estimates to account for construction and foundation settlement. It is recommended that additional borings be taken, and a complete settlement analysis be conducted during engineering design, to adequately assess settlement conditions.

3.1.7 Conclusion

It was determined that the 1997 study's limited analyses are considered adequate for cost estimating purposes of the Darlington Reservoir alternative. However, complete stability designs on all reaches should be conducted for all cases as specified in EM 1110-2-1902. It is recommended that a seepage analysis be performed based on EM 1110-2-1901, to better assess seepage conditions and accurately define seepage mitigation measures. A complete settlement analyses is recommended during PED phase to adequately assess settlement conditions.

3.2 DRY DAM ALTERNATIVES

Two additional dry dam alternatives were considered as part of this study, the Dry Dam on Sandy Creek alternative and the Dry Dam on Darlington, Lilley, and Bluff Creek alternative. These dry dams would be placed on tributaries along the Amite River. These dry dams were considered as a conceptual alternative. Foundation conditions are unknown within the proposed alignments and no subsurface investigations were conducted as part of this study. For cost estimating purposes, a scaled down dam cross section was derived from the Darlington Dam cross section. The design sections are conceptually based on site specific assumptions used in the 1997 report. No site-specific geotechnical analyses were performed at the individual dry dam locations.

SECTION 4
Datum and Topography

Light Detection and Ranging (LIDAR) data was obtained for this study from the Louisiana Department of Transportation (LADOTD). The datasource was LADOTD LIDAR for Amite Watershed, Louisiana. The LIDAR data acquisition occurred from January to March 2018.

- 2-foot LIDAR; Digital Elevation Model (DEM) grid developed by LADOTD
- Vertical Control = NAVD 88 (2009.55) GEOID12B
- LA SOUTH 1702 NAD83 map projection

The geographic information system (GIS) software tool, ArcGIS, was used to extract raster data around the Amite Dam and dry dam sites and generate contours at 1-foot intervals for all sites.

SECTION 5
Civil Design

5.1 DARLINGTON DAM

5.1.1 Two Options: Dry Dam and Reduced-Wet Dam

The design section (see Figure B:5-1) was taken from the 1997 report and consists of a reservoir with a 24-feet-wide crown at elevation 202.8 feet NAVD 88 (2009.55), side slopes of 1 vertical on 3 horizontal, from the crown to the elevation of the flood control pool at 172.8 feet NAVD 88 (2009.55). On the floodside, from the flood control elevation to the conservation pool elevation, the slope is 1 vertical on 6 horizontal. The flatter slope is to reduce the chances of sudden drawdown failures that tend to occur in this zone. Below the conservation pool elevation, the slope is 1 vertical on 4 horizontal. On the protected side, from the flood pool elevation to the conservation pool, the slope is 1 vertical on 5 horizontal. The flatter slope in this area will increase stability and will resist seepage forces that may concentrate in the lower portion of the dam. Below the conservation pool, the slope is 1 vertical on 3 horizontal. The outlet structure consists of three 10 feet by 10 feet concrete box culverts with a spillway at the flood control pool elevation. Updated quantities were obtained and provided to Cost Engineering.

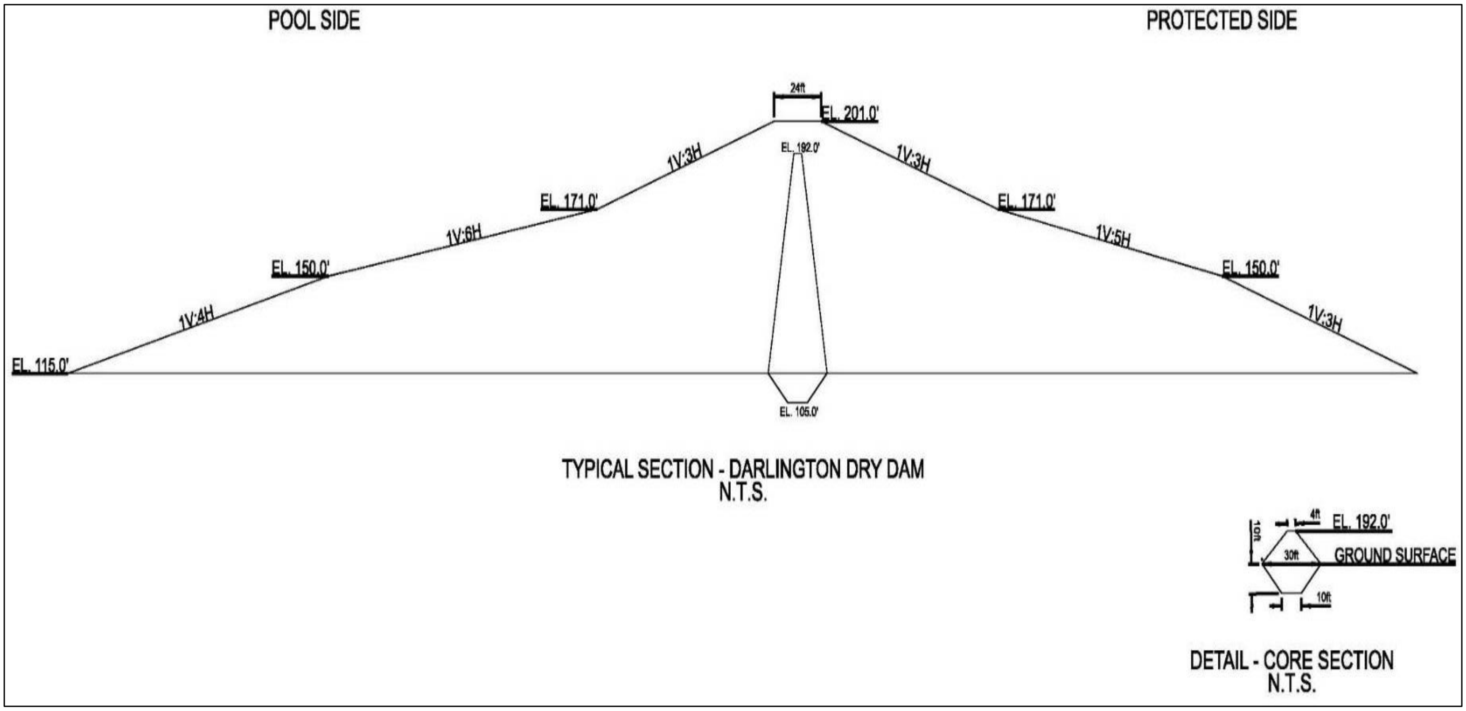


Figure B:5-1. Typical Section-Darlington Dry Dam

5.1.2 Borrow Assumptions

The top 5 feet of surface material would not be used for clay or random fill. For clay fill, assume a depth of 12 feet below the surface material, for a total depth of 17 feet. For random fill, assume a depth of 15 feet below the surface material, for a total depth of 20 feet. A ratio of 2:1 would be used for losses. For every 1.0 cubic yard (CY) of material needed, 2.0 CY of material would be obtained from the borrow source.

5.2 DRY DAM ON SANDY CREEK

5.2.1 Data & Analysis

For this study, no borings were taken, or geotechnical analysis performed on this alternative. All embankment dimensions were used from the 1992 study for the dry dam alternative.

The dam consists of a clay core with a random fill outer layer. Similarly, no hydraulic analysis was performed on the outlet structure for this study. For cost purposes, the cost of the outlet structure for Darlington Dam on the Amite River would be used for the outlet structures for these dry dams, with a scale factor provided by the MVN Hydraulic, Hydrology, and Coastal Engineering (HH&C) Branch. During a rain event, sluice gates would be closed to prevent flow and create a pool of water upstream of the dam. An emergency spillway would be placed at the flood control pool max elevation.

5.2.2 Borrow Assumptions

Borrow assumptions for this alternative are the same as those described in section 5.1.2. Dam Dimensions:

- Crown Width: 24 feet
- Embankment Slope 1:5

5.2.3 Quantities

Table B:5-1 provides pertinent dam dimensions for the Sandy Creek Dam that was used to generate quantities for the development of cost estimates.

Table B:5-1. Sandy Creek

<table>
<tr><td>Maximum Elevation (ft) (NAVD 88)</td><td colspan="3">160</td></tr>
<tr><td>Estimated Average Ground Elevation (ft) (NAVD 88)</td><td colspan="3">130</td></tr>
<tr><td>0.01 (100 yr) Annual Exceedance Probability (AEP) Pool Elevation (ft) (NAVD 88)</td><td colspan="3">150.4</td></tr>
<tr><td>0.002 (500 yr) AEP Pool Elevation (ft) (NAVD 88)</td><td colspan="3">155.3</td></tr>
<tr><td>Length (ft)</td><td colspan="3">7,719</td></tr>
<tr><td>Contour 160-foot Acreage (AC)</td><td colspan="3">3,552.37</td></tr>
<tr><td>Dam Footprint (AC)</td><td colspan="3">58</td></tr>
<tr><td>Borrow Acres (AC) (clay + random = total)</td><td colspan="3">20 + 132 = 152</td></tr>
<tr><td>Outlet Cost Scale Factor</td><td colspan="3">0.15</td></tr>
<tr><td rowspan="5">Quantities</td><td>Clay</td><td>195,405.06</td><td>CY</td></tr>
<tr><td>Random Fill</td><td>1,602,172.79</td><td>CY</td></tr>
<tr><td>Foundation Excavation</td><td>463,140.00</td><td>CY</td></tr>
<tr><td>Slurry Trench</td><td>540,330.00</td><td>SF</td></tr>
<tr><td>Outlet Cost Factor</td><td colspan="2">0.15</td></tr>
</table>

5.3 DRY DAM ON DARLINGTON, LILLEY, AND BLUFF CREEK

5.3.1 Data & Analysis

Data and analysis for this alternative are the same as described in Section 5.2.1.

5.3.2 Borrow Assumptions

Borrow assumptions for this alternative are the same as those described in section 5.1.2.
Dam Dimensions:

- Crown Width: 24 feet
- Embankment Slope: 1:5

Tables B:5-2 through B:5-4 provide pertinent dam dimensions that were used to generate quantities for the development of cost estimates.

Table B:5-2. Darlington Creek

	185		
	165		
	179.4		
	182.6		
	3,975		
	1,399.03		
	21		
	8 + 31 = 39		
	0.059		
		81,773.19	CY
		378,050.97	CY
		164,722.96	CY
		277,970.00	SF
		0.059	

Table B:5-3. Lilley Creek

	170		
	135		
	161.9		
	166.8		
	2,781		
	1,034.54		
	24		
	9 + 64 = 73		
	0.057		
		84,627.38	CY
		770,837.07	CY
		192,610.00	CY
		194,670.00	SF
		0.057	

Table B:5-4. Bluff Creek

Maximum Elevation (ft) (NAVD 88)	150		
Estimated Average Ground Elevation (ft) (NAVD 88)	130		
0.01 (100 yr) AEP Pool Elevation (ft) (NAVD 88)	143.5		
0.002 (500 yr) AEP Pool Elevation (ft) (NAVD 88)	145.8		
Length (ft)	4,978		
Contour 150-foot Acreage (AC)	1,218.04		
Dam Footprint (AC)	26		
Borrow Acres (AC) (clay + random = total)	10 + 39 = 49		
Outlet Cost Scale Factor	0.033		
Quantities	**Clay**	98,868.61	CY
	Random Fill	477,164.35	CY
	Foundation Excavation	206,494.81	CY
	Slurry Trench	348,460.00	SF
	Outlet Cost Factor	0.033	

SECTION 6
Structural Design

MVN's Structures Branch evaluated all data from various reports and/or previous studies to confirm that their assumptions and findings remain valid. The only alternative that had structural design aspects was the Darlington Dam alternative, which included a reinforced concrete spillway and a reinforced concrete outlet structure. No design criteria or calculations were provided within the 1992 study or the 1997 study reports. Consequently, those structures were not able to be thoroughly analyzed, except for their quantities.

Quantities for the 1997 study re-evaluation for the 0.04 (25 yr) AEP Reduced Wet Darlington Dam were completed and compared to the original 1992 study report. For quantities that were not easily calculated (due to little or no information), best estimates with contingencies were made.

Structures Branch also coordinated with other branches within Engineering Division to provide an assessment on the other proposed nonstructural alternatives.

6.1 QUANTITIES

Table B:6-1 provides estimated quantities from the 1992 study for the Darlington Dam 0.04 (25 yr) AEP Reduced Wet alternative that were projected to the 1997 study.

Table B:6-1. Darlington Dam Quantities

0.04 (25 yr) AEP Reduced Wet Amite River and Tributaries Probable Construction Cost Alternative 12 - Darlington Dam 0.04 (25 yr) AEP Reduced Wet Reservoir			
Item Description	**New Quantity (1997)**	**Old Quantity (1992)**	**Unit**
Dam Structure	Height of Dam: 202.8 LF	Levee Length: 19,100 LF	
Mobilization & Demobilization	1	1	JOB
Access Roads			
Low Level Outlet			
Site Access Roads	1	1	JOB
Spillway			
Site Access Roads	1	1	JOB
Care and Diversion of Water Dam			
Cofferdam	1	1	JOB
Low Level Outlet			
Dewatering Systems - Sumps & Pumps	1	1	JOB
Spillway			
Dewatering Systems - Sumps & Pumps	1	1	JOB
Earthwork for Structure			
Dam			
Site Work - General			
Item Description	**New Quantity (1997)**	**Old Quantity (1992)**	**Unit**
Clearing and Grubbing (no stumps)	450	270	AC
Foundation Excavation (with stumps) - Adjacent Disposal	3,069,000	255,000	CY
Slurry Trench Excavation - 70 ft Depth Ave	1,260,000	1,260,000	SF

Gravel Filter Material	0	1,165,000	CY
Filter Fabric	0	635,000	SY
Semi-compacted Fill - Random (Neat + 15%) (includes foundation fill)	11,800,000	9,010,000	CY
Compacted Fill - Select Clay (Neat + 25%)	856,000	1,040,000	CY
Fertilizing & seeding	450	275	AC
Pond Elevation Riprap 400 lb Stone 24 inch Thick	21,000		TN
Clearing and grubbing	0	0	AC
Structural Excavation - Adjacent Disposal	90,000	120,000	CY
Clearing and grubbing	8	10	AC
Common Excavation - Adjacent Disposal	90,000	120,000	CY
24-inch Rip Rap	4,700	4,700	TN
36-inch Rip Rap	15,000	15,000	TN
6-inch Bedding	2,500	2,500	CY
Filter Fabric	0	22,000	SY
Clearing and grubbing	20	20	AC
Structural Excavation - Adjacent Disposal	600,000	600,000	CY
Semi-compacted Fill - Random	15,000	15,000	CY
Compacted Fill - Select Clay	115,000	115,000	CY
Compacted Fill - Select Sand	26,000	26,000	CY
42-inch Rip Rap	0	123,000	TN
36-inch Rip Rap	105,464	0	TN
6-inch Bedding Material	12,000	12,000	CY
Slurry Trench Excavation - 75 ft Depth	76,000	76,000	SF
Gravel Filter Material	34,000	34,000	CY
6-inch Perforated PVC Pipe	46,000	46,000	LF
12-inch PVC Pipe	1,800	1,800	LF
Clearing and grubbing	100	100	AC
Common Excavation - Adjacent Disposal	6,200,000	6,200,000	CY

Low Level Outlet			
Item Description	**New Quantity (1997)**	**Old Quantity (1992)**	**Unit**
Sheet pile, PZ-22	5,000	5,000	SF
Spillway			
Sheet pile, PZ-27	33,000	33,000	SF
Concrete			
Low Level Outlet			
Culvert Structure - Reinforced Concrete			
Item Description	**New Quantity (1997)**	**Old Quantity (1992)**	**Unit**
Stabilization Slab	5,500	7,300	CY
Wall & Roof	10,400	10,400	CY
Gate Tower	380	380	CY
Alignment Collars	750	750	CY
Stoplogs	60	60	CY
Culvert Structure - Unreinforced Concrete			
Stabilization Slab	500	650	CY
Spillway			
Sand Cement Foundation Treatment	9,000	9,000	CY
Overflow Section - Reinforced Concrete			
Overlay	50,000	50,000	CY
Dowels	290,000	290,000	LB
Overflow Section - Unreinforced Concrete			
Roller Compacted Concrete	135,000	180,000	CY
Metals			
Low Level Outlet			
Trash Racks	30,000	30,000	LB
Miscellaneous Metals			
24-inch Vent Pipe	1,600	1,600	LF
3-Bulb Waterstop	3,500	3,500	LF
Expansion Joint Filler	11,500	11,000	SF
Gate and Equipment			
Low Level Outlet			
Sluice Gates (Weight: 7,500 lb each)	3	3	EA

Gate Operation Machinery	3	3	EA

SECTION 7
Relocations

7.1 GENERAL

The Fifth Amendment to the Constitution of the United States provides that just compensation will be paid for the taking of private property for public use. This “taking” of an interest in real estate is necessary for Federal Government to subordinate such interest in real estate. In publicly owned roads and utility systems, the Federal Courts have held that the liability of the United States for such acquisition is the cost of providing substitute facilities where substitute facilities are, in fact, necessary. This is the basis of the facility and utility relocation process. Therefore, it is incumbent that the MVN, Engineering Division, Design Services Branch, Relocations Team perform an investigation of the existing public utilities, facilities, and cemeteries located within the proposed project areas that may be impacted, while considering the current design requirements for the recommended plan. If such a facility, utility, cemetery, or town would affect the construction, operation, maintenance, repair, replacement, or rehabilitation of a USACE project, then the MVN Relocations Team must determine the appropriate disposition of the impacted facility. Some facilities may require either a permanent or temporary physical adjustment or displacement to support project activities, engineering requirements, and operation and maintenance needs.

The MVN Relocations Team was tasked with investigating, identifying, and verifying public facilities and utilities located within four dry creek retention dams: Darlington Creek, Lilley Creek, Bluff Creek, and Sandy Creek. Database research included the National Pipeline Database, State Online Natural Resources Information System (SONRIS), Louisiana Department of Natural Resources (LADNR), HTST-IHS, Penwell, Google Earth Pro, and the National Pipeline Mapping System (NPMS) data.

Based on the research and investigations conducted by the MVN Relocations Team, multiple facilities or utilities have been marked, labeled, and identified within the project areas of the alternatives. Figures B:7-1 through B:7-4 show the various roads, powerlines, pipelines, and cemeteries located within each alternative.

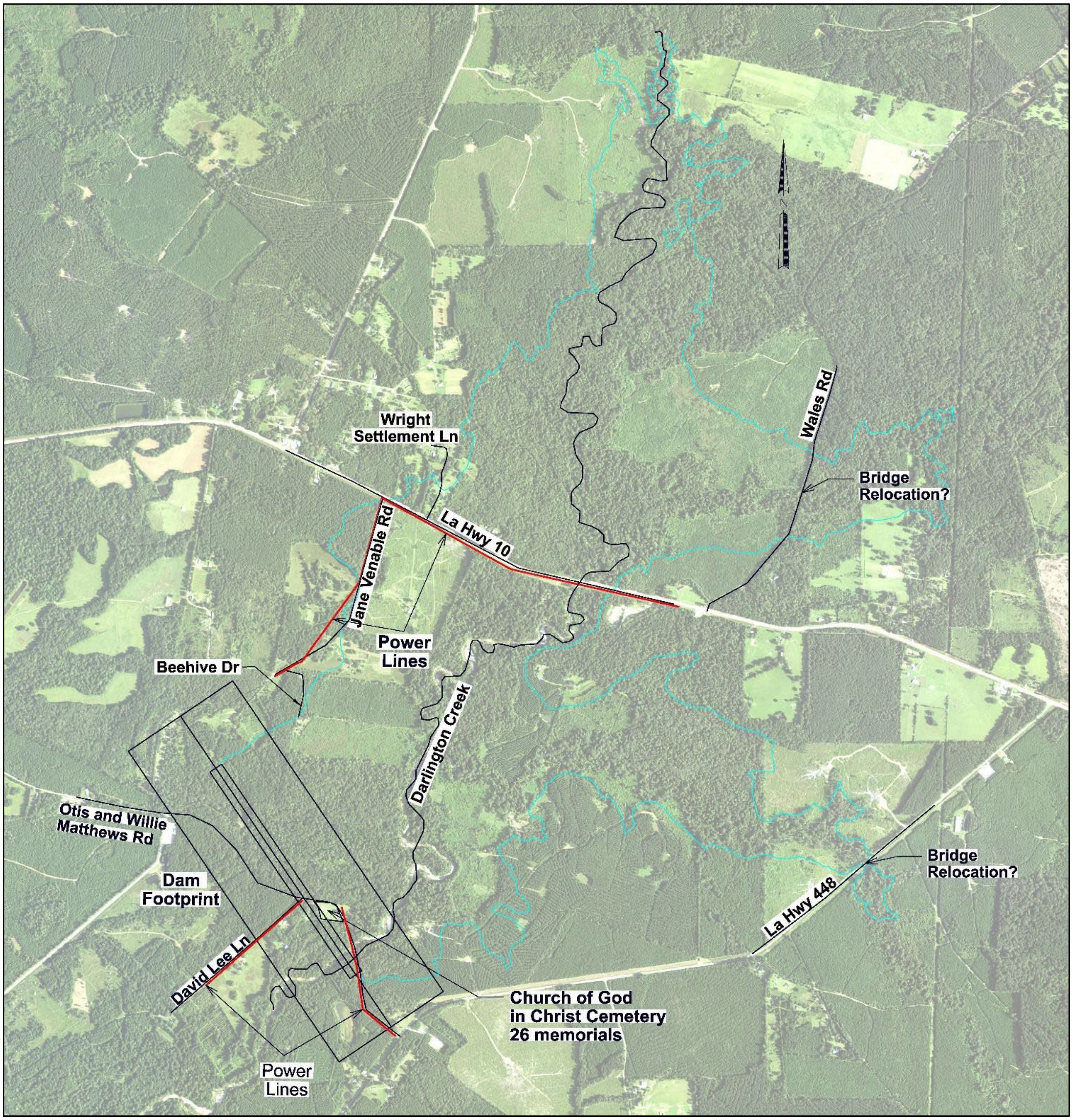


Figure B:7-1. Darlington Dam – Reduce Wet/Dry Reservoir Alternative

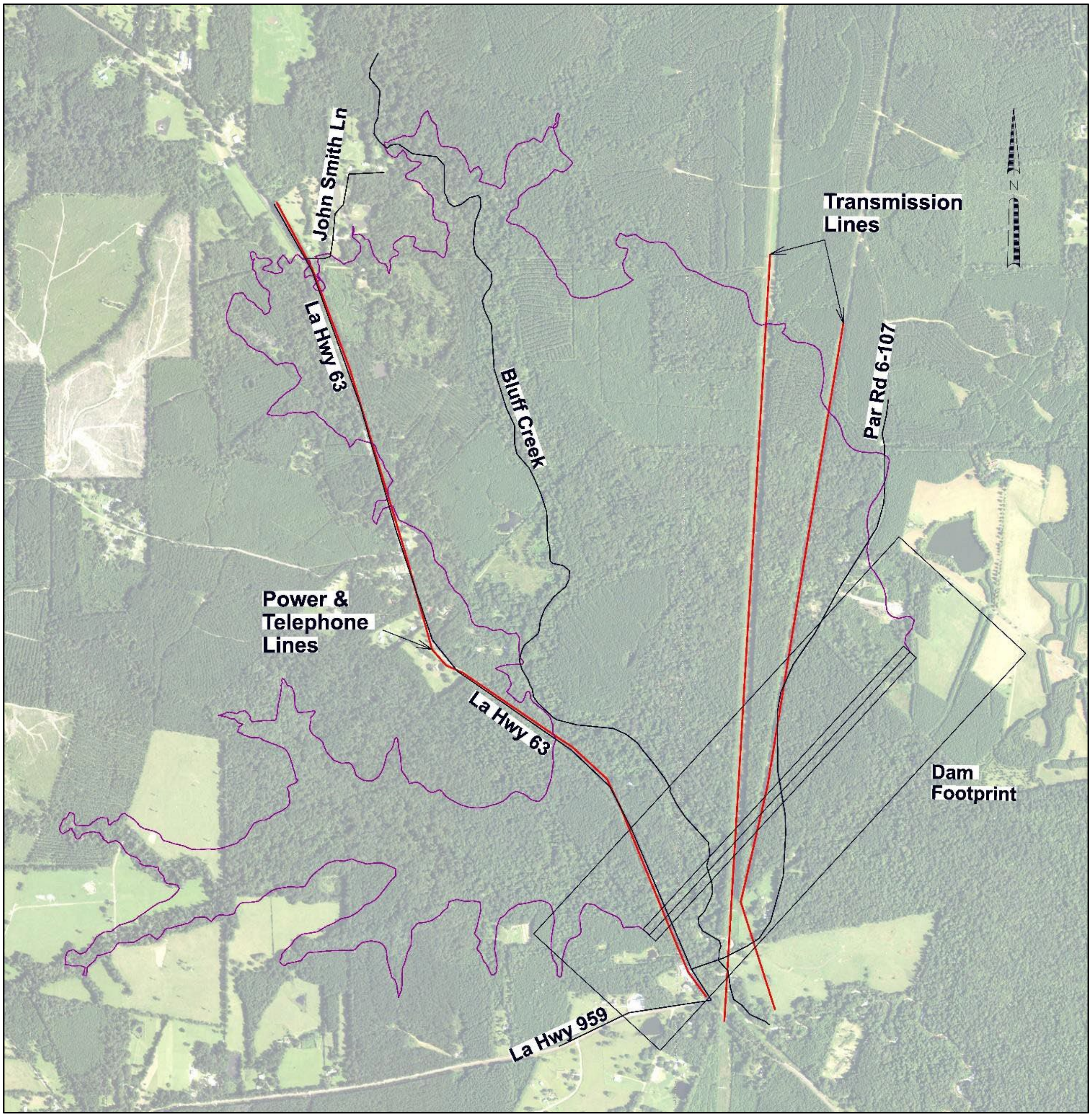


Figure B:7-2. Bluff Creek – Dry Dam Reservoir Alternative

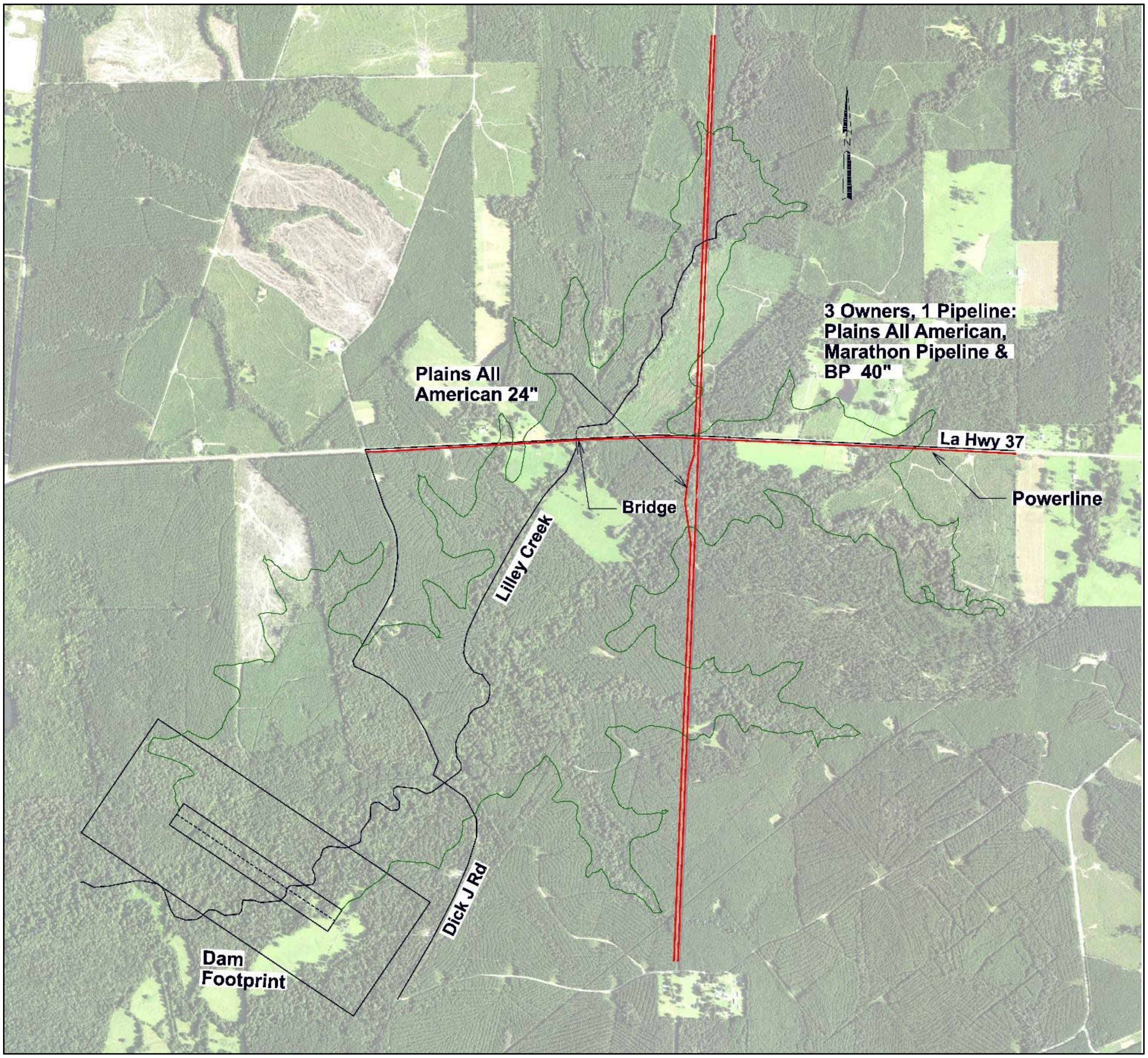


Figure B:7-3. Lilley Creek – Dry Dam Reservoir Alternative

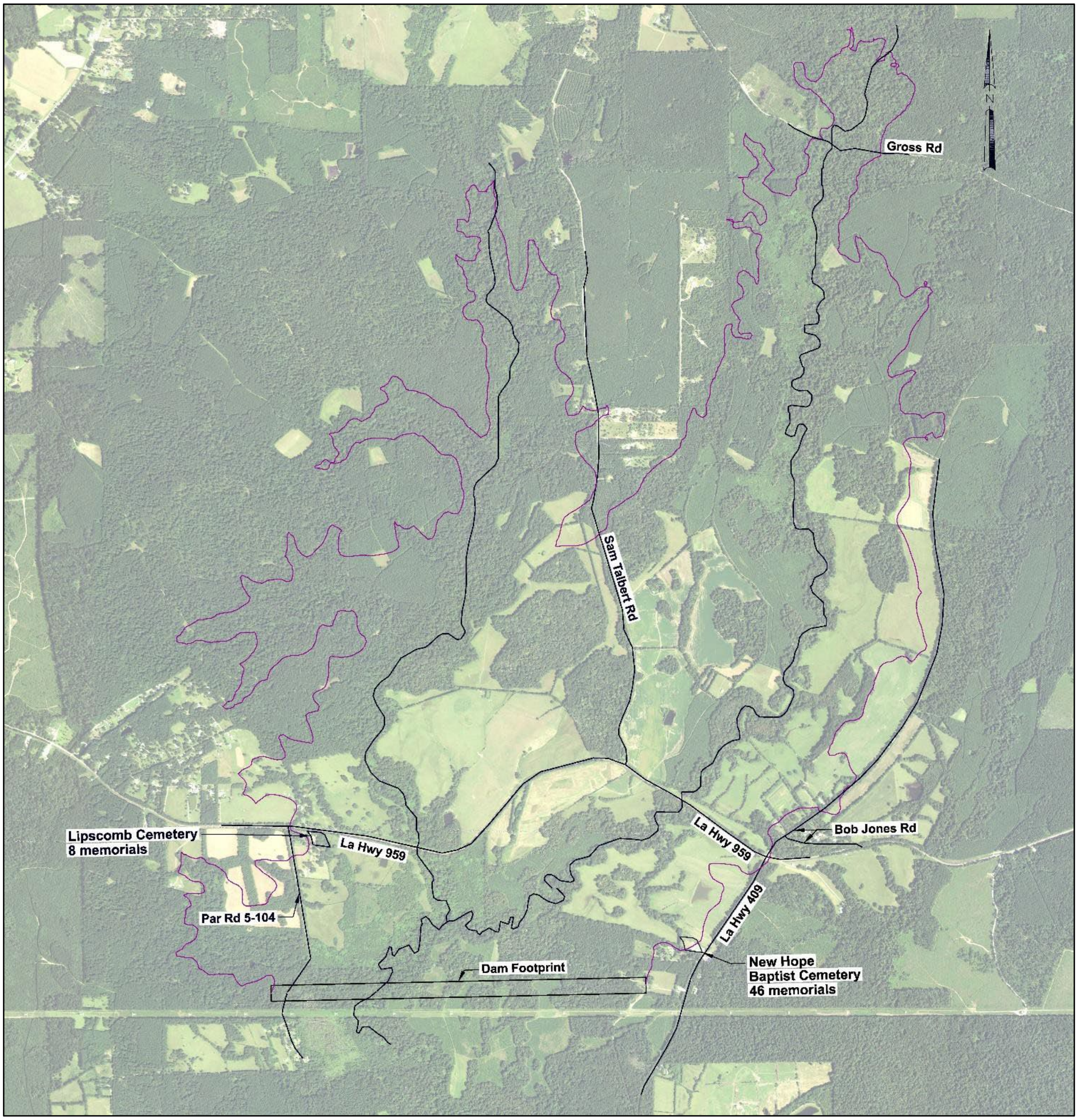


Figure B:7-4. Sandy Creek – Dry Dam Reservoir Alternative

7.2 ROADWAY RELOCATIONS

Roadways were generally agreed upon to be raised above 0.01 (100 yr) AEP flood elevation full reservoir. Selected roadways were chosen for evacuation routes, only in the case of emergencies. All other existing highways and roads that traverse the proposed reservoir would not be relocated, rerouted, or raised to accommodate a 0.01 (100 yr) AEP flood event, in accordance with LADOTD standards. Roads that only provide access to areas inside the reservoir limits would be considered abandoned and therefore were excluded from this study. However, one highway (LA Highway 448) located within the Darlington Creek dry reservoir and two secondary roads (Otis and Willie Matthews Road and David Lee Lane) located within the Darlington Creek wet reduced reservoir were impacted by the proposed earthen dams' alignments at these two reservoirs; thus, requiring them to be relocated up and over the proposed risk reduction required for continuing access for local traffic.

As potential evacuation routes, the following roadways were evaluated to ascertain whether they were above the 0.01 (100 yr) AEP flood elevation:

- Darlington Creek – LA Highway 10 (Figure B:7-1)
- Bluff Creek – Highway 63 (Figure B:7-2)
- Lilley Creek – Highway 37 (Figure B:7-3)
- Sandy Creek – LA Highway 409/Parish Road 104 (Figure B:7-4)

Portions of Highway 37 and Highway 63 fell below the 0.01 (100 yr) AEP flood elevation; therefore, requiring minimum relocations to raise them. LA Highway 10 required no relocation. Highway 959 crossing Sandy Creek was considered an evacuation route.

However, due to an initial high-cost estimate to raise over 2 miles of roadway over the 0.01 (100 yr) AEP flood elevation, it was determined not to be a feasible alternative. The selective route chosen at Sandy Creek was to re-route traffic south, either onto LA Highway 409 or onto Parish Road 104 to Pride, Louisiana as a by-pass alternative route.

The proposed design elevation of the top surface of the replacement of the selected road relocations and the stringer beams of replacement bridges are the 0.01 (100 yr) AEP design flood elevation plus an additional 3 feet of freeboard. Roadway design calls for 24 feet surface roadway with 8-foot shoulders. Highways 37 and 63 would require one bridge replacement at each segment of road relocation.

7.3 POWERLINE AND TELEPHONE RELOCATIONS

There would be minimal impacts of power distribution lines and telephone lines. The only telephone and distribution power lines requiring relocation are along Otis and Willie Matthews Road, David Lee Lane, Highway 37, and LA Highway 448. No transmission lines would require relocation through Bluff Creek and no distribution power lines or telephone lines along Highway 63 would require relocation. Confirmation is required to determine what type of lines (distribution power or transmission lines) are located east of the Darlington Dam–Reduce Wet/Dry Reservoir Alternative. However, it does not appear that they would be impacted.

7.4 PIPELINE RELOCATIONS

Pipelines located under proposed permanent water would not be required to be relocated or weighted down to offset negative buoyancy. All pipeline crossings were buried below ground at a minimum of 3 to 5 feet in depth. Minimum requirement for crossing permanent water is 8 to 10 feet in depth.

A. Darlington Dam – Reduce Wet/Dry Reservoir Alternative (Figure B:7-1)
   1. Williams Partners (2 – 36 inch and 1 – 30-inch pipelines)
   2. Koch and KKR & Co. (2 – 36-inch pipelines)
B. Lilley Creek – Dry Dam Reservoir Alternative (Figure B:7-3)
   1. Plains All American (24 – inch pipeline)
   2. Plains All American/Marathon/BP (40–inch pipeline)

7.5 CEMETERIES AND CHURCH RELOCATIONS

Three cemeteries have been identified and would be required to be relocated:

- Darlington Creek: Church of God in Christ Cemetery (Figure B:7-1)
- Sandy Creek: Lipscomb Cemetery and New Hope Baptist Cemetery (Figure B:7-4)

Preliminary investigations were conducted to identify the number of memorials at each cemetery. Eight memorials were identified at Lipscomb Cemetery, 46 memorials were identified at New Hope Cemetery, and 26 memorials were identified at Church of God in Christ Cemetery. There is easy access to relocate each cemetery to a nearby proposed site location that is within a 1-mile distance outside of each creek reservoir. Historical investigations, including contact of descendants, excavations, and re-interments including grave markers and burial vaults must meet state and local guidelines and regulations.

The Church of God in Christ Church, located adjacent to its cemetery, would have to be relocated outside the limits of Darlington Creek. This church's structure is estimated to have a living space of 5,000 square-feet, which services the local community. It is recommended that the church, along with its cemetery, be relocated to one location.

7.6 RELOCATIONS COST

This section details the relocation costs developed for each alternative.

The relocations cost estimates and contingencies shown for these alternatives were developed in 2019 and do not reflect the revised cost estimates and contingencies that were developed in 2023.

7.6.1 Darlington Dam – Reduced Wet Alternative

The relocation costs for this alternative are for one church, one cemetery, Matthew Road, Lee Lane, and LA 448. The cemetery base cost is $195,000. Including a 226 percent contingency, the cost is $637,000. The reason the cost contingency is very high is due to the likelihood for significant impacts related to scope growth. Using internet-based research, only one known cemetery was physically located within the boundaries of the flood pool of the dam, but it is believed that further in-depth research would reveal many smaller, unknown cemeteries throughout the project site that would need to be relocated. The base cost for the remaining relocations is $2,839,000. Including a 36 percent contingency, the cost is $3,863,000. The total relocations cost for this alternative is $4,500,000.

7.6.2 Darlington Dam – Dry Alternative

The relocation costs for this alternative are the same as those described in section 7.6.1 for the Darlington Dam – Reduced Wet Alternative.

7.6.3 Sandy Creek Dry Dam Alternative

The only relocation costs required for this alternative are for two cemeteries. The base cost is $415,600. Including a 222 percent contingency, the cost is $1,337,000. The cost contingency is very high due to the likelihood for significant impacts related to scope growth. Using internet-based research, two known cemeteries were physically located within the boundaries of the flood pool of the dam, but it is believed that further in-depth research would reveal several smaller, unknown cemeteries throughout the project site that would need to be relocated.

7.6.4 Three Tributary Dry Dams Alternative

The relocation costs required for this alternative are for one cemetery, three roads (O&W Rd/David Lee Rd, LA37 & LA63), and two bridges (LA37 & LA63). The base cost for the Cemetery Relocation is $195,000. Including a 222 percent contingency, the cost is $627,000. The cost contingency is very high for cemeteries due to the likelihood for significant impacts related to scope growth. Using internet-based research, one known cemetery was physically located within the boundaries of the flood pool of the dam, but it is believed that further in-depth research would reveal several smaller, unknown cemeteries throughout the project site that would need to be relocated. The base cost for the remainder relocations is $7,525,000. Including a 51 percent contingency, the cost is $11,350,000. The total relocations cost for this alternative is $11,977,000.

SECTION 8
References

USACE, New Orleans District, Amite River and Tributaries, Darlington Reservoir Feasibility Study, dated September 1992.

Harza Consultants (Response to original feasibility study), *Harza Engineering Report*, dated April 1995.

USACE, New Orleans District, (response to Harza Engineering Report), *Amite River and Tributaries, Darlington Reservoir Re-evaluation Study (Reconnaissance Scope)*, dated September 1997.

SECTION 9
List of Acronyms and Abbreviations

AC	Acerage
AEP	Annual Exceedance Probability
CY	Cubic Yard
DEM	Digital Elevation Model
EA	Each
EM	Engineering Manual
ER	Engineering Regulation
FOS	Factor of Safety
FT	Feet
GIS	Geographic Information System
HH&C	Hydraulic, Hydrology, and Coastal Engineering Branch
LADOTD	Louisiana Department of Transportation and Development
LB	Pound
LF	Linear Feet
LiDAR	Light Detection and Ranging
MSL	Mean Sea Level
MVN	New Orleans District
NAVD 88	North American Vertical Datum of 1988
PED	Preconstruction, Engineering, and Design
SF	Square Feet
TN	Ton
USACE	US Army Corps of Engineers
YR	Year

Mississippi Valley Division,
Regional Planning and Environment Division South

Amite River and Tributaries East of the Mississippi River, Louisiana Feasibility Study (ART)

Appendix D-1: Agency Coordination

December 2023

ENVIRONMENTAL APPENDIX

TABLE OF CONTENTS

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Louisiana Ecological
Services 200 Dulles Drive
Lafayette, Louisiana 70506

November 15, 2023

Colonel Cullen Jones
District Commander
U.S. Army Corps of Engineers
New Orleans District
7400 Leake Avenue
New Orleans, LA 70118-3651

Dear Colonel Jones:

The U.S. Army Corps of Engineers (USACE), Mississippi River Valley Division, Regional Planning and Environment Division South (RPEDS), is preparing a Draft Integrated Feasibility Report (DIFR) and Environmental Assessment (EA) for the Amite River and Tributaries East of the Mississippi River, Louisiana (ART). This study is investigating alternatives to reduce flood risk along the Amite River Basin, which covers portions of Amite, Lincoln, Franklin, and Wilkinson Counties in Mississippi as well as East Feliciana, St. Helena, East Baton Rouge, Livingston, Iberville, St. James, St. John the Baptist, and Ascension Parishes in Louisiana.

The Fish and Wildlife Service (Service) prepared a previous Draft Fish and Wildlife Coordination Act Reports for the ART Feasibility Study Environmental Impact Statement in October 2019 and two supplemental Planning Aid Letter (PAL) in December 2019 and April 2020.

This draft report contains an analysis of the impacts on fish and wildlife resources that would result from project implementation and provides recommendations to minimize those impacts. This draft report has been prepared by the Fish and Wildlife Service (Service) under the authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) and does not constitute the report of the Secretary of the Interior as required by section 2b of that act. The Service also provides comments within this report under the following authorities: the National Environmental Policy Act of 1969, as amended, the Endangered Species Act of 1973 (ESA, 87 Stat. 884, as amended; 16 U.S.C. 661 et seq.), the Migratory Bird Treaty Act (MBTA, 40 Stat. 755, as amended; 16 U.S.C. 703 et seq.), and the Bald and Golden Eagle Protection Act (BGEPA, 54 Stat. 250, as amended, 16 U.S.C. 668a-d). A copy of this report will be provided to the Louisiana Department of Wildlife and Fisheries (LDWF) for review, and their comments will be included in our final report.

The proposed action is authorized as part of the Bipartisan Budget Act of 2018, H. R. 1892—13, Title IV, Corps of Engineers - Civil, Department of the Army, Investigations, where funds are being made available for the expenses related to the completion, or initiation and completion, of flood and storm damage reduction, including shore protection studies which are currently authorized or which are authorized after the date of enactment of this act, to reduce risk from future floods and hurricanes. The funds are at full federal expense and are available for high-priority studies of projects in States and insular areas with more than one flood related major disaster declared pursuant to the Robert T. Stafford Disaster Relief and Emergency Assistance Act (42 U.S.C. 5121 et seq.) in calendar years 2014, 2015, 2016, or 2017.

This study area is being included based on the August 2016 flooding over southeast and south-central Louisiana, and is continuing investigation under the authorization provided by the Resolution of the Committee on Public Works of the United States Senate, adopted on April 14, 1967.

STUDY AREA

The study area is the Amite River Basin and tributaries (Figure 1). The Amite River Basin begins in southwest Mississippi and flows southward crossing the state line into southeastern Louisiana. The Amite River Basin includes 2,200 square miles flowing into the Amite River and its tributaries.

The study area is similar to the 1984 Amite Rivers and Tributaries Flood Control Initial Evaluation Study by USACE; however, it has been expanded to include areas that are impacted by backwater flooding to the southeast and east since they are hydraulically connected to the Amite River Basin and tributaries. Communities along the Amite River in East Baton Rouge, Ascension, and Livingston Parishes have undergone significant development since 1984 due to their proximity to Baton Rouge. Towns such as Prairieville, Gonzales, and Denham Springs are now subject to increased flood risks. No significant flood risks associated with the Amite River Basin were identified within the state of Mississippi; therefore, modeling and development of alternatives were focused on the state of Louisiana. This was confirmed with the Mississippi Soil and Water Conservation Commission, that there are no flooding impacts in the state of Mississippi from the Amite River and Tributaries in the state of Mississippi.

FISH AND WILDLIFE RESOURCES

The project area contains the Amite River and tributaries, sandbars, herbaceous and forested riparian wetlands, as well as upland forests. Two of the community types observed during roadside surveys were “small stream forests” and “hardwood slope forests” (LDWF 2009). Both communities contain yellow poplar, sweetgum, magnolia, and beech, as well as multiple species of oaks, hickories, and pines. The small stream forests also contain several species of elm and ash, as well as sycamore, cypress, cherry laurel, black gum, and river birch. These ecosystems provide valuable habitat for a variety of freshwater fish, mussels, crustaceans, reptiles, amphibians, birds, and mammals. Many of these species (game and non-game) provide economic value to the State and local communities through hunting, fishing, bird watching, etc.

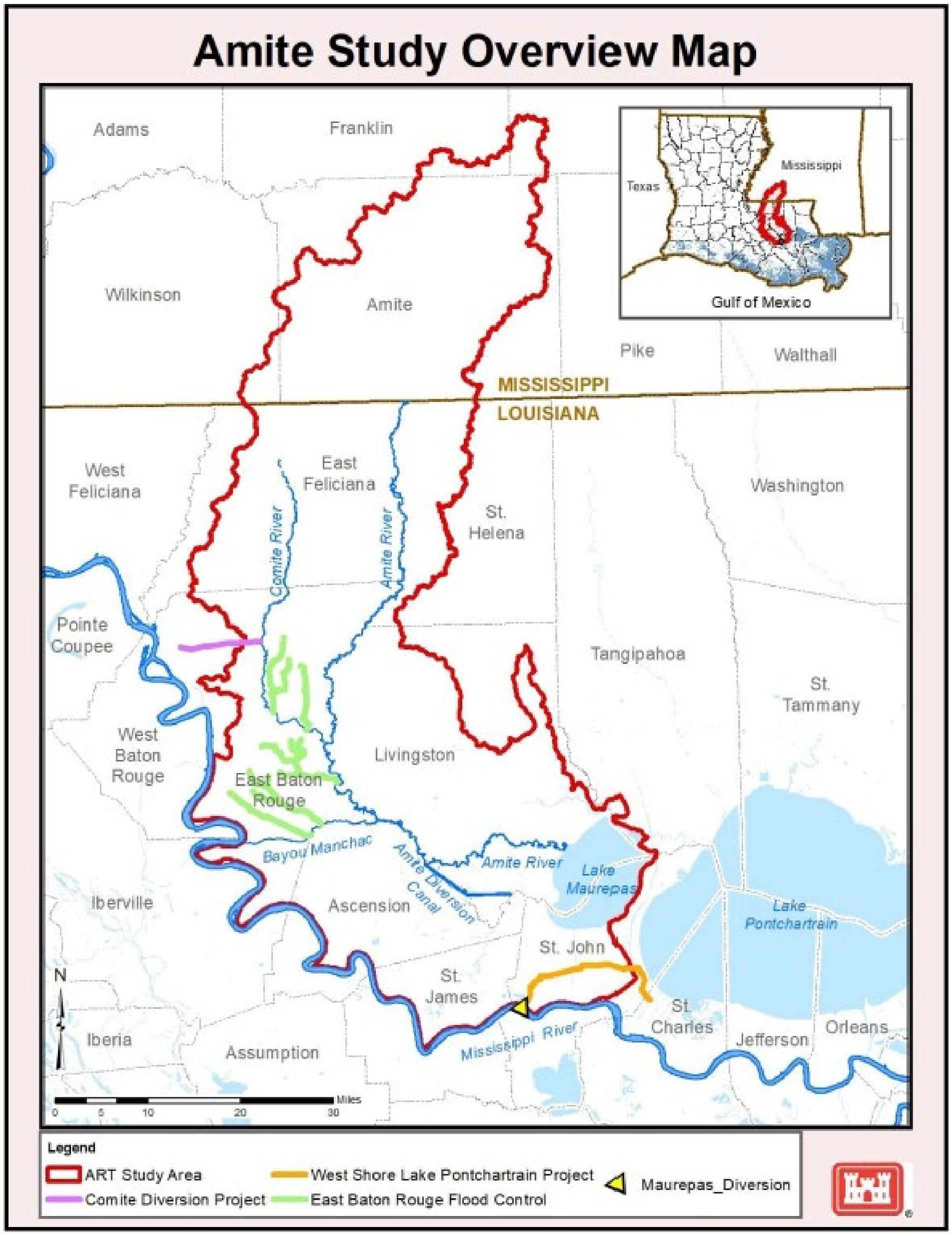


Figure 1. Amite River Basin and tributaries study area.

Federal trust species such as wading birds, waterfowl, and neotropical migrants all utilize the project area. Many of those species (i.e., little blue heron, wood thrush, prothonotary warbler, worm-eating warbler, Louisiana waterthrush, and painted bunting) have exhibited substantial population declines over the last 30 years, primarily as the result of habitat loss and fragmentation. The Amite River itself is of particular importance to several federally threatened and at-risk species that are discussed below. Maintaining unobstructed passage for those aquatic resources will be a necessary component of the project design. Additional State-listed at-risk species found within the project area include broadstripe topminnow (*Fundulus euryzonus*), Alabama shad (*Alosa alabamae*), Rayed creekshell (*Anodontoides radiatus*), and four-toed salamander (*Hemidactylium scutatum*).

The downstream portion of the Amite River has been altered by past deepening projects and a flood control project that rerouted flows. The middle portion of the Amit River has been impacted by sand and gravel mining. This mining has caused instability in the river resulting in the widening and shallowing of portions of the river. Loss of gravel bars has also contributed to this instability and the loss of that instream habitat. Increased turbidity and sedimentation from the instability has decreased aquatic diversity within the river. The upstream portion of the Amite River is adversely affected by incision of the channel due to the gravel mines. This creates turbidity and sedimentation problems as well further impacting less common and/or habitat specific species.

Threatened and Endangered Species

Within the study area, four threatened or endangered species are known to occur (Table1). Information regarding those species and their preferred habitats are provided below.

Table 1. List of threatened species known to occur within the project area.

Species	Species Group	Status
Inflated Heelsplitter Mussel	Mollusk	Threatened
Gulf Sturgeon	Fish	Threatened
West Indian Manatee	Mammal	Threatened
Northern Long-eared Bat	Mammal	Endangered

Inflated Heelsplitter

Federally listed as a threatened species, the Inflated heelsplitter mussel (*Potamilus inflatus*) was historically found in Louisiana in the Amite, Tangipahoa, and Pearl Rivers. Many life history aspects of the species are poorly understood but are likely similar to that of other members of the Unionidae family. Although the primary host fish for the species is not certain, investigation by K. Roe et al. (1997) indicates that the freshwater drum (*Aplodinotus grunniens*) is a suitable glochidial host for the species.

Based on the most recent survey data, the currently known range for the inflated heelsplitter in Louisiana occurs only in the lower third of the Amite River along the East Baton Rouge/Livingston Parish line from Spiller’s Creek, which is in the vicinity of Denham Springs downstream to the vicinity of Port Vincent. Because it has not been used widely for past or present gravel mining operations, the lower third of the Amite River (between Louisiana Highway 37 and Louisiana Highway 42) is more typical of a coastal plain river; being characterized by a silt substratum, less channelization, and slower water flow, all of which are characteristic of heelsplitter habitat. This freshwater mussel is typically found in soft, stable substrates such as sand, mud, silt, and sandy gravel, in slow to moderate currents. Heelsplitter mussels are usually found in depositional pools below sand point bars and in shallow pools between sandbars and riverbanks. Impacts from sand and gravel mining are believed to be decreasing the range of the inflated heelsplitter.

Major threats to this species in Louisiana are the loss of habitat resulting from sand and gravel dredging and channel modifications for flood control, as shown by the apparent local extirpation of the species in the extensively modified upper portions of the Amite River. If implementation of the proposed action has the potential to directly or indirectly affect the inflated heelsplitter or its habitat, further consultation with this office will be necessary.

Gulf Sturgeon

The Gulf sturgeon (*Acipenser oxyrhynchus desotoi*), federally listed as a threatened species, is an anadromous fish that occurs in many rivers, streams, and estuarine and marine waters along the northern Gulf coast between the Mississippi River and the Suwannee River, Florida. In Louisiana, Gulf sturgeon have been reported at Rigolets Pass, rivers and lakes of the Lake Pontchartrain Basin, the Pearl River System, the Amite River, and adjacent estuarine and marine areas. Spawning occurs in coastal rivers between late winter and early spring (i.e., March to May). Adults and sub-adults may be found in those rivers and streams until November, and in estuarine or marine waters during the remainder of the year. Gulf sturgeon less than two years old appear to remain in riverine habitats and estuarine areas throughout the year, rather than migrate to marine waters. Habitat alterations such as those caused by water control structures and navigation projects that limit and prevent spawning, poor water quality, and over-fishing have negatively affected this species. If implementation of the proposed action has the potential to directly or indirectly affect the Gulf sturgeon or its habitat, further consultation with this office will be necessary.

West Indian Manatee

The threatened West Indian manatee (*Trichechus manatus*) is known to regularly occur in Lakes Pontchartrain and Maurepas and their associated coastal waters and streams. It also can be found less regularly in other Louisiana coastal areas, most likely while the average water temperature is warm. Based on data maintained by the Louisiana Natural Heritage Program (LNHP), over 80 percent of reported manatee sightings (1999-2011) in Louisiana have occurred from the months of June through December. Manatee occurrences in Louisiana appear to be increasing and they have been regularly reported in the Amite, Blind, Tchefuncte, and Tickfaw Rivers, and in canals within the adjacent coastal marshes of southeastern Louisiana. Cold weather and outbreaks of red tide may adversely affect these animals. However, human activity is the primary cause for declines in species number due to collisions with boats and barges, entrapment in flood control structures, poaching, habitat loss, and pollution. Please see Appendix A for recommendations to minimize potential impacts to manatees during construction.

Northern long-eared bat

The northern long-eared bat (*Myotis septentrionalis*), federally listed as an endangered species, is a medium sized bat about 3 to 3.7 inches in length but with a wingspan of 9 to 10 inches and is distinguished by its long ears. Its fur color can range from medium to dark brown on the back and tawny to pale brown on the underside. The northern long-eared bat can be found in much of the eastern and north central United States and all Canadian provinces from the Atlantic Ocean west to the southern Yukon Territory and eastern British Columbia. In Louisiana, there have been confirmed reports of sightings in West Feliciana, Winn, and Grant parishes, although they can possibly be found in other parishes in the state. Some individuals were documented during mist net and bridge surveys on the Winn District of the Kisatchie National Forest and observed under bridges on the Winn District in Grant Parish.

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 motionless insects from vegetation and water surfaces.

The most prominent threat to this species is white-nose syndrome, a disease known to cause high mortality in bats that hibernate in caves. Other sources of mortality for northern long-eared bats are wind energy development, habitat destruction or disturbance, climate change and contaminants. If implementation of the proposed action has the potential to directly or indirectly affect the northern long-eared bat or its habitat, further consultation with this office will be necessary.

The USACE is responsible for determining whether the selected alternative is likely (or not likely) to adversely affect any listed species and/or critical habitat, and for requesting the Service's concurrence with that determination. If the USACE determines, and the Service concurs, that the selected alternative is likely to adversely affect listed species and/or critical habitat, a request for formal consultation in accordance with Section 7 of the Endangered Species Act should be submitted to the Service. That request should also include the USACE's rationale supporting their determination.

At-Risk Species

The Service's Southeast Region has defined "at-risk species" as those that are: 1) proposed for listing under the Endangered Species Act (ESA) by the Service; 2) candidates for listing under the ESA, which means the species has a "warranted but precluded 12-month finding"; or 3) petitioned for listing under the ESA, which means a citizen or group has requested that the Service add them to the list of protected species. Petitioned species include those for which the Service has made a substantial 90-day finding as well as those that are under review for a 90-day finding. As the Service develops proactive conservation strategies with partners for at-risk species, the states' Species of Greatest Conservation Need (defined as species with low or declining populations) will also be considered.

The Service's goal is to work with private and public entities on proactive conservation to conserve these species, thereby precluding the need to federally list as many at-risk species as possible. While not all species identified as at-risk will become ESA listed species, their potentially reduced populations warrant their identification and attention in project planning. Listed below are species currently designated as "at-risk" that may occur within the proposed study area.

Proposed Threatened

Alligator Snapping Turtle

The alligator snapping turtle (*Macrochelys temminckii*) may be found in large rivers, canals, lakes, oxbows, and swamps adjacent to large rivers. It is most common in freshwater lakes and bayous, but also found in coastal marshes and sometimes in brackish waters near river mouths. Typical habitat is mud-bottomed waterbodies having some aquatic vegetation. The alligator snapping turtle is slow growing and long lived. Sexual maturity is reached at 11 to 13 years of age (Ernst et al.1994). Because of this and its low fecundity, loss of breeding females is thought to be the primary threat to the species.

Alabama Hickorynut

The Alabama hickorynut (*Obovaria unicolor*) is a 1.2- to 2-inch-long freshwater mussel with round or elliptical shape. The outer shell (periostracum) is smooth and brown to yellow brown, with rays. This species is a long term brooder that is gravid 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 ready, they release from the host to find a suitable substrate. Suitable glochidial host fishes for this species include the naked sand darter (*Ammocrypta beani*), southern sand darter (*Ammocrypta meridiana*), Johnny darter (*Etheostoma nigrum*), Gulf darter (*Etheostoma swaini*), blackbanded darter (*Percina nigrofasciata*), dusky darter (*Percina sciera*), and redspot darter (*Etheostoma artesiae*). These are small fish that live along the bottoms of clear streams.

The Alabama hickorynut inhabits sand and gravel substrates in moderate currents in large streams. However, the presence of moderate gradient pool and riffle habitats in a variety of stream and river sizes may contain this species. In Louisiana, the Alabama hickorynut is known to occur in the Pearl and Amite River systems. Habitat modification and destruction due to siltation and impoundment threaten this species. It is also negatively affected by the pollution of streams and rivers.

Candidate Species

Monarch Butterfly
The monarch butterfly (*Danaus plexippus*) is a candidate species and not yet listed or proposed for listing. Consultation with U.S. Fish and Wildlife Service under section 7 of the Endangered Species Act is not required for candidate species, like the monarch. We encourage agencies, however, to take advantage of any opportunity they may have to conserve the species.

Unfortunately, the North American monarch population has severely declined. Habitat loss, pesticides, disease, climate change, predators, extreme weather, and other anthropogenic factors all threaten monarchs. Since the late 1990s both the eastern and western overwintering populations have declined by over 70 percent, as documented by World Wildlife Fund – Mexico in collaboration with SEMARNAT (Mexico's Ministry of Environment and Natural Resources), CONANP (Mexico's National Commission of Natural Protected Areas) and the Monarch Butterfly Biosphere Reserve (Semmens et. al 2016). Monarchs make an excellent flagship species for pollinator conservation. Creating habitat for monarchs by planting diverse, native nectar plants and milkweed also creates habitat for other pollinators which we rely on for pollination services in agricultural and natural settings. Conserving pollinators and their habitat has positive cascading effects leading to conservation of other animals like songbirds and mammals. This pays dividends towards the health of our natural and managed habitats, paving a future for our own species.

Adult monarch butterflies are large and conspicuous, with bright orange wings surrounded by a black border and covered with black veins. The black border has a double row of white spots, present on the upper side of the wings. In many regions where monarchs are present, monarchs breed year-round. Individual monarchs in temperate climates, such as eastern and western North America, undergo long-distance migration, and live for an extended period. In the fall, in both eastern and western North America, monarchs begin migrating to their respective overwintering sites. This migration can take monarchs distances of over 3,000 km and last for over two months.

Migratory Birds and Other Trust Resources

Bald Eagle
The proposed project area may provide nesting habitat for the bald eagle (*Haliaeetus leucocephalus*), which was officially removed from the List of Endangered and Threatened Species as of August 8, 2007. However, the bald eagle remains protected under the MBTA and BGEPA.

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., baldcypress, 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.

During project construction, on-site personnel should be informed of the possible presence of nesting bald eagles (*Haliaeetus leucocephalus*) near the project boundary, and should identify, avoid, and immediately report any such nests to this office. If an active or inactive eagle nest is discovered within 2 miles of the project footprint, then follow the bald and golden eagle guidelines to determine whether disturbance will occur and/or an incidental take permit is needed.

Wading Bird Colonies

In accordance with the MBTA and the FWCA, please be advised that the project area includes habitats that are commonly inhabited by colonial nesting waterbirds. We recommend that a qualified biologist inspect the proposed work sites for the presence of nesting colonies (during the nesting season) prior to any work being initiated that would impact the colony. For colonies containing nesting wading birds (i.e., herons, egrets, night-herons, ibis, and roseate spoonbills), anhingas, and/or cormorants, all activity occurring within 1,000 feet of a rookery should be restricted to the non-nesting period, depending on the species present.

In addition, we recommend that on-site contract personnel including project-designated inspectors be trained to identify colonial nesting birds and their nests, and avoid affecting them during the breeding season (i.e., the time period outside the activity window). Should on-site contractors and inspectors observe potential nesting activity, coordination with the Service and the Louisiana Department of Wildlife and Fisheries should occur.

DESCRIPTION OF TENTATIVELY SELECTED PLAN AND EVALUATED ALTERNATIVES

The project was designated as a Mega Study in early August 2023, which facilitated Project Development Team (PDT) efforts in an accelerated timeline. The Tentatively Selected Plan (TSP), in the publicly released 2019 Draft Integrated Feasibility Report/Environmental Impacts Statement (DIFR/EIS), included a $2.3 billion dry dam and nonstructural measures to address residual risk. This preliminary plan was initially determined to be feasible, but later revealed technical and policy concerns that were raised during the review process. As a result, this plan was further evaluated, but ultimately rejected as a consideration. With the removal of the Dry Dam alternative, the next highest National Economic Development (NED) Plan in the 2019 DFIR/EIS final array was the nonstructural plan (nonstructural includes measures such as structure elevations, relocations, and flood-proofing). To further assess the nonstructural only plan, three alternatives were developed as well as revisions to existing conditions to account for projects that alter hydrology. Additionally, hydraulic and hydrology models were modified for inclusion of storm surge downstream boundary conditions. The first alternative identified was the nonstructural NED plan using a new USACE method of aggregation and two additional alternatives that increased the comprehensive benefits for socially vulnerable areas.

Previous alternatives (15 alternatives) were discussed in the October 2019 FWCA Report and are herein incorporated by reference.

DESCRIPTION OF IMPACTS

The completion of the nonstructural plan (structure elevations, relocations, and flood-proofing of already developed areas) would result in minimal or no impacts to fish and wildlife resources.

SERVICE POSITION AND RECOMMENDATIONS

The Service does not object to the nonstructural plan of the TSP provided that the following recommendations are fully addressed.

1. If ring levees are proposed as part of the "non-structural" component of the TSP, the levee alignments should be located to avoid and minimize impacts to both herbaceous wetlands and forested communities (wet and non-wet) as much as possible. The acreage of wetlands and forested habitat enclosed within ring levees also should be minimized to the maximum extent practicable.

2. Avoid adverse impacts to bald eagle nesting locations and wading bird colonies through careful design of project features and timing of construction. During project construction, a qualified biologist should inspect the proposed construction site for the presence of documented and undocumented wading bird nesting colonies and bald eagles.

    a. All construction activity during the wading bird nesting season (February through October 31 for wading bird nesting colonies, exact dates may vary) should be restricted within 1,000 feet of a wading bird colony. If restricting construction activity within 1,000 feet of a wading bird colony is not feasible, the CPRA should coordinate with the Service to identify and implement alternative best management practices to protect wading bird nesting colonies.
    b. During construction activities, if a bald eagle nest is within or adjacent to the proposed project area, the applicant should follow the bald and golden eagle guidelines found on-line here to determine whether disturbance will occur and/or an incidental take permit is needed.

3. If implementation of the proposed action has the potential to directly or indirectly affect Inflated heelsplitter mussel, Gulf sturgeon, West Indian Manatee, or the Northern long-eared bat, then consultation with this office should be initiated.

4. West Indian manatees occasionally enter Louisiana coastal waters and streams during the warmer months (i.e., June through September). During in-water work in areas that potentially support manatees all personnel associated with the project should be instructed about the potential presence of manatees, manatee speed zones, and the need to avoid collisions with and injury to manatees. All personnel should be advised that there are civil and criminal penalties for harming, harassing, or killing manatees, which are protected under the Marine Mammal Protection Act of 1972, the Endangered Species Act of 1973, and state law. Additionally, personnel should be instructed not to attempt to feed or otherwise interact with manatees, although passively taking pictures or video would be acceptable. For more detail on avoiding contact with manatees refer to the Endangered and Threatened Species section of this document, contact this office.

5. The Service recommends that the USACE contact the Service for additional ESA section 7 consultation if: 1) the scope or location of the proposed project is changed significantly, 2) new information reveals that the action may affect listed species or designated critical habitat, 3) the action is modified in a manner that causes effects to listed species or designated critical habitat, or 4) a new species is listed or critical habitat designated.

We appreciate the cooperation of your staff on this project and look forward to our continued coordination to further protect fish and wildlife resources. Should you have any questions regarding our comments, please contact Cathy Breaux (337/291-3122) of this office.

Sincerely,

Brigette D. Firmin

Brigette D. Firmin BRIGETTE FIRMIN Digitally signed by BRIGETTE FIRMIN Date: 2023.11.15 11:27:36 -06'00'
Field Supervisor
Louisiana Ecological Services Office

cc: FWS, Ecological Services, Jackson, MS

Literature Cited

Ernst, C. H., J. E. Lovich, and R. W. Barbour. 1994. Turtles of the United States and Canada. Smithsonian Institution Press, Washington, DC.

Louisiana Department of Wildlife and Fisheries. 2009. The Natural Communities of Louisiana. Louisiana Natural Heritage Program.

Appendix A

Manatee Conditions/Recommendations

During in-water work in areas that potentially support manatees all personnel associated with the project should be instructed about the potential presence of manatees, manatee speed zones, and the need to avoid collisions with and injury to manatees. All personnel should be advised that there are civil and criminal penalties for harming, harassing, or killing manatees which are protected under the Marine Mammal Protection Act of 1972 and the Endangered Species Act of 1973.

Additionally, personnel should be instructed not to attempt to feed or otherwise interact with the animal, although passively taking pictures or video would be acceptable. We recommend the inclusion of the following measures into construction plans and specifications to minimize potential impacts to manatees in areas where they are potentially present:

- All on-site personnel are responsible for observing water-related activities for the presence of manatee(s). We recommend the following to minimize potential impacts to manatees in areas of their potential presence:

- All work, equipment, and vessel operation should cease if a manatee is spotted within a 50-foot radius (buffer zone) of the active work area. Once the manatee has left the buffer zone on its own accord (manatees must not be herded or harassed into leaving), or after 30 minutes have passed without additional sightings of manatee(s) in the buffer zone, in-water work can resume under careful observation for manatee(s).

- If a manatee(s) is sighted in or near the project area, all vessels associated with the project should operate at "no wake/idle" speeds within the construction area and at all times while in waters where the draft of the vessel provides less than a four-foot clearance from the bottom. Vessels should follow routes of deep water whenever possible.

- If used, siltation or turbidity barriers should be properly secured, made of material in which manatees cannot become entangled, and be monitored to avoid manatee entrapment or impeding their movement.

- Temporary signs concerning manatees should be posted prior to and during all in-water project activities and removed upon completion. Each vessel involved in construction activities should display at the vessel control station or in a prominent location, visible to all employees operating the vessel, a temporary sign at least 8½ " X 11" reading language similar to the following: "CAUTION BOATERS: MANATEE AREA/ IDLE SPEED IS REQUIRED IN CONSRUCTION AREA AND WHERE THERE IS LESS THAN FOUR FOOT BOTTOM CLEARANCE WHEN MANATEE IS PRESENT". A second temporary sign measuring 8½ " X 11" should be posted at a location prominently visible to all personnel engaged in water-related activities and should read language similar to the following: "CAUTION: MANATEE AREA/ EQUIPMENT MUST BE SHUTDOWN IMMEDIATELY IF A MANATEE COMES WITHIN 50 FEET OF OPERATION".

- Collisions with, injury to, or sightings of manatees should be immediately reported to the Service's Louisiana Ecological Services Office (337/291-3100) and the Louisiana Department of Wildlife and Fisheries, Natural Heritage Program (225/765-2821). Please provide the nature of the call (i.e., report of an incident, manatee sighting, etc.); time of incident/sighting; and the approximate location, including the latitude and longitude coordinates, if possible.

Mississippi Valley Division,
Regional Planning and Environment Division South

Amite River and Tributaries East of the Mississippi River, Louisiana

Appendix C: Cost Engineering

December 2023

CONTENTS

LIST OF ATTACHMENTS

LIST OF TABLES

SECTION 1

AMITE RIVER & TRIBUTARIES COST – FINAL ARRAY OF ALTERNATIVES

1.1 NONSTRUCTURAL MEASURES – RAISING, DRY FLOODPROOFING, WET FLOODPROOFING

With the removal of the Dry Dam alternative from further consideration, the next highest NED alternative and likely the only economically justified one was the Nonstructural Plan. The following four plans were included in the final array of alternatives:

Plan 1: No Action Alternative – Under this alternative, no Federal action would be taken to reduce flooding risk to the properties within the study areas. Implementation of the No Action Alternative (NAA) would result in the Future Without Project condition. The NAA serves as a baseline against which the proposed alternatives can be evaluated. Evaluation of the NAA involves assessing the economic and environmental effects that would result over the period of analysis if the proposed action did not take place.

Plan 2: Nonstructural NED Plan – NED Plan identified the number of structures in the 0.1, 0.04, and 0.02 AEP floodplain then a plan was chosen by identifying the highest net benefits floodplain event within 57 aggregates (0.1- 46 aggregates, 0.04 – 5 aggregates, 0.02 – 6 aggregates) floodplain to 0.01 AEP BFE for a total of 3,117 structures. Aggregates were arranged based on several factors (See Appendix G: Economic and Social Consideration). Plan 2 would include the elevation of 2,748 residential structures and Dry/Wet floodproofing of 369 nonresidential structures.

Plan 3: Nonstructural NED Plan + OSE Increment 1 – NED Plan expansion to include Socially Vulnerable sub aggregations that have positive net benefits in addition to the eligible structures included in Plan 2. Increased eligibility of structures by 72. Plan 3 would include the elevation of 2,815 residential structures and Dry/Wet floodproofing of 374 nonresidential structures.

Plan 4: Nonstructural NED Plan + OSE Increment 2 – NED Plan expansion to include all the additional Socially Vulnerable sub aggregations with the next highest aggregation regardless of economic justification on a reach level with residential structures considered for elevation and nonresidential structures considered for floodproofing. These additional sub aggregations to the NED Plan increased eligibility of structures by 181. Plan 4 would include the elevation of 2,918 residential structures and Dry/Wet floodproofing of 380 nonresidential structures.

1.1.1 Cost Estimate Development

The cost estimates for the final array of alternatives were prepared based on readily available USACE data and quantities provided by the project delivery team (PDT) and were developed using MCACES MII cost estimating software. The cost estimates used the standard approaches for a feasibility estimate structure regarding labor, equipment, materials, crews, unit prices, quotes, and sub and prime contractor markups. This philosophy was taken wherever practical within the time constraints. It was supplemented with estimating information from other sources, where necessary, such as quotes, bid data, Architect-Engineer (A-E) estimates and previously approved similar studies such as South Central Coastal. The estimates assume a typical application of tiered subcontractors. All the construction work (e.g., floodproofing, house raising.) is common to the Gulf Coast region. The construction sites are accessible from land and access is easily provided from various local highways.

The goals of cost engineering for the Amite River & Tributaries Feasibility Study are to present a Total Project Cost for the Tentatively Selected Plan (TSP) at the current price level to be used for project justification/authorization and to project costs forward in time for budgeting purposes. In addition, the costing efforts are intended to provide or convey a “fair and reasonable” estimate that depicts the local market conditions.

Composite costs were calculated for individual residential structures by type: slab and pier foundation, one- and two-story configuration, and for mobile home. See Appendix G: Economics and Social Consideration, Table G:4-1 for Nonstructural Elevation Costs for Residential Structures (FY23, $/Sq. ft). The cost per square foot to raise an eligible residential structure to the target height was multiplied by the footprint square footage of each structure to compute the costs to elevate the structure. Costs for floodproofing Commercial and Warehouses were derived by using the New Orleans District 2012 Donaldsonville to the Gulf study and escalating to 2023 costs. See Appendix G, Table G:4-2 Nonstructural Floodproofing Costs for Non-residential Structures (FY23). The structural inventories for the Nonstructural Alternatives were fully developed as an output of the HEC-FDA economic analysis model. The description of this model, and the way the per-square foot unit costs are applied can be found in Appendix: G Economics Appendix and Main Report.

1.1.2 Estimate Structure

The estimate was structured to develop the unit costs in Mii representing the standard “achitype” nonstructural work being performed. The Mii unit cost for the average structure of each type were applied to the voluminous quantities of structures to be raised or floodproofed in an Excel summary spreadsheet that was transferred to TPCS. All work activities and corresponding levels of effort were based upon conversations with Davies Shoring, LLC, Orleans Shoring in 2015.

Residential Elevation Projects were grouped according to these categories:

- Mobile Home, Low Lift - This includes manufactured homes raised a minimum of 2'-6" and a maximum of 6'-0" above the lowest adjacent grade. For the purpose of this estimate the average footprint square footage for sectional trailers was assumed to be 1254 sq.ft.
- Mobile Home, High Lift - This includes manufactured homes raised a minimum of 6'-6" and a maximum of 13'-0" above the lowest adjacent grade. For the purpose of this estimate the average footprint square footage for sectional trailers was assumed to be 1254 sq.ft.
- Pier-supported Frame House, Low Lift - This includes wood frame houses built on a pier and beam foundation raised a minimum of 2'-6" and a maximum of 6'-0" above the lowest adjacent grade. For the purpose of this estimate the average footprint square footage for a single-story home was assumed to be 1866 sq.ft. and two-story home was assumed to be 2239 sq.ft.
- Pier-supported Frame House, High Lift - This includes wood frame houses built on a pier and beam foundation raised a minimum of 6'-6" and a maximum of 13-0" above the lowest adjacent grade. For the purpose of this estimate the average footprint square footage for a single-story home was assumed to be 1866 sq.ft. and two-story home was assumed to be 2239 sq.ft.
- Slab-supported Frame House, Low Lift - This includes wood frame houses built on a concrete slab raised a minimum of 2'-6" and a maximum of 6-0" above the lowest adjacent grade. For the purpose of this estimate the average footprint square footage for a single-story home was assumed to be 1866 sq.ft. and two-story home was assumed to be 2239 sq.ft.
- Slab-supported Frame House, High Lift - This includes wood frame houses built on a concrete slab raised a minimum of 6'-6" and a maximum of 13-0" above the lowest adjacent grade. For the purpose of this estimate the average footprint square footage for a single-story home was assumed to be 1866 sq.ft. and two-story home was assumed to be 2239 sq.ft.

The work process for Mobile Homes and Pier-supported frame houses was as follows:

1. Individual homeowner completes program application and USACE determines eligibility.
2. Government selects contractor and enters into design build agreement.
3. Contractor prepares and submits for approval Guide Plans and Specifications, and Estimate on individual structure
4. Government approves of guide plans, specification, and estimate and approves for a start work.
5. Contractor obtains all necessary permits and Mobilize to the site.
6. Residents temporarily relocate.
7. Disconnect utilities.
8. Place Jacks and Cribbing.
9. Insert Steels.
10. Elevate Structure.
11. Install Piers.
12. Set Structure on Piers.

13. Anchor Structure.
14. For High Lifts, pour grade beams between piers and slab-on-grade.
15. Reconnect Utilities.
16. Install elevated landings and stairs.
17. Demobilization and Closeout.

The work process for Slab-supported houses was:

1. Individual homeowner completes program application and USACE determines eligibility.
2. Government selects contractor and enters into design build agreement.
3. Contractor prepares and submits for approval Guide Plans and Specifications and Estimate on individual structure.
4. Government approves of guide plans, specification, and estimate and approves for a start work.
5. Contractor obtains all necessary permits and mobilizes to site.
6. Residents temporarily relocate.
7. Disconnect utilities.
8. Excavate at perimeter and tunnels under slab on 8' centers.
9. Place Jacks and Cribbing.
10. Push segmented piles to refusal.
11. Elevate Structure.
12. Install Piers.
13. Anchor Structure.
14. For lower lifts, demo existing driveway and install new driveway adjusted to garage floor elevation.
15. For High Lifts, pour grade beams between piers and slab-on-grade.
16. Reconnect Utilities.
17. For Low Lifts, install Perimeter Enclosure.
18. Install elevated landings and stairs.
19. Demobilization and Closeout.

Commercial Floodproofing Projects were group according to the following categories:

- Commercial Dry Floodproofing – This includes protecting the lower 3’ of the structure from floodwater inundation. The average square footage was estimated according to occupancy type and ranged from 2,885 SF for a Multi-purpose facility to 76,758 SF for professional office space.
- Warehouse Wet Floodproofing – This includes retrofitting the building so that water may enter the building without causing any major damage. The square footage ranged from 376 SF to 36,667 SF. Work process is assumed to be the same for warehouse and fabrication commercial buildings.

The work process for dry floodproofing was as follows:

1. Individual owner completes program application and USACE determines eligibility.
2. Government selects contractor and enters into design build agreement.

3. Contractor prepares and submits for approval Guide Plans and Specifications, and Estimate on individual structure
4. Government approves of guide plans, specification, and estimate and approves for a start work.
5. Contractor obtains all necessary permits and mobilizes to site.
6. Demolition
7. Construct Flood Barrier
8. Construct Brick Veneer
9. Install Self Closing Flood Barriers for entrances

The work process for wet floodproofing was as follows:

1. Individual owner completes program application and USACE determines eligibility.
2. Government selects contractor and enters into design build agreement.
3. Contractor prepares and submits for approval Guide Plans and Specifications, and Estimate on individual structure
4. Government approves of guide plans, specification and estimate and approves for a start work.
5. Contractor obtains all necessary permits and mobilizes to site.
6. Electrical Work
7. Wet floodproofing
8. Protective coatings
9. Install flood vents

1.1.3 Bid Competition

It is assumed that there will not be an economically saturated market and that there will be bidding competition.

1.1.4 Contract Acquisitions Strategy

The project will use the traditional method of implementation. The “traditional method” of implementation is generally described in publications of the USACE National Floodproofing Committee and Flood Risk Management Planning Center of Expertise. Under the traditional method, the USACE District utilizes a federal procurement to obtain design and construction contractors for the various floodproofing and elevation measures. The Government will procure contracts that will allow a contractor to perform floodproofing work on multiple structures through a series of one or more task orders and who will be responsible for all work associated with flood risk mitigation approval of the engineering plans for each structure to final inspection. Additional implementation eligibility criteria and process descriptions are provided in Appendix I: Implementation Plan

1.1.5 Labor Shortages

It is assumed there will be a normal labor market pulled from the regional gulf coast region.

1.1.6 Labor Rate

Local labor market wages are above the local Davis-Bacon Wage Determination, so actual rates have been used. This is based on local information and payroll data received from MVN District construction representatives and estimators with experiences in past years.

1.1.7 Materials

Cost quotes are used on major construction items when available. Material price quotes were also taken from previous job, historical data and the Mii Cost Book. It was assumed that materials will be purchased as part of the contract. The estimate does not anticipate government furnished materials. Prices include delivery of materials.

1.1.8 Quantities

A structure inventory of residential and non-residential structures for the study area was obtained through the National Structure Inventory (NSI) version 2022. Economics estimated the number of square feet per total structure, along with other characteristics, such as one or two-story, slab or pier foundations, etc. For more information on how structures were selected for each alternative see Appendix F: Economics and Social Consideration.

1.1.9 Equipment

Rates used are based on the latest USACE Engineer Pamphlet (EP)-1110-1-8, Region III. Adjustments are made for fuel, filters, oil, and grease (FOG) prices and Facility Capital Cost of Money (FCCM). Judicious use of owned verses rental rates was considered based on typical contractor usage and local equipment availability. Only a few select pieces of marine/marsh equipment are considered rental. Full FCCM/Cost of Money rate is latest available; MII program takes the EP recommended discount, no other adjustments have been made to the FCCM. Equipment was chosen based on historical knowledge of similar projects.

1.1.10 Fuels

Fuels (gasoline, on and off-road diesel) were based on local market averages for on-road and off-road for the Gulf Coast area. Historic data gathered in the Greater New Orleans area over the last 10 years shows fuel cost have risen and fallen at irregular rates; therefore, an average fuel cost was assumed.

1.1.11 Crews

Major crew and productivity rates were developed and studied by ARADIS engineers in conjunction with local professionals familiar with the type of work. All the work is typical to the Louisiana area. The crews and productivities were checked by local MVN senior cost estimators, discussions with contractors and comparisons with historical cost data. Crew work hours are assumed to be 8 hours 5 days per week, which is typical to the area and type of work.

1.1.12 Unit Prices

The unit prices found within the various project estimates will fluctuate within a range between similar construction units such as Residential Structures and Commercial Structures. Variances are a result of low lift, high lift, type of commercial structure, small and large business markups, subcontracted items, designs and estimates by others.

1.1.13 Relocation Costs

Not applicable.

1.1.14 Mobilization

Contractor mobilization and demobilization (mob/demob) are based on the assumption that most of the contractors will be coming from within the Gulf Coast/Southern region. Minimal equipment is required for the nonstructural work.

1.1.15 Field Office Overhead

The estimate used a field office overhead rate based on the average of relevant jobs. The reason this was done is because similar work is being done and the job office overhead should also be similar.

1.1.16 Home Office Overhead

Estimate percentages range based upon consideration of 8(a), small business, and unrestricted prime contractors. The rates are based upon estimating and negotiating experience, and consultation with local construction representatives. Different percent are used when considering the contract acquisition strategy regarding small business 8(a), competitive small business and large business, high to low respectively. This project will assume an acquisition strategy of small business and assume a Home Office overhead of 7 percent.

1.1.17 Taxes

Local taxes will be applied based on the parishes that contain the work. Reference the tax rate website for Louisiana: http://www.salestaxstates.com.

1.1.18 Bond

Bond is assumed 0.83 percent applied against the prime contractor, assuming large contracts. No differentiation was made between large and small businesses.

1.1.19 Real Estate Costs

Real Estate (RE) costs were developed and provided by the Realty Specialist and placed in WBS-02 Lands and Damages. The RE cost for each alternative includes land costs, acquisition costs and 25 percent for contingencies.

1.1.20 Environmental Costs

Not applicable.

1.1.21 Cultural Resources Costs

Cultural Resources (CR) costs were provided by the Archaeologist, Natural/Cultural Resources Analyst and placed in WBS-13 Cultural Resources Preservation. The CR costs for each alternative include Cultural Surveys and mitigation of resources if required.

1.1.22 Planning, Engineering and Design (PED)

Some itemized line-item costs are included in the direct costs for specific implementation/administrative steps (Gov't and contractor) of each of the projects (Non-Real Estate portion). Additional more PED costs have been included in PED Account 30 for more overall programmatic efforts such as Project Management, Planning & Environmental Compliance, Contracting, Planning During Construction and Project Operations. Account 30 PED assumed a range of 10-18 percent until implementation is further defined during TSP feasibility design phase.

1.1.23 Supervision and Administration (S&A)

Some itemized line-item costs are included in the direct costs for specific implementation/administrative steps for Government administration of each of the projects (Non-Real Estate portion). Additional more S&A costs have been included in S&A Account 31 for more overall programmatic Construction Management efforts. It is assumed Account 31 S&A is 10 percent until implementation is further defined during TSP feasibility design phase. It is anticipated the government will utilize a MATOC contract mechanism and have multiple contractors responsible for multiple structures.

1.1.24 Contingencies

Nonstructural Alternatives only differed in number of eligible structures. Contingencies for the final array of Nonstructural Alternatives were assumed to be similar in scope and regional area to South Central Coastal Nonstructural Project, therefore in lieu of performing the USACE Abbreviated Cost Risk Analysis (ARA) the same contingency approved for South Central Coastal Project of 32 percent was applied to all alternatives. South Central Coastal contingencies were developed using the USACE Cost and Schedule Risk Analysis (CSRA) process and the Crystal Ball Software that evaluates schedule and cost related risks. A separate CSRA will be performed on the recommended plan during the feasibility design phase.

1.1.25 Escalation

Escalation used is based upon the latest version of the USACE Engineering Manual (EM) 1110-2-1304 Civil Works Construction Cost Index System (CWCCIS).

1.1.26 Hazardous, Toxic, and Radioactive Waste (HTRW)

The cost estimate does not include cost for any Hazardous, Toxic, and Radioactive Waste (HTRW) mitigation. The estimate does include survey costs to detect any potential (HTRW). A Phase I Environmental Site Assessment will be conducted prior to structure being approved for floodproofing or house raising. Appendix I: Implementation Plan describes the eligibility criteria, process, and responsibility related to HTRW concerns.

1.1.27 Schedule

The project schedule was developed based on the construction of the individual features of work to include all residential and commercial buildings chosen by the PDT.

1.1.28 Cost Estimates

Tables C:1-1 through C:1-6 show the baseline Project First Cost for each Final Array alternatives using the minimum and maximum range in %PED. Cost estimates for the Final Array of alternatives were developed at 2023 prices.

Table C:1-1. Plan 2: Nonstructural NED Plan (18%PED, 10%S&A)

Feature	Cost	Contingency	Total
01 Lands & Damages	$84,481,000	$12,120,000	$105,601,000
18 Cultural Resources Preservation	$6,741,000	$2,157,000	$8,898,000
19 Buildings, Grounds & Utilities	$854,529,000	$273,449,000	$1,127,978,000
30 PED	$155,029,000	$49,609,000	$204,638,000
31 Construction Management	$86,127,000	$27,561,000	$113,688,000
TOTAL	$1,186,906,000	$373,896,000	**$1,560,803,000**

Table C:1-2. Plan 2: Nonstructural NED Plan (10%PED, 10%S&A)

Feature	Cost	Contingency	Total
01 Lands & Damages	$84,481,000	$21,120,000	$105,601,000
18 Cultural Resources Preservation	$6,741,000	$2,157,000	$8,898,000
19 Buildings, Grounds & Utilities	$854,529,000	$273,449,000	$1,127,978,000
30 PED	$86,127,000	$27,561,000	$113,688,000
31 Construction Management	$86,127,000	$27,561,000	$113,688,000
TOTAL	$1,118,005,000	$351,848,000	**$1,469,853,000**

Table C:1-3. Plan 3: Nonstructural NED Plan + OSE Increment 1(18%PED, 10%S&A)

Feature	Cost	Contingency	Total
01 Lands & Damages	$86,445,000	$21,611,000	$108,056,000
18 Cultural Resources Preservation	$6,886,000	$2,204,000	$9,090,000
19 Buildings, Grounds & Utilities	$878,418,000	$281,094,000	$1,159,512,000
30 PED	$159,335,000	$50,994,000	$210,348,000
31 Construction Management	$88,530,000	$28,330,000	$116,860,000
TOTAL	$1,219,634,000	$384,232,000	**$1,603,866,000**

Table C:1-4. Plan 3: Nonstructural NED Plan + OSE Increment 1(10%PED, 10%S&A)

Feature	Cost	Contingency	Total
01 Lands & Damages	$86,445,000	$21,611,000	$108,056,000
18 Cultural Resources Preservation	$6,886,000	$2,204,000	$9,090,000
19 Buildings, Grounds & Utilities	$878,418,000	$281,094,000	$1,159,512,000
30 PED	$88,530,000	$28,330,000	$116,860,000
31 Construction Management	$88,530,000	$28,330,000	$116,860,000
TOTAL	$1,148,810,000	$361,568,000	**$1,510,378,000**

Table C:1-5. Plan 4: Nonstructural NED Plan + OSE Increment 2(18%PED, 10%S&A)

Feature	Cost	Contingency	Total
01 Lands & Damages	$89,423,000	$22,356,000	$111,779,000
18 Cultural Resources Preservation	$7,104,000	$2,273,000	$9,377,000
19 Buildings, Grounds & Utilities	$908,017,000	$290,565,000	$1,198,582,000
30 PED	$164,722,000	$52,711,000	$217,433,000
31 Construction Management	$91,512,000	$29,284,000	$120,796,000
TOTAL	$1,260,778,000	$397,189,000	**$1,657,967,000**

Table C:1-6. Plan 4: Nonstructural NED Plan + OSE Increment 2(10%PED, 10%S&A)

Feature	Cost	Contingency	Total
01 Lands & Damages	$89,423,000	$22,356,000	$111,779,000
18 Cultural Resources Preservation	$7,104,000	$2,273,000	$9,377,000
19 Buildings, Grounds & Utilities	$908,017,000	$290,565,000	$1,198,582,000
30 PED	$91,512,000	$29,284,000	$120,796,000
31 Construction Management	$91,512,000	$29,284,000	$120,796,000
TOTAL	$1,187,568,000	$373,762,000	**$1,561,331,000**

The NED Plan selected is “Plan 2: Nonstructural NED Plan” which presently has a Benefit Cost Ratio (BCR) range of 1.03-0.97 and includes Dry/Wet floodproofing or elevation of 3,117 structures located in the 0.1 (46 aggregates), 0.02 (5 aggregates) or 0.04 (6 aggregates) floodplain to 0.01 AEP BFE.

Flood risk and residual risk to those structures caused by coastal storm flooding were estimated to be reduced to:

- 2,748 residential structures,
- 369 nonresidential structures.

The TSP selected is “Plan 4: Nonstructural NED Plan + OSE Increment 2” which presently has a BCR range of 0.995 to 0.94 and includes floodproofing or elevation of 3,298 structures (NED Plan + 181 structures for Socially Vulnerable areas).

The New Orleans District is presently pursuing a policy exception for the following USACE Policy: ER 1105-2-100 2-3(f)(1) stating: “The National Economic Development (NED)Plan. For all project purposes except ecosystem restoration, the alternative plan that reasonably maximizes net economic benefits consistent with protecting the Nation’s environment, the

NED plan, shall be selected. The ASA CW may grant an exception when there are overriding reasons for selecting another plan based upon comprehensive benefits or other Federal, State, local and international concerns." If the policy exception is not granted, the TSP will default to "Plan 2: Nonstructural NED Plan".

See Appendix G: Economics and Social Consideration, Tables G:5-1 thru 5-3 Annual Costs and Benefits Summary to see the BCR for all the alternatives.

1.1.29 Total Project Cost Summary

The Total Project Cost Summary (TPCS) addresses the inflation through project completion; accomplished by escalation to the mid-point of construction per CWCCIS as required by ER 1110-2-1302 and ETL 1110-2-573. The TPCS includes Federal and non-Federal costs for all construction features of the project, lands and damages, as well as PED and S&A, along with the appropriate contingencies and escalation associated with these activities. The TPCS is formatted according to the CWWBS. The TPCS was prepared using the MCACES/MII cost estimate, contingencies developed, the project design and construction schedule, and estimates of PED and S&A. The TPCS is provided as Attachment 1 for "TSP - Total Project Cost Summary (TPCS)" which includes Plan 4: Nonstructural NED Plan + OSE Increment 2 showing two Tables for Total Project cost, one using maximum 18%PED and the other using minimum 10%PED.

SECTION 2

AMITE RIVER & TRIBUTARIES COST – FOCUSED ARRAY OF ALTERNATIVES

2.1 GENERAL

2.1.1 Cost Estimate Development

Cost estimates for Structural Alternatives were developed at a Class 4 Level of effort utilizing Parametric costs, Historical costs, or the latest MCACES MII cost estimating software. The cost estimates used the standard approaches for a feasibility estimate structure regarding labor, equipment, materials, crews, unit prices, quotes, and sub and prime contractor markups. This philosophy was taken wherever practical within the time constraints. It was supplemented with estimating information from other sources, where necessary, such as quotes, bid data, and Architect-Engineer (A-E) estimates. The intent was to provide or convey a “fair and reasonable” estimate that depicts the local market conditions. The estimates assume a typical application of tiered subcontractors. All of the construction work (e.g., dam structure, dredging, excavation, dewatering, pilings, rock, etc.) is common to the Gulf Coast region. The construction sites are accessible from land and access is easily provided from various local highways.

The cost estimates for the Non-Structural Alternatives were developed by the US Army Corps of Engineers, Mississippi Valley Division, New Orleans District (MVN) Economist, and are discussed in the Appendix: F Economics and Main Report.

2.1.2 Estimate Structure

The estimates are structured to reflect the projects performed. The estimates have been subdivided by alternative and US Army Corps of Engineers (USACE) feature codes.

2.1.3 Bid Competition

It is assumed that there will not be an economically saturated market and that there will be bidding competition.

2.1.4 Contract Acquisition Strategy

There is no declared contract acquisition plan/types at this time. It is assumed that the contract acquisition strategy will be similar to past projects with large, unrestricted, design/bid/build contracts.

2.1.5 Labor Shortages

It is assumed there will be a normal labor market pulled from the regional gulf coast region.

2.1.6 Labor Rate

Local labor market wages are above the local Davis-Bacon Wage Determination, so actual rates have been used. Local payroll information was not available; therefore, regional gulf coast information was used from MVN construction representatives and estimators with experiences in past years.

2.1.7 Materials

Cost quotes are used on major construction items when available. Recent cost quotes may include concrete, steel sheet piling, rock, gravel, and sand. The assumption is that materials will be purchased as part of the construction contract. The estimate does not anticipate government furnished materials, except for borrow materials. Prices include delivery of materials.

All borrow material is assumed government furnished. Specific sources for borrow material have not yet been established. The non-Federal local sponsor has assisted with researching possible sources and stated there is very likely acceptable borrow for random fill within a 5 mile radius of the project and within a 20 mile radius of the project for clay fill. An assumed average one-way haul distance of 5 miles was used for random fill and an average one way haul distance of 20 miles for clay fill was used, until a borrow source has been confirmed. Haul speeds are estimated using a 40 mph speed average, given the rural access roads and highways.

The borrow quantity calculations followed the MVN Geotechnical guidance:

> Hauled Levee: 10 BCY (bank cubic yards) of borrow material = 12 LCY (loose cubic yards) hauled = 8 ECY (embankment cubic yards) compacted.

Soil compaction factors can vary considerably with soil material gradation and moisture content. As borrow data was not available at this time materials obtained for fill were assumed to mimic Bonnet Carre Spillway borrow materials.

2.1.8 Quantities

Quantities for dam alternatives were provided by civil and structural designers for the various alternatives.

2.1.9 Equipment

Rates used are based from the latest USACE Engineer Pamphlet (EP)-1110-1-8, Region III. Adjustments are made for fuel, filters, oil, and grease (FOG) prices and Facility Capital Cost of Money (FCCM). Judicious use of owned verses rental rates was considered based on typical contractor usage and local equipment availability. Only a few select pieces of marine/marsh equipment are considered rental. Full FCCM/Cost of Money rate is latest available; MII program takes the EP recommended discount, no other adjustments have been made to the FCCM. Equipment was chosen based on historical knowledge of similar projects.

2.1.10 Severe and Rental Rates

Severe equipment rates were used, where applicable, for various pieces of equipment in the hydraulic dredging crews where they may come in contact with any harsh environment.

Rental rates were used, where applicable, for various pieces of marine and marsh equipment, where rental is typical, such as marsh backhoes.

2.1.11 Fuels

Fuels (gasoline, on and off-road diesel) were based on local market averages for on-road and off-road for the Gulf Coast area. Historic data gathered in the Greater New Orleans area over the last 10 years shows fuel cost have risen and fallen at irregular rates; therefore, an average fuel cost was assumed.

2.1.12 Crews

Major crew and productivity rates were developed and studied by senior USACE estimators familiar with the type of work. All of the work is typical to the Gulf Coast area and MVN Cost Engineers. The crews and productivities were checked by local MVN estimators, discussions with contractors and comparisons with historical cost data. Major crews include haul, earthwork, piling, concrete, and hydraulic dredging.

Most crew work hours are assumed to be 10 hours, 6 days/week, which is typical to the area. Marine based bucket excavation/dredging operators are assumed to work two 12 hours shifts, 7 days/week.

A 10 percent markup on labor for weather delay is selectively applied to the labor in major earthwork placing detail items and associated items that would be affected by weather making it unsafe or difficult to place (trying to run dump trucks on a wet levee) or be detrimental/non-compliant to the work being done (trying to place/compact material in the rain). The 10 percent markup is to cover the common practice of paying for labor arriving to the job site and then being sent home due to minor weather, which is part of known average weather impacts as reflected within the standard contract specifications. The markup was not applied to small quantities where this can be scheduled around.

2.1.13 Unit Prices

The unit prices found within the various project estimates will fluctuate within a range between similar construction units such as floodwall concrete, earthwork, and piling. Variances are a result of differing haul distances (trucked or barged), small or large business markups, subcontracted items, designs, and estimates by others.

2.1.14 Relocation Costs

Relocation costs are defined as the relocation of public roads, bridges, railroads, and utilities required for project purposes. In cases where potential significant impacts were known, costs were included within the cost estimate.

2.1.15 Mobilization

Contractor mobilization and demobilization (mob/demob) are based on the assumption that most of the contractors will be coming from within the Gulf Coast/Southern region. Mob/demob costs are based on historical studies of detailed Government estimate mob/demob, which are in the range of approximately 3 to 5 percent of the construction costs. With undefined acquisition strategies and assumed individual project limits, the estimate utilizes a slightly more comprehensive, approximate 4 percent value (min) applied at each contract rather than risking minimizing mob/demob costs by detailing costs based on an assumed number of contracts. This value also matches well with values previously prescribed by USACE Walla Walla District, which has studied historical rates.

2.1.16 Field Office Overhead

The estimate used a field office overhead rate of 12 percent for the prime contractors at budget level development. Based on historical studies and experience, USACE Walla Walla District has recommended typical rates ranging from 9 percent to 11 percent for large civil works projects; however, the 9-11 percent rate does not consider possible incentives such as camps, allowances, travel trailers, meals, etc., which have been used previously to facilitate large or remote projects. With undefined acquisition strategies and assumed individual project limits, the estimate utilizes a more comprehensive percentage based approach applied at each contract rather than risking minimizing overhead costs by detailing costs based on an assumed number of contracts. The applied rates were previously discussed among numerous USACE Cost Engineers including Walla Walla, Vicksburg, Norfolk, Huntington, St. Paul, and New Orleans Districts.

2.1.17 Overhead Assumptions

Overhead assumptions may include superintendent, office manager, pickups, periodic travel, costs, communications, temporary offices (contractor and government), office furniture, office supplies, computers and software, as-built drawings and minor designs, tool trailers, staging setup, camp/facility/kitchen maintenance and utilities, utility service, toilets, safety equipment, security and fencing, small hand and power tools, project signs, traffic control, surveys, temp fuel tank station, generators, compressors, lighting, and minor miscellaneous.

2.1.18 Home Office Overhead

Estimate percentages range based upon consideration of 8(a), small business, and unrestricted prime contractors. The rates are based upon estimating and negotiating experience, and consultation with local construction representatives. Different percent are used when considering the contract acquisition strategy regarding small business 8(a), competitive small business and large business, high to low respectively. The applied rates were previously discussed among numerous USACE Cost Engineers including Walla Walla, Vicksburg, Norfolk, Huntington, St. Paul, and New Orleans Districts.

2.1.19 Taxes

Local taxes will be applied based on the parishes that contain the work. Reference the tax rate website for Louisiana: http://www.salestaxstates.com.

2.1.20 Bond

Bond is assumed 1 percent applied against the prime contractor, assuming large contracts. No differentiation was made between large and small businesses.

2.1.21 Real Estate Costs

Real Estate (RE) costs were developed and provided by the Realty Specialist and placed in WBS-02 Lands and Damages. The RE cost for each alternative includes land costs, acquisition costs (including acquisition of agricultural land for borrow) and 25% for contingencies.

2.1.22 Environmental Costs

Environmental costs were provided by the Environmentalist and placed in Work Breakdown Structure WBS-06 Fish and Wildlife Facilities. The Environmental costs for each alternative include only mitigation of the flood protection alignment footprint.

2.1.23 Cultural Resources Costs

Cultural Resources (CR) costs were provided by the Archaeologist, Natural/Cultural Resources Analyst and placed in WBS-13 Cultural Resources Preservation. The CR costs for each alternative include Cultural Surveys and mitigation of resources if required. For borrow sites, known or identified cultural resource sites will be avoided.

2.1.24 Planning, Engineering, and Design (PED)

The PED cost includes such costs as project management, engineering, planning, designs, investigations, studies, reviews, value engineering and Engineering During Construction (EDC). Historically, a rate of approximately 12 percent for Engineering and Design (E&D) plus small percentages for other support features is applied against the estimated construction costs. Other USACE civil works districts such as St. Paul, Memphis, and St. Louis have reported values ranging from 10-15 percent for E&D. Additional support features might include project management, engineering, planning, designs, investigations, studies, reviews, and value engineering. An E&D rate of 12 percent was applied.

2.1.25 Supervision and Administration (S&A)

Historically, a range from 5 percent to 15 percent, depending on project size and type, was applied against the estimated construction costs. Other USACE civil works districts such as St. Paul, Memphis, and St. Louis report values ranging from 7.5-10 percent. Consideration includes that a portion of the S&A effort could be performed by contractors. S&A costs are percentage based. An S&A rate of 11 percent was applied.

2.1.26 Contingencies

Contingencies for the focused array of Structural Alternatives were developed using the USACE Abbreviated Cost Risk Analysis (ARA) program. An ARA is a qualitative approach used by PDT to address key risk concerns for major features of work and their impact to cost and schedule drivers such as Project Scope Growth, Acquisition Strategy, Construction Elements, Quantities, Specialty Fabrication or Equipment, Cost Estimate Assumptions, and External Project Risks. A separate ARA was prepared for each alternative to differentiate between the alternatives. Each alternative had very similar features of work and similar risk concerns, but the Sandy Creek Dry Dam and the three Tributary Dams had higher risk contingencies due of lack of geotechnical and Hydrological data and historical information in the area of these smaller dams and design scaled down some quantities of the larger Darlington Dam to minimize design effort at this phase.

2.1.27 Escalation

Escalation used is based upon the latest version of the USACE Engineering Manual (EM) 1110-2-1304 Civil Works Construction Cost Index System (CWCCIS).

2.1.28 Hazardous, Toxic, and Radioactive Waste (HTRW)

The estimate does not include costs for any potential Hazardous, Toxic, and Radioactive Waste (HTRW). A Phase I Environmental Site Assessment will be conducted prior to the Final IFR and EIS. The final report will include any estimated costs to address potential HTRW.

2.1.29 Schedule

The project schedule for each alternative was developed based on the construction line items for each feature of work.

For the Darlington Dam – Reduced Wet and Dry Dam Alternatives, it was assumed Engineering and Design (E&D), Cultural Resources Surveys and Cultural Mitigation, Environmental T&E Species and Habitat Mitigation, and Real Estate acquisition would start in 2021 and construction would begin in 2022. The construction duration for each alternative would be 4 years, with completion in 2026.

For Sandy Creek Dry Dam and the three Tributary Dry Dam Alternatives it was assumed E&D, Cultural Resources Surveys and Cultural Mitigation, Environmental T&E Species Investigation and Habitat Mitigation, and Real Estate acquisition would start in 2021 and construction would begin in 2024. The construction duration for each alternative would be for 2 years, with completion by 2026.

2.1.30 Cost Estimates

Tables C:2-1 through C:2-4 show the baseline project First Cost for each focused array alternative. Cost estimates for the focused array of alternatives were developed at 2019 price levels.

Table C:2-1. Darlington Dam – Reduced Wet

Feature	Cost	Contingency	Total
01 Lands & Damages	$133,490,000	$30,785,000	$164,275,000
02 Relocations	$3,034,000	$1,466,000	$4,500,000
04 Dams	$448,369,000	$178,595,000	$626,964,000
06 Fish & Wildlife Facilities	$569,050,000	$112,762,000	$681,812,000
18 Cultural Resources Preservation	$83,445,000	$28,624,000	$112,069,000
30 PED	$92,538,000	$36,912,000	$129,450,000
31 Construction Management	$49,654,000	$19,807,000	$69,461,000
TOTAL	$1,379,580,000	$408,951,000	**$1,788,531,000**

Table C:2-2. Darlington Dam - Dry

Feature	Cost	Contingency	Total
01 Lands & Damages	$133,299,000	$30,722,000	$164,021,000
02 Relocations	$3,034,000	$1,466,000	$4,500,000
04 Dams	$441,389,000	$175,260,000	$616,649,000
06 Fish & Wildlife Facilities	$159,894,000	$31,684,000	$191,578,000
18 Cultural Resources Preservation	$78,506,000	$27,607,000	$106,113,000
30 PED	$91,107,000	$36,229,000	$127,336,000
31 Construction Management	$48,887,000	$19,439,000	$68,326,000
TOTAL	$956,116,000	$322,407,000	**$1,278,523,000**

Table C:2-3. Sandy Creek Dry Dam

Feature	Cost	Contingency	Total
01 Lands & Damages	$12,568,000	$3,395,000	$15,963,000
02 Relocations	$416,000	$921,000	$1,337,000
04 Dams	$80,773,000	$39,709,000	$120,482,000
06 Fish & Wildlife Facilities	$29,681,000	$5,881,000	$35,562,000
18 Cultural Resources Preservation	$41,947,000	$17,313,000	$59,260,000
30 PED	$16,644,000	$8,329,000	$24,973,000
31 Construction Management	$8,931,000	$4,469,000	$13,400,000
TOTAL	$190,960,000	$80,017,000	**$270,977,000**

Table C:2-4. Three Tributary Dry Dams

Feature	Cost	Contingency	Total
01 Lands & Damages	$15,366,000	$3,662,000	$19,028,000
02 Relocations	$7,720,000	$4,257,000	$11,977,000
04 Dams	$99,105,000	$47,604,000	$146,709,000
06 Fish & Wildlife Facilities	$33,696,000	$6,677,000	$40,373,000
18 Cultural Resources Preservation	$57,464,000	$24,443,000	$81,907,000
30 PED	$21,899,000	$10,632,000	$32,531,000
31 Construction Management	$11,751,000	$5,704,000	$17,455,000
TOTAL	$247,001,000	$102,979,000	**$349,980,000**

Additionally, there were two nonstructural alternatives that were included in the Focused Array of Alternatives which were assessments of all residential and non-residential structures located within the 0.04 and 0.02 AEP flood plains of the study area. The cost estimates for the 0.04 and 0.02 AEP nonstructural features were developed based on the cost of reducing risk of damage to the structures in the year 2026 respective flood plains. Details of these costs and their development are presented in Appendix F.

- Nonstructural 0.04 AEP Alternative - First Cost - $1,335,282,000
- Nonstructural 0.02 AEP Alternative - First Cost - $2,160,836,000

Based on the economic analysis alone of the focused array the National Economic Development (NED) plan was preliminarily determined to be the Darlington Dry Dam, which was also the PDT's Tentatively Selected Plan (TSP). To further evaluate possible inclusion of nonstructural features into the TSP, Economics performed additional preliminary analysis of the flood risk that remains in the floodplain after the proposed alternative is implemented. This is known as the residual flood risk and nonstructural measures can be used to reduce the residual risk associated with the TSP. The preliminary analysis found a total of 3,252 residential structures and an additional 314 non-residential structures in the 0.04 AEP floodplain that were considered eligible for acquisition, elevation and flood proofing conditional to certain criteria as described in Appendix F. The baseline project cost for the preliminary TSP/NED plan which includes the Darlington Dry Dam combined with the nonstructural measures is shown in Table C:2-5.

Table C:2-5. Darlington Dry Dam With 0.04 AEP Elevations & Floodproofing

Feature	Cost	Contingency	Total
01 Lands & Damages	$133,299,000	$30,722,000	$164,021,000
02 Relocations	$3,034,000	$1,466,000	$4,500,000
04 Dams	$441,389,000	$175,260,000	$616,649,000
06 Fish & Wildlife Facilities	$159,894,000	$31,684,000	$191,578,000
18 Cultural Resources Preservation	$78,506,000	$27,607,000	$106,113,000
30 PED	$91,107,000	$36,229,000	$127,336,000
31 Construction Management	$48,887,000	$19,439,000	$68,326,000
Nonstructural 0.04 AEP - First Cost	$761,485,000	$262,713,000	$1,024,198,000
TOTAL	$1,717,601,000	$585,120,000	**$2,302,721,000**

Further details of how the Nonstructural 0.04 AEP - First Cost was developed can be found in Appendix F.

After further TSP Public, Policy and Technical Reviews and additional detailed re-evaluation and discoveries it led to mounting concerns the preliminary selected Dry Dam alternative did not meet USACE tolerable risk guidelines due to economic risk/cost effectiveness, potential societal life risk, and environmental acceptability. For these reasons the Dry Dam alternative (including Sandy Creek Dry Dam) have been removed from further consideration consistent with USACE policy of acceptability and implement ability in accordance with ER 1105-2-100. See Main Report Section 4.6 2019 TSP PUBLIC, POLICY AND TECHNICAL REVIEWS AND ADDITIONAL DETAILED EVALUATION for details of 2019 evaluation of the Dry Dam alternative which led to it being screened out.

Focusing on the one remaining alternative, the Nonstructural alternative would be further evaluated under PB 2019-03 guidance utilizing a sub aggregation method for the study area in determining the Final Array of Nonstructural alternatives.

Attachment 1: TSP – Total Project Cost Summary (TPCS)

PROJECT: Amite River & Trib., Plan 4 - NED + OSE Increment 2, 18%PED,10%SA
PROJECT NO: P2 xxxxxx
LOCATION: Various Parishes

DISTRICT: MVN District
POC: CHIEF, COST ENGINEERING, xxx

PREPARED: 12/7/2023

This Estimate reflects the scope and schedule in report; Supplemental Second Draft Report - December 2023

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)						TOTAL PROJECT COST (FULLY FUNDED)			
						Program Year (Budget EC): 2024 Effective Price Level Date: 1 OCT 23									
WBS NUMBER A	Civil Works Feature & Sub-Feature Description B	COST ($K) C	CNTG ($K) D	CNTG (%) E	TOTAL ($K) F	ESC (%) G	COST ($K) H	CNTG ($K) I	TOTAL ($K) J	Spent Thru: 1-Oct-23 ($K)	TOTAL FIRST COST ($K) K	INFLATED (%) L	COST ($K) M	CNTG ($K) N	FULL ($K) O
18	CULTURAL RESOURCE PRESERVATION	$7,104	$2,273	32.0%	$9,377	0.0%	$7,104	$2,273	$9,377	$0	$9,377	22.2%	$8,678	$2,777	$11,456
19	BUILDINGS, GROUNDS & UTILITIES	$908,017	$290,565	32.0%	$1,198,582	0.0%	$908,017	$290,565	$1,198,582	$0	$1,198,582	22.2%	$1,109,265	$354,965	$1,464,230
	#N/A	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	#N/A	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	#N/A	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	#N/A	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	#N/A	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	#N/A	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	CONSTRUCTION ESTIMATE TOTALS:	$915,121	$292,839		$1,207,960	0.0%	$915,121	$292,839	$1,207,960	$0	$1,207,960	22.2%	$1,117,944	$357,742	$1,475,686
01	LANDS AND DAMAGES	$89,423	$22,356	25.0%	$111,779	0.0%	$89,423	$22,356	$111,779	$0	$111,779	18.9%	$106,362	$26,590	$132,952
30	PLANNING, ENGINEERING & DESIGN	$164,722	$52,711	32.0%	$217,433	0.0%	$164,722	$52,711	$217,433	$0	$217,433	27.1%	$209,366	$66,997	$276,364
31	CONSTRUCTION MANAGEMENT	$91,512	$29,284	32.0%	$120,796	0.0%	$91,512	$29,284	$120,796	$0	$120,796	27.1%	$116,315	$37,221	$153,535
	PROJECT COST TOTALS:	$1,260,778	$397,189	31.5%	$1,657,967		$1,260,778	$397,189	$1,657,967	$0	$1,657,967	23.0%	$1,549,986	$488,550	$2,038,537

______________ CHIEF, COST ENGINEERING, xxx

ESTIMATED TOTAL PROJECT COST: $2,038,537

______________ PROJECT MANAGER, xxx

______________ CHIEF, REAL ESTATE, xxx

______________ CHIEF, PLANNING, xxx

______________ CHIEF, ENGINEERING, xxx

______________ CHIEF, OPERATIONS, xxx

______________ CHIEF, CONSTRUCTION, xxx

______________ CHIEF, CONTRACTING,xxx

______________ CHIEF, PM-PB, xxxx

______________ CHIEF, DPM, xxx

TSP – Plan 4: Nonstructural NED Plan + OSE Increment 2(18%PED and 10%S&A).

PROJECT: Amite River & Trib. Plan4 - NED + OSE Increment 2, 10%PED, 10%SA
PROJECT NO: P2 xxxxxx
LOCATION: Various Parishes

DISTRICT: MVN District
POC: CHIEF, COST ENGINEERING, xxx

PREPARED: 12/7/2023

This Estimate reflects the scope and schedule in report; Supplemental Second Draft Report - December 2023

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)						TOTAL PROJECT COST (FULLY FUNDED)			
						Program Year (Budget EC): 2024 Effective Price Level Date: 1 OCT 23									
WBS NUMBER A	Civil Works Feature & Sub-Feature Description B	COST ($K) C	CNTG ($K) D	CNTG (%) E	TOTAL ($K) F	ESC (%) G	COST ($K) H	CNTG ($K) I	TOTAL ($K) J	Spent Thru: 1-Oct-23 ($K)	TOTAL FIRST COST ($K) K	INFLATED (%) L	COST ($K) M	CNTG ($K) N	FULL ($K) O
18	CULTURAL RESOURCE PRESERVATION	$7,104	$2,273	32.0%	$9,377	0.0%	$7,104	$2,273	$9,377	$0	$9,377	22.2%	$8,678	$2,777	$11,456
19	BUILDINGS, GROUNDS & UTILITIES	$908,017	$290,565	32.0%	$1,198,582	0.0%	$908,017	$290,565	$1,198,582	$0	$1,198,582	22.2%	$1,109,265	$354,965	$1,464,230
	#N/A	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	#N/A	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	#N/A	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	#N/A	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	#N/A	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	#N/A	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	CONSTRUCTION ESTIMATE TOTALS:	$915,121	$292,839		$1,207,960	0.0%	$915,121	$292,839	$1,207,960	$0	$1,207,960	22.2%	$1,117,944	$357,742	$1,475,686
01	LANDS AND DAMAGES	$89,423	$22,356	25.0%	$111,779	0.0%	$89,423	$22,356	$111,779	$0	$111,779	18.9%	$106,362	$26,590	$132,952
30	PLANNING, ENGINEERING & DESIGN	$91,512	$29,284	32.0%	$120,796	0.0%	$91,512	$29,284	$120,796	$0	$120,796	27.1%	$116,315	$37,221	$153,535
31	CONSTRUCTION MANAGEMENT	$91,512	$29,284	32.0%	$120,796	0.0%	$91,512	$29,284	$120,796	$0	$120,796	27.1%	$116,315	$37,221	$153,535
	PROJECT COST TOTALS:	$1,187,568	$373,762	31.5%	$1,561,330		$1,187,568	$373,762	$1,561,330	$0	$1,561,330	22.7%	$1,456,935	$458,774	$1,915,708

_____________ CHIEF, COST ENGINEERING, xxx

_____________ PROJECT MANAGER, xxx

_____________ CHIEF, REAL ESTATE, xxx

_____________ CHIEF, PLANNING, xxx

_____________ CHIEF, ENGINEERING, xxx

_____________ CHIEF, OPERATIONS, xxx

_____________ CHIEF, CONSTRUCTION, xxx

_____________ CHIEF, CONTRACTING,xxx

_____________ CHIEF, PM-PB, xxxx

_____________ CHIEF, DPM, xxx

ESTIMATED TOTAL PROJECT COST: $1,915,708

TSP – Plan 4: Nonstructural NED Plan + OSE Increment 2(10%PED and 10%S&A).

Attachment 2: TSP - MII Cost Estimate Output

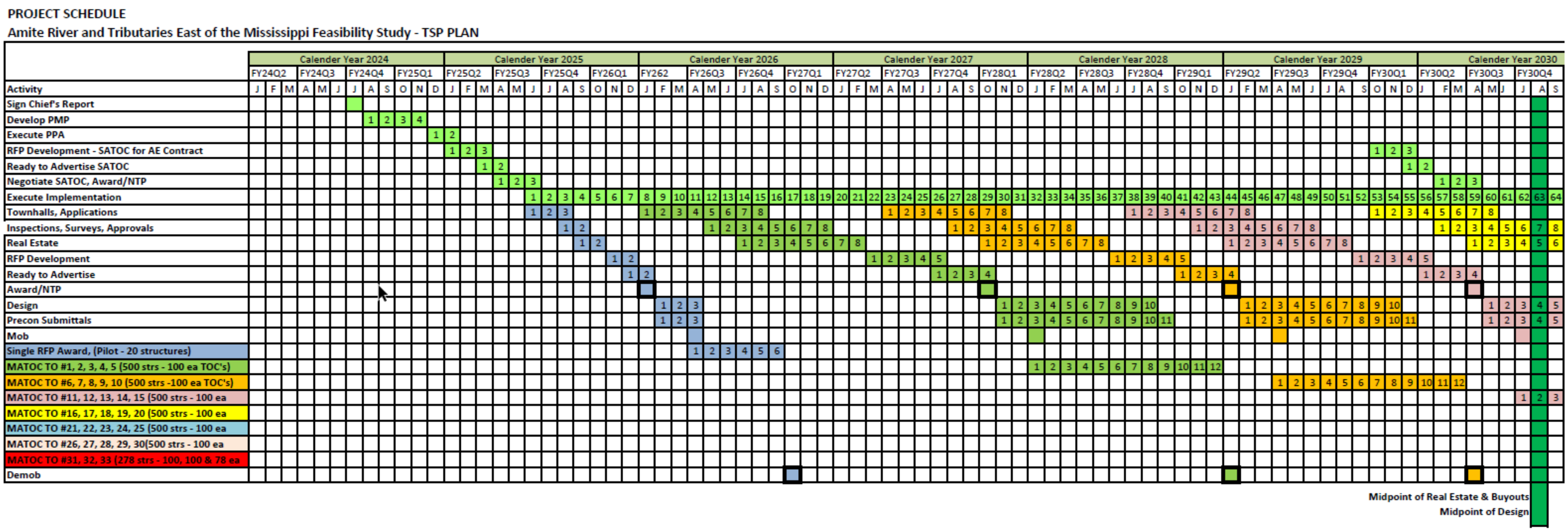
Amite and Tributaries Feasibility Study

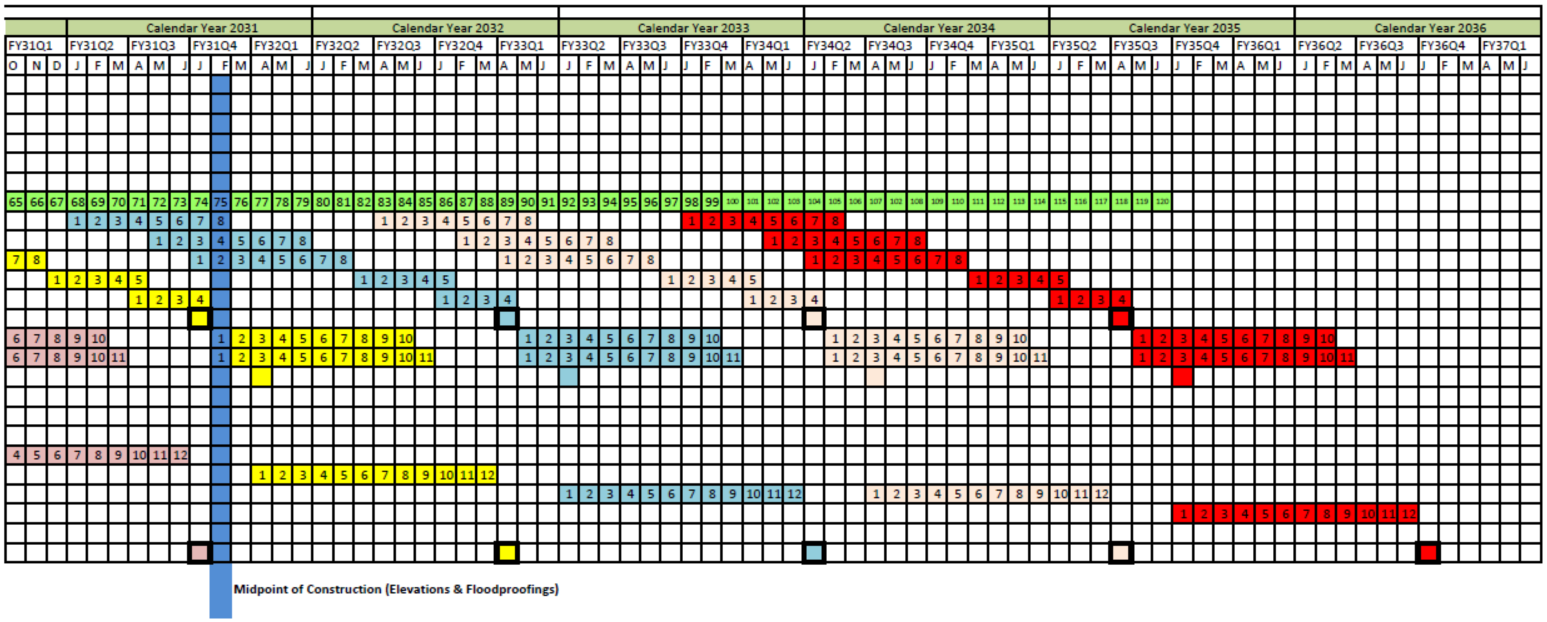
Plan 4 - NED + OSE Increment 2

Floodproofing Measures

Category	Number of Structures	Extended Direct Costs	Temporary Housing	Implementation Admin	Total
Mobile Homes - Raised	142	$22,682,846	$0	$3,270,828	$25,953,673.63
1 STY Pier - Raised	28	$4,989,831	$0	$644,952	$5,634,783.03
2 STY Pier - Raised	39	$6,181,990	$0	$898,326	$7,080,315.91
1 STY Slab - Raised	1662	$502,059,389	$0	$38,282,508	$540,341,896.67
2 STY Slab - Raised	1047	$231,915,891	$0	$24,116,598	$256,032,488.94
Commercial - Dry FP	217	$38,475,446	$0	$4,998,378	$43,473,824.40
Warehouses - Wet FP	163	$25,745,074	$0	$3,754,542	$29,499,615.91
Warehouses - Fabrication - Wet FP	0	$0	$0	$0	$0.00
		$0		$0	$0.00
Subtotal	3,298	$832,050,466	$0.00	$75,966,132	**$908,016,598.48**

Attachment 3: TSP - Project Schedule




Calendar Year 2031
Calendar Year 2032
Calendar Year 2033
Calendar Year 2034
Calendar Year 2035
Calendar Year 2036
FY31Q1 FY31Q2 FY31Q3 FY31Q4 FY32Q1 FY32Q2 FY32Q3 FY32Q4 FY33Q1 FY33Q2 FY33Q3 FY33Q4 FY34Q1 FY34Q2 FY34Q3 FY34Q4 FY35Q1 FY35Q2 FY35Q3 FY35Q4 FY36Q1 FY36Q2 FY36Q3 FY36Q4 FY37Q1
Midpoint of Construction (Elevations & Floodproofings)

Mississippi Valley Division,
Regional Planning and Environment Division South

Amite River and Tributaries East of the Mississippi River, Louisiana Feasibility Study (ART)

Appendix D: Environmental

December 2023

ENVIRONMENTAL APPENDIX

TABLE OF CONTENTS

Mississippi Valley Division,
Regional Planning and Environment Division South

Amite River and Tributaries East of the Mississippi River, Louisiana Feasibility Study (ART)

Appendix D-2: Supporting information

December 2023

CONTENTS

LIST OF TABLES

LIST OF FIGURES

Section 1

Inventory and Forecast Conditions

1.1 ENVIRONMENTAL SETTINGS

1.1.1 Land Use

Table D:1-1 and Figure D:1-1 show the land use classification in acres in 2015 study area. This data indicates that majority of the land in the study area consists of forested wetlands (i.e. Woody Wetlands), Shrub/Scrub, and Evergreen Forest. The lower half of the Amite River Basin (ARB) is also more developed compared to the lands in the upper ARB.

Table D:1-1. Land Use Classification in the Study Area

Amite Land Use		
Type	Acres	Percent
Open Water	0	0%
Developed, Open Space	414,851	6%
Developed, Low Intensity	343,755	5%
Developed, Medium Intensity	143,804	2%
Developed, High Intensity	42,675	1%
Hay/Pasture	624,560	9%
Cultivated Crops	362,253	5%
Barren Land	39,880	1%
Deciduous Forest	171,630	2%
Evergreen Forest	1,116,398	16%
Mixed Forest	239,171	3%
Shrub/Scrub	1,165,556	17%
Herbaceuous	137,011	2%
Woody Wetlands	2,123,732	30%
Emergent Herbaceuous Wetlands	104,067	1%
Total	7,029,343	100%
Developed	945,085	14%
Agricultural	986,813	14%
Undeveloped	5,097,445	72%
Total	7,029,343	100%
Source: USGS National Land Cover Database 2015		

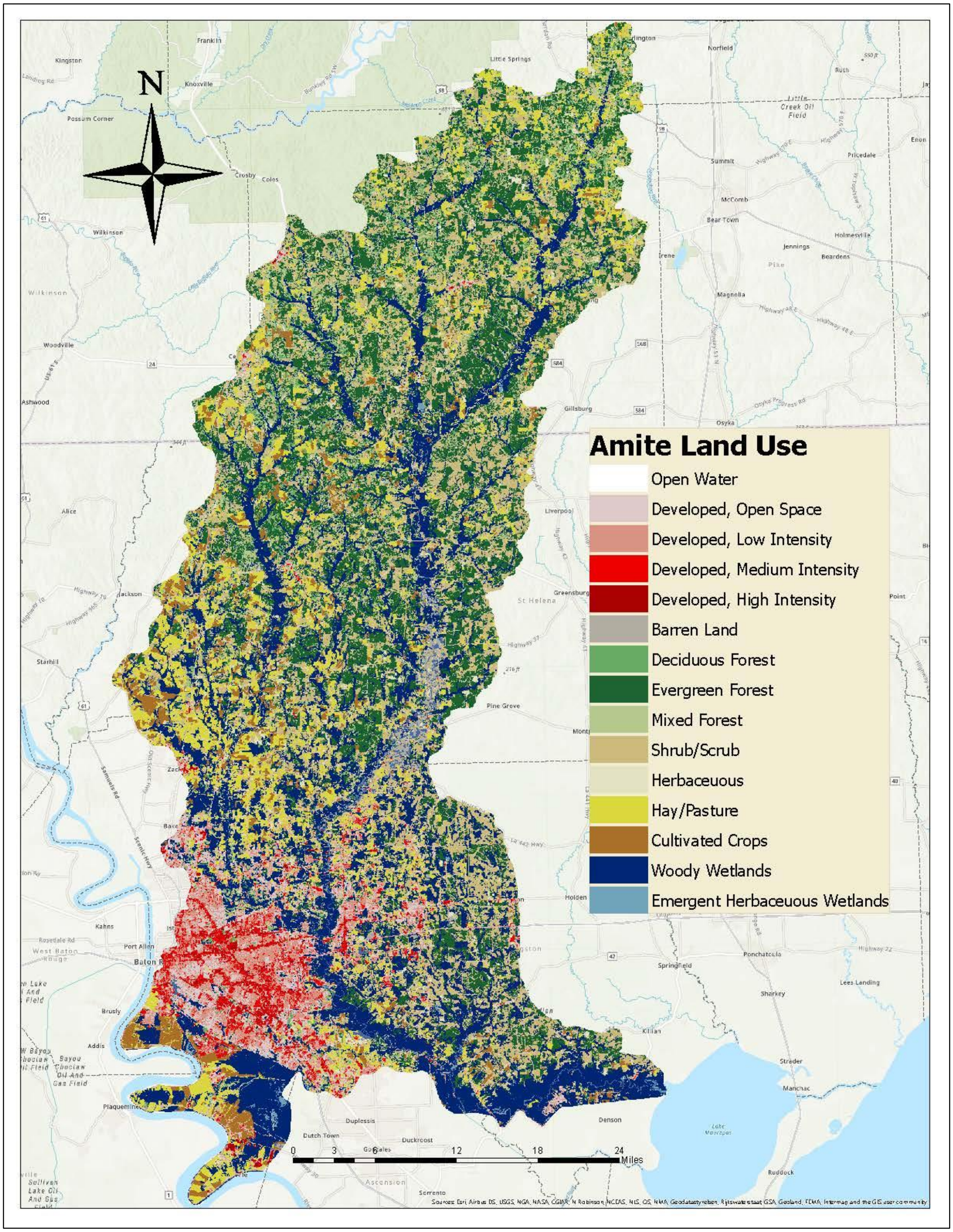


Figure D:1-1. Land Use Classification

1.1.2 Climate

Table D:1-2 consists of the monthly temperature normals recorded from the Baton Rouge Metro Airport, LA monitoring station by the National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center (NCDC). Retrieved 15 April 2019 from https://www.ncdc.noaa.gov/cdo-web/datatools/normals.

Table D:1-2. 1981-2010 Temperature Normals from Baton Rouge Metro Airport, LA US

MONTH	PRECIP (IN)	MIN TMP (°F)	AVG TMP (°F)	MAX TMP (°F)
Jan	5.72	41.2	51.7	62.3
Feb	5.04	44.5	55.1	65.7
Mar	4.41	50.3	61.5	72.7
Apr	4.46	56.8	68.1	79.3
May	4.89	65.2	75.7	86.2
Jun	6.41	71.4	81.1	90.9
Jul	4.96	73.7	83.0	92.2
Aug	5.82	73.4	82.9	92.5
Sep	4.54	68.5	78.6	88.7
Oct	4.70	57.9	69.3	80.8
Nov	4.10	48.9	60.4	71.9
Dec	5.60	42.7	53.4	64.1

Normal annual precipitation for the ARB is 60.5 inches, although for the period 1980 through 1991 rainfall averaged 64 inches a year. The ARB experienced drought conditions (-2 or less on the Palmer Drought Severity Index) during the modern era years of 1952, 1963, 1981, 1999, and 2000. Southerly, maritime winds prevail for much of the year, resulting in the potential for highly variable rainfall over the ARB. Daily variations are frequently measured in inches. Even for a 30-year averaging period, annual precipitation at various weather stations throughout the ARB ranged from 56 to 67 inches. The wettest month is December with an average monthly normal rainfall of 6.14 inches. October is the driest month averaging 3.50 inches.

High cumulative rainfall events (e.g., 6 inches or more in less than 72 hours) over large areas of the ARB are caused under two typical scenarios: slow moving cold fronts encountering warm moist coastal air in late-winter or early spring; and slow-moving tropical storms in summer or early fall. High short-term localized rainfall intensities (e.g., over one inch in an hour) can occur under these two scenarios and are also experienced in a third scenario—heavy summer-time thunderstorms. Severe riverine flooding in the lower ARB has occurred under extreme examples of all three scenarios, with minor localized flood events typically occurring at least once per year in small, poorly drained catchments. Record floods often result when significant rainfall events occur in the context of above-average seasonal rainfall patterns, which sustain high soil moisture saturation and floodplain water levels. In addition to rainfall-riverine flood events, the lower ARB is also subject to wind-driven coastal flooding associated with slow-moving tropical storms. Prolonged heavy southerly winds cause high water levels along the southeastern Louisiana coast (e.g., Breton and Mississippi Sounds), causing back-step rises in Lakes Borgne, Pontchartrain, and Maurepas. Lake Maurepas levels above 3 feet mean sea level (MSL) typically impact the lower ARB at least once per year. Tropical storms have pushed levels above 6 feet MSL.

1.1.3 Flood Events

Table D:1-3 indicates the top 10 pre-2016 crests based on USGS gauges for the Amite River at Denham Springs and Comite River at Joor Rd (with peak stage data as far back as 1921 and 1943, respectively) and the peak discharge for five of the Amite River floods at Denham Springs.

Table D:1-3. Pre-August 2016 ARB Flood Crests for Amite and Comite Rivers (2017 ARB Drainage and Water Conservation District)

	Amite River at Denham Springs, LA US 190			**Comite River at Comite, LA Joor Road**	
	Gauge Datum (ft)	**Discharge (cfs)**	**Date**	**Gauge Datum (ft)**	**Date**
1	41.5	112,000	4/8/1983	30.99	6/9/2001
2	41.08	110,000	4/23/1977	29.72	4/7/1983
3	39.88		1/27/1990	27.58	1/21/1993
4	39.27		3/15/1921	27.45	9/4/2008
5	38.34	82,700	6/9/2001	27.22	4/28/1997
6	38.15		1/22/1993	26.54	1/26/1990
7	36.7	68,600	4/24/1979	26.38	4/12/1995
8	36.5	60,200	3/27/1973	26.16	3/12/2016
9	36.33		5/20/1953	25.99	4/23/1979
10	36.23		9/5/2008	25.64	5/19/1953
Conversion from Gauge Datum to ft NAVD88					
	- 1.35			+ 22.1	

See NOAA, Advanced Hydrologic Prediction Services websites for gauges.

Table D:1-4 presents a summary of estimated damages from the August 2016 Louisiana flooding.

Table D:1-4. Summary of Damages by Category

Damages Category	Loss in Millions
Residential Housing Structures	$3,844.2
Residential Housing Contents	$1,279.8
Automobiles	$378.8
Agriculture	$110.2
Business Structures	$595.6
Business Equipment	$262.8
Business Inventories	$1,425.5
Business Interruption Loss	$836.4
Total	$8,733.3

Source: Terrell, D. 2016. The Economic Impact of August 2016 Floods on the State of Louisiana. http://gov.louisiana.gov/assets/docs/RestoreLA/SupportingDocs/Meeting-9-28-16/2016-August-Flood-Economic-Impact-Report_09-01-16.pdf

1.2 RELEVANT RESOURCES

This section contains a description of relevant resources that are in the area of influence of the proposed project. The important 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.

Relevant resources that are in the area of influence of the project are: wetlands; uplands; aquatic resources and fisheries; wildlife; threatened, endangered, and protected species; geology, soils and water bottoms, and prime and unique farmland; water quality; and air quality.

Section 2
Natural Resources

2.1 WETLANDS

Figure D:2-1 shows the National Wetlands Inventory data within the study area (https://www.fws.gov/wetlands/). Table D:2-1 provides a list of the National Wetlands Inventory and the number of acres of each type within the study area.

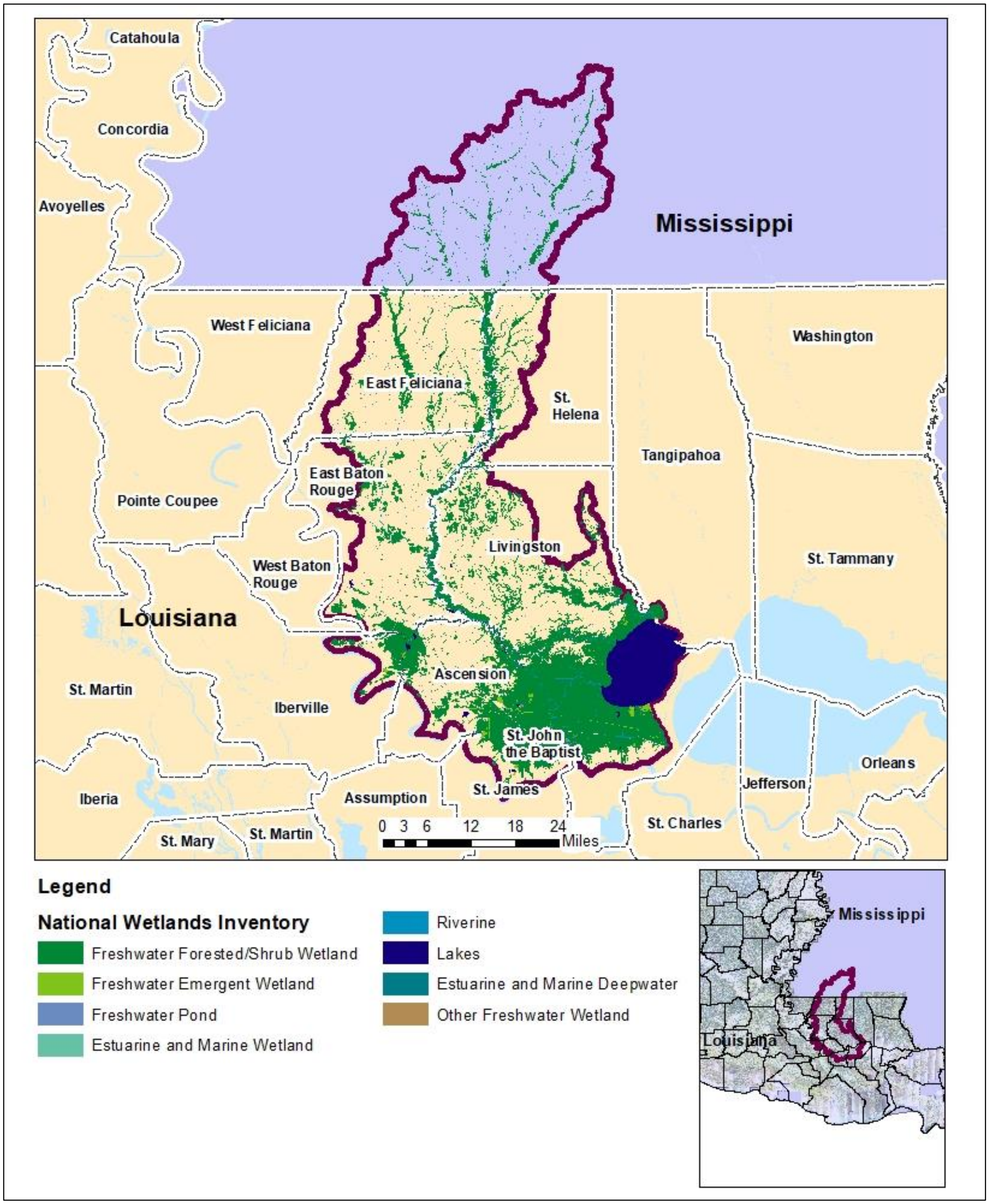


Figure D:2-1. Study Area Wetlands (National Wetlands Inventory)

Table D:2-1. National Wetlands Inventory for the Study Area

Wetland classification	Acres
Estuarine and Marine Deepwater	11.91
Freshwater Emergent Wetland	8,450.29
Freshwater Forested/Shrub Wetland	367,324.26
Freshwater Pond	7,984.49
Lake	61,879.89
Riverine	13,353.02

Mississippi Alluvial Plain vegetation includes:

- Swamp, found in low-lying areas typically adjacent to waterways, is dominated by cypress and tupelo-gum trees.
- Riverine habitats along stream and river bottoms and bottomland forests are comprised of water tupelo, willow, sycamore, cottonwoods, green ash, pecan, elm, cherrybark oak, and white oak trees; these are often interspersed with Chinese tallow. Depending upon the locations, riverine habitats grade into higher elevated and better drained areas comprised of oak-pine forests.
- Oak-pine forest types dominate the better drained areas especially surrounding Lake Charles and Sulfur and include longleaf pine, loblolly pine, slash pine, sweetgum, elm, southern red oak, water oak, black gum and Chinese tallow trees.
- Pasture and rangelands with mixtures of perennial grasses and legumes (e.g., bermundagrass, Pensacola bahiagrass, tall fescue, and white clover) comprise the majority of the outlying areas surrounding the cities of Abbeville, Erath, and Delcambre.

Mississippi Alluvial Plain consists of back barrier vegetated areas; freshwater, intermediate, brackish, and saline marsh; interspersed with bayous, lakes, ponds and other waters some of which may include submerged aquatic vegetation (SAVs). Vegetation typically follows the salinity gradient (O'Neil 1949; Chabreck et al. 1972; Gosselink et al. 1979; Visser et al. 2000).

- Gulf shorelines vegetation includes sea-beach orach, sea rocket, pigweed, beach tea, salt grass, seaside heliotrope, common and sea purslane, marsh-hay cordgrass, and coastal dropseed (LCA, 2004, Gosselink et al., 1979).
- Marsh types: Visser et al. (2000), expanding on previous studies by Penfound and Hathaway (1938) and Chabreck (1970), classified freshwater marsh in the Chenier Plain as a combination of maidencane and bulltongue arrowhead; intermediate marsh as sawgrass, saltmeadow cordgrass, and California bulrush; brackish marsh as saltmeadow cordgrass, chairmaker's bulrush, and sturdy bulrush; and saline marsh as smooth cordgrass, needlegrass rush, and saltgrass.

- Submerged Aquatic Vegetation: wild celery, duckweed, pickerelweed, sago pondweed, southern naiad.

2.2 INVASIVE PLANTS

Invasive plants include water hyacinth, alligatorweed, hydrilla, common salvinia, giant salvinia, Chinese tallow, Chinese privet, Cogon grass, Johnsongrass, Japanese privet, Japanese honeysuckle, common ragweed, rescuegrass, sticky Chickweek, purple nutsedge, mimosa tree. These invasive species compete with native flora for resources such as nutrients and light, community structure and composition, and ecosystem processes. Water hyacinth, common salvinia, giant salvinia, and hydrilla all limit the amount of light penetrating the water column which affects plankton biomass production. Alligatorweed, Chinese tallow, and Chinese privet are of minimal wildlife value and can proliferate until they become the only dominant plant species in the area, limiting food available for wildlife.

2.3 WETLAND LOSS

The processes of wetland loss can result from the gradual decline of marsh vegetation due to inundation and saltwater intrusion, as well as from storm surge events, both of which can eventually lead to complete loss of marsh vegetation. As marsh vegetation is lost, underlying soils are more susceptible to erosion and are typically lost as well, leading to deeper water and precluding marsh regeneration. Significant accretion of sediments is then required in order for marsh habitat to reestablish.

Perhaps the most serious and complex problem in the study area is the rate of land and habitat loss. Coastal Louisiana wetlands are one of the most critically threatened environments in the United States. These wetlands are in peril because Louisiana currently experiences greater coastal wetland loss than all other states in the contiguous United States combined (Couvillion, et al., 2017). The Louisiana coastal plain accounts for 90 percent of the total coastal marsh loss in the nation (USACE 2004). Couvillion et al. (2011) analyses shows coastal Louisiana has undergone a net change in land area of about -1,883 square miles of wetlands from 1932 to 2010. Trend analyses from 1985 to 2010 show a wetland loss rate of about 16.57 square miles per year.

Some wetland loss might also be related to livestock grazing. Moderate grazing alone is not believed to cause wetland loss, but it may be the "final straw" in marshes experiencing additional stresses such as flooding or saltwater intrusion.

The effects of recent hurricanes have accelerated forested wetland loss.

2.4 FUTURE CONDITIONS FOR VEGETATION RESOURCES AND INVASIVE PLANT SPECIES

The current wetland gain/loss trends as well as a change in wetland composition would continue to area vegetation zones.

Wetland losses are predicted to result in:

- Some unknown extent of existing riverine bottomland hardwood (BLH) and associated swamp habitats would be converted to more efficient water conveyance channels as human populations and development increase.
- Some unknown extent of existing pasture and rangelands would be converted to rural, suburban and urban human habitats, generally in the order presented, as human populations and development increase.
- Habitat switching would occur due to increasing sea level rise, subsidence, shoreline erosion and other land loss drivers.
- Gulf shoreline recession rates, varying between +8 feet to -52.9 feet per year, would result in Gulf shoreline rollover onto interior marshes thereby converting these existing habitats to barrier shorelines.
- Inland ponds and lakes shoreline loss rates, varying between 3.6 feet and 9.3 feet, would result in conversion of existing salt, brackish, and intermediate/fresh marsh to shallow open water habitats.

Invasive species will continue to proliferate. New species will become problematic in the future. This will add additional pressures to native animals and natural ecosystems. Invasive species management is and will continue to use money that could have been used for managing natural systems.

2.5 UPLANDS

Rare, Unique, and Imperiled Vegetative Communities. The Louisiana Natural Heritage Program (LNHP) documented the following rare, unique, and imperiled communities. These communities contribute to the diversity and stability of the coastal ecosystem. Table D:2-2 displays information from the LNHP database identifying rare, unique or imperiled vegetative communities.

Table D:2-2. Louisiana Natural Heritage Program Rare, Unique, or Imperiled Vegetative Communities

Vegetative Communities	Basins or Parish(es)
Cypress Swamp	Iberville
Cypress-Tupelo Swamp	Ascension, Iberville, Livingston, St. James, St. John the Baptist,
Baldcypress-Swamp Blackgum Swamp	Florida Parishes on northshore of Lake Maurepas
Bottomland Hardwood Forest	All Parishes
Small Stream Forest	All Florida Parishes
Hardwood Slope Forest	E. Feliciana, St. Helena
Spruce Pine-Hardwood Flatwood	Livingston, East Baton Rouge and Ascension Parishes

https://www.wlf.louisiana.gov/assets/Conservation/Protecting_Wildlife_Diversity/Files/rare_natural_communities_tracking_list_2022.pdf

Small stream forests (also called “Riparian Forests”) are relatively narrow wetland forests occurring along small rivers and large creeks in central, western, southeastern, and northern Louisiana. They are seasonally flooded for brief periods. The percentage of sand, silt, calcareous clay, acidic clay, and organic material in the soil is highly variable (depending on local geology) and has a significant effect on species composition. Soils are typically classified as siltloams. This community includes the phase formerly designated as riparian sandy branch 29 bottom. At times, the community is quite similar in species composition to hardwood slope forests (beech-magnolia forests). For a list of tree species in this community, see Table D:2-3.

Rare Vegetation Communities Future Conditions. Existing conditions and trends of land loss and development are expected to continue, resulting over time, in the loss of these valuable vegetative communities.

Table D:2-3. Rare Vegetative Species List for Forest Communities in the project area (From LDWF Natural Communities of Louisiana)

Small Stream Forest (Overstory Species)	
COMMON NAME	**SCIENTIFIC NAME**
southern magnolia	*Magnolia grandiflora*
blackgum	*Nyssa sylvatica*
white oak	*Quercus alba*
laurel oak	*Quercus laurifolia*
sweetgum	*Liquidambar styraciflua*
red maple	*Acer rubrum*
shagbark hickory	*Carya ovata*
white ash	*Fraxinus americana*
cherry laurel	*Prunus caroliniana*
yellow poplar	*Liriodendron tulipifera*
baldcypress	*Taxodium distichum*
sweet bay	*Magnolia virginiana*
beech	*Fagus grandifolia*
swamp white oak	*Quercus michauxii*
water oak	*Quercus nigra*
cherrybark oak	*Quercus pagoda*
sycamore	*Platanus occidentalis*
river birch	*Betula nigra*
bitternut hickory	*Carya cordiformis*
water ash	*Fraxinus caroliniana*
winged elm	*Ulmus alata*
spruce pine (Florida Parishes)	*Pinus glabra*
loblolly pine	*Pinus taeda*
Small Stream Forest (Midstory and Understory Species)	
COMMON NAME	**SCIENTIFIC NAME**
silverbell	*Halesia diptera*
arrow-wood	*Viburnum dentatum*
sweetleaf	*Symplocos tinctoria*
wild azalea	*Rhododendron canescens*
ironwood	*Carpinus caroliniana*
Virginia willow	*Itea virginica*
hazel alder	*Alnus serrulata*

bigleaf snowbell	*Styrax grandifolia*
starbush (FL Parishes)	*Illicium floridanum*
swamp cyrilla (FL Parishes)	*Cyrilla racemiflora*
leucothoe (FL Parishes)	*Leucothoe axillaris*
winterberry (FL Parishes)	*Ilex verticillata*
sebastian bush (FL Parishes)	*Sebastiana fruticosa*
fetterbush (FL Parishes)	*Lyonia lucida*
leucothoe (FL Parishes)	*Leucothoe racemosa*

2.6 AQUATIC RESOURCES AND FISHERIES

Table D:2-4. Fish Species in the Amite River Watershed by Family, Scientific and Common Names (from LDWF Amite River Water Body Management Plan)

Achiridae – American soles	
Trinectes maculates	northern hogchoker
Acipenseridae – sturgeons	
Acipenser oxyrhynchus desotoi	Gulf sturgeon
Amiidae – bowfin	
Amia calva	bowfin
Aphredoderidae – trout perches	
Aphredoderus sayanus	pirate perch
Anguillidae – freshwater eels	
Anguilla rostrata	American eel
Atherinopsidae	New World silversides
Labidesthes sicculus	brook silverside
Menidia beryllina	inland silverside
Catostomidae – suckers	
Carpiodes carpio	river carpsucker
Erimyzon sucetta	lake chubsucker
Erimyzon oblongus	creek chubsucker
Erimyzon claviformis	western creek chubsucker
Erimyzon tenuis	sharpfin chubsucker
Hypentelium nigricans	northern hogsucker
Minytrema melanops	spotted sucker

Moxostoma poecilurum	blacktail redhorse
Ictiobus bubalus	smallmouth buffalo
Ictiobus cyprinellus	bigmouth buffalo
Ictiobus niger	black buffalo
Centrarchidae - sunfishes	
Ambloplites ariommus	shadow bass
Centrarchus macropterus	flier
Elassoma zonatum	banded pygmy sunfish
Lepomis cyanellus	green sunfish
Lepomis humilis	orangespotted sunfish
Lepomis macrochirus	bluegill
Lepomis gulosus	warmouth
Lepomis marginatus	dollar sunfish
Lepomis megalotis	longear sunfish
Lepomis microlophus	redear sunfish
Lepomis symmetricus	bantam sunfish
Micropterus punctulatus	spotted bass
Micropterus salmoides	largemouth bass
Pomoxis annularis	white crappie
Pomoxis nigromaculatus	black crappie
Clupeidae – herrings	
Alosa chrysochloris	skipjack herring
Dorosoma cepedianum	gizzard shad
Dorosoma petenense	threadfin shad
Brevoortia patronus	Gulf menhaden
Cyprinidae - carps and minnows	
Macrhybopsis aestivalis	speckled chub
Macrhybopsis storeriana	silver chub
Hybopsis winchelli	clear chub
Notemigonus crysoleucas	golden shiner
Hybopsis amnis	pallid shiner
Luxilus chrysocephalus	striped shiner
Lythrurus fumeus	ribbon shiner

Notropis longirostris	longnose shiner
Notropis maculatus	taillight shiner
Lythrurus roseipinnis	cherryfin shiner
Notropis texanus	weed shiner
Cyprinella venusta	blacktail shiner
Notropis volucellus	mimic shiner
Opsopoeodus emiliae	pugnose minnow
Pimephales promelas	fathead minnow
Pimephales vigilax	bullhead minnow
Hybognathus hayi	cypress minnow
Cyprinus carpio	common carp
Notropis atherinoides	emerald shiner
Hypophthalmichthys molitrix	silver carp
Elopidae – tarpons	
Elops saurus	ladyfish
Engraulidae – anchovies	
Anchoa mitchilli	bay anchovy
Esocidae – pikes	
Esox americanus	grass pickerel
Esox niger	chain pickerel
Fundulidae – topminnows and killifishes	
Fundulus chrysotus	golden topminnow
Fundulus catenatus	studfish
Fundulus notatus	blackstripe topminnow
Fundulus olivaceus	blackspotted topminnow
Fundulus euryzonus	broadstripe topminnow
Ictaluridae - North American catfishes	
Ameiurus melas	black bullhead
Ameiurus natalis	yellow bullhead
Ameiurus nebulosus	brown bullhead
Ictalurus furcatus	blue catfish
Ictalurus punctatus	channel catfish
Pylodictis olivaris	flathead catfish

Noturus gyrinus	tadpole madtom
Noturus leptacanthus	speckled madtom
Noturus miurus	brindled madtom
Noturus nocturnes	freckled madtom
Lepisosteidae - gars	
Lepisosteus oculatus	spotted gar
Lepisosteus osseus	longnose gar
Lepisosteus platostomus	shortnose gar
Lepisosteus spatula	alligator gar
Moronidae – temperate basses	
Morone mississippiensis	yellow bass
Morone chrysops	white bass
Mugilidae – mullets	
Mugil cephalus	striped mullet
Petromyzontidae	northern lampreys
Ichthyomyzon gagei	southern brook lamprey
Paralichthyidae – flounders	
Paralichthys lethostigma	southern flounder
Percidae – perches	
Ammocrypta beanii	naked sand darter
Etheostoma chlorosomum	bluntnose darter
Etheostoma fusiforme	swamp darter
Etheostoma proeliare	cypress darter
Etheostoma stigmaeum	speckled darter
Etheostoma swaini	Gulf darter
Etheostoma zonale	banded darter
Percina maculata	blackside darter
Percina nigrofasciata	blackbanded darter
Percina vigil	saddleback darter
Percina sciera	dusky darter
Ammocrypta vivax	scaly sand darter
Percina caprodes	logperch
Poeciliidae – livebearers	

Gambusia affinis	western mosquitofish
Poecilia latipinna	sailfin molly
Heterandria formosa	least killifish
Polyodontidae – paddlefishes	
Polyodon spathula	paddlefish
Sciaenidae – drums	
Aplodinotus grunniens	freshwater drum
Micropogonias undulatus	Atlantic croaker
Sparidae – porgies	
Archosargus probatocephalus	sheepshead
Lagodon rhomboides	pinfish
Syngnathidae – pipefishes and seahorses	
Syngnathus scovelli	Gulf pipefish

2.7 WILDLIFE

Table D:2-5. Game and Non-Game Birds in Study Area

COMMON AND SCIENTIFIC NAME	OCCURENCE
American Kestrel (*Falco sparverius paulus*)	September to March
Anhinga (*Anhinga anhinga*)	July to March (FWS)
Bald Eagle (*Haliaeetus leucocephalus*)	August to May
Barn Swallow (*Hirundo rustica*)	February to November
Barred Owl (*Strix varia*)	Resident
Belted Kingfisher (*Megaceryle alcyon*)	Resident
Blue Jay (*Cyanocitta cristata*)	Resident
Carolina Chickadee (*Poecile carolinensis*)	Resident
Carolina Wren (*Thryothorus ludovicianus*)	Resident
Cattle Egret (*Bubulcus ibis*)	September to April (FWS)
Cedar Waxwing (*Bombycilla cedrorum*)	November to May
Chimney Swift (*Chaetura pelagica*)	March to November
Double-crested Cormorant (*Phalacrocorax auritus*)	July to March (FWS)
Downy Woodpecker (*Picoides pubescens*)	Resident

COMMON AND SCIENTIFIC NAME	OCCURENCE
Eastern Phoebe (*Sayornis phoebe*)	October to March
European Starling (*Sturnus vulgaris*)	Resident
Great Egret (*Ardea alba*)	August to February (FWS)
Reddish Egret	August to March (FWS)
Hooded Merganser (*Lophodytes cucullatus*)	November to May
Kentucky Warbler (*Oporornis formosus*)	March to September
Killdeer (*Charadrius vociferus*)	Resident
Lesser Scaup (*Aythya affinis*)	October to March
Little Blue Heron (*Egretta caerulea*)	Resident
Great Blue Heron	August to February (FWS)
Tricolored Heron	August to March (FWS)
Green Heron	September to March (FWS)
Black-crowned Night-Heron	September to March (FWS)
Yellow-crowned Night-Heron	September to March (FWS)
Mallard (*Anas platyrhynchos*)	Resident
Mississippi Kite (*Ictinia mississippiensis*)	April to August
Mourning dove (*Zenaida macroura*)	Resident
Northern Mockingbird (*Mimus polyglottos*)	Resident
Prothonotary Warbler (*Protonotaria citrea*)	March to October
Red-bellied Woodpecker (*Melanerpes erythrocephalus*)	Resident
Red-shouldered Hawk (*Buteo lineatus*)	Resident
Red-tailed Hawk (*Buteo jamaicensis*)	Resident
Ring-billed Gull (*Larus delawarensis*)	November to April
Ring-necked Duck (*Aythya collaris*)	October to March
Roseate Spoonbill (*Platalea ajaja*)	August to April (FWS)
Ruby-throated Hummingbird (*Archilochus colubris*)	Resident
Snowy Egret (*Egretta thula*)	August to March (FWS)
Turkey Vulture (*Cathartes aura*)	Resident
White Ibis (*Eudocimus albus*)	September to April (FWS)
White-eyed Vireo (*Vireo griseus*)	Resident
White-throated Sparrow (*Zonotrichia albicollis*)	October to April

COMMON AND SCIENTIFIC NAME	OCCURENCE
Wood duck (*Aix sponsa*)	Resident
Wood Thrush (*Hylocichla mustelina*)	March to October
Yellow-billed Cuckoo (*Coccyzus americanus*)	March to October

Table D:2-6. Mammals in the Study Area

COMMON NAME	SCIENTIFIC NAME
fox squirrel	*Sciurus niger*
grey squirrel	*Sciurus carolinensis*
mink	*Neovison vison*
opossum	*Didelphis virginiana*
raccoon	*Procyon lotor*
swamp rabbit	*Sylvilagus aquaticus*
white-tailed deer	*Odocoileus virginianus*

Table D:2-7. Amphibians in the Study Area

COMMON NAME	SCIENTIFIC NAME
bullfrog	*Lithobates catesbeianus*
cricket frog	*Acris crepitans*
Gulf coast toad	*Incilius valliceps*
southern leopard frog	*Lithobates sphenocephalus*

Table D:2-8. Reptiles in the Study Area

COMMON NAME	SCIENTIFIC NAME
American alligator	*Alligator mississippiensis*
snapping turtle	*Chelydra serpentina*
eastern spiny softshell	*Apalone spinifera*
red-eared slider	*Trachemys scripta elegans*
speckled kingsnake	*Lampropeltis holbrooki*
broad-banded water snake	*Nerodia fasciata confluens*
western cottonmouth	*Agkistrodon piscivorus leucostoma*

2.8 THREATENED, ENDANGERED, AND PROTECTED SPECIES

Factors regarding the existing conditions for threatened and endangered species in the study area principally stem from the alteration, degradation, and loss of habitats; and human disturbance. The continued high rate of commercial development throughout the study area continues to reduce available wetland habitat to threatened and endangered species. This creates increased intra- and interspecific competition for rapidly depleting resources between not only the various threatened and endangered species but also other more numerous fauna.

On March 13, 2019, U.S. Army Corps of Engineers (USACE), Mississippi Valley Division, New Orleans District (CEMVN) obtained from the USFWS lists of threatened and endangered species that may occur in the proposed project location, and/or may be affected by the proposed project (See Appendix D-1). Table D:2-9 provides a summary of these findings including the presence of critical habitat. Descriptions for species that may be affected follow below.

Table D:2-9. Threatened (T), Endangered (E), & Protected (P) Species

Scientific name	Common name and status (T, E, or P)	Found in Study Area	Determination of Effects: May Affect, Not Likely to Adversely Affect (NLAA), or Likely to Adversely Affect (LAA)
Potamilus inflatus	Alabama Heelsplitter Mussel (T)	Yes	No effect
Acipenser oxyrhynchus desotoi	Atlantic Sturgeon (T)	Yes	No effect
Trichechus manatus	West Indian Manatee (T)	Yes	No effect
Myotis septentionalis	Northern long-eared bat (E)	Yes	No effect
Haliaeetus leucocephalus	Bald Eagle (P)	Yes	No effect

2.8.1 West Indian Manatee

Federally listed as a threatened species, *Trichechus manatus* (West Indian manatees) occasionally enter Lakes Pontchartrain and Maurepas, and associated coastal waters and streams during the summer months (i.e., June through September). Manatee occurrences appear to be increasing, and they have been regularly reported in the Amite, Blind, Tchefuncte, and Tickfaw Rivers, and in canals within the adjacent coastal marshes of Louisiana. The manatee has declined in numbers due to collisions with boats and barges, entrapment in flood control structures, poaching, habitat loss, and pollution. Cold weather and outbreaks of red tide may also adversely affect these animals.

Public data on manatee sightings have provided benefits for conservation efforts, according to Hieb et al. (2017). Ongoing manatee population growth, future climate change, or other large-scale environmental perturbations are likely to continue altering the timing, duration, and location of manatee visits to the northern Gulf of Mexico. Although publicly sourced data and citizen-science efforts have inherent biases, on a decadal time scale these datasets could provide comprehensive information on manatee habitat use than is possible by direct observations.

2.8.2 Gulf Sturgeon

Acipenser oxyrhynchus desotoi (the Gulf sturgeon), federally listed as a threatened species, is an anadromous fish that occurs in many rivers, streams, and estuarine waters along the northern Gulf coast between the Mississippi River and the Suwannee River, Florida. In Louisiana, Gulf sturgeon have been reported at Rigolets Pass, rivers and lakes of the Lake Pontchartrain basin, and adjacent estuarine areas. Spawning occurs in coastal rivers between late winter and early spring (i.e., March to May). Adults and sub-adults may be found in those rivers and streams until November, and in estuarine or marine waters during the remainder of the year. Sturgeon less than 2 years old appear to remain in riverine habitats and estuarine areas throughout the year, rather than migrate to marine waters. Habitat alterations such as those caused by water control structures that limit and prevent spawning, poor water quality, and over-fishing have negatively affected this species.

On March 19, 2003, the US Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) published a final rule in the Federal Register (Volume 68, No. 53) designating critical habitat for the Gulf sturgeon in Louisiana, Mississippi, Alabama, and Florida. The proposed project; however, does not occur within nor would it impact designated Gulf sturgeon critical habitat.

2.8.3 Inflated Heelsplitter Museel

Federally listed as a threatened species, the Alabama heelsplitter mussel (*Potamilus inflatus*) was historically found in Louisiana in the Amite, Tangipahoa, and Pearl Rivers. Many life history aspects of the species are poorly understood but are likely similar to that of other members of the Unionidae family. Although the primary host fish for the species is not certain, investigation by K. Roe et al. (1997) indicates that the freshwater drum (Aplodinotus grunniens) is a suitable glochidial host for the species.

Based on the most recent survey data, the currently known range for the Alabama heelsplitter in Louisiana occurs only in the lower third of the Amite River along the East Baton Rouge/Livingston Parish line from Spiller's Creek, which is in the vicinity of Denham Springs downstream to the vicinity of Port Vincent. Because it has not been used widely for past or present gravel mining operations, the lower third of the Amite River (between

Louisiana Highway 37 and Louisiana Highway 42) is more typical of a coastal plain river; being characterized by a silt substratum, less channelization, and slower water flow, all of which are characteristic of heelsplitter habitat. This freshwater mussel is typically found in soft, stable substrates such as sand, mud, silt, and sandy gravel, in slow to moderate currents. Heelsplitter mussels are usually found in depositional pools below sand point bars and in shallow pools between sandbars and river banks.

Major threats to this species in Louisiana are the loss of habitat resulting from sand and gravel dredging and channel modifications for flood control, as shown by the apparent local extirpation of the species in the extensively modified upper portions of the Amite River.

2.8.4 Northern Long-Eared Bat

The northern long-eared bat (*Myotis septentrionalis*), federally listed as an endangered species, is a medium sized bat about 3 to 3.7 inches in length but with a wingspan of 9 to 10 inches and is distinguished by its long ears. Its fur color can range from medium to dark brown on the back and tawny to pale brown on the underside. The northern long-eared bat can be found in much of the eastern and north central United States and all Canadian provinces from the Atlantic Ocean west to the southern Yukon Territory and eastern British Columbia. In Louisiana, there have been confirmed reports of sightings in West Feliciana, Winn, and Grant parishes, although they can possibly be found in other parishes in the state. Some individuals were documented during mist net and bridge surveys on the Winn District of the Kisatchie National Forest and observed under bridges on the Winn District in Grant Parish.

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 motionless insects from vegetation and water surfaces.

The most prominent threat to this species is white-nose syndrome, a disease known to cause high mortality in bats that hibernate in caves. Other sources of mortality for northern long-eared bats are wind energy development, habitat destruction or disturbance, climate change and contaminants. If implementation of the proposed action has the potential to directly or indirectly affect the northern long-eared bat or its habitat, further consultation with this office will be necessary.

The USACE is responsible for determining whether the selected alternative is likely (or not likely) to adversely affect any listed species and/or critical habitat, and for requesting the Service's concurrence with that determination. If the USACE determines, and the Service concurs, that the selected alternative is likely to adversely affect listed species and/or critical habitat, a request for formal consultation in accordance with Section 7 of the Endangered Species Act should be submitted to the Service. That request should also include the USACE's rationale supporting their determination.

2.8.5 Bald Eagle

The project-area forested wetlands provide nesting habitat for *Haliaeetus leucocephalus* (the bald eagle), which was officially removed from the List of Endangered and Threatened Species on August 8, 2007. There is one active bald eagle nest that is known to exist within the proposed project area; however, other nests may be present that are not currently listed in the database maintained by the Louisiana Department of Wildlife and Fisheries.

Bald eagles nest in Louisiana from October through mid-May. They typically nest in mature trees (e.g., bald cypress, sycamore, willow, etc.) near fresh to intermediate marshes or open water in the southeastern Parishes. Areas with high numbers of nests include the north shore of Lake Pontchartrain and the Lake Salvador area. Major threats to this species include habitat alteration, human disturbance, and environmental contaminants (i.e., organochlorine pesticides and lead).

Breeding bald eagles occupy "territories" that they will typically defend against intrusion by other eagles, and that they likely return to each year. A territory may include one or more alternate nests that are built and maintained by the eagles, but which may not be used for nesting in a given year. Potential nest trees within a nesting territory may, therefore, provide important alternative bald eagle nest sites. Bald eagles are vulnerable to disturbance during courtship, nest building, egg laying, incubation, and brooding. Disturbance during this critical period 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.

Although the bald eagle has been removed from the List of Endangered and Threatened Species, it continues to be protected under the MBTA and the Bald and Golden Eagle Protection Act (BGEPA). The 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/sites/default/files/documents/national-bald-eagle-management-guidelines_0.pdf.

Those 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. On-site personnel should be informed of the possible presence of nesting bald eagles within the project boundary, and should identify, avoid, and immediately report any such nests to this office. If a bald eagle nest is discovered within or adjacent to the proposed project area, then an evaluation must be performed to determine whether the project is likely to disturb nesting bald eagles. That evaluation may be conducted on-line at: https://www.fws.gov/media/bald-eagle-monitoring-guidelines-southeastern-us. Following completion of the evaluation, that website will provide a determination of whether additional consultation is necessary. A copy of that determination should be provided to this office.

2.9 GEOLOGY, SOILS AND WATER BOTTOMS, AND PRIME AND UNIQUE FARMLAND

Figure D:2-2 shows the study area divided into three regions with distinctive landforms, topographies, and associated floodplain characteristics.

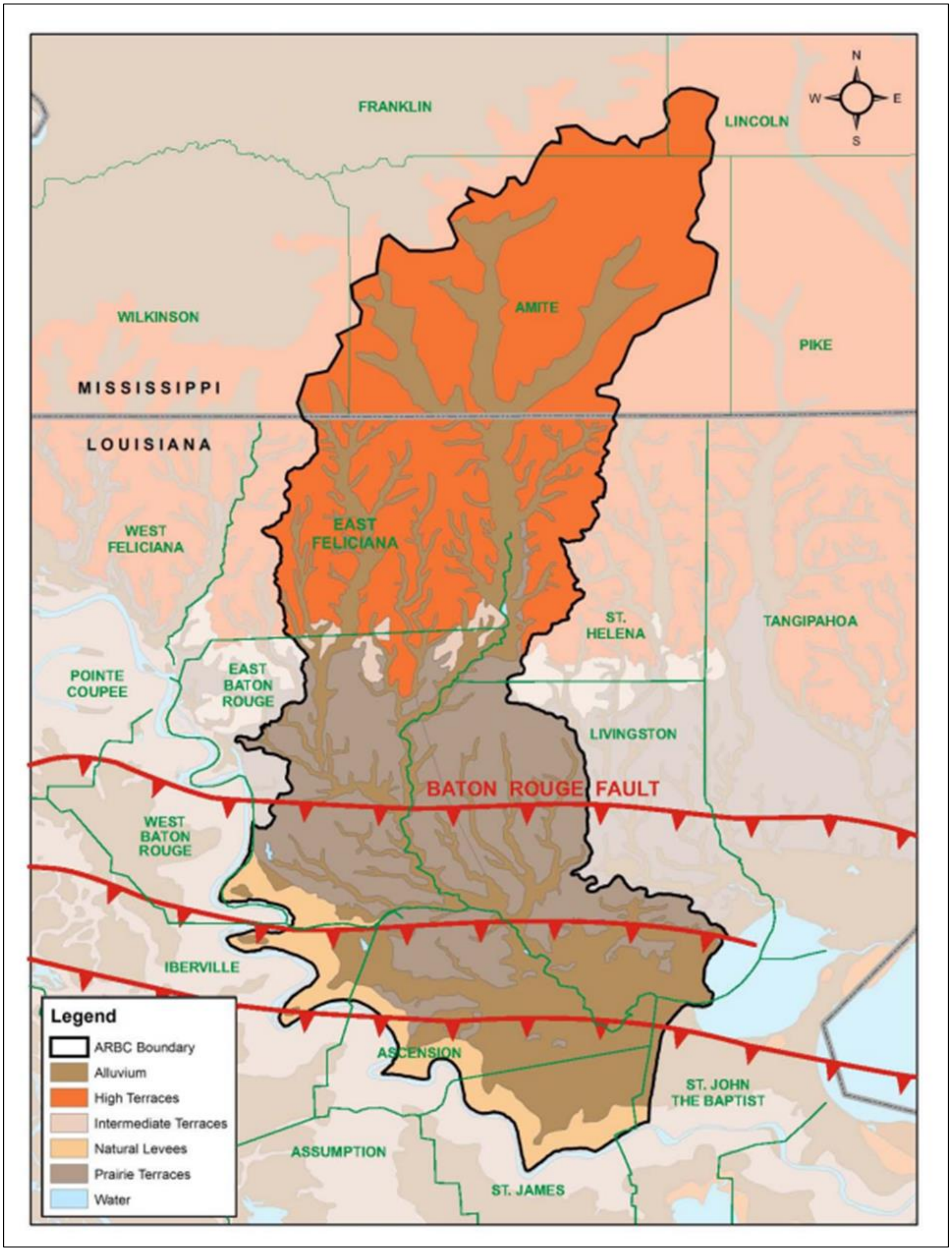


Figure D:2-2. Study Area Landforms

2.10 SOILS, WATER BOTTOMS, AND PRIME AND UNIQUE FARMLAND

The Farmland Protection Policy Act of 1981 (FPPA) was enacted to minimize the extent that Federal programs contribute to the 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.

Under this policy, soil associations are used to classify areas according to their ability to support different types of land uses, including urban development, agriculture, and silviculture. The USDA Natural Resource Conservation Service (NRCS) designates areas with particular soil characteristics as either “Farmland of Unique Importance,” “Prime Farmland,” “Prime Farmland if Irrigated,” or variations on these designations. Prime farmland, as defined by the FPPA, is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. Farmland of unique importance is land other than prime farmland that is used for the production of specific high-value food and fiber crops, such as citrus, tree nuts, olives, cranberries, and other fruits and vegetables. A recent trend in land use in some areas has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, drought-prone, and less productive, and cannot be easily cultivated as compared to prime farmland (NRCS 2016).

For a map of the soil textures, see Figure D:2-3 and Table D:2-10.

For a map and acreage of land classification of prime and unique farmlands, see Figure D:2-4 and Table D:2-10.

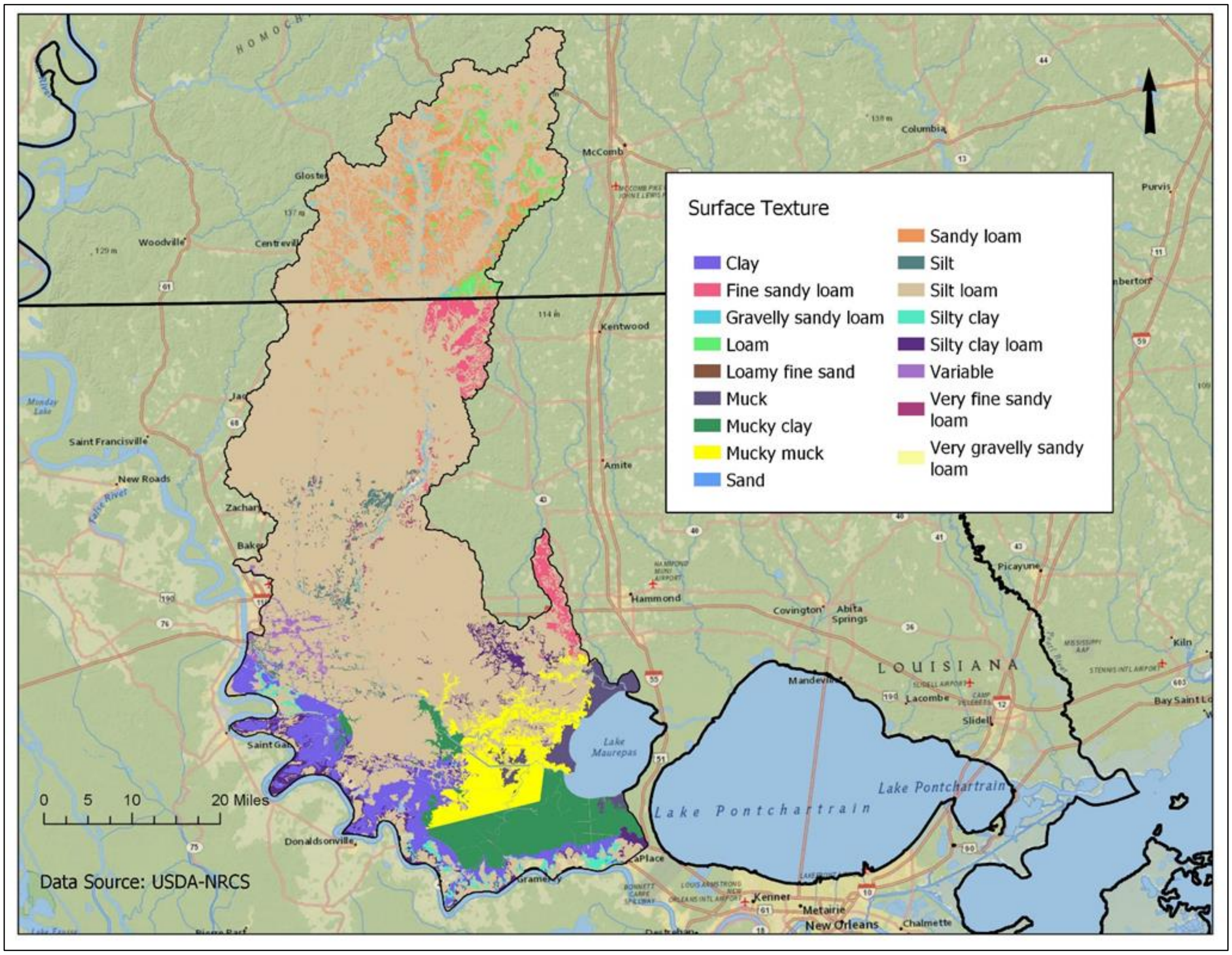


Figure D:2-3. Soil Textures in the Study Area

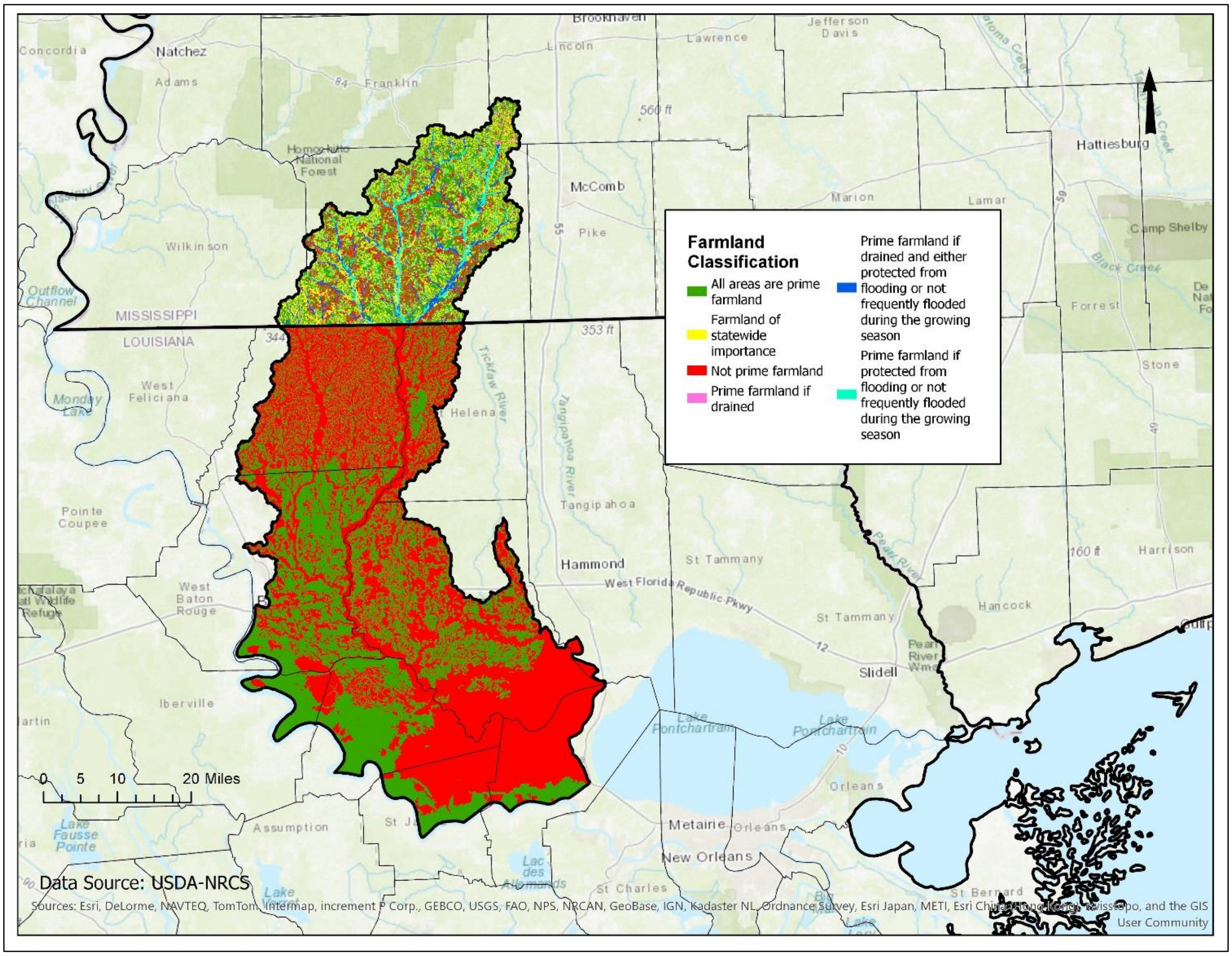


Figure D:2-4. Prime and Unique Farmland Classification Map of Study Area

Table D:2-10. Prime and Unique Farmland Acres in the Study Area

Mississippi Counties	
Acres	**Farmland Type**
148,443.12	All areas are prime farmland
94,551.75	Farmland of statewide importance
58,333.22	Not prime farmland
1,624.24	Prime farmland if drained
35,413.52	Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
31,044.76	Prime farmland if protected from flooding or not frequently flooded during the growing season
369,410.63	**Total**

Louisiana Parishes	
Acres	**Farmland Type**
503,703.59	All areas are prime farmland
755,798.58	Not prime farmland
1,259,502.16	**Total**

2.11 WATER QUALITY

Nineteen water bodies in the Amite Watershed are listed as impaired for one or more designated uses in the *2016 Integrated Report of Water Quality in Louisiana.* Designated uses include swimming, boating, fishing, drinking water, and outstanding natural resource (i.e. Louisiana Scenic Rivers).

Most of the segments are impaired for fish and wildlife propagation and swimming. In the Amite Watershed, the top five suspected causes of impairment are 1) dissolved oxygen, 2) nitrate/nitrite (nitrite plus nitrate as N), 3) fecal coliform, 4) Phosphorus (Total), and 5) Turbidity (See Table D:2-11).

Table D:2-11. Water Quality 305(b) Impaired Waterbodies in the Study Area

Sub-segment Number	Subsegment Description	Size (mi)	Designated Water Body Uses* PCR	SCR	FWP	DWS	ONR	Impaired Use for Suspected Cause	Suspected Causes of Impairment	Suspected Sources of Impairment
LA040301_00	Amite River-From Mississippi state line to La. Highway 37 (Scenic)	30	F	N	N		N	Fish and Wildlife Propogation (FWP)	Mercury in Fish Tissue	Atmospheric Deposition - Toxics
LA040301_00	Amite River-From Mississippi state line to La. Highway 37 (Scenic)	30	F	N	N		N	FWP	Mercury in Fish Tissue	Source Unknown
LA040301_00	Amite River-From Mississippi state line to La. Highway 37 (Scenic)	30	F	N	N		N	FWP	Turbidity	Sand/gravel/rock Mining or Quarries
LA040301_00	Amite River-From Mississippi state line to La. Highway 37 (Scenic)	30	F	N	N		N	FWP	Turbidity	Sand/gravel/rock Mining or Quarries
LA040301_00	Amite River-From Mississippi state line to La. Highway 37 (Scenic)	30	F	N	N		N	FWP	Fecal Coliform	On-site Treatment Systems (Septic Systems and Similar Decentralized Systems)
LA040302_00	Amite River-From LA 37 to Amite River Diversion Canal	69	N	F	N			FWP	Mercury in Fish Tissue	Atmospheric Deposition - Toxics
LA040302_00	Amite River-From LA 37 to Amite River Diversion Canal	69	N	F	N			FWP	Mercury in Fish Tissue	Source Unknown
LA040302_00	Amite River-From LA 37 to Amite River Diversion Canal	69	N	F	N			FWP	Oxygen, Dissolved	Natural Sources
LA040302_00	Amite River-From LA 37 to Amite River Diversion Canal	69	N	F	N			FWP	Fecal Coliform	On-site Treatment Systems (Septic Systems and Similar Decentralized Systems)
LA040302_00	Amite River-From LA 37 to Amite River Diversion Canal	69	N	F	N			FWP	Fecal Coliform	Sanitary Sewer Overflows (Collection System Failures)
LA040303_00	Amite River-From Amite River Diversion Canal to Lake Maurepas	21	F	F	N			FWP	Mercury in Fish Tissue	Atmospheric Deposition - Toxics
LA040303_00	Amite River-From Amite River Diversion Canal to Lake Maurepas	21	F	F	N			FWP	Mercury in Fish Tissue	Source Unknown
LA040303_00	Amite River-From Amite River Diversion Canal to Lake Maurepas	21	F	F	N			FWP	Nitrate/Nitrite (Nitrite + Nitrate as N)	Upstream Source

LA040303_00	Amite River-From Amite River Diversion Canal to Lake Maurepas	21	F	F	N			FWP	Oxygen, Dissolved	Upstream Source
LA040303_00	Amite River-From Amite River Diversion Canal to Lake Maurepas	21	F	F	N			FWP	Phosphorus (Total)	Upstream Source
LA040304_00	Grays Creek-From headwaters to Amite River	20	N	F	N			FWP	Chloride	Natural Sources
LA040304_00	Grays Creek-From headwaters to Amite River	20	N	F	N			FWP	Nitrate/Nitrite (Nitrite + Nitrate as N)	On-site Treatment Systems (Septic Systems and Similar Decentralized Systems)
LA040304_00	Grays Creek-From headwaters to Amite River	20	N	F	N			FWP	Nitrate/Nitrite (Nitrite + Nitrate as N)	Package Plant or Other Permitted Small Flows Discharges
LA040304_00	Grays Creek-From headwaters to Amite River	20	N	F	N			FWP	Oxygen, Dissolved	On-site Treatment Systems (Septic Systems and Similar Decentralized Systems)
LA040304_00	Grays Creek-From headwaters to Amite River	20	N	F	N			FWP	Oxygen, Dissolved	Package Plant or Other Permitted Small Flows Discharges
LA040304_00	Grays Creek-From headwaters to Amite River	20	N	F	N			FWP	Phosphorus (Total)	On-site Treatment Systems (Septic Systems and Similar Decentralized Systems)
LA040304_00	Grays Creek-From headwaters to Amite River	20	N	F	N			FWP	Phosphorus (Total)	Package Plant or Other Permitted Small Flows Discharges
LA040304_00	Grays Creek-From headwaters to Amite River	20	N	F	N			FWP	Sulfates	Natural Sources
LA040304_00	Grays Creek-From headwaters to Amite River	20	N	F	N			FWP	Total Dissolved Solids	Natural Sources
LA040304_00	Grays Creek-From headwaters to Amite River	20	N	F	N			FWP	Fecal Coliform	On-site Treatment Systems (Septic Systems and Similar Decentralized Systems)
LA040305_00	Colyell Creek; includes tributaries and Colyell Bay	76	F	F	N			FWP	Mercury in Fish Tissue	Atmospheric Deposition - Toxics

LA040305_00	Colyell Creek; includes tributaries and Colyell Bay	76	F	F	N			FWP	Mercury in Fish Tissue	Source Unknown
LA040305_00	Colyell Creek; includes tributaries and Colyell Bay	76	F	F	N			FWP	Nitrate/Nitrite (Nitrite + Nitrate as N)	On-site Treatment Systems (Septic Systems and Similar Decentralized Systems)
LA040305_00	Colyell Creek; includes tributaries and Colyell Bay	76	F	F	N			FWP	Oxygen, Dissolved	On-site Treatment Systems (Septic Systems and Similar Decentralized Systems)
LA040305_00	Colyell Creek; includes tributaries and Colyell Bay	76	F	F	N			FWP	Phosphorus (Total)	On-site Treatment Systems (Septic Systems and Similar Decentralized Systems)
LA040305_00	Colyell Creek; includes tributaries and Colyell Bay	76	F	F	N			FWP	Total Dissolved Solids	Source Unknown
LA040401_00	Blind River-From Amite River Diversion Canal to mouth at Lake Maurepas (Scenic)	5	F	F	N		N	FWP	Mercury in Fish Tissue	Atmospheric Deposition - Toxics
LA040401_00	Blind River-From Amite River Diversion Canal to mouth at Lake Maurepas (Scenic)	5	F	F	N		N	FWP	Mercury in Fish Tissue	Source Unknown
LA040401_00	Blind River-From Amite River Diversion Canal to mouth at Lake Maurepas (Scenic)	5	F	F	N		N	FWP	Non-Native Aquatic Plants	Introduction of Non-native Organisms (Accidental or Intentional)
LA040401_00	Blind River-From Amite River Diversion Canal to mouth at Lake Maurepas (Scenic)	5	F	F	N		N	FWP	Oxygen, Dissolved	Natural Sources
LA040401_00	Blind River-From Amite River Diversion Canal to mouth at Lake Maurepas (Scenic)	5	F	F	N		N	FWP	Turbidity	Natural Sources
LA040402_00	Amite River Diversion Canal-From Amite River to Blind River	10	F	F	N			FWP	Mercury in Fish Tissue	Atmospheric Deposition - Toxics
LA040402_00	Amite River Diversion Canal-From Amite River to Blind River	10	F	F	N			FWP	Mercury in Fish Tissue	Source Unknown
LA040402_00	Amite River Diversion Canal-From Amite River to Blind River	10	F	F	N			FWP	Oxygen, Dissolved	Natural Sources

LA040403_00	Blind River-From headwaters to Amite River Diversion Canal (Scenic)	20	F	F	N		F	FWP	Mercury in Fish Tissue	Atmospheric Deposition - Toxics
LA040403_00	Blind River-From headwaters to Amite River Diversion Canal (Scenic)	20	F	F	N		F	FWP	Mercury in Fish Tissue	Source Unknown
LA040403_00	Blind River-From headwaters to Amite River Diversion Canal (Scenic)	20	F	F	N		F	FWP	Non-Native Aquatic Plants	Introduction of Non-native Organisms (Accidental or Intentional)
LA040403_00	Blind River-From headwaters to Amite River Diversion Canal (Scenic)	20	F	F	N		F	FWP	Oxygen, Dissolved	Natural Sources
LA040403_00 555632	Petite Amite River - Located within subsegment LA040403_00. This unit is added for advisory tracking purposes only and is not a subsegment as defined by LAC 33:IX.1123.A. et seq. No other assessment is made for this waterbody.	11			N			FWP	Mercury in Fish Tissue	Atmospheric Deposition - Toxics
LA040403_00 555632	Petite Amite River - Located within subsegment LA040403_00. This unit is added for advisory tracking purposes only and is not a subsegment as defined by LAC 33:IX.1123.A. et seq. No other assessment is made for this waterbody.	11			N			FWP	Mercury in Fish Tissue	Source Unknown

*Designated Use Descriptions
PCR = Primary Contact Recreation (swimming)
SCR = Secondary Contact Recreation (boating)
FWP = Fish and Wildlife Propagation (fishing)
DWS = Drinking Water Supply
ONR = Outstanding Natural Resource
F = Fully supporting designated use; N = Not supporting designated use

2.12 AIR QUALITY

The U.S. Environmental Protection Agency (EPA), Office of Air Quality Planning and Standards has set National Ambient Air Quality Standards for six principal pollutants, called “criteria” pollutants. They are carbon monoxide, nitrogen dioxide, ozone, lead, particulates of 10 microns or less in size (PM-10 and PM-2.5), and sulfur dioxide. Ozone is the only parameter not directly emitted into the air but forms in the atmosphere when three atoms of oxygen (03) are combined by a chemical reaction between oxides of nitrogen and volatile organic compounds in the presence of sunlight. Motor vehicle exhaust and industrial emissions, gasoline vapors, and chemical solvents are some of the major sources of nitrogen and volatile organic compounds, also known as ozone precursors. Strong sunlight and hot weather can cause ground-level ozone to form in harmful concentrations in the air. The Clean Air Act General Conformity Rule (58 FR 63214, November 30, 1993, Final Rule, Determining Conformity of General Federal Actions to State or Federal Implementation Plans) dictates that a conformity review be performed when a Federal action generates air pollutants in a region that has been designated a non-attainment or maintenance area for one or more National Ambient Air Quality Standards. A conformity assessment would require quantifying the direct and indirect emissions of criteria pollutants caused by the Federal action to determine whether the proposed action conforms to Clean Air Act requirements and any State Implementation Plan.

The general conformity rule was designed to ensure that Federal actions do not impede local efforts to control air pollution. It is called a conformity rule because Federal agencies are required to demonstrate that their actions “conform with” (i.e., do not undermine) the approved State Implementation Plan for their geographic area. The purpose of conformity is to (1) ensure Federal activities do not interfere with the air quality budgets in the State Implementation Plans; (2) ensure actions do not cause or contribute to new violations, and (3) ensure attainment and maintenance of the National Ambient Air Quality Standards.

The Amite River and Tributaries Study Area includes eight parishes in Louisiana and three counties in southwest Mississippi. Ascension, East Baton Rouge, East Feliciana, Iberville, Livingston, and St. Helena parishes are located in the Baton Rouge metropolitan area which has been designated by the EPA as a maintenance area for ozone under the 8-hour standard effective December 27, 2016. This classification is the result of area-wide air quality modeling studies, and the information is readily available from the LDEQ, Office of Environmental Assessment and Environmental Services.

Federal activities that are proposed in the ozone-maintenance area may be subject to the State’s general conformity regulations as promulgated under LAC 33:III.14.A, Determining Conformity of General Federal Actions to State or Federal Implementation Plans. A general conformity applicability determination is made by estimating the total of direct and indirect volatile organic compound (VOC) and nitrogen oxide (NO^X) emissions caused by the construction of the project. Prescribed de minimis levels of 100 tons per year per pollutant are applicable in Ascension Parish. Projects that would result in discharges below the de minimis level are exempt from further consultation and development of mitigation plans for reducing emissions.

Section 3
References and Resources

Project References

Couvillion, B.R. 2011. Land Area Change in Coastal Louisiana from 1932 to 2010. https://pubs.usgs.gov/sim/3164/downloads/SIM3164_Pamphlet.pdf

Couvillion, B.R. 2017. Land area change in coastal Louisiana (1932 to 2016). https://pubs.er.usgs.gov/publication/sim3381

Hieb, E.E. et al. 2017. Sighting demographics of the West Indian manatee Trichechus manatus in the north-central Gulf of Mexico supported by citizen-sourced data. *Endangered Species Research.*

Mississippi River Valley Division,
Regional Planning and Environment Division South

Amite River and Tributaries East of the Mississippi River, Louisiana Feasibility Study (ART)

Appendix D-3: Cultural Resources

December 2023

CONTENTS

DEPARTMENT OFTHE **ARMY**
CORPS OF ENGINEERS, NEW ORLEANS DISTRICT
7400 LEAKE AVE
NEW ORLEANS LA 70118-3651

JUN 10 2019

Regional Planning and
Environment Division, South
Environmental Planning Branch
Attn: CEMVN-PDS-N

Kristin Sanders, SHPO
LA State Historic Preservation Officer
P.O. Box 44247
Baton Rouge, LA 70804-4241

RE: Notice of Intent to Prepare Programmatic Agreement Regarding "Amite River and **Tributaries-East of the Mississippi River, Louisiana, Flood Risk Management Feasibility Study."**

Dear Ms. Sanders:

The United States Army Corps of Engineers (USAGE), New Orleans District (CEMVN), is initiating the process to develop a Programmatic Agreement (PA) for the Amite River and Tributaries-East of the Mississippi River, Louisiana (ART), Flood Risk Management Feasibility Study pursuant to Section 106 of the National Historic Preservation Act (NHPA), as amended (54 U.S.C. § 300101 et seq.), and Section 110 of the NHPA, that require Federal agencies to take into account the effect of their undertakings on historic properties during the planning process and consult with stakeholders regarding these effects. This letter is intended to notify the LA State Historic Preservation Officer (LA SHPO) pursuant to 36 CFR Part 800.14(b) of our plan to develop a project-specific PA that establishes procedures to satisfy the CEMVN's Section 106 responsibilities with regard to the programmatic review of this feasibility study and allows CEMVN to coordinate Section 106 reviews with its evaluation of the proposed action's potential for significant impacts to the human and natural environment required by the National Environmental Policy Act (NEPA), as amended (42 U.S.C. § 4321 et seq.). The PA will address the potential to effect historic properties that are eligible for or listed on the National Register of Historic Places (NRHP), including archaeological sites, districts, buildings, structures, and objects that are significant in American history, architecture, archaeology, engineering, and/or sites of religious and cultural significance on or off Tribal Lands [as defined in 36 CFR § 800.16(x)] that may be affected by this undertaking. We invite the LA SHPO to participate in this consultation since it may involve important questions of policy or interpretation and will result in the development of a PA that governs the application of the Section 106 process with regards to the proposed Undertaking.

Study Authority

The ART Flood Risk Management Feasibility Study was initiated by a resolution of the committee on Public Works of the United States Senate, adopted on April 14, 1967. CEMVN is conducting the present ART Flood Risk Management Feasibility Study under the standing authority of *The Bipartisan Budget Act of 2018 (Pub. L. 115-123), Division B, Subdivision 1, H.R. 1892-13, Title IV, Corps of Engineers-Civil, Department of the Army, Investigations,* for flood and storm damage risk reduction. The lead Federal agency for this proposed action is the USAGE. The Louisiana Department of Transportation and Development (LA DOTO) is the non- Federal sponsor. The feasibility study phase is 100% federally funded. Due to the limits set under the Bipartisan Budget Act of 2018, only flood control measures are being investigated in this study.

Study Area

The study area, which includes the Amite River Basin, encompasses an area of approximately 3,450 square miles consisting of eight (8) Louisiana parishes (East Feliciana, St. Helena, East Baton Rouge, Livingston, Iberville, Ascension, St. James, and St. John the Baptist), Maurepas Lake, and four (4) Mississippi counties {Amite, Wilkinson, Franklin, and Lincoln). Over three- fourths of the study area is located within the parishes of southeastern Louisiana, east of the Mississippi River and north of Lake Maurepas. The upper one-fourth of the study area's drainage area is located in the southwestern Mississippi counties. However, none of the initial array of alternates presently being considered are located within the state of Mississippi. A map depicting the study area is included as Figure 1.

Study Purpose and Background

Rainfall from hurricanes, tropical storm events, and local storms pose a significant risk to the communities, ecosystems, and industries of the Amite River Basin. Flooding stemming from the Amite River and its tributaries has caused significant repetitive flood damages to residential and non-residential structures as well as industrial, commercial, and agricultural facilities within the present study area. Flooding within the Amite River Basin is typically derived from two (2) primary sources. Upper basin inundation is caused from headwater flooding from rainfall events. Lower basin inundation is caused by a combination of drainage from headwaters and backwater flooding. As recently as August 2016, the Amite basin saw significant flooding well outside of normal stages causing impacts to thousands of homes and businesses and to the Nation's critical infrastructure including to lengthy closures of the 1-10 and 1-12 transportation system.

Furthermore, the flood was responsible for at least 13 deaths and the rescue of over 19,000 people prompting presidentially-declared disaster declarations to be issued for multiple parishes in the Amite River basin.

In accordance with the 1967 study authority, a feasibility-level study was initiated by USAGE during the early 1990's which led to construction recommendations that are currently being implemented such as the Comite River Diversion and the East Baton Rouge Flood Control Project. In response to the August 2016 flooding, the entire ART study area is now being reevaluated to determine whether additional improvements for flood control are recommended with particular reference to the Amite River, Bayou Manchac, Comite River, and their tributaries. The present study will reevaluate previously proposed alternates that were not carried forward at the time of the 1990's study as well as consider new alternatives not previously assessed.

SMART Planning Framework

CEMVN is conducting this study according to the Specific, Measurable, Attainable, Risk Informed, Timely (SMART) planning framework for civil works feasibility studies for water resources development projects. The SMART planning process is intended to improve and streamline feasibility studies, reduce their cost, and expedite their completion. The study works progressively through a six-step planning process: 1) identifying problems and opportunities, 2) inventorying and forecasting conditions, 3) formulating alternative plans, 4) evaluating alternative plans, 5) comparing alternative plans, and 6) selecting a plan. From a NHPA/NEPA perspective, the SMART planning process is broken out into four (4) separate phases over the course of the study (Figure 2): Scoping; Alternative Evaluation and

Analysis; Feasibility-Level Analysis; and Integrated Feasibility Report (IFR)/Environmental Impact Statement (EIS) development. On April 02, 2019, CEMVN published a Notice of Intent to Prepare a Draft Environmental Impact Statement for the ART Feasibility Study in the Federal Register (Vol. 84, No. 63) and USACE began providing to the public NEPA compliance documentation on the designated project website at https://www.mvn.usace.army.mil/Amite-River-and-Tributaries/.

CEMVN intends to continue to use this website to post additional project information throughout the development of the IFR/EIS. The IFR/EIS examines the existing condition of environmental and cultural resources within the study area and analyzes potential impacts to those resources as a result of implementing the alternatives. At the feasibility level, there may be insufficient funding and time to conduct required NHPA cultural resources studies and/or mitigation and typically additional feasibility work still remains to be completed on the cultural, environmental, engineering, cost estimating, economic, real estate, and construction elements of the plan.

Therefore, prior to approving the Undertaking, the agency may propose to develop a project-specific PA in consultation with stakeholders when the federal agency cannot fully determine how the Undertaking may affect historic properties or the location of historic properties and their significance and character.

There are five (5) key milestones that mark significant decisions in the SMART planning process (Figure 2): Alternatives Milestone; Tentatively Selected Plan (TSP) Milestone; Agency Decision Milestone; Civil Works Review Board; and Chiefs Report Milestone. Table 1 (below) provides a schedule of proposed milestone dates for the ART Flood Risk Management Feasibility Study:

Table 1. Proposed Study Milestone Schedule

Milestone	**Scheduled**	**Actual**	**Complete**
Alternate Milestone	Feb 7, 2019	Feb 7, 2019	Yes
Tentatively Selected Plan	Oct 3, 2019	**TBD**	**No**
Release Draft Report to Public	Dec 4, 2019	TBD	**No**
Agency Decision Milestone	Apr3,2020	**TBD**	**No**
Final Report Transmittal	Apr14,2021	**TBD**	**No**
Chief's Report	Oct 1, 2021	**TBD**	**No**

Upon the completion of the Draft IFR/EIS a stakeholder/public comment period will be initiated in conjunction with technical, peer, and policy reviews. Subsequently, results of the reviews and additional feasibility work will be incorporated into the final Chiefs Report, which will again be made available for stakeholder/public review. Following the execution of a PA, the Chief of Engineers may then proceed with making a final recommendation on the project and issuing a Record of Decision (ROD) in compliance with NHPA and NEPA.

Consideration of Alternates

Proposed measures for the ART Flood Risk Management Feasibility Study are intended to provide the best comprehensive solutions to the Amite River Basin that meet the study objective: to reduce flood damages along the main channel and tributary streams of the Amite River, Bayou Manchac, and Comite Rivers. Other objective considerations include:

- Reduce flood damages in the Amite River Basin to business, residents and infrastructure;
- Reduce risk to human life from flooding from rainfall events;
- Reduce interruption to the nation's transportation corridors;
- Reduce risks to critical infrastructure (e.g. medical centers, schools, transportation etc.);
- Enhance functionality of existing flood risk reduction systems (locally and federally constructed), including evaluation of impacts due to an increase in frequency of rainfall events.

The alternatives will be further developed in the IFR/EIS. A map displaying the initial array of alternatives under consideration is included as Figure 3.

Section 106 Consultation

CEMVN has determined that the proposed action constitutes an Undertaking as defined in 36 CFR § 800.16(y) and has the potential to cause effects on historic properties. This letter initiates formal Section 106 consultation pursuant to 36 CFR § 800.3(c). Due to time and budget constraints for this Undertaking associated with the SMART Planning framework, CEVMN proposes to develop a project-specific PA pursuant to 36 CFR § 800.14(b)(3). The goal of this Section 106 consultation is to provide a project-specific framework for addressing this complex Undertaking and establish protocols for continuing consultation with the LA SHPO, Tribal Governments, and other stakeholders. The PA would identify consulting parties, define applicability, establish review timeframes, stipulate roles and responsibilities of stakeholders, summarize Tribal consultation procedures, consider the views of the SHPO/THPO and any other consulting parties, afford for public participation, develop programmatic allowances to exempt certain actions from Section 106 review, provide the measures CEMVN will implement to develop an Area of Potential Effects (APE) in consultation with external stakeholders, outline a standard review process for plans and specifications as they are developed, determine an appropriate level of field investigation to identify and evaluate historic properties within the APE and the potential to affect historic properties and/or sites of religious and cultural significance, streamline the assessment and resolution of Adverse Effects through avoidance, minimization, and programmatic treatment approaches for mitigation, establish reporting frequency and schedule, provide provisions for post-review unexpected discoveries and unmarked burials, and incorporate the procedures for amendments, duration, termination, dispute resolution, and implementation.

CEMVN proposes to send future notices, draft agreements, and other background information to consulting parties by e-mail to minimize communication delays and expedite the development of the PA. Please let CEMVN know if this is impractical, so we can make alternative arrangements.

A date and time for the initial Section 106 consultation meeting has not been set. Upon selection of a TSP, CEMVN will schedule a teleconference with consulting parties. The purpose of the initial meeting will be to discuss the proposed Undertaking, the APE, and determine the appropriate steps to identify, evaluate, avoid, minimize, and mitigate potential adverse effects.

CEMVN will notify the SHPO and other likely consulting parties regarding the meeting as soon as possible and forward information regarding the meeting location, a conference call-in number, and the Agenda.

Please do not hesitate to notify CEMVN regarding any information your office may wish to provide at this time concerning the proposed undertaking and its potential to significantly affect historic properties and/or of any other relevant parties who you feel may have an interest in participating in this consultation. Should you have any questions or need additional information regarding this undertaking or the SMART Planning Framework, please contact Jeremiah Kaplan, Archaeologist at Jeremiah.H.Kaplan@usace.army.mil or (504) 862-2004.

Sincerely,

HARPER.MARSHALL.KEVIN.1536114358 Digitally signed by HARPER.MARSHALL.KEVIN.1536114358 Date: 2019.06.07 09:36:04 -05'00'

MARSHALL K. HARPER
Chief, Environmental Planning Branch

CC:File
LASHPO
An electronic copy of this letter with enclosures will be provided to the Section 106 Inbox, section106@crt.la.gov.

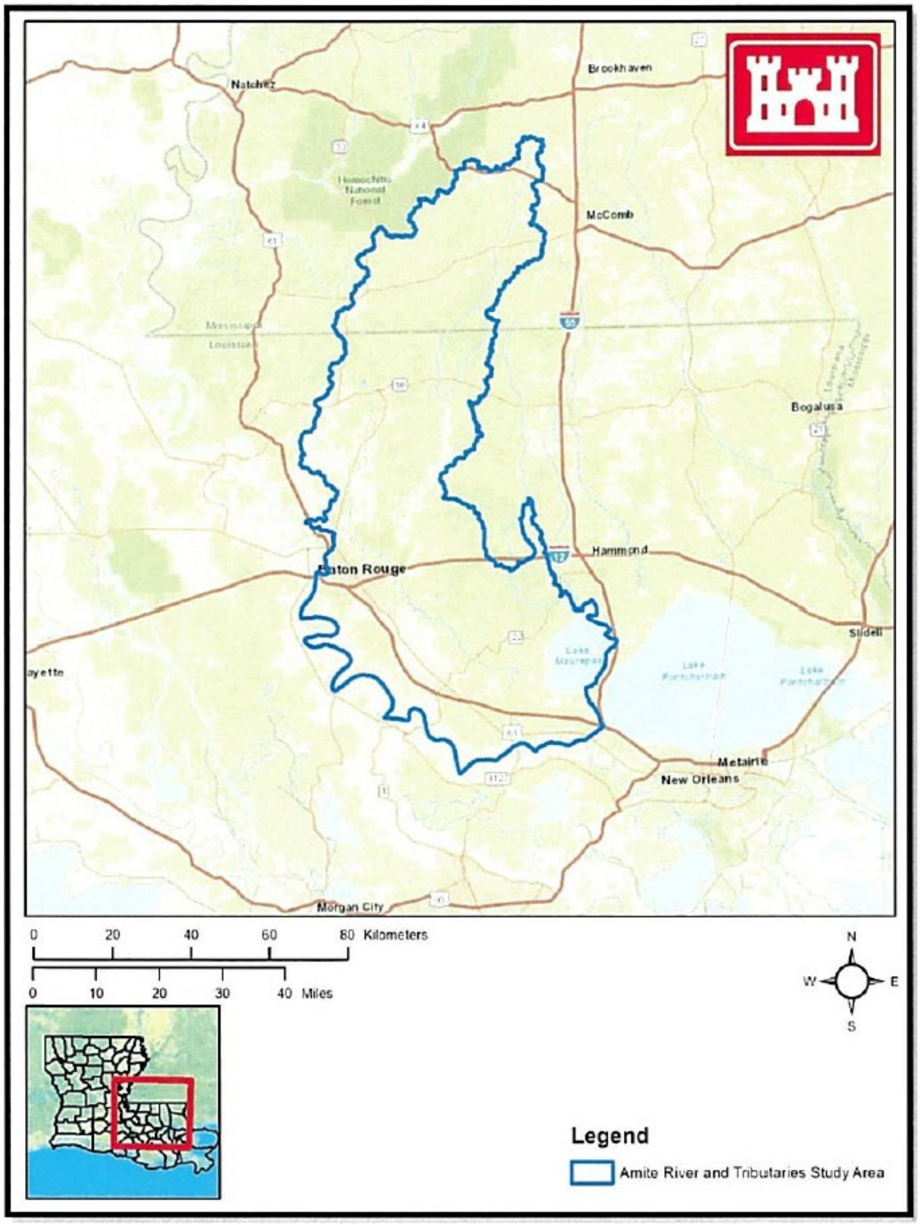


Figure 1. Transportation imagery displaying location of the ART study area.

Section 106 Consultation, SMART Planning and NEPA Compliance Processes

SMART Planning Phase	SMART Planning Milestone	NEPA Compliance	Section 106 Consultation
1 Scoping	Alternatives (AM)	Notice of Intent and Public Scoping	**Initiate Process** - Define Undertaking - Notify SHPO/THPO - Identify tribes and other Consulting Parties & Involve Public - Determine APE - Conduct Literature & Records Searches - Develop Research/Sampling strategies
2 Alternatives Evaluation & Analysis	Tentatively Selected Plan (TSP)	Circulate Draft EIS with integrated FS *including 106 documentation*	**Identify Historic Properties** - Phase 1 Sample Survey of APE - Phase 2 National Register Eligibility Surveys/Testing for TSP - Consult with SHPO/THPO, Tribes et al. - Involve public **Assess Effects to NRHP Eligible Sites** - Apply criteria of adverse effect - Consult with SHPO/THPO, Tribes et al. **Resolve Adverse Effects** - Avoid, minimize or mitigate - Develop & coordinate draft MOA, PA and, or HPTPs - Consult with SHPO/THPO et al. **Draft Mitigation Plan** - Develop costs for IFR/EIS
3 Feasibility Level Analysis	Agency Decision Milestone on Recommended Plan (ADM)	Respond to and Address Comments; finalize EIS	**Finalize MOA or PA** - Final inputs to IFR/EIS - Obtain SHPO/ACHP and other signatures - Obtain waiver for data recovery costs > 1%
4 Complete final report	Civil Works Review Board (CWRB)	Report S&A review	**Agreement (MOA/PA) or ACHP Comment**
5 File Final Report	Chief's Report	File with EPA Sign ROD	**Represent commitments in ROD**

Figure 2. Section 106 Consultation, SMART Planning and NEPA Compliance Processes.

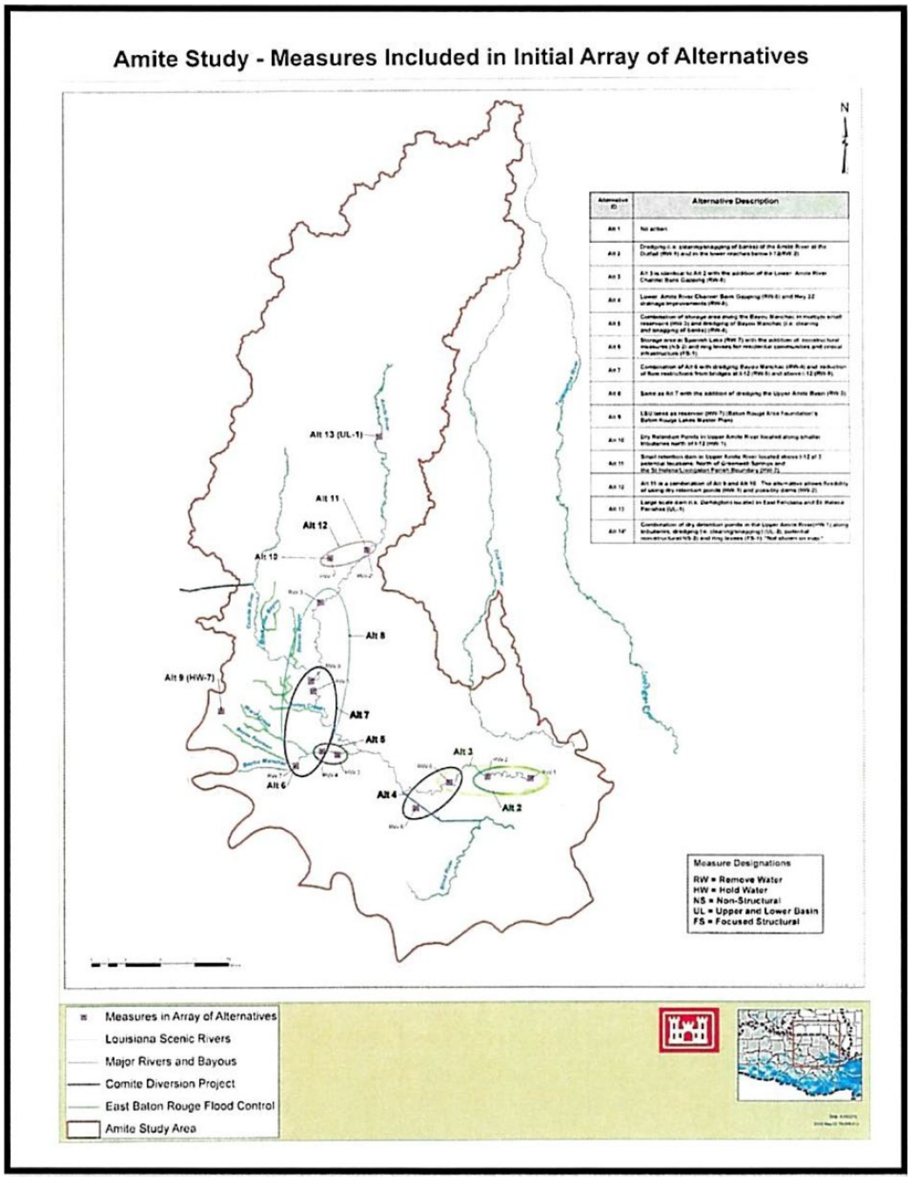
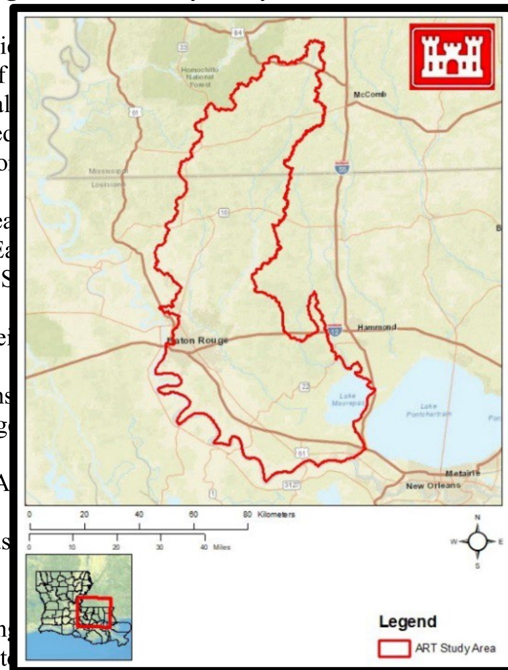


Figure 3. ART feasibility study area initial array of alternates (https://www.mvn.usace.army.mil/Portals/56/docs/BBA%2018/Amite_Initial_Array_of_Alternatives_36x48_04242019.pdf).

DRAFT PROGRAMMATIC AGREEMENT AMONG THE U.S. ARMY CORPS OF ENGINEERS, NEW ORLEANS DISTRICT; LOUISIANA DEPARTMENT OF TRANSPORTATION DEPARTMENT; LOUISIANA STATE HISTORIC PRESERVATION OFFICER OF THE DEPARTMENT OF CULTURE, RECREATION & TOURISM; [TRIBES], REGARDING THE AMITE RIVER AND TRIBUTARIES EAST OF THE MISSISSIPPI RIVER, LOUISIANA, FLOOD RISK MANAGEMENT PROJECT.

I. **Draft Overview of Amite PA**
   a. Parties to the Document
      i. USACE (Signatory)
      ii. LA DOTD (Signatory)
      iii. Louisiana SHPO (Signatory)
      iv. Tribes (TBD)
      v. Others (TBD)
   b. Preliminary Outline Sections of the Document
      i. Whereas Clauses/Preamble
      ii. Stipulations
         - General
         - Project Review
            1. Consulting Parties
            2. APE
            3. Identification and Evaluation
            4. Findings of No Historic Properties Affected
            5. Application of the Criteria of Adverse Effect
            6. Resolution of Adverse Effects
            7. Objections
         - Other Considerations
         - Implementation of Agreement
         - Execution
      iii. Administrative Stipulations
      iv. Signature Pages
      v. Appendix 1: *Contact Information*
      vi. Appendix 2: *Treatment Measures*

Public Notice NHPA/NEPA[1]
Notice of Intent to Prepare Programmatic Agreement Regarding Amite River and Tributaries-East of the Mississippi River, Louisiana, Flood Risk Management Feasibility Study



The United States Army Corps of Engineers (USACE), New Orleans Distri Programmatic Agreement (PA) for the Amite River and Tributaries-East of Risk Management Feasibility Study pursuant to Section 106 of the National (54 U.S.C. § 300101 et seq.), and Section 110 of the NHPA, that require Fed their undertakings on historic properties during the planning process and co

The study area, which includes the Amite River Basin, encompasses an area approximately 3,450 square miles consisting of eight Louisiana parishes (Ea Feliciana, St. Helena, East Baton Rouge, Livingston, Iberville, Ascension, S James, and St. John the Baptist) and four Mississippi counties (Amite, Wilkinson, Franklin, and Lincoln). None of the initial array of alternates bei considered are located within the state of Mississippi.
Proposed measures are intended to provide the best comprehensive solutions the Amite River Basin that meet the study objective: to reduce flood damag along the main channel and tributary streams of the Amite River, Bayou Manchac, and Comite Rivers. USACE began providing to the public NEPA compliance documentation on the designated project website at https://www.mvn.usace.army.mil/Amite-River-and-Tributaries/. CEMVN intends continue to use this website to post additional project information.

CEMVN has determined that the proposed action constitutes an Undertakin defined in 36 CFR § 800.16(y) and has the potential to cause effects on hist properties. Accordingly, CEVMN proposes to develop a project- specific PA pursuant to 36 CFR § 800.14(b)(3) to provide a framework for addressing this complex Undertaking and establish protocols for continuing consultation with the LA State Historic Preservation Officer (LA SHPO), Tribal Governments, and other stakeholders. The PA would identify consulting parties, define applicability, establish review timeframes, stipulate roles and responsibilities of stakeholders, summarize Tribal consultation procedures, consider the views of the SHPO/ Tribal Historic Preservation Officer and other consulting parties, afford for public participation, develop programmatic allowances to exempt certain actions from Section 106 review, provide the measures CEMVN will implement to develop an Area of Potential Effects (APE) in consultation with external stakeholders, outline a standard review process for plans and specifications as they are developed, determine an appropriate level of field investigation to identify and evaluate historic properties and/or sites of religious and cultural significance within the APE, streamline the assessment and resolution of Adverse Effects through avoidance, minimization, and programmatic treatment approaches for mitigation, establish reporting frequency and schedule, provide provisions for post-review unexpected discoveries and unmarked burials, and incorporate the procedures for amendments, duration, termination, dispute resolution, and implementation.

To help further develop a course of action for this project CEMVN is requesting your input by June 29, 2019, concerning the proposed Undertaking and its potential to significantly affect historic properties and/or of relevant parties who may have an interest in participating in this consultation. Comments can be sent electronically to: AMITEFS@usace.army.mil, or, mail comments to: Cultural & Social Resources Section (CEMVN-PDP-CSR), USACE, Room 140, 7400 Leake Ave., New Orleans, LA 70118-3651.

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[1] CEMVN is issuing this public notice as part of its responsibilities under the Advisory Council on Historic Preservation's regulations, 36 CFR Part 800, implementing Section 106 of the National Historic Preservation Act of 1966, as amended (54 U.S.C. § 306108). This notice applies to activities carried out under the Congressional authority for the ART Flood Risk Management Feasibility Study under the standing authority of The Bipartisan Budget Act of 2018 (Pub. L. 115-123), Division B, Subdivision 1, H. R. 1892-13, Title IV, Corps of Engineers-Civil, Department of the Army, Investigations, for flood and storm damage risk reduction. CEMVN is also required to fulfill the Council of Environmental Quality regulations (NEPA regulations, 43 FR 55978 (1978)) that provide policy and procedures to enable CEMVN officials to be informed and to take into account environmental considerations when authorizing or approving CEMVN actions that may significantly affect the environment of the United States. It is the intent of NEPA that federal agencies encourage and facilitate public involvement to the extent practicable in decisions that may affect the quality of the environment.

Mississippi River Valley Division,
Regional Planning and Environment Division South

Amite River and Tributaries East of the Mississippi River, Louisiana Feasibility Study (ART)

Appendix D-4: Environmental Justice

December 2023

CONTENTS

LIST OF TABLES

LIST OF FIGURES

Section 1

Environmental Justice

The Environmental Justice (EJ) Appendix D-4 provides more detailed information than is available in the Environmental Assessment's (EA) EJ Section 3.2.3.3, in the main feasibility report. The EJ appendix provides information on the methodology used to identify areas of EJ concern. The EJ assessment in Chapter 5 of the EA identifies impacts to these areas of EJ concern and describes how residents may be beneficially and adversely impacted by the Federal action. Appendix D-4 also provides tables and figures not in the main report.

EJ is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people should bear a disproportionate share of the negative environmental consequences resulting from industrial, governmental, and commercial operations or policies. (https://www.epa.gov/environmentaljustice/learn-about-environmental-justice, accessed 01/2023).

EJ is institutionally significant because of Executive Order (EO) 12898 of 1994, EO 14008 of 2021 and the Department of Defense's Strategy on Environmental Justice of 1995. Federal agencies are to identify and address any disproportionately high and adverse human health or environmental effects of Federal actions to minority and/or low-income populations and to those populations challenged with environmental hazards.

This resource is technically significant because the social and economic welfare of minority and low-income populations may be positively or adversely disproportionately impacted by the proposed actions. This resource is publicly significant because of public concerns about the fair and equitable treatment (fair treatment and meaningful involvement) of all people with respect to environmental and human health consequences of Federal laws, regulations, policies, and actions.

Below are other relevant EOs and memorandum related to EJ:

- Executive Order 13985, Advancing Racial Equity and Support for Undeserved Communities through the Federal government dated 20 January 2021;

- Executive Order 13990, Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis dated 20 January 2021;
- Executive Order 14008, Tackling the Climate Crisis at Home and Abroad dated 27 January 2021; Office of Management and Budget Memorandum M-21-28;
- Comprehensive Documentation of Benefits in Decision Document, January 5, 2021, Issued by the Assistant Secretary of the Army (Civil Works);
- Indian Self-Determination and Education Assistance Act, as Amended (25 U.S. Code Chapter 46) SACW Subject; Implementation of Environmental Justice and the Justice40 Initiative 2;
- Water Resources Development Act (WRDA) of 2020, December 27, 2020;
- Interim Implementation Guidance for the Justice40 Initiative, dated 20 July 2021; and Memorandum for Commanding General. U.S. Army Corps of Engineers Subject: Implementation of Environmental Justice and the Justice40 Initiate Dated 15 March 2022.
- Executive Order 14096: Revitalizing Our Nation's Commitment to Environmental

1.1 JUSTICE FOR ALL

Minority populations are those persons who identify themselves as Black, Hispanic, Asian American, American Indian/Alaskan Native, Pacific Islander, some other race, or a combination of two or more races. A minority population exists where the percentage of minorities in an affected area either exceeds 50 percent or is meaningfully greater than in the general population. Low-income populations as of 2020 are those whose income are $26,200 for a family of four and are identified using the Census Bureau’s statistical poverty threshold. For the purpose of this study, a low-income population is defined as residents in a geographic area, such as a census block group, exceeding Louisiana’s 2020 low-income percentage of 19.6 percent. Minority and low-income populations, identified using the above thresholds, are considered areas of EJ concern and an evaluation of the Federal action impacts to areas of EJ concern is provided in this section.

EO 12898 directs Federal agencies to identify and address any disproportionately high adverse human health or environmental effects of Federal actions to minority and/or low-income populations. Areas of EJ concern are identified to help inform planners as to the location of those areas needing a particular focus and attention when determining the impacts of the Federal action, as described in EO 12898. Federal agencies should assess the effects of their projects on communities with EJ concerns in accordance with EO 12898: Environmental Justice, 1994 and EO 14008, Tackling the Climate Crisis at Home and Abroad, 2021. For U.S. Army Corps of Engineers, compliance with these EOs is mandatory pursuant to Section 112(b)(1) of WRDA 2020 (Public Law 116-260). (“In the formulation of water development resources projects, the Secretary shall comply with any existing Executive Order regarding environmental justice . . . to address any disproportionate and adverse human health or environmental effects on minority communities, low-income communities, and Indian Tribes.”). For purposes of consistency with EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income

Populations, the terms “minority populations” and low-income populations” are used in this document.

1.2 JUSTICE40

EO 14008, signed by President Biden in April 2023, is a commitment to securing environmental justice and spurring economic opportunity for disadvantaged communities that have been historically marginalized and overburdened by pollution and underinvestment in housing, transportation, water and wastewater infrastructure, and health care. As per EO 14008, the Federal government has made it a goal that 40 percent of the overall benefits of certain Federal investments flow to disadvantaged communities that are marginalized, underserved, and overburdened by pollution. This goal has been designated the Justice40 Initiative.

The Council on Environmental Quality developed the Climate and Economic Justice Screening Tool (CEJST) to assist identifying economically disadvantaged communities. The CEJST uses several burdens that qualify a census tract as disadvantaged. Burden categories in CEJST include housing, health, climate change, energy, legacy pollution, transportation, water/wastewater infrastructure, and workplace development. For a tract to be considered disadvantaged, it must be at or above the 90th percentile in one or more burdens and be at or above the 65th percentile for low income. Detailed methodology can be found on the CEJST website.

Out of 146 census tracts in the ART study area, 57 are historically burdened by a CEJST burden category. These identified communities would be impacted disproportionately by inundation events as they may not have the resources to recover from the impacts or be able to properly mitigate prior to the event. Refer to Appendix F, Economic and Social Considerations, Section 7.2.6 for more information on Justice40.

For the EJ assessment, the project delivery team (PDT) used U.S Census data to identify areas of EJ concern (minority and low-income communities) within the ART study area. Twelve parishes or counties comprise the ART study area, including Ascension, East Baton Rouge, East Feliciana, Iberville, Livingston, St. Helena, St. James and St. John the Baptist Parishes in Louisiana and the Mississippi Counties of Amite, Franklin, Lincoln and Wilkinson.

For purposes of the EJ analysis, “environmental justice communities” were defined as communities that meet established thresholds for identifying low-income residents or who identify as a person of color, or minority. Methods for determining thresholds are explained in the Environmental Protection Agency's (EPA) EJ Promising Practices document and are presented below.

1.2.1 Census Data

The PDT used the National Historical Geographic Information System (NHGIS) tool to obtain the most recent U.S. Census Bureau 5-year survey data, 2017-2021, herein referred to as 2021 data. Similar data is available through the EJSCREEN tool. Data for cities and towns and for U.S. Census block groups are presented, which helps highlight areas of EJ concern for different geographic areas. Cities and towns are identified by the U.S. Census Bureau. The U.S. Census block is a geographic area consisting of several smaller U.S. Census blocks, which are combined to form block groups. Each of these groups represent geographic areas and people living in communities.

1.2.2 Low-income threshold criteria

A reference area's percentage of residents living below poverty was used as the threshold for identifying areas of EJ concern based upon poverty status. The state of Louisiana is the reference area for the study area that is located in Louisiana and is the state of Mississippi for study area counties. The 2021 percentage of Louisiana residents living below the poverty level is 18.8 percent and for Mississippi is 19.4 percent. Any area in Louisiana and Mississippi the study, area that consists of 18.8 and 19.4 percent or more of residents living below poverty, respectively, is considered an area of EJ concern. The poverty income level for year 2021 in the United States was $26,500 for a family of four.

1.2.3 Minority population threshold criteria

If 50 percent of residents in an area identify as a person of color (minority), then the area is considered an area of EJ concern. Additionally, if the percentage of minority residents in an area is meaningfully greater (15 percent) than the percentage minority in the state of Louisiana or Mississippi, that area is also considered an area of EJ concern. The threshold used to identify minority areas of EJ concern is the lower of the two. In this case, the minority threshold used to identify areas of EJ concern in Louisiana is 48.5 percent or greater and in Mississippi is 50 percent or greater.

Data for parishes and counties gives a broad-brush overview of the study area's likelihood of having residents living in areas of EJ concern based upon the minority composition and low-income status. Tables D4-1 and D4-2 show the racial composition for the Louisiana parishes and Mississippi counties in the study area. Six of the eight Louisiana parishes in the study area are considered areas of EJ concern based upon exceeding the minority threshold of 48.5 percent and only one of the four Mississippi counties in the ART study area is an area of EJ concern and exceeds the 50 percent threshold, Wilkinson County.

Table D-4-1. 2021 U. S. Census Bureau Information

	Louisiana Parishes								
Race and Ethnicity	**Ascension**	**East Baton Rouge**	**East Feliciana**	**Iberville**	**Livingston**	**St. Helena**	**St. James**	**St. John the Baptist**	**State of LA**
Total Population	125,289	455,447	7,502	30,651	141,057	10,881	20,390	42,704	4,657,305
Not Hispanic	117,797	435,520	7,363	29,768	135,147	10,660	20,029	39,840	4,408,523
White	84,024	199,459	2,120	14,327	120,869	4,808	9,933	13,522	2,693,832
Black	28,360	205,826	4,992	14,366	9,466	5,583	10,065	24,380	1,475,549
Native American	328	492	54	21	172	60	-	4	21,492
Asian	1,587	14,096	-	16	1,188	-	5	365	79,562
Hawaiian	36	74	-	-	9	-	-	-	2,017
Some Other Race	492	1,309	23	196	127	-	-	716	16,965
Two or more races	2,970	14,264	174	842	3,316	209	26	853	119,106
Hispanic	7,492	19,927	139	883	5,910	221	361	2,864	248,782
White	2,148	7,011	14	365	2,816	198	115	1,503	112,043
Black	175	853	50	24	46	-	-	216	10,453
Native American	44	282	-	3	201	-	-	-	4,058
Asian	94	18	-	-	36	-	-	11	876
Hawaiian	-	-	-	-	-	-	48	-	155
Some other race	3,275	7,623	51	118	1,611	12	148	682	62,662
Two or more races	1,756	4,140	24	373	1,200	11	50	452	58,535
Percent Minority*	**32.90%**	**56.20%**	**71.70%**	**53.30%**	**14.30%**	**55.80%**	**51.30%**	**68.30%**	**42.20%**

*includes Population Not Hispanic non white races and all Hispanic races

Red highlighted numbers represent Parishes with Minority threshold being exceeded and are considered areas of EJ concern.

U.S. Census Bureau 2017-2021, ACS

Table D4-2. 2021 U. S. Census Bureau Information, Mississippi

	Mississippi Counties				
Race	**Amite County**	**Franklin County**	**Lincoln County**	**Wilkinson County**	**State of MS**
Total Population	12,718	7,705	34,910	8,706	2,967,023
Not Hispanic	12,710	7,703	34,447	8,623	2,871,380
White	7,317	4,806	23,331	2,417	1,661,874
Black	5,193	2,758	10,665	6,020	1,109,577
Native American	2	12	-	-	11,587
Asian	15	-	161	2	28,758
Hawaiian	-	-	-	-	993
Some Other race	20	28	2	111	6,743
Two or more races	163	99	288	73	51,848
Hispanic	8	2	463	83	95,643
White	-	1	305	43	40,115
Black	-	-	12	-	3,837
Native American	7	-	-	-	1,770
Asian	-	-	-	-	334
Hawaiian	-	-	-	-	136
Some Other race	1	1	11	40	31,310
Two or more races	-	-	135	-	18,141
Percent Minority*	**42.50%**	**37.60%**	**33.20%**	**72.20%**	**44.00%**

*includes Population Not Hispanic non white races and all Hispanic races					
Note: Red highlighted numbers represent Counties with Minority threshold being exceeded					
and are identified areas of EJ concern.					
Source: U.S. Census Bureau 2017-2021, ACS					

Table D-4-3 shows the percentage of people living below poverty for the Parish and counties in the ART study area. The EPA recommends using the state's low-income percentage to identify areas of EJ concern, which is 18.8 percent for Louisiana for year 2021 and 19.4 percent for Mississippi for 2021. Two parishes in Louisiana, Iberville and St. Helena, and all four of the counties in Mississippi meet or exceed the poverty threshold and are considered areas of EJ concern.

Table D-4-3. Places within Study Area, Percent of Population Living Below Poverty

Parish/County	Population for Whom Poverty Status is Known	% of Population Living Below Poverty
State of LA	4,531,545	18.80%
Ascension	124,142	9.80%
East Baton Rouge	445,909	17.70%
East Feliciana	16,459	13.90%
Iberville	27,421	18.90%
Livingston	139,802	10.70%
St. Helena	10,666	25.20%
St. James	20,189	12.00%
St. John the Baptist	42,088	14.90%
State of MS	2,874,132	19.40%
Amite County	12,622	30.80%
Franklin County	7,628	22.90%
Lincoln County	34,451	20.00%
Wilkinson County	7,536	21.40%
Note: Red Highlighted numbers indicate Parishes/Counties considered areas of EJ concern		
Source: U.S. Census Bureau 2017-2021 ACS		

However, there may be neighborhoods within these large parishes and counties that meet the criteria for an area of EJ concern and those that do not meet the criteria for being an area of EJ concern.

A more refined and zoomed in approach uses U.S. Census block groups, which are much smaller geographic areas compared to cities and towns. Census block groups are smaller geographic areas made up of Census blocks (the smallest geographic area for which U.S. Census data is available).

A closer look at the study area reveals pockets of neighborhoods with EJ concerns located in Census block groups within the larger parishes and counties, which are identified in Figure D-4-1. The colored polygons depict the U.S. Census Block groups in the study area that meet or exceed minority or low-income thresholds (or both) used to identify areas of EJ concern.

Just under 800,00 people live in the ATR study area, defined as the population in Louisiana and Mississippi block groups within or intersecting the ATR study area. The vast majority are in Louisiana. Just over 380,000 of the ART study area population live in areas of EJ concern.

About 150,000 residents live in EJ areas (green polygons) identified as meeting both minority and poverty criteria, roughly 160,000 are in EJ areas (yellow polygons) identified as meeting just the minority threshold, while the remainder, about 73,000 people, live in EJ areas (blue polygons) identified using the poverty criteria.

The Census block groups shown on Figure D4-4 represent the areas of EJ concern in the ART study area and are the focus of the EJ impacts assessment in Chapter 5 of the EA, which identifies adverse and beneficial effects from the Federal action.

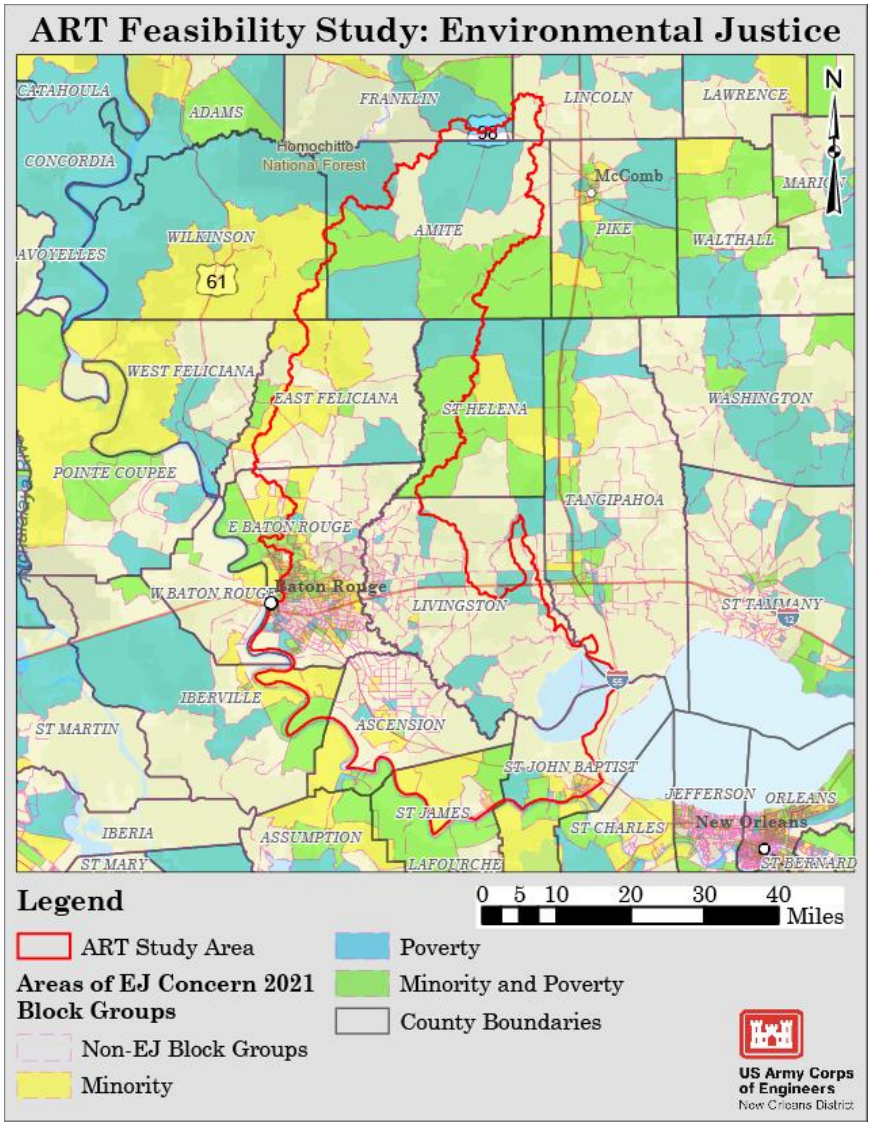

Figure D4-1. Areas of EJ concern at the Block Group Level, Study Area

Source: Steven Manson, Jonathan Schroeder, David Van Riper, Tracy Kugler, and Steven Ruggles. IPUMS National Historical Geographic Information System: Version 16.0 [dataset]. Minneapolis, MN: IPUMS. 2021. http://doi.org/10.18128/D050.V16.0

Demographic indicators are often used as proxies for a community's health status and potential susceptibility to pollution. Environmental and demographic data and indicators may be viewed separately or in combination. The EJ indexes presented in Table D-4-3 combines demographic data with environmental indicators and are presented as a percentile.

The EJSCREEN tool, developed by EPA, uses environmental indicators to help identify environmental risks to communities. EPA selected the following environmental indicators for use in the 2020 version of EJSCREEN:

1. Air pollution
   a. PM2.5 level in air.
   b. Ozone level in air.
   c. NATA air toxics:
      i. Diesel particulate matter level in air. Air toxics cancer risk.
      ii. Air toxics respiratory hazard index.
2. Traffic proximity and volume: Amount of vehicular traffic nearby, and distance from roads.
3. Lead paint indicator: Percentage of housing units built before 1960, as an indicator of potential exposure to lead.
4. Proximity to waste and hazardous chemical facilities or sites: Number of significant industrial facilities and/or hazardous waste sites nearby, and distance from those:
   d. National Priorities List (NPL) sites.
   e. Risk Management Plan (RMP) Facilities.
   f. Hazardous waste Treatment, Storage and Disposal Facilities (TSDFs).
5. Wastewater discharge indicator: Proximity to toxicity-weighted wastewater discharges

If an EJ area's exposure to the environmental indicators is above the 80^{th} percentile in the state or the nation and the Federal action exacerbates any of those environmental risks, a potential disproportionate impact may occur. Specifically, a disproportionate impact occurs when a proposed project impacts a much higher percentage of minority and low-income populations than other communities located within the project area or when the benefits and impacts are not evenly distributed between EJ and non-EJ communities. According to EPA, environmental indicators above the 80^{th} percentile in the state or nation indicate that one could expect environmental concerns.

The EJ study area includes parishes in Louisiana and counties in Mississippi, with the majority of the study area being in Louisiana. Environmental indicators for the ART study area are presented in Table D4-4. Five of the indexes are at or above the 80^{th} percentile as compared to Louisiana or the nation and include particulate matter, ozone, air toxics cancer risk, toxic releases to air, and wastewater discharge. Much of the construction activities associated with the tentatively selected plan will not exacerbate the five noted environmental concerns as identified by EPA's EJSCREEN tool. Nonetheless, best management practices will be used to avoid, reduce, and contain temporary impacts to human health and safety. For more information on air quality, refer to Section 5.3.1.8 of the EA.

Table D4-4, EJSCREEN Environmental Indicators, ART Study Area

SELECTED VARIABLES	VALUE	STATE AVERAGE	PERCENTILE IN STATE	USA AVERAGE	PERCENTILE IN USA
POLLUTION AND SOURCES					
Particulate Matter	9.22	8.62	81	8.08	78
Ozone (ppb)	61.7	59.8	88	61.6	55
Diesel Particulate Matter	0.281	0.247	68	0.261	64
Air Toxics Cancer Risk* (lifetime risk per million)	44	32	95	25	94
Air Toxics Respiratory	0.45	0.38	43	0.31	70
Toxic Releases to Air	49,000	15,000	93	4,600	98
Traffic Proximity	71	86	69	210	48
Lead Paint (% Pre-1960 Housing)	0.11	0.22	45	0.3	37
Superfund Proximity	0.073	0.076	72	0.13	56
RMP Facility Proximity	0.42	0.62	61	0.43	73
Hazardous Waste Proximity	1.2	1.1	66	1.9	64
Underground Storage Tanks	1.7	2.2	62	3.9	56
Wastew ater Discharge	1.2	49	94	22	92

Note: This report shows the values for environmental and demographic indicators and EJSCREEN indexes. It shows environmental and demographic raw data (e.g., the estimated concentration of ozone in the air), and also shows what percentile each raw data value represents. These percentiles provide perspective on how the selected block group or buffer area compares to the entire state, EPA region, or nation. For example, if a given location is at the 95th percentile nationwide, this means that only 5 percent of the US population has a higher block group value than the average person in the location being analyzed. The years for which the data are available, and the methods used, vary across these indicators. Important caveats and uncertainties apply to this screening-level information, so it is essential to understand the limitations on appropriate interpretations and applications of these indicators. Please see EJSCREEN documentation for discussion of these issues before using reports. For additional information, see: www.epa.gov/environmentaljustice

1.2.4 EJ Outreach and Meetings

EJ outreach meetings were conducted for the Amite River and Tributaries Feasibility Report Environmental Impact Statement on February 28, 2023, and March 1, 2023, to inform and engage residents about the flood risk reduction measures, which included the nonstructural plan.

Outreach efforts focused on civic and faith-based organizations that serve residents in areas of EJ concern, including local churches, libraries, nonprofits, and community center. Initial and follow-up calls were made to 29 churches, four community centers, three nonprofits, and three academic institutions. Of those contacted, six churches, two community centers, two nonprofits, and two academic institutions agreed to disseminate our one-page summary of the outreach effort to the residents of whom they serve. Twelve people attended the meetings, including Non-Governmental Organizations (NGOs), a professor from an academic institution and community members.

Several questions were asked by attendees and included the following:

- How will the dam impact nearby cemeteries in St. Helena Parish? (If there would be relocation)
- What kind of financial support would homeowners receive to participate in the nonstructural plan?
- Under a structural plan, does the Corps have to buy-out the homes of those living nearby?
- Does the widening and expansion of I-10 and I-12 effect/have anything to do with the proposed project?
- How does the dam impact migratory and endangered species?
- Clarification on the EJ maps, specifically the source of the data and what was being represented.
- Clarification about what kind of structures are included in ~4,000 structures to be impacted.

Questions related to the dam are no longer relevant since the dam is no longer considered a constructible alternative. More information is provided in the EJ assessment in the environmental assessment (EA) of the main report that details the out-of-pocket costs homeowners may be responsible and other implementation requirements to have their houses elevated and the possible programs and entities that may assist bridging the financial gap to participate in the elevation program. Finally, related to the last two bullets, the EJ report in the EA and in this appendix explains the sources of data and methods used to identify areas of EJ concern.

References and Resources

Project References

Couvillion, B.R. 2011. Land Area Change in Coastal Louisiana from 1932 to 2010. https://pubs.usgs.gov/sim/3164/downloads/SIM3164_Pamphlet.pdf

Couvillion, B.R. 2017. Land area change in coastal Louisiana (1932 to 2016). https://pubs.er.usgs.gov/publication/sim3381

Hieb, E.E. et al. 2017. Sighting demographics of the West Indian manatee Trichechus manatus in the north-central Gulf of Mexico supported by citizen-sourced data. *Endangered Species Research.*

Mississippi Valley Division,
Regional Planning and Environment Division South

Amite River and Tributaries East of the Mississippi River, Louisiana

Appendix E: Real Estate Plan

December 2023

CONTENTS

LIST OF FIGURES

ANNEX

Section 1
Purpose of Real Estate Plan

This Real Estate Plan (REP) is prepared in support of the Final Feasibility Study for the Amite River and Tributaries Study East of the Mississippi River Project. It sets forth the real estate requirements and costs for the implementation and construction of the Tentatively Selected Plan (TSP). The lands, easements, and rights-of-way required for the project are outlined in this REP, in accordance with the requirements of Engineering Regulation (ER) 405-1-12. The information contained herein is tentative and preliminary in nature, intended for planning purposes only, and is subject to change. This REP supersedes all prior draft REPs associated with the study.

1.1 PROJECT PURPOSE

The purpose of the Amite River and Tributaries (ART), East of the Mississippi River, Louisiana Feasibility Study (study) is to investigate flood risk solutions to reduce flood damages caused by rainfall in the Amite River Basin (ARB).

The non-Federal Sponsor (NFS) is the State of Louisiana, acting by and through, the Louisiana Department of Transportation and Development (LADOTD). A Feasibility Cost Share Agreement (FCSA) was executed between the Department of the Army and the NFS and executed on October 3, 2018.

An original Draft Integrated Feasibility Report and Environmental Impact Statement (DIFR/EIS) was released to the public on November 26, 2019. The TSP of the 2019 DIFR/EIS was the creation of a new large-scale dry dam with a nonstructural component. However, during review, extensive technical and policy concerns found the dam infeasible as designed. The Supplemental Second Draft Integrated Feasibility Study Report and Environmental Assessment (SSDIFR/EA) that this REP supports addresses the details of a revised TSP.

1.2 PROJECT LOCATION

The study area is the ARB and its tributaries. The ARB begins in southwest Mississippi and flows southward, crossing the state line into southeastern Louisiana. The ARB includes 2,200 square miles flowing into the Amite River and its tributaries (Figure E:1-1). It includes portions of Amite, Lincoln, Franklin, and Wilkinson Counties in Mississippi, as well as East Feliciana, St. Helena, East Baton Rouge, Livingston, Iberville, St. James, St. John the Baptist, and Ascension Parishes in Louisiana.

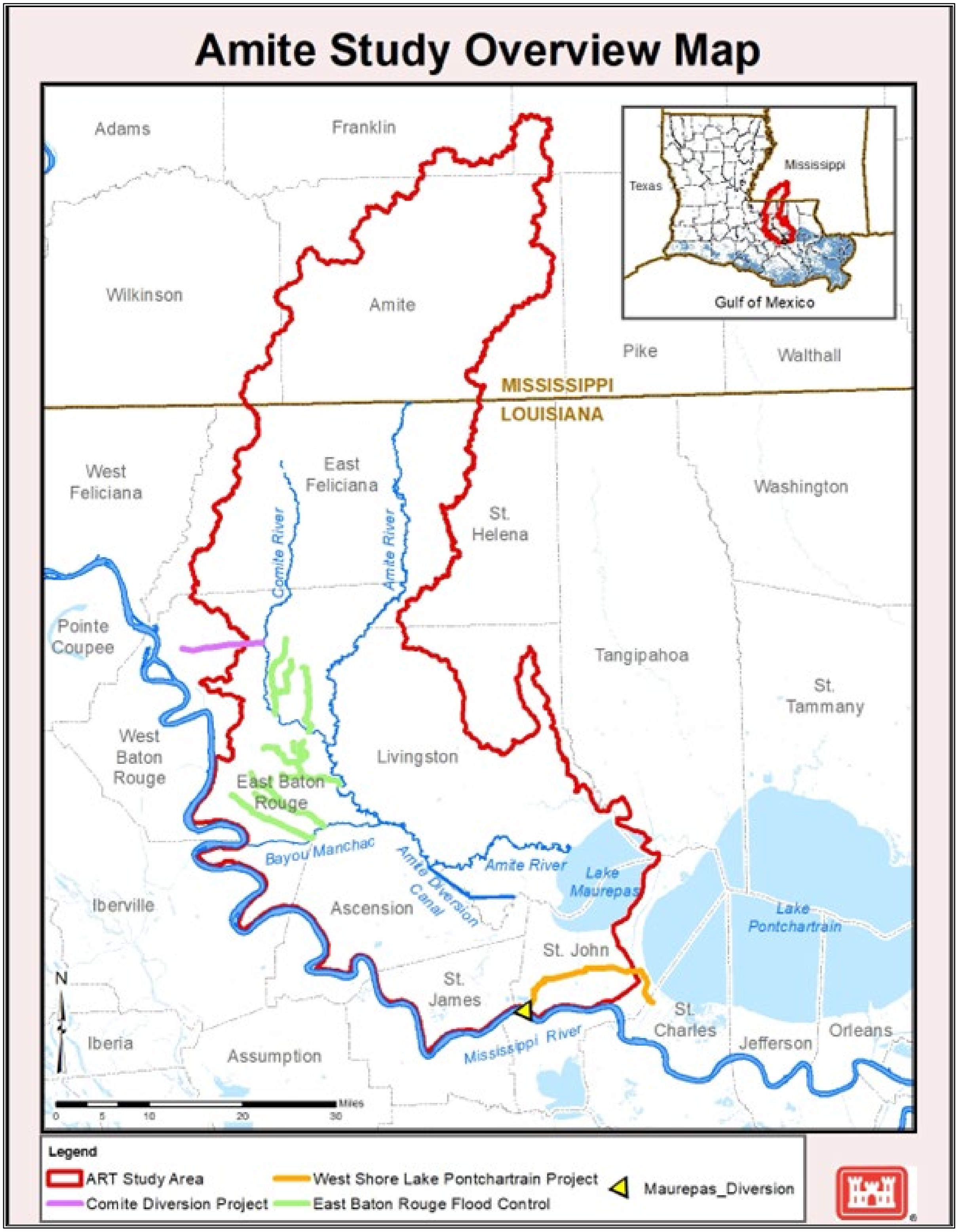

Figure E:1-1. Study Area

1.3 PROJECT AUTHORITY

The study is funded as a part of the Bipartisan Budget Act of 2018, H. R. 1892—13, Title IV, Corps of Engineers—Civil, Department of the Army, Investigations, where funds are being made available for the expenses related to the completion, or initiation and completion, of flood and storm damage reduction, including shore protection studies which are currently authorized or which are authorized after the date of enactment of this act, to reduce risk from future floods and hurricanes.

This study area is being included based on the August 2016 flooding over southeast and south-central Louisiana, and is continuing investigation under the authorization provided by the Resolution of the Committee on Public Works of the United States Senate, adopted on April 14, 1967:

> *RESOLVED BY THE COMMITTEE ON PUBLIC WORKS OF THE UNITED STATES SENATE, That the Board of Engineers for Rivers and Harbors, created under Section 3 of the River and Harbor Act approved June 13, 1902, be, and is hereby requested to review the report of the chief of Engineers on Amite River and Tributaries, Louisiana, published as House Document Numbered 419, Eighty-fourth Congress. And other pertinent reports, with a view to determining whether the existing project should be modified in any way at this time with particular reference to additional improvements for flood control and related purposes on Amite River, Bayou Manchac, and Comite River and their tributaries*. (US Senate Committee on Public Works, 1967).

Section 2

Description of the Plan and Lands, Easements, Rights-of-Way, Relocations, and Disposal (LERRD) Sites

The TSP consists of implementing nonstructural measures to reduce the risk of damages from flooding to residential and non-residential structures in the study area. The TSP involves elevations of residential structures and flood proofing of nonresidential structures. To preliminarily qualify for inclusion in the Nonstructural Plan, a structure must have a First Floor Elevation (FFE) at or below the applicable floodplain based on hydrologic conditions predicted to occur in 2026 (the beginning of the 50-year period of analysis). The FFE threshold varies by location throughout the parishes.

Nonstructural flood risk management measures are techniques for reducing accountable flood damage to existing structures within a floodplain. These techniques consist of treatments to floodproof non-residential structures or raise/elevate residential structures. Floodproofing consists of constructing or installing features designed to allow water to flow in and out of a structure but prevent the contact of water to essential utilities or mechanicals of the structure. Elevations involve raising the lowest finished floor of a residential structure to a height that is above the flood level. The entire foundation of the structure will be lifted and placed on a new foundation, i.e. columns, piers, posted or raised foundation walls; and all utilities and mechanical equipment, such as air conditioners and hot water heaters, will also be elevated.

The New Orleans District is presently pursuing a policy exception for the following USACE Policy: ER 1105-2-100 2-3(f)(1) stating: “The National Economic Development (NED) Plan. For all project purposes except ecosystem restoration, the alternative plan that reasonably maximizes net economic benefits consistent with protecting the Nation’s environment, the NED plan, shall be selected. The Assistant Secretary of the Army for Civil Works (ASA (CW)) may grant an exception when there are overriding reasons for selecting another plan based upon comprehensive benefits or other Federal, state, local, and international concerns.”

The TSP is presently Plan 4: Nonstructural Plan with additive for OSE (Other Social Effects) for positive and negative benefits because it provides flood risk reduction in terms of national economic development along with the added benefit of flood risk reduction to vulnerable and disadvantaged communities, maximizing the OSE account. While this plan is not the NED Plan, it provides the best level of comprehensive flood risk reduction to the ARB study area and is the Comprehensive Benefit Plan for this study. If the policy exception is not granted, the TSP will default to Plan 2: Nonstructural NED Plan.

Plan 4: Nonstructural Plan with additive for OSE for positive and negative net benefits

Plan 4 was developed by integrating into the NED plan all the additional SV sub aggregations with the next highest aggregation regardless of economic justification with residential structures considered for elevation and nonresidential structures considered for floodproofing. A total of approximately 3,298 structures in the study area met the requirement of having a First Floor Elevation (FFE) at or below the applicable floodplain. Of the approximate total of 3,298 structures, there are approximately 2,918 residential structures and 380 nonresidential structures. Property owner participation in the Nonstructural Plan is voluntary.

Plan 2: Nonstructural NED Plan

The initial Nonstructural NED plan involves the floodproofing or elevation of 3,117 structures located in the floodplain. Plan 2 would include the elevation of 2,748 residential structures and floodproofing of 369 nonresidential 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.

It is anticipated that implementation of the NS Plan will occur over an approximate 7-year period, with an estimated 500 structures to be elevated and/or floodproofed per year. However, the scale is highly dependent upon the number of structures receiving NS measures and the amount of funding allocated in any given year.

In order to be preliminarily eligible for inclusion in the Nonstructural Plan the follow criteria must be met:

1. The structure must have a first-floor elevation at or below the applicable floodplain (which may be either a 10, 25, or 50 year floodplain depending on the location of the structure), based on hydrologic conditions predicted to occur in 2026 (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, as defined herein.
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.

Detailed plans and specifications for implementing NS measures are still in development as of this writing and will be finalized as part of the Preconstruction Engineering and Design (PED) phase of the project. The PED phase occurs after Congress authorizes the Recommended Plan. Additional structure-specific analysis will be performed during PED to determine final eligibility and the most appropriate and cost-effective floodproofing measures to be employed including analysis of elevations and floodproofing alternatives. 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.

For elevations, foundations must be designed to properly address all loads and effects, be appropriately connected to the floor structure above, and utilities must be properly elevated. Elevations will not exceed 13 feet. If the required elevation is greater than 13 feet above ground level, the structure would still be eligible for elevation up to that height with the residual risk present. It is estimated than 99 percent of the structures BFE based on 2076 hydrology is below 13 feet. If after completion of the investigation of the property, USACE determines that the structure is eligible for elevation, the entire foundation of the structure will be lifted and placed on a new foundation (i.e., columns, piers, posted or raised foundation walls) so that the lowest habitable finished floor is at or above the 100-year BFE. All utilities and mechanical equipment, such as air conditioners and hot water heaters, will also be raised to or above this elevation. Property owners may choose to raise the structure, utilities, and/or mechanical equipment in excess of the BFE; however, costs attributable to elevations in excess of the minimum requirements set forth herein are not eligible and must be born solely by the property owner. Tenants of structures that will be elevated, who are temporarily displaced by the project implementation, are 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 (P.L. 91-646). Property owner/occupants of eligible residential structures who willingly participate in the residential elevation program are not considered displaced persons, and therefore, may not be entitled to receive relocation assistance benefits.

Dry floodproofing involves techniques applied to keep non-residential structures dry by sealing the structure to keep floodwaters out. In dry floodproofing, the portion of a structure that is below the BFE (walls and other exterior components) is sealed to make it watertight and substantially impermeable to floodwaters. Such watertight impervious membrane sealant systems can include wall coatings, waterproofing compounds, impermeable sheeting, and supplemental impermeable wall systems, such as cast-in-place concrete. Doors, windows, sewer and water lines, and vents are closed with permanent or removable shields or valves. Application of sealants and shields should involve a determination of the structural soundness of a building and its corresponding ability to resist flood and flood-related loads. An engineer should be involved in any design of dry floodproofing mitigation systems so that they can evaluate the building and run calculations to determine the appropriate height of dry floodproofing.

USACE and/or the NFS will engage in a public education campaign to inform property owners and any impacted renters of those properties of the nonstructural plan including, but not limited to eligibility criteria, the application process, responsibilities of property owners to clear title and remediate contaminated properties, and other key information about the project. USACE and/or the NFS shall prepare and distribute written materials such as project information pamphlets, letters of invitation to participate, and public meeting notices. In addition, USACE and/or the NFS will issue press releases, hold public meetings and workshops, make presentations to homeowner's associations and other civic groups and organizations, and utilize a variety of social media and other public relations methods to inform property owners and tenants of the project.

LER Requirements:

Residential property owners will be required to grant a temporary right-of-entry to USACE and the NFS to enter in and upon the property to conduct such property and structural investigations deemed necessary for USACE to determine final eligibility of the structure for participation in the project. These investigations may include structural inspections, surveys, limited environmental testing and site assessments, inspections to verify current elevation and determine elevation requirements, and to conduct other activities deemed necessary by USACE.

It is assumed that all eligible properties have legal access by way of public streets or existing public right of way (ROW). Further, it is assumed that residential and non-residential properties participating in the program will have adequate site area to accommodate the staging of required materials and equipment. For the purposes of this REP, the assumption is that no further real estate rights need to be acquired for access to the properties or staging. Should additional ROW be necessary, standard temporary work area or access easements could be acquired.

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. See Section 4, Estates, for additional discussion.

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.

Once construction funds are appropriated for this project, the LADOTD, as the NFS, and the Department of the Army will enter into a project partnership agreement (PPA). After the signing of a PPA, the NFS will acquire the necessary land, easements, and rights of way to construct the project. The NFS will be responsible for ensuring the requirements of the proposed project are met. Operation, maintenance, repair, rehabilitation, and replacement

(OMRR&R) will be limited to visual inspections and are not expected to require access to the property.

Since the report was prepared during a feasibility level study, the required real estate interests presented are preliminary estimates based only on existing, readily available Geographic Information System data. The LER requirements are subject to change with plan optimization during the PED phase when final plans, specifications, and detailed drawings are prepared. Additionally, the Plan is based on previous and on-going USACE projects and studies that contain a nonstructural component in the tentatively selected and recommended plans; however, the implementation of the Nonstructural Plan for this study may be modified when new USACE guidance is issued for the implementation of nonstructural plans and as the study progresses. Please see figure E:2-1 for a map depicting the location of Preliminary Eligible Structures for the TSP.

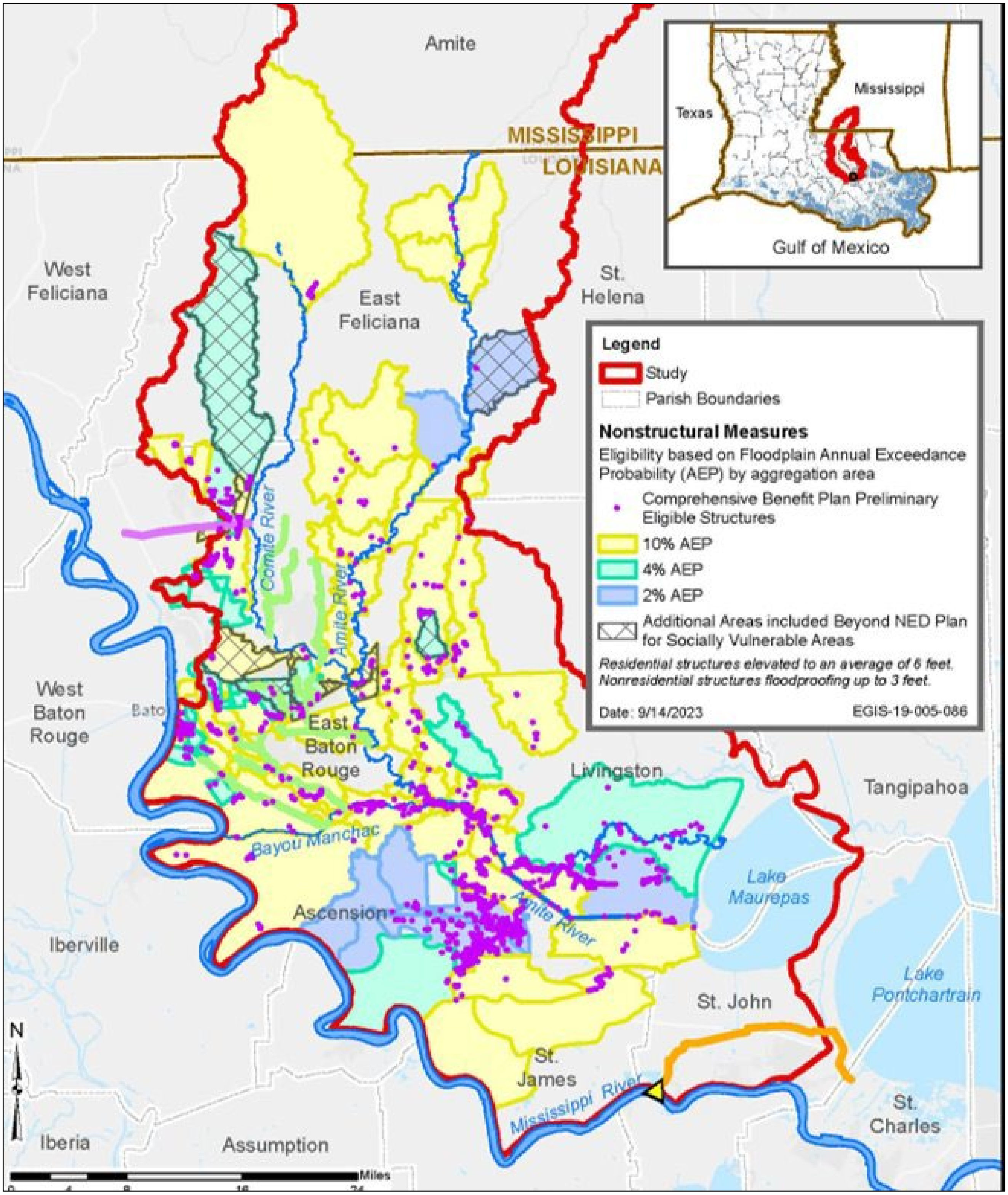

Figure E:2-1. Comprehensive Benefits Plan with Eligible Structures (TSP)

Section 3
Non-Federal Sponsor Owned LERRD

The non-Federal sponsor (NFS) is the Louisiana Department of Transportation and Development (LADOTD). It is assumed that the NFS sponsor does not own any of the LERRD required for the project.

Section 4
Estates

4.1 ESTATE TO BE ACQUIRED

Since there is currently no USACE-approved standard estate for a nonstructural measure, a non-standard permanent Restrictive Easement will be developed for the construction, operation, and maintenance of the nonstructural treatment. The easement will identify restrictions owners must take or abstain from to ensure the long-term performance of the nonstructural treatment, covenants that would run with the land, and to allow for future OMRR&R requirements. OMRR&R will be limited to visual inspections and is not expected to require access to the property. The draft easement language will be submitted through CEMVD to CEHQ-RE as a request for approval of a Non-Standard Estate.

Section 5
Existing Federal Projects within LERRD Required for the Project

Federal projects within the study area include:

- Bayou Manchac-Clearing and snagging on Bayou from mouth to below Ward Creek, mile 7.81;
- Comite River-Channel enlargement and realignment on Comite from its mouth to Cypress Bayou at mile 10;
- Blind River-Intermittent Clearing/snagging on Blind River below Lake Maurepas;
- Amite River-Enlargement/realignment between Bayou Manchac (35.75) to control weir at (25.3); intermittent clearing/snagging from mouth Comite (mile 54) to Bayou Manchac (35.75);
- Amite Diversion Channel-Construct weir and diversion 19 miles long from mile 25.3 on the Amite to mile 4.8 on the Blind River. Weir org. design 1,500' at sea level divided into 1,000 & 500' sections and then modified to include 5x20' boat way.

Two authorized USACE construction projects, Comite River Diversion and the East Baton Rouge Flood Control, are located in or adjacent to the study area and will impact the hydrology of the Amite River Basin when construction is completed. The impacts of these projects are being considered during the feasibility study and the Preconstruction Engineering & Design phase.

Section 6

Federally-Owned Lands within LERRD Required for the Project

None of the LER identified in the Tentatively Selected Plan is within or overlaps an existing Federal project.

Section 7
Federal Navigation Servitude

The navigation servitude is the dominant right of the Federal Government, under the Commerce Clause of the U.S. Constitution, to use, control, and regulate the navigable waters of the United States and submerged lands thereunder for various commerce-related purposes including navigation and flood control. In tidal areas, the servitude extends to all lands within the bed and banks of a navigable stream that lie below the ordinary high-water mark. There are no project elements proposed within such waters and the project serves no navigation purpose.

Section 8
Project Maps

Located throughout report

Section 9
Induced Flooding

The proposed project includes nonstructural solutions only and will not induce flooding in new areas or increase flooding in existing flood-prone areas.

Section 10
Baseline Cost Estimate

The Baseline Cost Estimate for Real Estate (BCERE) establishes the estimated financial costs that are attributed to the TSP's real estate requirements. It includes the LER acquisition costs, incidental acquisition costs (e.g., land surveys, appraisals, title work, relocation assistance benefits, coordination meetings, etc.), and a risk-based contingency. These estimates are preliminary and may be refined during PED.

The estimated total cost for Real Estate for Plan 4 is $111,779,000. 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 2,918 structures) and floodproofing (approximately 380 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). These costs, which include a contingency, are estimated to be approximately $34,400 per residential structure and $30,000 per non-residential structure. Costs of elevating and floodproofing the structures are construction costs and are not included as real estate costs.

The estimated total cost for Real Estate for Plan 2, if a waiver is not obtained, is $105,601,000. This plan would involve elevating approximately 2,748 structures and floodproofing approximately 369 structures.

Because nonstructural floodproofing measures are optional, and there will likely be a net benefit to the raised or floodproofed structure after the work is complete, landowners will not be compensated for the real property instruments required to be eligible for the project.

Because the estimated costs of the LERRDs required for the project do not exceed 10 percent of the estimated total project costs, a gross appraisal was not prepared for this project. LERRDs costs are based on cost estimates prepared by the MVN Appraisal & Planning Branch in September 2023.

Section 11
P.L. 91-646 Relocation Assistance Benefits

Public Law 91-646 provides uniform equitable treatment of persons and businesses displaced by a Federal or Federally assisted project. PL 91-646 and its implementing regulations at 49 CFR Part 24 (Uniform Act) requires the NFS to provide assistance and certain benefits to be paid to all persons and businesses that are displaced and must be relocated from their residence or place of business due to a Federally funded project.

Participation in a nonstructural plan is voluntary. Property owners who elect to participate are not considered displaced persons and are not eligible to receive relocation assistance benefits (per 49 C.F.R. Section 24.2.a(9)(ii) (E) and 49 C.F.R. Section 24.101(a)(2)). However, tenants who must temporarily relocate because property owners elect to participate may be eligible for relocation assistance benefits. It is unknown at this time how many tenant-occupied properties there are among those properties identified for elevation. Tenants who are required to relocate will be afforded relocation assistance benefits in accordance with Public Law 91-646 guidelines. Relocation assistance costs are included in the estimated BCERE provided in Section 10.

The TSP proposes flood-proofing of non-residential buildings. Public records indicate that most of these structures are occupied by one or more businesses. At this time, the floodproofing scope of work is not expected to interrupt business operations and no temporary business relocations of tenant business are expected.

Section 12
Mineral Activity/Timber/Crops

The Louisiana Department of Natural Resources provides a Strategic Online Natural Resources Information System (SONRIS), which contains up-to-date information on oil & gas activity in the State of Louisiana. Review of this information indicated that there are oil and gas wells within the project area, but there does not appear to be any present or anticipated mining and drilling activity that may affect project purposes and the operation thereof. There are no known present or anticipated timber harvesting activities within the LER required for the TSP.

Section 13
Non-Federal Sponsor Capability Assessment

The project requires the acquisition of non-standard estates for the nonstructural measures. These estates must be approved by USACE-HQ prior to any NFS acquisitions.

A Capability Assessment will be completed and included as an appendix to the REP before the final REP is prepared. Based on prior USACE projects, Louisiana Department of Transportation and Development is expected to be fully capable of acquiring and providing lands, easements and rights-of-way for the construction and operation and maintenance of the project.

The NFS is aware of Public Law 91-646 requirements and the requirements for documenting expenses for credit purposes.

If the Recommended Plan is authorized for construction, funded, and implemented, the NFS will be required to execute a PPA with the Department of the Army. The PPA shall outline the items of local cooperation required of the NFS. The PPA requires, among other things, that the NFS provide all real property interests (LERRDs) required for construction, operation, and maintenance of the project. The NFS must also 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.

Section 14
Zoning Ordinances

No zoning ordinances are proposed in lieu of, or to facilitate, acquisition in connection with the project. The nonstructural measures are voluntary in nature and would be available only to existing eligible structures as defined within the TSP. During PED, planning and zoning regulations would be further reviewed, and discussions would be conducted with the NFS regarding the development and adoption of land use regulations for future activities within the project area to prevent future flood losses to life and real property. The NFS will be required to coordinate these matters with the local planning commissions.

Section 15
Acquisition Schedule

The nonstructural measures include residential elevations and flood proofing of non-residential structures. Such work would require execution of an agreement between the landowner and the NFS. In addition, the following administrative functions, among others, would be required: title research, HTRW analysis, and structural condition analysis, and additional property inspections to determine eligibility. Temporary rights of entry would have to be obtained from the owners in order to perform some of these administrative duties.

Tasks shown below would likely vary by property. Considering the vast number of structures estimated to be eligible for the nonstructural plan, 7 years is estimated as the overall anticipated implementation time required for the total number of structures. This estimate assumes an overlap of the required tasks and this time frame is dependent upon a finalized nonstructural implementation plan, the availability of contractors to perform the elevations and floodproofing measures, and assumes that project funding will be available every year. This estimated schedule is expected to be refined as more information becomes available during PED and implementation of the authorized project. Refer to Appendix I of the SSDIFR/EA for a more detailed discussion of the nonstructural implementation plan.

Estimated Schedule per structure:

Obtain Right-of-Entry for Investigations (To Determine Eligibility)	1 month
Title research/ Review of Title	1 month
Preliminary Investigations (i.e. HTRW, structural, surveys, etc.)	2-3 months
Execution of agreement b/w landowner & NFS & curative docs	3 months
Filing Agreement between landowner & NFS	1 month
Relocation of Displaced Tenants	1 month
Residential elevation or non-residential floodproofing	2 months

Section 16
Facility/Utility Relocations

There are no utility or facility relocations anticipated or currently required within the proposed project footprint.

ANY CONCLUSION OR CATEGORIZATION CONTAINED IN THIS REPORT THAT AN ITEM IS A UTILITY OR FACILITY RELOCATION IS PRELIMINARY ONLY. THE GOVERNMENT WILL MAKE A FINAL DETERMINATION OF THE RELOCATIONS NECESSARY FOR THE CONSTRUCTION, OPERATION OR MAINTENANCE OF THE PROJECT AFTER FURTHER ANALYSIS AND COMPLETION AND APPROVAL OF FINAL ATTORNEY'S OPINIONS OF COMPENSABILITY FOR EACH OF THE IMPACTED UTILITIES AND FACILITIES.

Section 17
HTRW and Other Environmental Considerations

Investigations will be conducted during the PED Phase to identify the presence of HTRW such as lead paint, friable asbestos and asbestos-containing materials. If any HTRW is identified and the property owner elects to participate in the project, the property owner shall be obligated, at its sole cost and expense, to conduct all necessary response and remedial activities in full compliance with all applicable local, state, and federal regulations and provide proof of same before the nonstructural treatment is performed on their property. No environmental impacts were considered in the LER estimate.

Section 18
Landowner Attitude

Generally, there is local support for a project that reduces flood risk and damage. There is no anticipated opposition for the TSP since it consists of a nonstructural plan that is 100 percent voluntary.

Section 19
Risk Notification

A risk notification letter has not been sent to the NFS. The NFS will be notified in writing about the risks associated with acquiring real property rights before the execution of the Project Partnership Agreement and the Government's formal notice to proceed with acquisition. This will be sent prior to the final report.

Section 20
Other Real Estate Issues

It is not anticipated that there will be any other real estate issues for this project.

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Amite River and Tributaries Study East of the Mississippi River, Louisiana

Appendix F: Plan Formulation

December 2023

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Section 1
Introduction

This appendix supplements the information in Section 4 of the main report and includes tables and maps used in the development, screening, and evaluation of management measures and alternative plans. The ART goals, objectives, and constraints are identified in Section 2 of the main report. They are included here as a point of reference for screening purposes (Table F-1).

Table F-1 – Objectives and Constraints

OBJECTIVES	CONSTRAINTS
Reduce risk to human life from flooding.	Avoid induced development, to the maximum extent practicable, which contributes to increased life safety risk.
Reduce rainfall flood damages in the ARB to industrial, commercial, agricultural facilities, and residential and nonresidential structures.	None
Reduce interruption to the nation's transportation corridors in particularly the I-10/I-12 infrastructure.	None
Reduce risks to critical infrastructure (e.g. medical centers, schools, transportation etc.).	None

Additionally, several planning considerations were identified for plan formulation that would not require the removal of an alternative plan, but were assessed as part of the plan formulation process:

- Avoid or minimize negative impacts to:
  - threatened and endangered species and protected species;
  - critical habitat, e.g., threatened and endangered species (T&E);
  - water quality;
  - cultural, historic, and Tribal resources;
  - recreation use in the basin.
- Recognition/awareness that reaches of the Amite and Comite Rivers are Scenic Rivers, which may require legislative changes in order to implement alternatives.
- Consistency with local floodplain management plans by not inducing flooding in other areas.

Section 2
Management Measures

Measures considered for this study are discussed in Section 4, Sub-section 4.1. This section provides additional information about those measures that were evaluated and removed from further consideration during the planning process. Due to the large size of the study area, for presentation and discussion purposes, the ARB was divided into three areas that have distinct geomorphology: the Upper Basin, Central Basin, and Lower Basin (Figures F-1 through F-3).

The ARB primarily has flooding from two different sources. The upper basin flooding is caused from headwater flooding from rainfall events. The lower basin flooding is caused by a combination of drainage from headwaters and backwater flooding from tides, wind setup, and flooding from tropical storm events. Thirty-four nonstructural and structural management measures of a variety of scales were identified for evaluation to reduce the risk of flood damages within the ARB (Table F-2).

The management measures use one or more combinations of Concept/Formulation Strategy for Flood Risk Management (FRM) as follows:

- Remove Water (RW) = Removing water more quickly out of the basin
- Hold Water (HW) = During heavy rainfall events water would be held back from flowing down the basin until water levels drop to reduce the flood risk.
- Nonstructural (NS) = does not modify or restrict the natural flood
- Upper and Lower Basin (UL) = Alternative that likely results in reduced flood risk for the entire basin.
- Focused Structural (FS) = Focused Structural measures to protect critical Facilities

2.1 NONSTRUCTURAL MEASURES

Nonstructural measures (NS) reduce the human exposure or vulnerability to a flood hazard without altering the nature or extent of the flood hazard. Nonstructural alternatives could be used in conjunction with any of the structural flood mitigation alternatives to optimize the cost/benefit ratio.

- Nonphysical (NS-1): Consists of flood warning system/evacuation plans. While adequate land use and floodplain management development regulations already exist, it warranted further evaluation.
- Physical NS (NS-2): Consists of property acquisition and relocation assistance, elevation, and/or flood proofing of structures.

2.2 STRUCTURAL MEASURES

Structural measures are those that are physical modifications designed to reduce the frequency of damaging levels of flood inundation. Retention structures are large, regional, below grade structures, designed to attenuate flood peaks and release downstream at non-damaging flow rates. The following features are being considered:

- .01 Annual Exceedance Probability (AEP) dry dams along smaller Amite River Tributaries north of I-12 and/or below I-12 (HW-1).
- Large and small scale dams in the upper portion of the ARB (HW-2 and UL-1).
- Storage Area at Spanish Lake Basin (RW-7)
- Reservoirs along Bayou Manchac (HW-3)
- Diversion Structures: Diversion structure(s) located in the lower portions of the ARB that can divert flow to the Mississippi River. Gravity Fed and Pump diversions were considered as well as modifications to the Comite and Amite Rivers diversions that are presently in place RW-10 through RW-16)
- Channelization: There are numerous possible variations of this measure, including dredging channelization segments in specific downstream reaches of the river combined with upstream detention (RW-1 through RW-4, RW-18 through RW-20, and UL-2)
- Ring Levees: Ring levees, or similar, could be constructed to protect communities and other significant structures and/or lands (FS-1).
- Drainage Improvements: Numerous possibilities such as a combination of contoured swales or road cuts with traditional drainage infrastructure (culverts, catch basins, flow control structures and slotted pipe) to regulate the flow and discharge of storm water south of French Settlement (RW-17 and HW-5).
- Bridge improvements: Change in design to bridges where applicable to reduce the restriction of the flow of the Amite River and tributaries (RW-5, RW-8, RW-9).
- Dredging of Lakes: Increase the depth of the Lake Maurepas and University Lakes to increase the hold capacity of the lakes during extreme rainfall events and tide/wind backwater flooding for Lake Maurepas (RW-22 and HW-7).
- Channel Bank Gapping: Select cuts into the banks of the Amite River and Tributaries (RW-6 and RW-21).
- Levee System: A system of multiple earthen embankment, floodwall, or similar structures along a water course (RW-23).
- Floodgate: Closure of tidal pass at Lake Maurepas/Lake Pontchartrain or Hwy 61 at Blind River to reduce backwater flooding caused by tides and wind driven flooding (HW-4 and HW-6).

2.3 SCREENING CRITERIA

The screening criteria were derived for the specific planning study using planning objectives, constraints, and considerations and opportunities of the project area.

Due to the limited ability to generate new data prior to the Alternatives Milestone, metrics relied principally upon existing data and professional judgment.

2.4 SCREENING OF MEASURES

Each measure was qualitatively assessed using a 4-point scale on whether it met the objective(s) or avoids constraints and considerations as discussed in Section 1 by using the following criteria: Exceeds (++), Meets (+), No Change (n), or Decreases (-) (Table F-2). After evaluating, the USACE formed Project Delivery Team (PDT) consisting of USACE members, the non-Federal sponsor and other interested state and Federal agencies, reviewed the results to reevaluate the highest scoring alternatives should be retained. In some cases, some of the higher scoring management measures were screened out.

The scoring results were compiled and averaged and 19 measures were carried forward for alternative development. Below is a general discussion of those measures that were screened, which were limited to structural.

2.4.1 Diversion Structures (RW-10, RW-11 and RW-13 thru RW-16)

The Mississippi River at the proposed locations (RW-11, RW-13, and RW-15) has a much higher elevation in comparison to the adjacent Amite River and tributaries. A negative flow would not be achievable by gravity fed means; therefore, the gravity fed diversions to the Mississippi River were screened out. The Bayou Conway (RW-10), Romeville (RW-14), and Union (RW-16) locations, proposed for a pump at the Mississippi River with a diversion, were screened, but Bayou Manchac (RW-12) was carried forward due to the complexity of the area and potential benefits. The pump stations would have a limited radius of influence, the cost would be very significant due to the head losses associated with the pump distances needed, and there would be limited opportunities to place a diversion due to large, developed areas under forced drainage systems.

2.4.2 Channelization (RW-18 thru RW-20)

Dredging the outfall at Blind River (RW-18), the Lower Blind River (RW-19), and Colyell Creek (RW-20) were screened out in part due to limited benefits. Based on the LADOTD 2018 Report on Investigation into the Potential Hydraulic Impacts of Dredging the Lower Amite River, dredging near the mouth of Lake Maurepas would result in negligible amounts of water surface elevation reduction due to the flood elevations being controlled by the Lake and influenced by tides. Colyell Creek has also limited benefits due to the low density of structures along the creek.

2.4.3 Drainage Improvements (RW-17 and HW-5)

Modifications to Comite Diversion (RW-17) was screened out. The Comite Diversion project is currently in pre-engineering construction and design under the Bipartisan Budget Act of 2018. Dry Retention Ponds along the Lower Amite River (HW-5) was screened in part because the geomorphology of the Lower Amite is extremely flat, which prevents the use of dry retention ponds to be feasible in the area below I-12.

2.4.4 Channel Bank Gapping (RW-21)

Select cuts of the bank of the Amite River at the Amite River Diversion (RW-21) was screened out in part because it would have very limited FRM benefits and would only likely affect stages directly on the Amite River diversion channel. It would also potentially impact backwater areas. Channel bank gaping along the Amite River was carried forward as an alternative for further evaluation (RW-6).

2.4.5 Dredging of Lakes (RW-22)

Increasing the depth of the Lake Maurepas (RW-22) by dredging was screened for several reasons including: limited benefits and significant impacts to the Lake Maurepas ecosystem. Additionally, overtime the measure could be ineffective with relative sea level rise since it is hydrologically connected to Lake Pontchartrain. Dredging of University Lakes was carried forward as an alternative for further evaluation (HW-7).

2.4.6 Levee System (RW-23)

A system of multiple earthen embankment, floodwall, or similar structures along a water course whose purpose is flood risk reduction or water conveyance constructed to reduce flooding risk to communities and other significant structures and/or lands. A levee system was screened due to geotechnical constraints and flood inducement. A large levee system would have a larger footprint and a greater potential to encounter local geotechnical constraints. (i.e. subsidence, fissures). There are also few locations along the ART that have high ground points to tie in levees which would result in most communities requiring ring levees, which would increase the life safety risk since there would be no direct access to higher ground if the levee failed. Also, levees along the Amite River in highly density population areas would cause a larger peak discharge in downstream portions which would result in induced flooding.

2.4.7 Floodgates (HW-4 and HW-6)

Floodgates at Hwy 61 at Blind River (HW-4) were screened out in part because the measure would require significant improvements to other infrastructure to make it work and there would be limited benefits. Lake Maurepas/Lake Pontchartrain (HW-6) was screened in part due to limited benefits, significant impacts to the Lake Maurepas ecosystem, and historically, there has been significant public opposition to closing off the passes.

Table F-2 – Management Measures

		Exceeds (++), Meets (+), No Change (n), or Decreases (-) the Objective NA were used for Measures that were strictly NER Measures				Avoids Constraint/Considerations High (++), Medium (+), Low to no issue or not applicable (n), or Conflicts (-) with the Constraint/Consideration							
		Obj1	**Obj2**	**Obj3**	**Obj4**	**Con1**	**Con2**	**Con3**	**Con4**	**Con5**	**Con6**	**Con7**	**Con8**
Measure ID	**Description**	**Reduce flood damages from rainfall**	**Reduce risk to human life from flooding events**	**Reduce interruption to the nation's transportation corridors**	**Reduce risks to critical infrastructure (e.g. medical centers, schools, transportation etc.);**	**T&E**	**Critical Habitat**	**Cultural**	**Water Quality**	**Scenic Rivers**	**Local Flood Management Plans**	**BBA Authorization limits**	**Not to induce development within flood plain**
RW-1	Dredging of Outfall @ Amite River	+	n	n	n	n	n	-	+	-	n	+	n
RW-2	Dredging of Lower Amite River	+	n	n	n	n	n	-	+	-	n	+	n
RW-3	Dredging of Upper Amite River	+	n	-	n	n	n	-	n	-	n	+	n
RW-4	Dredging of Bayou Manchac	+	n	++	+	n	n	-	n	-	n	+	n
RW-5	Bridge Restrictions/ Improvements for I-12	+	n	+	+	n	n	-	+	-	n	+	n
RW-6	Amite River Channel Bank Gapping	+	n	n	+	n	n	-	+	+	+	+	n

		Exceeds (++), Meets (+), No Change (n), or Decreases (-) the Objective NA were used for Measures that were strictly NER Measures				Avoids Constraint/Considerations High (++), Medium (+), Low to no issue or not applicable (n), or Conflicts (-) with the Constraint/Consideration							
		Obj1	**Obj2**	**Obj3**	**Obj4**	**Con1**	**Con2**	**Con3**	**Con4**	**Con5**	**Con6**	**Con7**	**Con8**
Measure ID	**Description**	**Reduce flood damages from rainfall**	**Reduce risk to human life from flooding events**	**Reduce interruption to the nation's transportation corridors**	**Reduce risks to critical infrastructure (e.g. medical centers, schools, transportation etc.);**	**T&E**	**Critical Habitat**	**Cultural**	**Water Quality**	**Scenic Rivers**	**Local Flood Manag-ement Plans**	**BBA Author-ization limits**	**Not to induce develop-ment within flood plain**
RW-7	Storage Area at Spanish Lake, Ascension/Iberville Parish	+	n	+	+	-	-	-	-	+	-	+	+
RW-8	Hwy 22 and Port Vincent Bridge Drainage Improvements	+	n	n	n	-	-	n	+	+	+	-	+
RW-9	Upper Amite Bridge Restrictions/ Improvements	+	n	+	+	n	n	-	+	-	n	+	n
RW-10	Bayou Conway Pump to Mississippi River	+	n	+	+	n	-	-	n	+	n	n	+
RW-11	Diversion Gravity Fed (Manchac)	+	n	+	+	n	-	-	n	-	n	+	+
RW-12	Diversion Pump Station (Manchac)	+	n	+	+	n	-	-	n	-	n	+	+

		Exceeds (++), Meets (+), No Change (n), or Decreases (-) the Objective NA were used for Measures that were strictly NER Measures				Avoids Constraint/Considerations High (++), Medium (+), Low to no issue or not applicable (n), or Conflicts (-) with the Constraint/Consideration							
		Obj1	**Obj2**	**Obj3**	**Obj4**	**Con1**	**Con2**	**Con3**	**Con4**	**Con5**	**Con6**	**Con7**	**Con8**
Measure ID	**Description**	**Reduce flood damages from rainfall**	**Reduce risk to human life from flooding events**	**Reduce interruption to the nation's transportati on corridors**	**Reduce risks to critical infrastructure (e.g. medical centers, schools, transportatio n etc.);**	**T&E**	**Critical Habitat**	**Cultural**	**Water Quality**	**Scenic Rivers**	**Local Flood Manag-ement Plans**	**BBA Author-ization limits**	**Not to induce develop-ment within flood plain**
RW-13	Diversion Gravity Fed (Union)	+	n	n	n	n	-	n	n	+	n	n	+
RW-14	Diversion Pump Station (Union) with conveyance channel	+	n	n	n	n	-	n	n	+	n	n	+
RW-15	Diversion Gravity Fed (Romeville)	+	n	n	n	n	-	n	n	+	n	n	+
RW-16	Diversion Pump Station (Romeville) with conveyance channel	+	n	n	n	n	-	n	n	+	n	n	+
RW-17	Modifications to Comite Diversion	+	n	n	n	n	n	-	n	-	n	-	n
RW-18	Dredging of Outfall @ Blind River	+	n	n	n	n	n	-	+	-	n	+	n

		Exceeds (++), Meets (+), No Change (n), or Decreases (-) the Objective NA were used for Measures that were strictly NER Measures				Avoids Constraint/Considerations High (++), Medium (+), Low to no issue or not applicable (n), or Conflicts (-) with the Constraint/Consideration							
		Obj1	Obj2	Obj3	Obj4	Con1	Con2	Con3	Con4	Con5	Con6	Con7	Con8
Measure ID	**Description**	**Reduce flood damages from rainfall**	**Reduce risk to human life from flooding events**	**Reduce interruption to the nation's transportati on corridors**	**Reduce risks to critical infrastructure (e.g. medical centers, schools, transportatio n etc.);**	**T&E**	**Critical Habitat**	**Cultural**	**Water Quality**	**Scenic Rivers**	**Local Flood Manag-ement Plans**	**BBA Author-ization limits**	**Not to induce develop-ment within flood plain**
RW-19	Dredging of Lower Blind River	+	n	n	n	n	n	-	+	-	n	+	n
RW-20	Dredging of Colyell Creek	n	n	n	n	-	-	-	-	-	n	+	n
RW-21	Amite River Diversion Channel Bank Gapping	n	n	n	n	n	n	n	+	+	+	n	n
RW-22	Dredging of Lake Maurepas	n	n	n	n	-	-	-	-	-	n	+	n
RW-23	Levees System	n	-	+	+	n	n	-	-	-	n	+	-
HW-1	.01 AEP Dry Dams-Upper Amite Tributaries	+	n	+	+	n	n	n	+	n	n	+	n
HW-2	Small Dry Dams on Amite River - Upper Amite	++	+	+	+	n	n	-	+	-	+	+	n
HW-3	Reservoirs along Bayou Manchac	+	n	+	+	n	n	-	n	-	n	n	n

		Exceeds (++), Meets (+), No Change (n), or Decreases (-) the Objective NA were used for Measures that were strictly NER Measures				Avoids Constraint/Considerations High (++), Medium (+), Low to no issue or not applicable (n), or Conflicts (-) with the Constraint/Consideration							
		Obj1	Obj2	Obj3	Obj4	Con1	Con2	Con3	Con4	Con5	Con6	Con7	Con8
Measure ID	**Description**	**Reduce flood damages from rainfall**	**Reduce risk to human life from flooding events**	**Reduce interruption to the nation's transportation corridors**	**Reduce risks to critical infrastructure (e.g. medical centers, schools, transportation etc.);**	**T&E**	**Critical Habitat**	**Cultural**	**Water Quality**	**Scenic Rivers**	**Local Flood Manag-ement Plans**	**BBA Author-ization limits**	**Not to induce develop-ment within flood plain**
HW-4	Flood Gate at Blind River Hwy 61	+	n	n	+	-	n	n	n	-	n	n	n
HW-5	Dry Retention Ponds- Lower Amite	+	n	n	n	-	n	-	n	n	n	n	n
HW-6	Closures at Tidal Passes	+	n	n	+	-	-	n	-	n	n	-	n
HW-7	University Lakes as Reservoir	+	n	n	n	n	n	n	n	n	++	+	n
UL-1	Large Scale .04 AEP Dam -Upper Amite (i.e. Darlington)	++	n	++	++	-	-	-	n	-	+	++	n
NS-1	Flood warning/Monitoring systems	n	++	+	n	n	n	n	n	n	n	n	n
UL-2	Dredging of Amite River Tributaries	+	+	+	+	n	n	-	n	-	n	+	n

		Exceeds (++), Meets (+), No Change (n), or Decreases (-) the Objective NA were used for Measures that were strictly NER Measures				Avoids Constraint/Considerations High (++), Medium (+), Low to no issue or not applicable (n), or Conflicts (-) with the Constraint/Consideration							
		Obj1	**Obj2**	**Obj3**	**Obj4**	**Con1**	**Con2**	**Con3**	**Con4**	**Con5**	**Con6**	**Con7**	**Con8**
Measure ID	**Description**	**Reduce flood damages from rainfall**	**Reduce risk to human life from flooding events**	**Reduce interruption to the nation's transportati on corridors**	**Reduce risks to critical infrastructure (e.g. medical centers, schools, transportatio n etc.);**	**T&E**	**Critical Habitat**	**Cultural**	**Water Quality**	**Scenic Rivers**	**Local Flood Manag-ement Plans**	**BBA Author-ization limits**	**Not to induce develop-ment within flood plain**
NS-2	Nonstructural Improvements for high frequency events	+	+	n	n	n	n	n	n	n	n	+	n
FS-1	Ring Levees around Critical Facilities	+	+	n	+	n	n	-	n	n	n	+	n

Note: Shaded cells are measures that were not carried forward during the screening process.
NA = Not Applicable

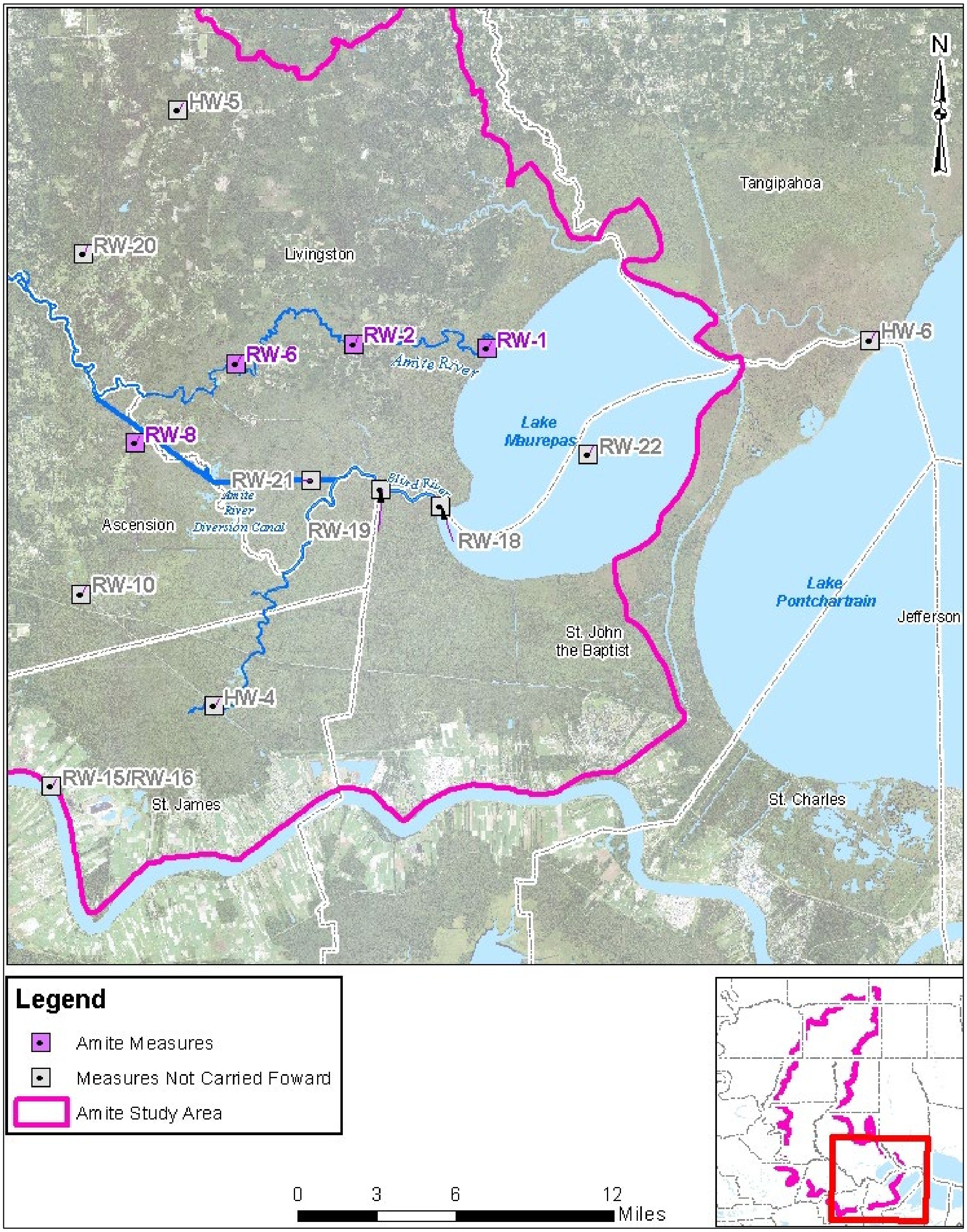

Figure F-1 – Management Measures Located in the Lower ARB

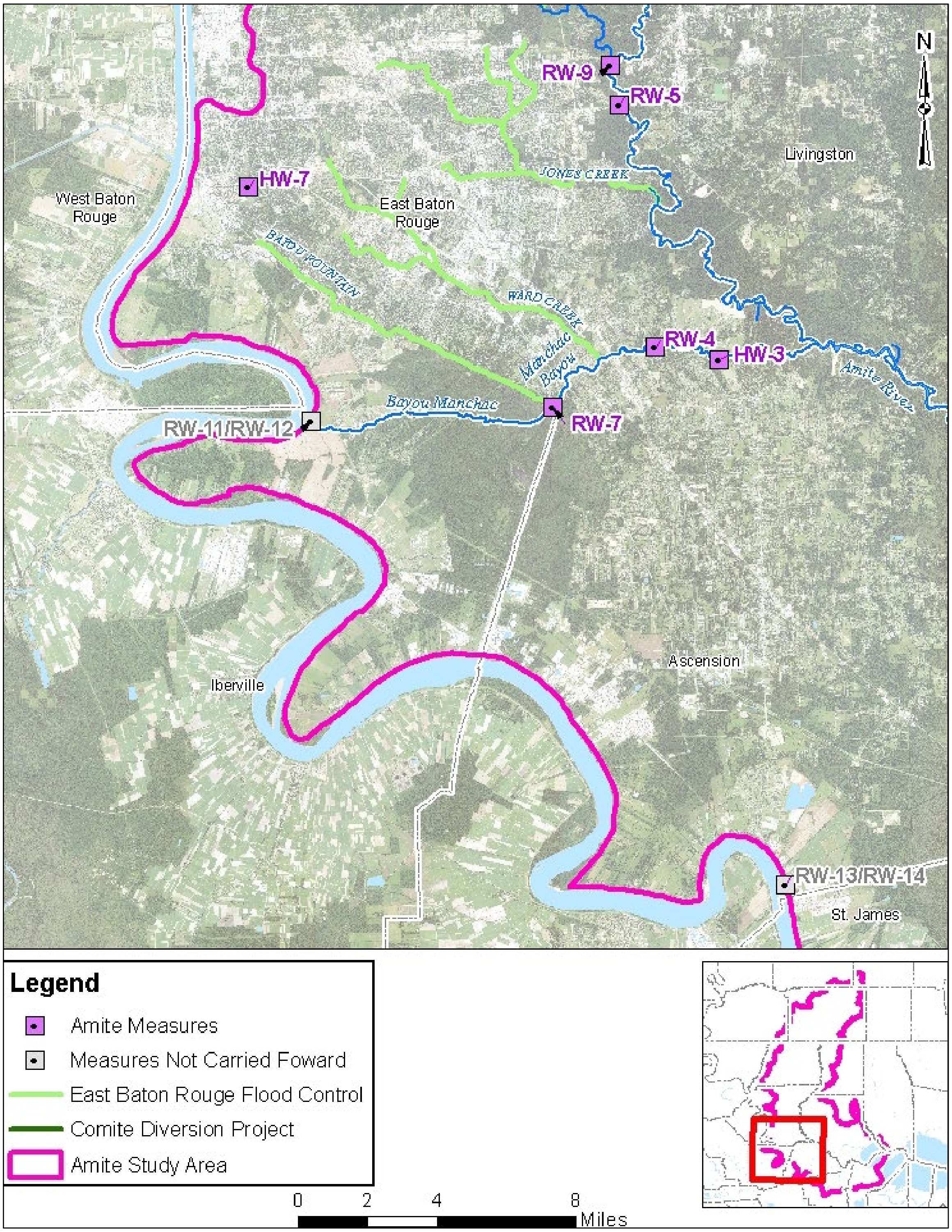

Figure F-2 – Management Measures Located in the Central ARB

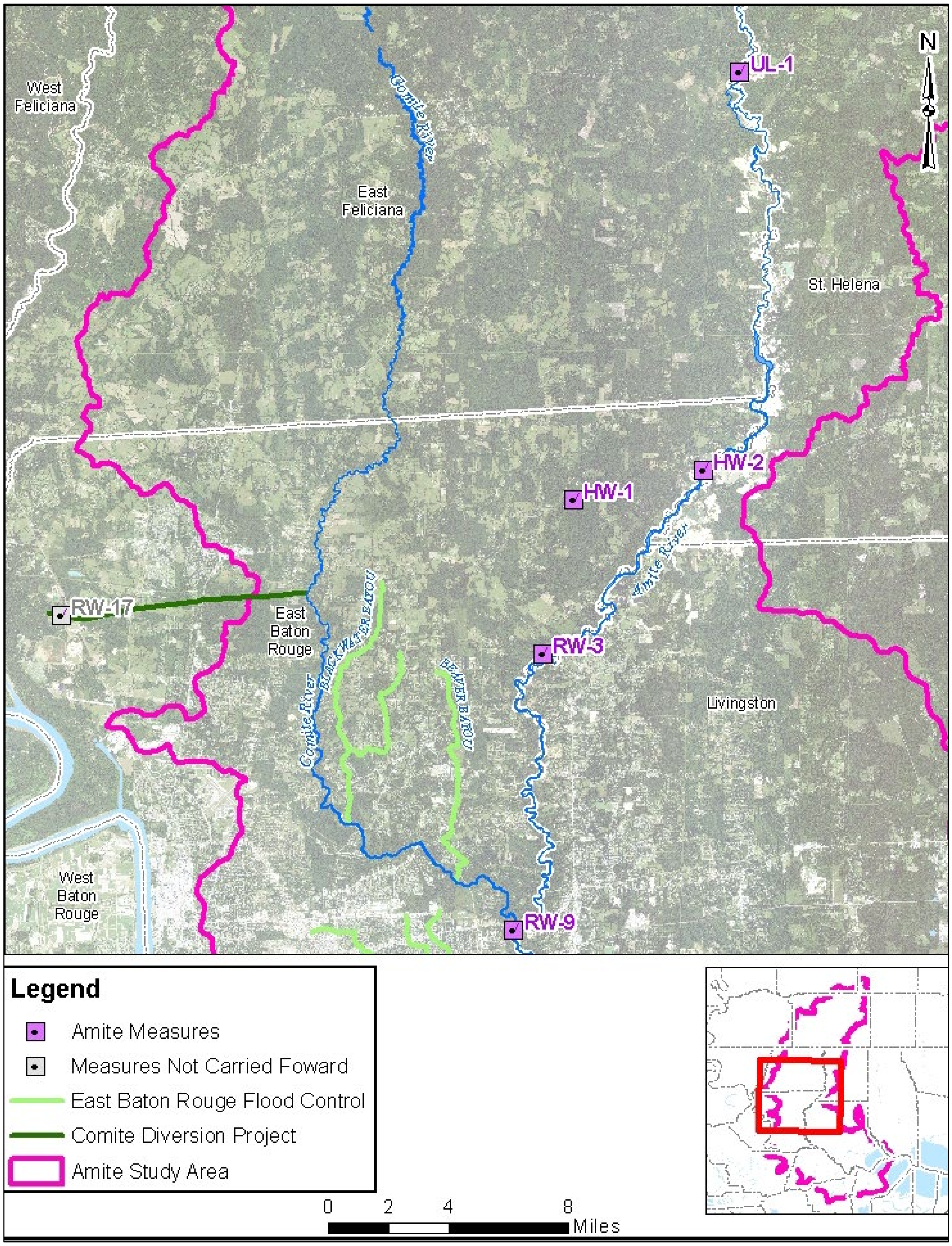

Figure F-3 – Management Measures Located in the Upper ARB

Section 3

Initial Array of Alternatives

3.1 DEVELOPMENT OF INITIAL ARRAY OF ALTERNATIVE

Fifteen alternatives were assembled through the plan formulation process. Thirteen alternative plans were initially identified using one or more of the 19 management measures that were carried forward after the screening process. Two additional alternatives (Alternatives 14 and 15) were identified through public scoping, as discussed in Section 2.4 of the main report. Similarly, to the development of management measures, for presentation and discussion purposes, the ARB was divided into areas of hydraulic influence as follows:

- Lower Basin
- Central Basin
- Upper Basin
- Upper and Lower Basin

NEPA regulations (40 CFR 1502.14(d)) requires that a No Action plan be considered as a viable alternative in the final array of plans. It represents future conditions that will likely occur if USACE takes no action. The No Action plan is included as Alternative 1. In accordance with Section 73 of the Water Resources Development Act of 1974, a minimum of one primarily nonstructural plan must be considered; therefore, Alternative 13 for nonstructural is included.

3.1.1 Influence Area Lower Basin

Three alternatives were identified with an influence area of the lower ARB near Lake Maurepas that use the strategy of removing water out of the basin more quickly than baseline conditions (Figure F-1). The alternatives could be combined into several different combinations, but they focus on dredging (i.e. clearing/snagging of banks) of the Amite River in the lower reaches and outfall, channel bank gapping, and Hwy 22 drainage improvements.

Alternative 2: Dredging of the Amite River outfall (RW-1) and in the lower reaches of the Amite River (RW-2). The dredging would include scraping, clearing, and snagging of the banks. This potentially had an influence area from Colyell Creek to Lake Maurepas and some backwater areas.

Alternative 3: Lower Amite River Channel Bank Gapping (RW-6). This potentially had an influence area from French Settlement to Lake Maurepas.

Alternative 4: Hwy 22 and Port Vincent Bridge drainage improvements (RW-8). This potentially had an influence area from French Settlement to the River Outlet. This alternative included the assessment of the local hydrology to identify restrictions from the Port Vincent and Highway 22 bridges. Placing culverts in the area as well as the Ascension Parish proposed plan of placing a Causeway for a portion of Hwy 22 instead of the roadway and small bridge currently in place were assessed as part of this alternative.

3.1.2 Influence Area Central Basin

Five alternatives (Alternatives 5-9) were identified that focus on addressing flood risk in the central portion of the ARB including the area of Bayou Manchac (Figure F-2). Alternatives 5 and 6 focus on the Bayou Manchac Area and include dredging (i.e. clearing/snagging of banks), small dry reservoirs, and operation of flood gates and pumps.

Alternatives 7 and 8 focus on the central portion of the Amite River and Alternative 9 focuses on a tributary to Bayou Manchac that flows into the Amite River.

Alternative 5: Dredging (RW-4) and storage along Bayou Manchac in multiple small reservoirs (HW-3). The dredging would include scraping, clearing, and snagging of the banks. This potentially had an influence area for the entire Bayou Manchac area.

Alternative 6: Flood gate with Pump to Mississippi River along with open flood gates at Turtle/Alligator Bayous (RW-7), nonstructural (NS-2), and focused structural (FS-1). This alternative includes placing a flood gate on Bayou Manchac at Airline Hwy in order to address flooding from the Amite River. Pumping to Mississippi River with a conveyance channel along Bluebonnet was included in order to address the water in Bayou Manchac between the floodgate and the Mississippi River, along with the flood gates at Turtle and Alligator Bayous to remain open so the water would flow into the natural retention area, Spanish Lake. Additionally, the alternative included nonstructural measures to address potential impacts as well and focused nonstructural such as ring levees for residential communities and critical infrastructure in the area.

Alternative 7: Reduction of flow restrictions from bridges at I-12 (RW-5) and above I-12 (RW-9). Public feedback has expressed concern over the I-12 and Hwy 190 Bridges contributing to flooding.

Alternative 8: Dredging of the Upper and Central Amite Basin, above I-12 (RW-3). The dredging would include scraping, clearing and snagging of the banks. This potentially had an influence area for the Upper and Central portions of the Amite River.

Alternative 9: University Lakes as reservoirs (HW-7). This alternative is part of the Baton Rouge Area Foundation's Baton Rouge Lakes Master Plan with a potential influence of the Bayou Duplanier area. The plan includes changing the local hydrology including the use of weirs.

3.1.3 Influence Area Upper Amite River Basin

Two alternatives (Alternatives 10 and 11) were identified with an influence area of the upper ARB that use the strategy of holding water to address extreme frequency flood events (Figure F-3).

Alternative 10: Dry Dams along tributaries (HW-1). The .01 AEP dry dams would be placed on the larger tributaries that flow into the Amite River to provide flood risk reduction to the immediate areas and to delay the release of water being conveyed into the Amite River.

Alternative 11: Small dry dams on the Amite River (HW-2). This alternative is from the recommendations in the 1995 ARBC commissioned study which recommended three locations: Grangeville Bridge, just North of Greenwell Springs, and the St. Helena/Livingston Parish Boundary.

3.1.4 Influence Area of Upper and Lower Amite River Basin

Four alternatives (Alternatives 12 through 15) were identified as having an influence area of the upper and lower ARB. These alternatives include holding water back by a large scale dam, nonstructural, and natural river restoration.

Alternative 12: Large scale .04 AEP dam (UL-1). This alternative is from the recommendations in the 1997 Darlington Reservoir RF-evaluation Study by USACE. The alternative includes an earthen dam that could be dry or wet, located on the Amite River in East Feliciana and St. Helena Parishes (Figure F-3).

Alternative 13: Nonstructural (NS-1 and NS-2). Nonstructural allows for people and structures that are exposed and vulnerable to flood risk to adapt to flooding and to risks associated with flooding. NS-1 measure improves the Flood warning/Monitoring systems by installing rain gauges in the state of Mississippi and real time water level gauges in the backwater areas so predictive flooding could be identified more easily as requested by the Natural Weather Service. NS-2 measure consist of improving elevation and/or flood proofing of residential and non-residential structures or acquisitions/relocation assistance of floodplain properties. The alternative is located throughout the ARB.

Alternative 14: Conversion of sand and gravel mines in the Amite Riverine to bottomland hardwood forest and swamp forest. Per request of the Healthy Gulf Coalition letter submitted on 23 April 2019, the alternative was added and includes the conversion of 14,000 acres of fallow mines. This alternative is considered a natural and nature-based measure.

Alternative 15: *Restoration of River Meanders.* Per request of the USFWS letter submitted on 25 June 2019, the alternative was added. It includes restoring meanders to critical sections of the river where straightening has occurred due to sand and gravel mining operations. No specific locations were suggested; however, based on the recommendations in the 2011 USACE Amite River Field Investigation and Geomorphic Assessment Report, the reach of the river from approximately river mile 114 to 73 had 21 preliminary restoration sites (Figure F-4). This alternative is considered a natural and nature-based measure.

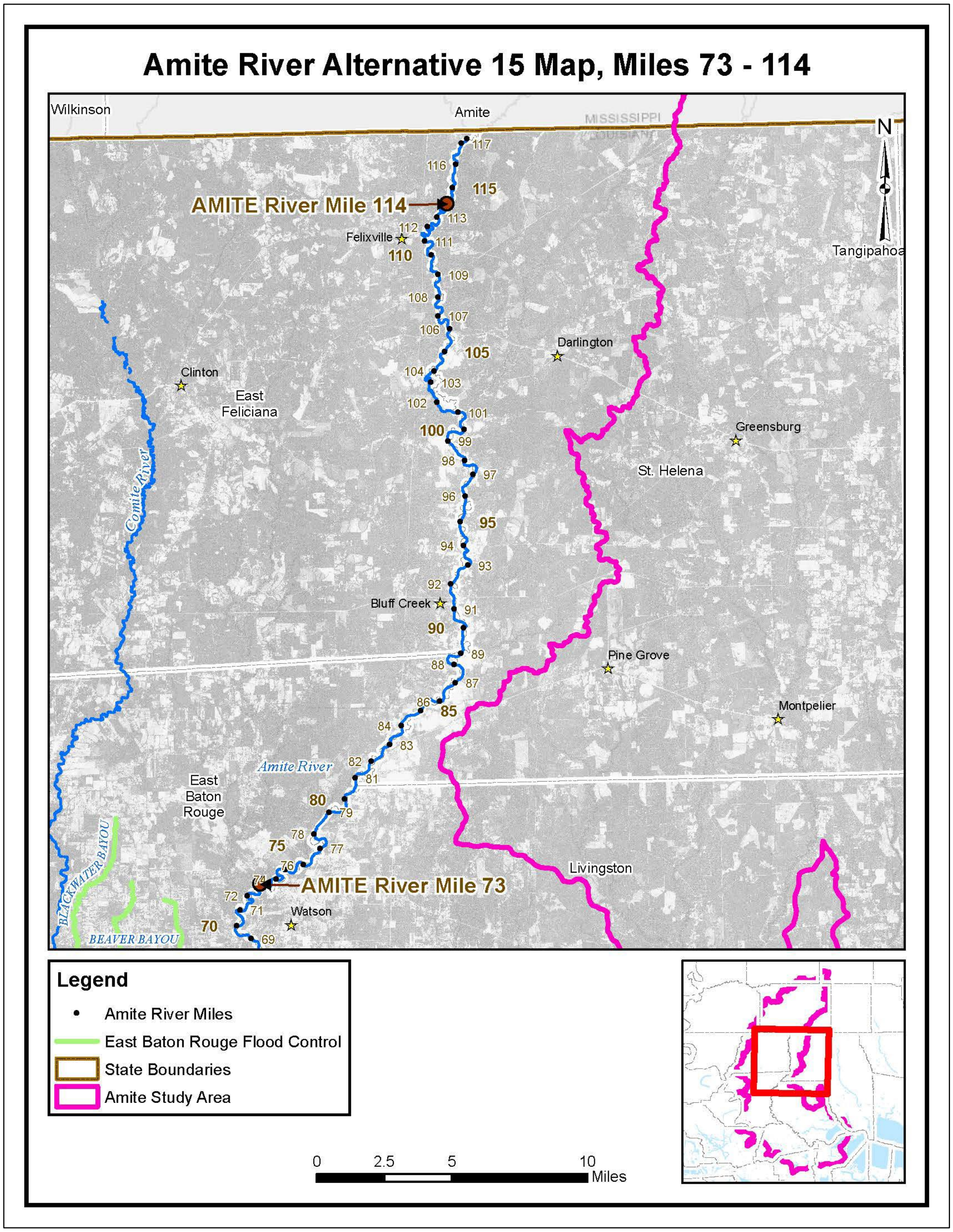

Figure F-4 – Location of Alternative 15

3.2 SCREENING CRITERIA

After the alternatives were assembled, a qualitative screening process was employed to carry forward the alternatives that showed the most promise (Table F-3). Alternatives were assessed using the same specific planning study criteria used to assess individual mitigation measures as described in Section 2.2.

3.3 SCREENING OF ALTERNATIVES

The scoring results were compiled and averaged. After scoring, the PDT reviewed the results and confirmed that the highest scoring alternatives should be retained in addition to No Action and nonstructural. Alternatives 1, 10, 12, and 13 were carried forward to the final array of alternatives for further assessment and are discussed in the text of the main report. The lower scoring alternatives were reviewed further and were screened. Below is a general discussion regarding why each of the alternatives were screened. Appendix G of the main report provides an in-depth discussion of the hydrology of the ARB and of the areas that would be influenced by the alternatives.

3.3.1 Alternative 2: Dredging of the Amite River Outfall and in the Lower Reaches of the Amite River

Per the LADOTD's 24 January 2019 report by Dewberry Engineers Inc., the alternative ranged from a water surface elevation reduction of a maximum of 4-5 inches and would require dredging of 2-8 million cubic yards to begin seeing the lowerings. With a cost estimate minimum of $20-80 million for dredging and without a high density of structures that would be impacted, this alternative would have limited benefits.

3.3.2 Alternative 3: Lower Amite River Channel Bank Gapping

The Lower Amite River has very low banks and quickly overflows; therefore, the alternative has limited benefits. Also, implementing bank gapping could cause shoaling of the river; thus resulting in reduced capacity of the river to carry flood water.

3.3.3 Alternative 4: Hwy 22 and Port Vincent Bridge Drainage Improvement

Appendix G of the main report provides an H&H discussion of the modeling results for this area including a discussion regarding Hwy 16 for Colyell Creek and the need for additional surveys to assess this area, which is outside of this feasibility study. While lowerings could be achieved at each of these areas, the drainage would provide limited benefits due to the low density of structures in the area.

3.3.4 Alternative 5: Dredging and Storage along Bayou Manchac in Multiple Small Reservoirs

Along Bayou Manchac there are limited areas that are largely undeveloped that would be available to build small reservoirs. Additionally, as stated in the USACE 1995 Feasibility Study for the East Baton Rouge Parish Watershed Flood Control Projects, due to the lack of topographical relief of the watershed detention/retention storage, basins were determined to be impractical. Required containment structures, in conjunction with land requirements would be excessive in order to achieve significant flow retention. Detention/retention storage basins would also only reduce flood risk during localized rainfall events.

Clearing and snagging was determined to increase the flood risk as water would move more quickly into the area since the flooding along Bayou Manchac is in part due to backwater flooding from the Amite River.

3.3.5 Alternative 6: Flood Gate with Pump to Mississippi River along with Open Flood Gates at Turtle/Alligator Bayous, Nonstructural and Focused Structural

This alternative was screened out due to limited benefits and in large part due to the size and costs of the pumps required to implement the alternative. It was estimated that ten 1,000 cfs pumps each with 10' diameter discharge would be needed to pump into the Mississippi River over the levee.

3.3.6 Alternative 7: Reduction of Flow Restrictions from Bridges

Based on the hydraulic model for baseline conditions, minimal flow restrictions from bridges along the Amite River were identified; therefore it was screened out due to limited benefits. Many of the bridge restrictions presented by the public during the scoping of the study are likely from debris carried by the water during a flood event such as vegetation and general trash that become trapped within the bridge support system located in the river channel resulting in a reduction of flow.

3.3.7 Alternative 8: Dredging of the Upper and Central Amite Basin above I-12

The hydraulic model for baseline conditions did not show any areas of significance where clearing/snagging would reduce flood risk reduction benefits due to the size of the channel and the floodplain.

3.3.8 Alternative 9: University Lakes as Reservoirs

The Baton Rouge Area Foundation provided their modeling and costs for the suggested plan. While the plan does have flood risk reduction benefits, they were not enough to justify the project based on FRM alone; therefore, the alternative was screened.

3.3.9 Alternative 11: Small Dry Dams on the Amite River (HW-2)

The potential benefits from this alternative, as well as in channel weirs, would be limited to very few higher frequency events, since the river very quickly flows out of the channel. The limited benefits would also have to be adjusted for inducements of flooding upstream including along small tributaries. Additionally, in the upper basin where the small dry dams were proposed, the channel is up to 2 miles wide at flooding stages and the dam and/or weir would have to be fairly large with significant bank armoring. Without significant bank armoring and tie in points, these measures would have the potential to change the geomorphology and course of the river. This alternative was screened based on limited benefits.

3.3.10 Alternative 14: Conversion of Sand and Gravel Mines in the Amite Riverine to Bottomland Hardwood Forest

The baseline conditions of the H&H model shows that the area of the sand and gravel mines is already providing a higher storage/retention than what the conversion of floodplain forest would provide so the alternative was screened. Additionally, the location of the gravel pits are primarily not immediately adjacent to the main channel of the Amite River, so the velocity reductions from the conversion of the area to Bottomland Hardwood forest would be very limited.

3.3.11 Alternative 15: Restoration of River Meanders

Adding river meanders to the Amite River would increase the length of the river and thus additional storage capacity, and floodwaters would be slowed down on their journey to inundate populated areas downstream. There are potential benefits from this alternative at higher frequency events, but very unlikely at lower frequency events; therefore, the alternative was screened due to limited benefits. Appendix H of the main report provides further H&H discussion of the alternative assessment.

3.4 THE FOCUSED AND FINAL ARRAY OF ALTERNATIVES

Most alternatives assessed had very little reduction in flood risk and limited benefits. The less frequent AEP events (25 yr and up) cause the majority of flooding issues in the Amite River Basin. The rainfall events, combined with a steep hydraulic gradient from the headlands of the basin to the flat middle and lower basins, provide for a significant backwater effect at the lower end of the system at Lake Maurepas. Once the water accumulates and backs up, it can no longer exit the basin and the basin begins to fill. This unique hydrology was evaluated with numerous measures and alternatives that resulted in primarily shifting water from one place to another within the damage areas while not reducing the backwater effect and thus not allowing water to drain from the basin. In essence, other alternatives could not get to the core of the issues because they were not removing water from hydraulic budget. Because water backs up into the watershed, water surface elevations did not lower in specific areas or overall. This in turn did not allow for significant lowering of water surface elevation in damage areas. The parishes in the study area have a combined population of about 900,000 with more than half of the population living in East Baton Rouge Parish. The study area has over 260,000 structures and of those, about 80 percent are in the central portion of the ARB, north of Bayou Manchac. The remaining alternatives that were not screened, were those that provided storage of water to attenuate flooding downstream in heavily developed areas. Those alternatives are the focused array of alternatives.

The focused and final array of alternatives carried forward for consideration and evaluated are presented in Sections 4 through 7 of the Main Report.

Table F-3 – Alternatives

			Exceeds (++), Meets (+), No Change (n), or Decreases (-) the Objective				Avoids Constraint/Considerations High (++), Medium (+), Low to no issue or not applicable (n), or Conflicts (-) with the Constraint/Consideration							
Alt ID	**Measures**	**Alternative Description**	**Reduce flood damages from rainfall**	**Reduce risk to human life from flooding events**	**Reduce interrupti-on to the nation's transporta tion corridors**	**Reduce risks to critical infrastru cture (e.g. medical centers, schools, transport ation etc.);**	**T&E**	**Critical Habitat**	**Cultural**	**Water Quality**	**Scenic Rivers**	**Local Flood Manag-ement Plans**	**BBA Authorizat-ion limits**	**Not to induce development within flood plain**
Alt 1	No Action	No action would be taken under this plan. Damages would continue into the future.	n	n	n	n	n	n	n	n	n	n	n	n
Alt 2	RW-1+RW-2	Dredging of the Amite River outfall (RW-1) and in the lower reaches of the Amite River (RW-2)	+	n	n	n	n	n	-	+	-	n	+	n
Alt 3	RW-6	Lower Amite River Channel Bank Gapping (RW-6)	+	n	n	n	n	n	-	+	-	n	+	n
Alt 4	RW-8	Hwy 22 and Port Vincent Bridge drainage improvements (RW-8)	+	n	n	n	n	n	-	+	-	n	+	n
Alt 5	HW-3+ RW-4	Dredging (RW-4) and storage along Bayou Manchac in multiple small reservoirs (HW-3)	+	n	+	+	n	n	-	n	-	n	n	n

			Exceeds (++), Meets (+), No Change (n), or Decreases (-) the Objective				**Avoids Constraint/Considerations High (++), Medium (+), Low to no issue or not applicable (n), or Conflicts (-) with the Constraint/Consideration**							
Alt 6	RW-7+NS-2+FS-1	Flood gate at Airline Hwy, Pump to MS River, open flood gates at Turtle and Alligator Bayous (RW-7) with the addition of nonstructural measures (NS-2) and ring levees for residential communities and critical infrastructure (FS-1)	+	n	++	++	n	n	-	n	-	n	+	n
Alt 7	RW-5+RW-9	Reduction of flow restrictions from bridges at I-12 (RW-5) and above I-12 (RW-9)	+	n	++	++	-	n	-	n	-	n	+	n
Alt 8	RW-3	Dredging of the Upper and Central Amite Basin, above I-12 (RW-3)	+	n	++	++	-	n	-	n	-	n	+	n
Alt 9	HW-7	University Lakes as reservoirs (HW-7)	+	n	n	n	n	n	n	n	n	++	+	n
Alt 10	HW-1	.01 AEP Dry Dams along tributaries (HW-1)	+	n	+	+	n	n	n	+	n	n	+	n
Alt 11	HW-2	Small dry dams on the Amite River (HW-2)	++	+	+	+	-	-	-	+	-	+	+	n
Alt 12	UL-1	Large scale .04 AEP dam (UL-1)	++	n	++	++	+	n	-	n	-	+	++	n
Alt 13	NS-1+ NS-2	Nonstructural (NS-1 and NS-2)	++	+	n	++	n	n	-	n	n	+	++	n
Alt 14	None	Conversion of sand and gravel mines in the Amite Riverine to bottomland hardwood forest and swamp forest	n	n	n	n	++	n	-	++	++	n	n	n
Alt 15	None	Restoration of River Meanders	n	n	n	n	+	++	-	n	n	n	-	n

Section 4
Focused Array of Alternatives

The focused array of alternatives, is the same alternatives as previously identified in the final array in the publicly released 2019 DIFR/EIS, are presented in Table F-3 and the locations of the structural alternatives are presented on Figure F-5 and Figure F-6.

Table F-3 – Focused Array of Alternatives

Alt ID	Management Measures	Alternative Description
Alt 1	No Action	No action would be taken under this plan. Damages would continue into the future.
Alt 10	HW-1	0.01 AEP Dry Dams along tributaries (HW-1)
Alt 12	UL-1	Large scale 0.04 AEP dam (UL-1)
Alt 13	NS-1+ NS-2	Nonstructural (NS-1 and NS-2)

4.1 NO ACTION

Under the no action alternative, no risk reduction would occur. The area would continue to experience damages from rainfall and wind/tide-induced flooding. This would be exacerbated in the lower ARB due to relative sea level rise.

4.2 DRY DAMS ALONG TRIBUTARIES

A 0.01 AEP dam design and locations were chosen to try to capture the most benefits by lowering the peak stage height along the Amite River by holding water back along larger tributaries in the upper basin. The alternative for dry dams along tributaries was divided further into two different alternatives after the initial assessment to ensure incremental justification of the dry dams. The alternative was broken into H&H analysis runs for one dam along Sandy Creek and the other run, which combined the smaller dams along Darling, Lilley, and Bluff Creeks. Limited data was available; therefore, many assumptions were made, such as the geology of the area, the dam theoretical section, the outlet and spillway structure design, borrow material, and quantities, as discussed in Appendix B.

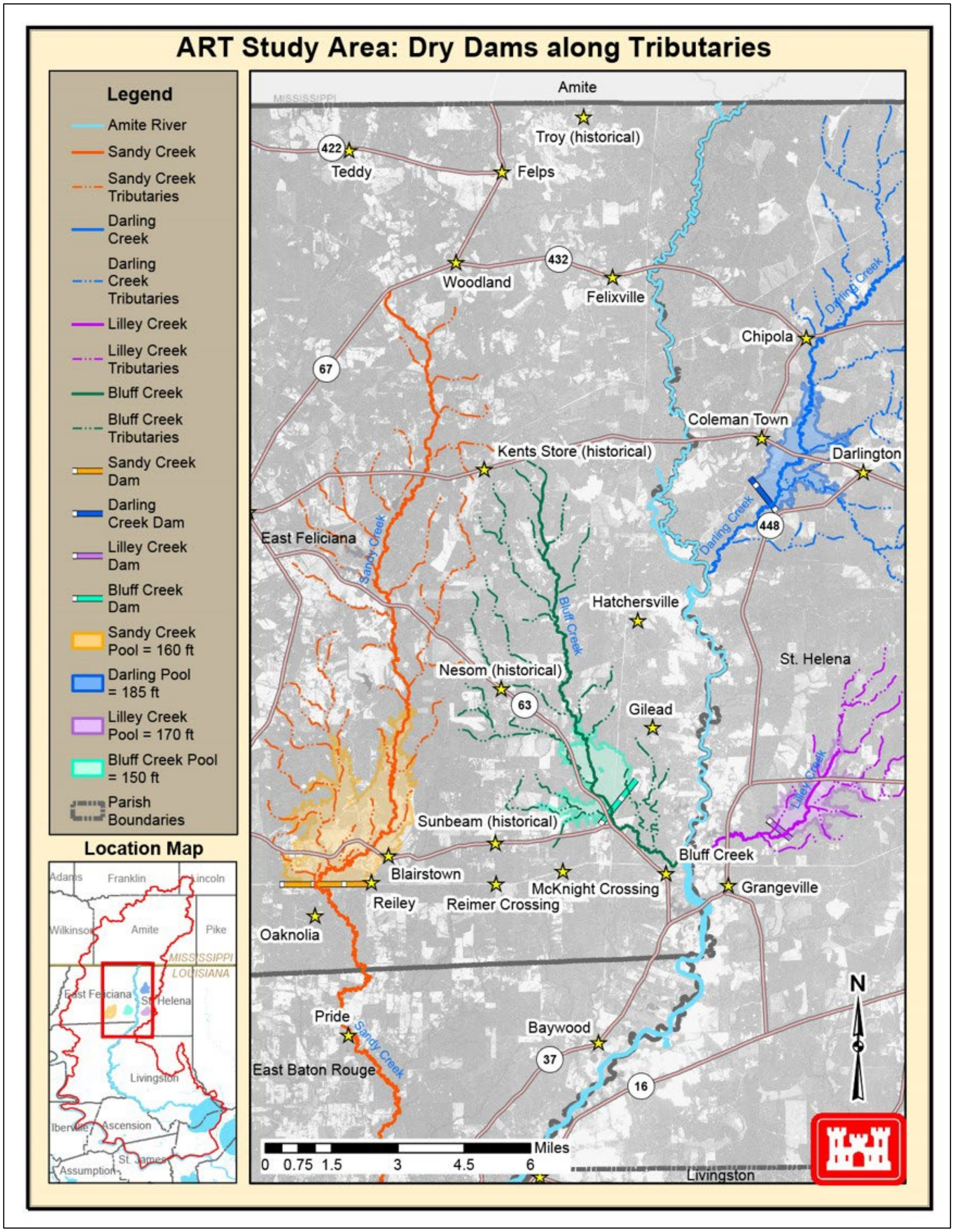

Figure F-5 – Location of Dry Dams along Tributaries

4.3 LARGE SCALE 0.04 AEP DAM (DARLINGTON DAM)

The large scale 0.04 AEP Darlington Dam alternative consists of an earthen dam on the Amite River with the option of being a wet or dry dam. Because this alternative was previously studied, data for analyzing it was available in the “Amite River and Tributaries, Darlington Reservoir Re-evaluation Study (Reconnaissance Scope),” dated September 1997. The location of the dam was selected because of the short width of the floodplain, resulting in a shorter length of dam. The shorter width floodplain results in a smaller area of potential inundation, which reduces the required land and flow easement purchases. The upper reach of the Amite River floodplain, where it converges with the East and West Fork Rivers, is broader (ERDC/GSL TR-07-26, 2007) and would require significantly more costs and land acquisition for siting of the dam. The current location also avoids inundation to more densely populated areas such as Liberty, Mississippi.

The 1997 report used the same design section for a wet or a dry dam (Figure F–6 and Appendix B of this report). A wet dam would consist of a permanently flooded reservoir/conservation pool, while the reservoir for a dry dam would be used only during flood events to accommodate outflow and thus minimize inundation to the surrounding area. The dry dam would have a crown elevation 1.8 feet lower than the reduced-wet.

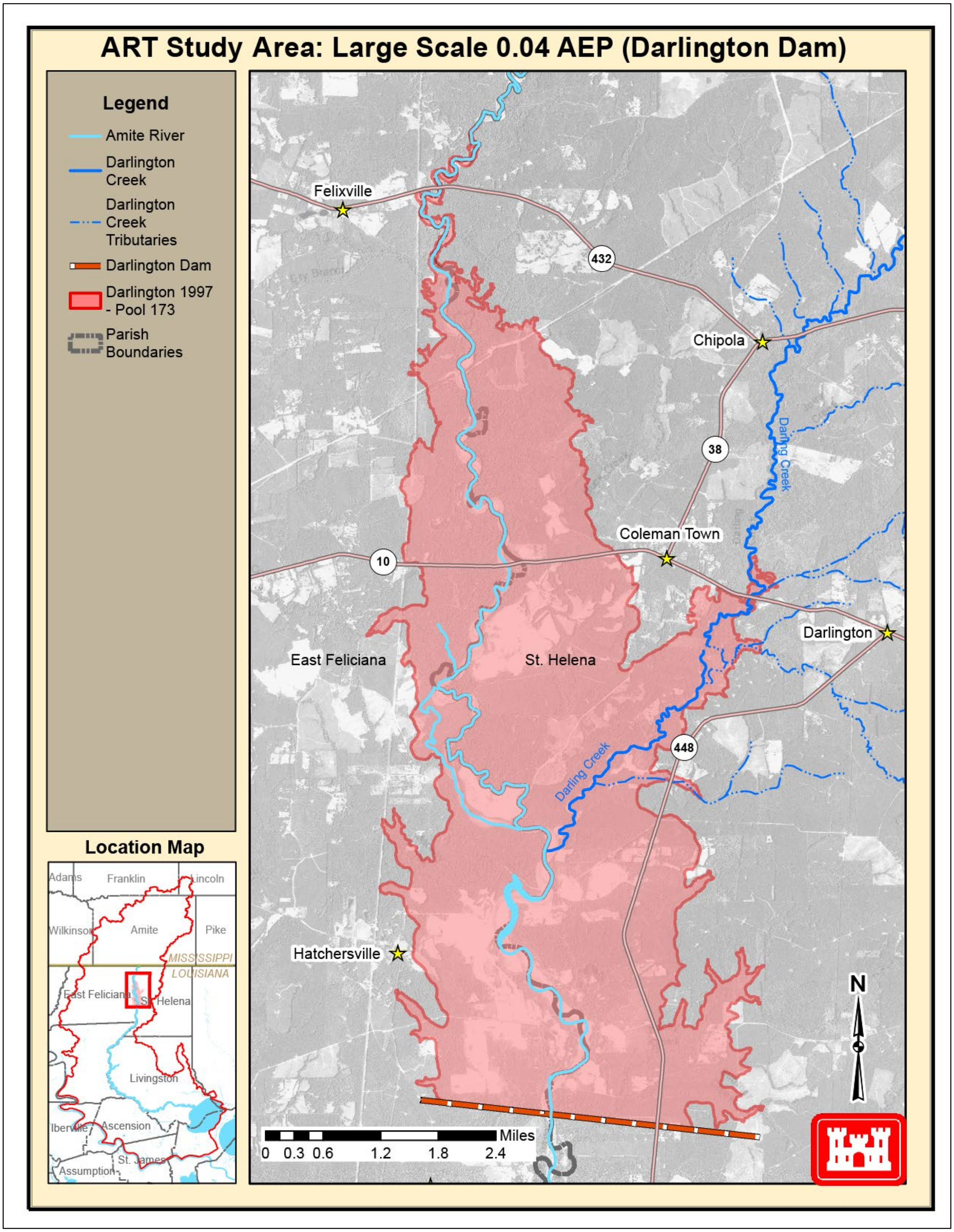

Figure F-6 – Close up of Large Scale 0.04 AEP Dam (Darlington Dam)

4.4 NONSTRUCTURAL

A nonstructural assessment was completed that looked at the effectiveness of implementing physical nonstructural measures (NS-2) such as structure elevations, and floodproofing. For evaluation purposes, the nonphysical measures (NS-1) which consists of flood warning system/evacuation plans were not included in the evaluation since there are no economic benefits that can be derived, but these measures are intended to reduce incremental risk at low cost. Regardless of the recommended plan chosen, the residual risk with the plan in place, along with the potential consequences, will be communicated to the NFS to become a requirement of any communication and evacuation plan.

An inventory of residential and non-residential structures was developed using the National Structure Inventory (NSI) version 2.0 for the portions of the study area impacted by flooding from rainfall and sea-level rise associated with the future without project condition. An assessment of all structures located in the 0.04 and 0.02 AEP floodplains was performed.

The second nonstructural alternative that was evaluated included acquisition and relocation for all structures located in the 0.04 aggregated floodplain. In this alternative, the costs of acquisitions, with relocation assistance to displaced persons, were compared with the expected annual damages reduced by the demolition of structures from the floodplain. For the analysis of the nonstructural alternative as a standalone alternative, acquisitions were not carried forward because the cost of the alternative exceeded the damages reduced (benefits).

4.5 2019 ECONOMIC ANALYSIS

An economic analysis of the focused array of alternatives was performed based on the Hydraulics and Hydrology (H&H) model outputs and the economics functions. Water surface profiles were provided for eight annual exceedance probability (AEP) events: 0.50 (2-year), 0.20 (5-year), 0.10 (10-year), 0.04 (25-year), 0.02 (50-year), 0.01 (100-year), 0.005 (200-year), and 0.002 (500-year). Annualized costs and benefits were calculated, and the Benefit Cost Ratio (BCR) was estimated for each alternative. Each of the alternatives should have benefits long into the future but guidance limits it to the 50-year period of analysis from 2026 to 2076. The economic analysis yielded several alternatives that are in the Federal interest and from which a TSP can be identified. Three alternatives were screened due to negative net benefits: the nonstructural plan for a 0.02 AEP floodplain, large scale 0.04 AEP wet Darlington Dam and the three 0.01 AEP dry dams on the Darlington, Lilley, and Bluff Creeks (Table F-4).

Table F-4 – Summary of Costs and Benefits for Focused Array of Alternatives based on 2019 Evaluation

First Cost		$2,160,836	$1,788,531	$1,278,523	$270,977	
Interest During Construction		$7,34	$100,590	$71,907	$7,477	
Total Investment Cost		$2,168,176	$1,889,121	$1,350,430	$278,455	
Annualized Project Costs	$49,628	$80,311	$69,975	$50,021	$10,314	
Annual OMRR&R	$0	$0	$658	$439	$220	
Total Annual Costs	$49,628	$80,311	$70,633	$50,461	$10,534	
Total Annual Benefits	$53,547	$63,542	$65,066	$65,066	$13,649	
Net Annual Benefits	$3,919	-$16,769	-$5,567	$14,605	$3,115	
Benefit to Cost Ratio	1.08	0.79	0.92	1.29	1.3	

Mississippi Valley Division,
Regional Planning and Environment Division South

Amite River and Tributaries East of the Mississippi River, Louisiana

Appendix G - Economic and Social Consideration
December 2023

CONTENTS

TABLES

LIST OF FIGURES

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SECTION 1
Background Information

1.1 INTRODUCTION

1.1.1 General

This appendix presents an economic evaluation of the flood risk management Plans for the Amite River and Tributaries (ART) Study East of the Mississippi River, Louisiana. It was prepared in accordance with Engineering Regulation (ER) 1105-2-100, Planning Guidance Notebook, and ER 1105-2-101, Planning Guidance, Risk Analysis for Flood Damage Reduction Studies. The National Economic Development Procedures Manual for Flood Risk Management and Coastal Storm Risk Management, prepared by the Water Resources Support Center, Institute for Water Resources, was also used as a reference, along with the User's Manual for the Hydrologic Engineering Center Flood Damage Analysis Model (HEC-FDA).

This appendix consists of a description of the methodology used to determine National Economic Development (NED) damages and benefits under existing and future conditions and the project costs. The analysis used Fiscal Year (FY) 2024 (October 2023) price levels, the FY 2023 Federal discount rate of 2.75 percent, and a 50-year period of analysis with the year 2026 as the base year.

1.1.2 NED Benefit Categories Considered

The NED procedure manuals for coastal and urban areas recognize four primary categories of benefits for flood risk management measures: inundation reduction, intensification, location, and employment benefits. The majority of the benefits attributable to a project Plan generally result from the reduction of actual or potential damages caused by inundation. Inundation reduction includes the reduction of physical damages to structures, contents, and vehicles and indirect losses to the national economy. Due to the nature of this project, physical flood damages to structures and their contents was the only NED benefit category included in this analysis.

1.1.3 Regional Economic Development

When the economic activity lost in a flooded region can be transferred to another area or region in the national economy, these losses cannot be included in the NED account. However, the impacts on the employment, income, and output of the regional economy are considered part of the Regional Economic Development (RED) account. The input-output macroeconomic model RECONS can be used to address the impacts of the construction spending associated with the project Plans.

1.1.4 Other Social Effects

The Other Social Effects (OSE) account includes impacts to overarching social themes including social vulnerability & resiliency, health & safety, economic vitality, social connectedness, participation, and environmental justice as it relates to the Justice 40 initiative. Impacts to these social themes are prevalent in flood risk management projects and are evaluated and discussed in the OSE account.

The economics team evaluated outcomes of the various Plans on socially vulnerable populations using the Center for Disease Control, Agency for Toxic Substances and Disease Registry's Social Vulnerability Index and US. Census Bureau statistics, United States Geological Survey Food Atlas, and the Council on Environmental Quality's Climate and Economic Justice Screening Tool. Additionally, the PDT evaluated the life safety risk to the study area utilizing submergence criteria from the LifeSim technical manual.

1.2 DESCRIPTION OF THE STUDY AREA

1.2.1 Geographic Location

The ART study area includes the Amite River Basin in addition to an influence area directly south of the basin, which extends to the Mississippi River. The area includes portions of four Mississippi counties: Amite, Lincoln, Franklin, and Wilkinson in the upper portion of the basin; and portions of eight Louisiana parishes: East Feliciana, St. Helena, East Baton Rouge, Livingston, Iberville, St. James, St. John the Baptist, and Ascension in the mid- to lower-basin. An inventory of residential and non-residential structures was developed for the portions of these counties and parishes within the HEC-RAS modeled area. The West Shore Lake Pontchartrain (WSLP) project, which covers the portions of the St. James and St. John the Baptist Parishes within the ART study area, was not included in the ART hydraulic modeling. To avoid double counting benefits that will be realized by construction of WSLP, structures within the St. James and St. John the Baptist were removed from the ART structure inventory. Figure G:1-1 shows the structure inventory and the boundaries of the counties/parishes along with the study area boundary.

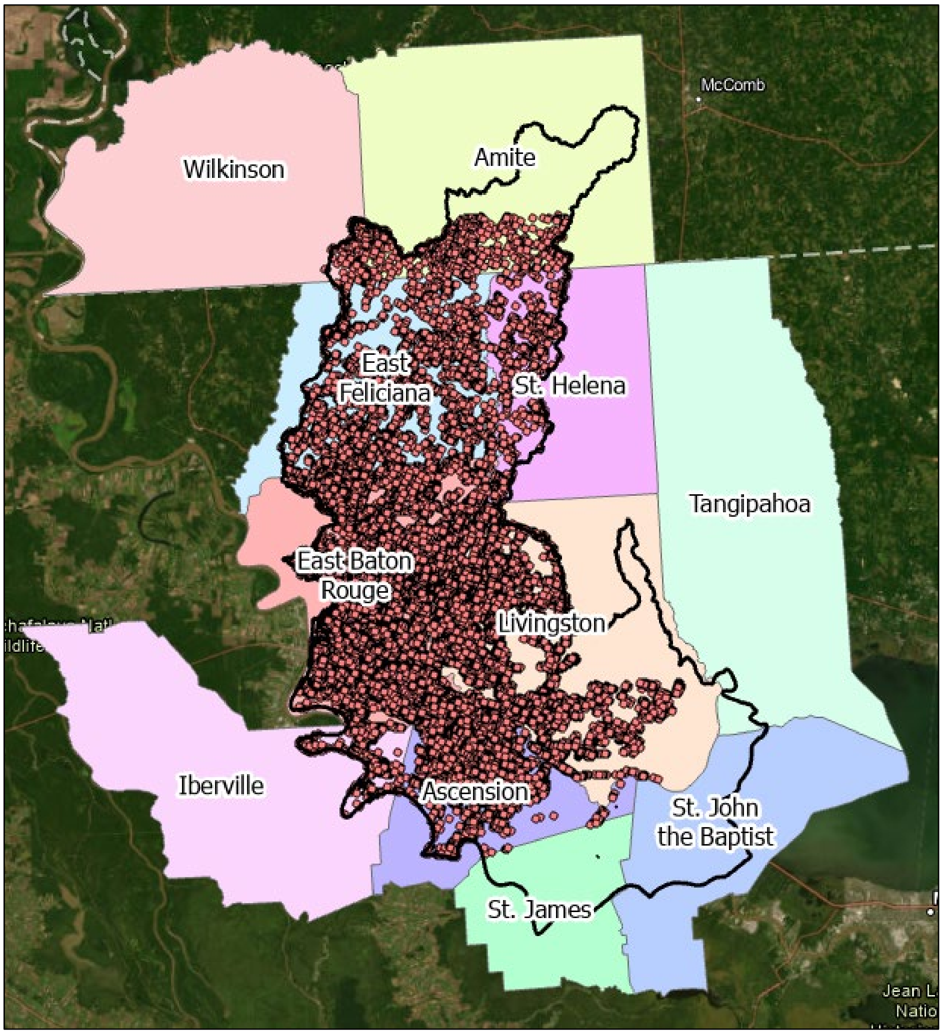


Figure G:1-1. Parish/County Boundaries, Structure Inventory, & Study Area Boundary

1.2.2 Study Area Reaches

The portion of the study area included in the hydraulic model was divided into 106 reaches with each of the structure points functioning as a station. These settings were used to calculate flood damages using version 1.4.3 of the HEC-FDA certified model. Figure G:1-2 shows the study area reach boundaries for the ART study area.

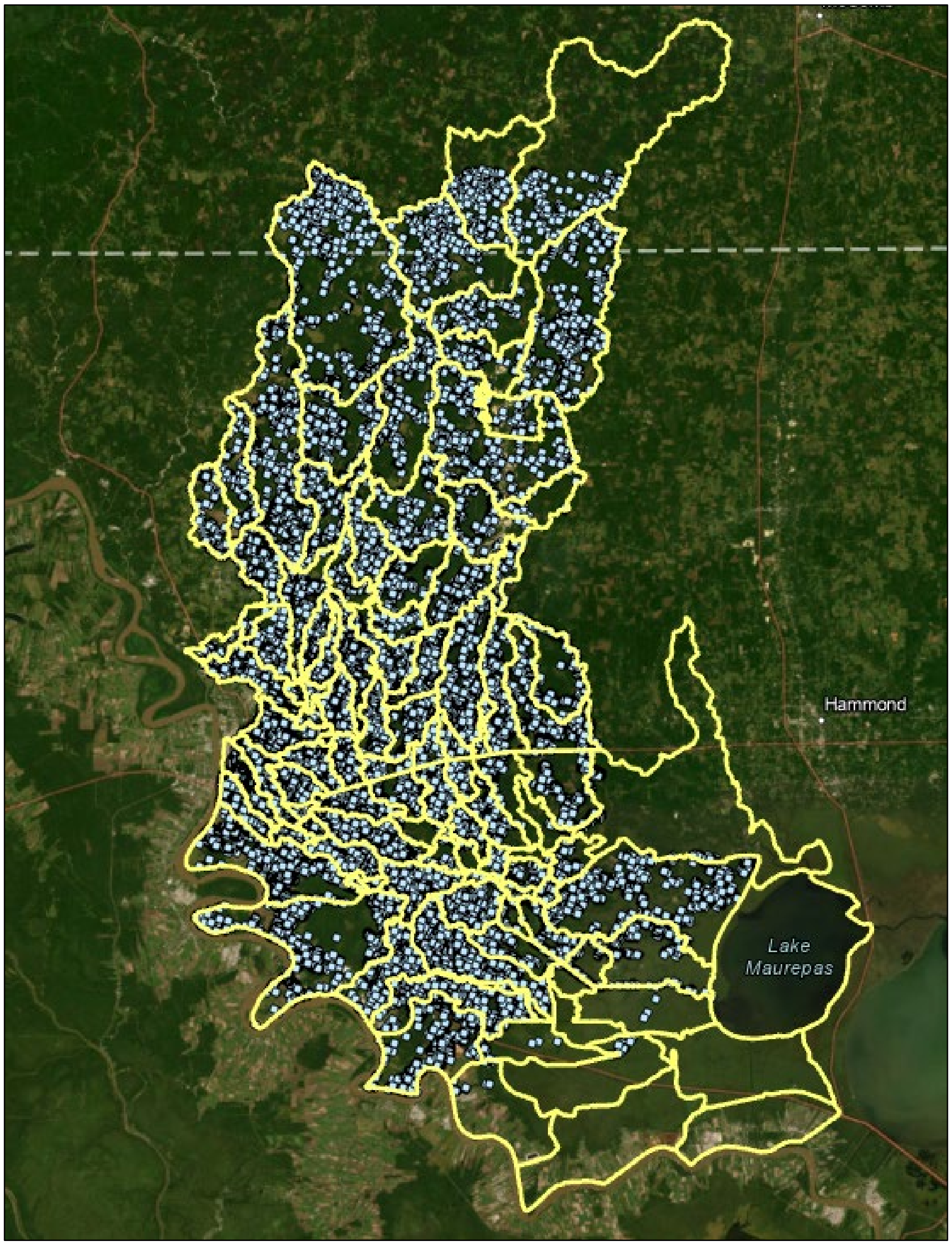


Figure G:1-2. Reach Boundaries, Structure Inventory

Sub-Reaches with Social Vulnerability Considerations

To evaluate the impacts to the OSE account, study area reaches based on hydraulic characteristics shown in Figure G:1-3 were further divided into sub-reaches based on social vulnerability. The CDC's Social Vulnerability Index (SVI) uses the American Community Survey (BOC) to quantify a community's ability to respond and cope with a hazardous event. Within the overall SVI, there are four subthemes that are incorporated, which include Socioeconomic Status, Household Characteristics, Racial & Ethnic Minority Status, and Housing Type & Transportation. To identify areas experiencing social vulnerability, a 90th percentile threshold was applied across the four themes, in addition to the overall vulnerability. Out of 191 Louisiana Census Tracts within the ART study area, there were 46 that were identified as experiencing social vulnerability. Economic reaches intersecting with tracts experiencing social vulnerability were divided into sub-reaches in the HEC-FDA model to evaluate how the existing and future without project conditions will affect areas experiencing social vulnerability and develop Plans that specifically target these areas.

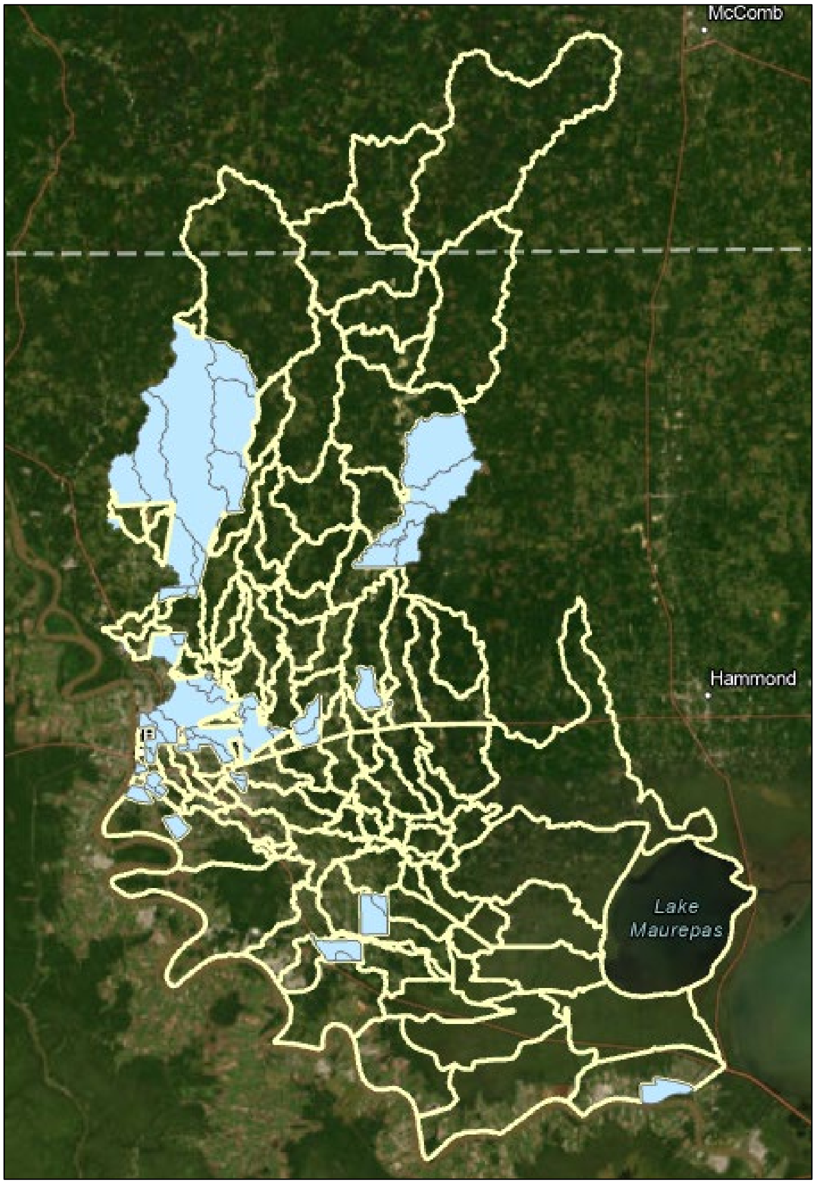


Figure G:1-3. Reach Boundaries, Sub-reaches with Social Vulnerability

1.2.3 Land Use

The total number of acres of developed, agricultural, and undeveloped land in the study area is shown in Table G:1-1. As shown in the table, undeveloped land makes up the majority of the study area with 13 percent of the total acres categorized as developed land.

Table G:1-1. Land Use in the Study Area

Land Class Name	Acres	Percentage of Total
Developed Land	945,085	13%
Agricultural Land	986,813	14%
Undeveloped Land	5,097,445	73%
Total	7,029,343	100%

Source: USGS National Land Cover Database 2015

1.2.4 Compliance with Policy Guidance Letter (PGL) 25 and Executive Order 11988

Given continued growth in employment and income, it is expected that development will continue to occur in the study area with or without a flood risk management project and will not conflict with PGL 25 and EO 11988, which state that the primary objective of a flood risk reduction project is to protect existing development, rather than to make undeveloped land available for more valuable uses. However, the overall growth rate is anticipated to be the same with or without the project in place. Thus, the project would not induce development, but would rather reduce the risk of the population being displaced after a major storm event.

1.3 RECENT FLOOD HISTORY

1.3.1 Flood Events

The study area has experienced riverine flooding from excessive rainfall events in addition to incurring flood damages associated with storm surge from hurricanes and tropical storms. Since 1851, the paths of 51 tropical events have crossed the study area. The paths and intensities of these storms are shown in Figure G:1-4.

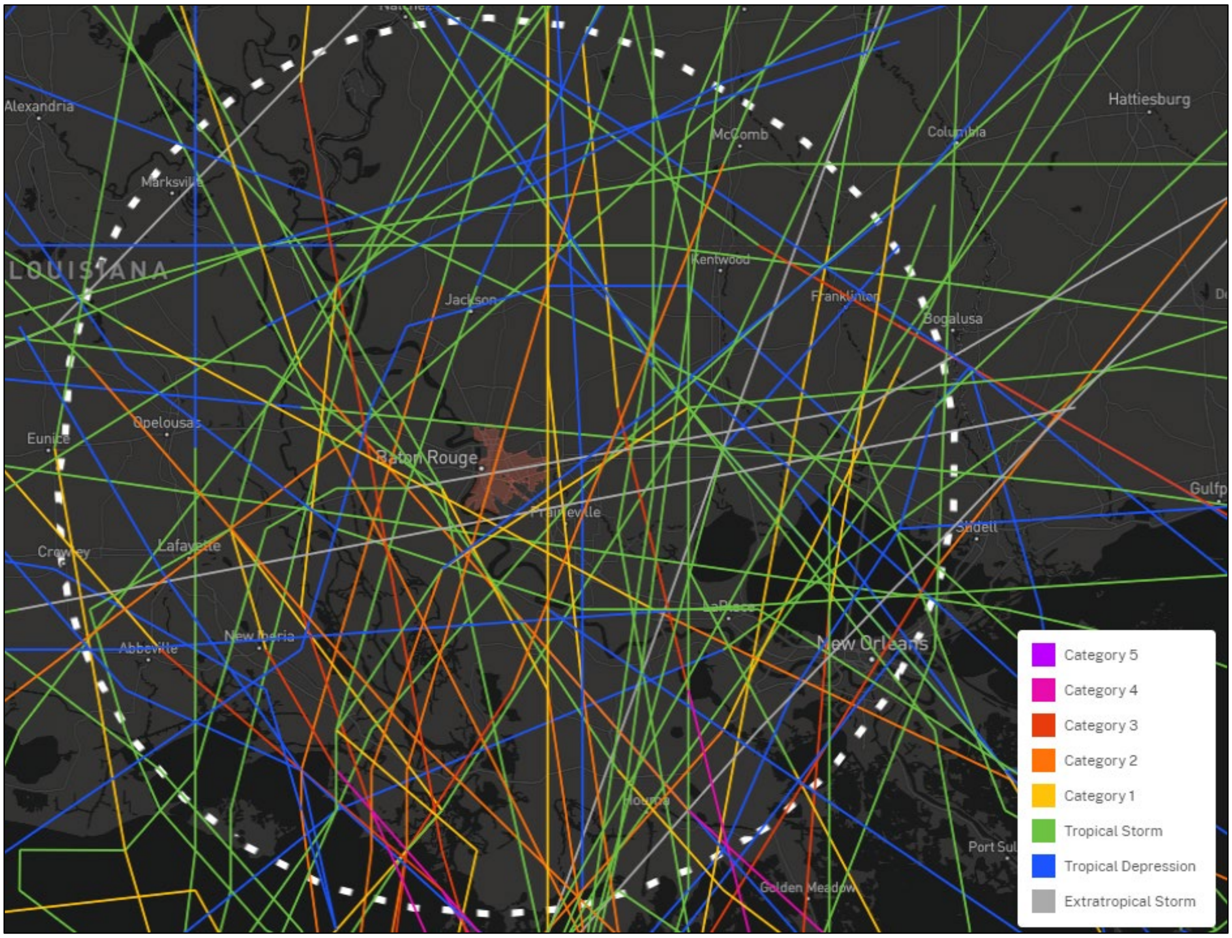


Figure G:1-4. Hurricane and Tropical Storm Paths Since 1851

1.3.2 FEMA Flood Claims

The most recent riverine event to affect the study area was the 2016 Louisiana Floods. This event brought catastrophic flooding damage to Baton Rouge and the surrounding areas with both localized flooding and riverine flooding from the Amite and Comite Rivers and their tributaries. The FEMA flood claims for the most recent events to impact the area are shown in Table G:1-2.

Table G:1-3 shows the FEMA flood claims paid between January 1978 and September 2023 for all counties and parishes in the study area. The table includes the number of claims, number of paid losses, and the total amount paid in the dollar value at the time of the payment. The table excludes losses that were not covered by flood insurance.

Table G:1-1. Top Tropical Storms by Amount Paid by FEMA

Event	Month & Year	Number of Paid Claims	Total Amount Paid (millions)
Hurricane Andrew	August 1992	5,242	$128.9
Hurricane Rita	September 2005	8,921	$348.7
Hurricane Gustav	September 2008	4,396	$88.9
Hurricane Ike	September 2008	45,374	$2,074.1
Tropical Storm Lee	September 2011	9,725	$377.6
2016 Louisiana Floods	August 2016	20,641	$1,689.2
Hurricane Zeta	October 2020	1,041	$17.3
Hurricane Ida	September 2021	21,637	$1,112.0
Tropical Storm Nicholas	September 2021	254	$5.6

Source: Federal Emergency Management Agency (FEMA)

Note 1: Total amount paid is at price level at time of the event.
Note 2: Claims and amount paid are for entire event, which may include areas outside of the study area.

Table G:1-2. FEMA Flood Claims by Parish/County (January 1978-September 2023)

Parish	Total Number of Claims	Number of Paid Claims	Total Payments (millions)
Ascension	6,005	5,141	$285.7
East Baton Rouge	18,958	15,792	$948.5
East Feliciana	14	12	$0.6
Iberville	544	439	$7.3
Livingston	10,270	8,829	$477.2
St. Helena	51	36	$1.7
St. James	206	144	$3.4
St. John the Baptist	8,725	7,209	$483.4
Total	44,773	37,602	$2,207.8

Source: Federal Emergency Management Agency (FEMA)

1.4 SCOPE OF STUDY

1.4.1 Problem Description

The study area is urban with pockets of rural communities scattered among the eight-county area. Flood risk management is the only authorized purpose for the study. 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 study area. Since authorization is limited to flood risk management, project formulation was conducted based on hydraulics associated with just riverine flooding. After formulation, damage analysis for both without project and with project conditions was conducted based on predominant condition hydraulics that incorporate both riverine flooding and storm surge to accurately capture project performance and residual risk. The predominant condition hydraulics takes the higher of the water surface elevation at a certain probability generated by two hydrologic boundary condition scenarios: one condition accounts for basin-wide extreme rainfall events with normal highwater downstream boundary condition, and a secondary condition that has negligible basin rainfall with storm surge downstream boundary conditions. The details of these HEC-RAS models used to compute predominant condition hydraulics is available in the H&H Appendix.

1.4.2 Nonstructural – Final Array

Three nonstructural plans have been carried forward to the final array; they include elevating residential structures and floodproofing non-residential structures. Elevating residential structures for the plans in the final array relied on a target elevation of the future 0.01 AEP stage, not to exceed 13 feet and floodproofing non-residential structures up to 3 feet using dry floodproofing strategies.

Nonstructural Plan Development

Nonstructural plan development in the final array relied on the comparison of the costs and benefits of floodplain aggregations on a reach level. Eligibility for nonstructural floodplain aggregations was determined using the future (2076) riverine water surface elevations at various riverine flooding events (0.1 AEP, 0.04 AEP, and 0.02 AEP). Structures with flooding above the first-floor at each of the flooding events were included in the floodplain aggregations. To determine the economic benefits for comparison, expected annual damage was calculated in HEC-FDA for each of the three floodplain aggregations (0.1 AEP, 0.04 AEP, and 0.02 AEP). A detailed description of the HEC-FDA calculations can be found in Section 2. Parametric construction cost estimates including a 32 percent contingency were developed in collaboration with New Orleans District cost engineering and reported out on a reach level for comparison to economic benefits. Table G:1-4 displays the number of structures included at each floodplain aggregation included in the plans used for nonstructural Plan development.

Table G:1-3. Structures with First-Floor Flooding by Floodplain

Floodplain	Residential	Non-Residential	Total Structures
0.1 AEP (10 year)	2,654	331	2,985
0.04 AEP (25 year)	3,866	474	4,340
0.02 AEP (50 year)	5,428	672	6,100

Plan 2 Nonstructural NED Plan

Eligibility for nonstructural measures in Plan 2 relied on the optimization of the floodplain aggregations in Table G:1-4. For each reach, the floodplain aggregation that received the highest net benefits, when compared to cost, was selected for inclusion in the plan. Table G:1-5 displays the number of structures eligible for nonstructural measures. Of the total reaches, 46 reaches were optimized at the 0.1 AEP floodplain, 5 reaches were optimized at the 0.04 AEP floodplain, and 6 were optimized at the 0.02 AEP floodplain.

Plan 3 Nonstructural NED + OSE Increment 1

Eligibility for nonstructural measures in Plan 3 relied on the sub-reaches developed using social vulnerability described in Section 1.2. Structures included in Plan 2 were also included in Plan 3, with the addition of structures within sub-reaches that retained positive net benefits. For Plan 3, 54 reaches with structures within the 0.1 AEP floodplain, 8 reaches with structures within the 0.04 AEP, and 6 reaches with structures within the 0.02 AEP floodplain were included in the plan. The total number of structures included in Plan 3 is shown in Table G:1-5.

Plan 4 Nonstructural NED + OSE Increment 2

Eligibility for nonstructural measures in Plan 4 also relied on the sub-reaches developed using social vulnerability. Structures included in Plan 2 were included in Plan 4, with the addition of structures within socially vulnerable sub-reaches within the next highest floodplain aggregation. For example, if the reach was optimized at the 0.1 floodplain for Plan 2, if the sub-reach was socially vulnerable then in Plan 4 that sub-reach was bumped up the 0.04 AEP floodplain and additional structures were included in the plan. Plan 4 includes 19 additional reaches and 182 additional structures. Plan 4 includes 59 reaches with structures within the 0.1 AEP floodplain, 13 reaches with structures within the 0.04 AEP floodplain, and 7 reaches with structures within the 0.02 AEP floodplain.

Table G:1-4. Structures Eligible for Nonstructural Measures by Plan

Plans in Final Array	Elevate	Floodproof	Total Structures
Plan 2	2,748	369	3,117
Plan 3	2,815	374	3,189
Plan 4	2,918	380	3,298

SECTION 2

Economic and Engineering Inputs to the HED-FDA Model

2.1 HEC-FDA MODEL

2.1.1 Model Overview

The Hydrologic Engineering Center Flood Damage Analysis (HEC-FDA) Version 1.4.3 Corps-certified model was used to calculate the damages and benefits for the Amite River and Tributaries FRM evaluation. 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 uncertainty surrounding each of the economic and engineering variables was also entered into the model. Either a normal probability distribution (with a mean value and a standard deviation) or a triangular probability distribution (with a most likely maximum, and minimum value) was entered into the model to quantify the uncertainty associated with the key economic variables. A normal probability distribution was entered into the model to quantify the uncertainty surrounding the first-floor elevations. While normal distributions were preferred to represent the uncertainty in the economic variables, triangular distributions were utilized in select variables where not enough observations were known to fully develop a normal distribution. Instead of modeling without uncertainty, the economics team decided to use a triangular distribution to represent known variations in the data. The number of years that stages were recorded at a given gauge was entered for each study area reach to quantify the hydrologic uncertainty or error surrounding the stage-probability relationships.

2.2 ECONOMIC INPUTS TO THE HEC-FDA MODEL

2.2.1 Structure Inventory

A structure inventory of residential and non-residential structures for the study area was obtained through the National Structure Inventory (NSI) version 2022. After collection, the following modifications were made:

- Ground elevations were assigned based on the LiDAR data used in the hydraulic model, and foundation heights were assigned based on Google Earth Street View and sampling techniques;
- NSI occupancy types were assigned a corresponding occupancy from the 2023 RSMeans Square Foot Catalog;

- Total depreciated structure values were calculated based on the 2023 RSMeans Square Foot Catalog;
- Depth-damage functions were assigned to structure categories and structure occupancies;
- Stations (smaller geographic areas within a reach having consistent water surface profiles) and study area reaches (larger geographic area, containing stations, used to report damage results) were assigned to individual structures using GIS tools.

The 2024 RSMeans Square Foot Catalog was used to index all structure values to a 2024 price level. Table G:2-1 shows the total number of structures in the inventory by category.

Table G:2-1. Number of Structures by Category

Residential	Commercial	Industrial	Public	Total Structures
180,141	16,767	5,157	1,577	203,642

Structure Values. The 2023 RSMeans Square Foot Costs Data catalog (RSMeans catalog) was used to assign a depreciated replacement cost to the residential and non-residential structures in the study area reaches. Residential replacement costs per square foot were provided for four exterior walls types (wood siding on wood frame, brick veneer on wood frame, stucco on wood frame, and solid masonry) and three sizes (1-story, 2-story, and split-level) for homes constructed with average quality materials. An average replacement cost per square foot for the four exterior wall types was calculated for each size. Based on windshield surveys, it was determined that the majority of the structures in the study area were in average condition, with an approximate age of 20 years. The associated depreciation proportion was used to calculate a most-likely depreciated square foot cost. An additional regional adjustment factor (85 percent of the national square foot costs) for the Baton Rouge area was then applied to the depreciated cost per square foot. The square footage for each of the individual residential structures was multiplied by the most-likely depreciated cost per square for the average construction class to obtain a total depreciated cost.

Non-residential replacement costs per square foot were provided in the RSMeans catalog for six exterior wall types, which were specific to each occupancy type. An average replacement cost per square foot was calculated for each of the six exterior wall types in each non-residential occupancy. The RSMeans catalog depreciation schedule for non-residential structures provides depreciation percentages for three building materials: frame, masonry on wood, and masonry on masonry or steel. Based on windshield surveys, it was determined that the majority of the structures in the study area were built with masonry on wood, with an observed age of 20 years. The associated depreciation proportion was used to calculate a most-likely depreciated square foot cost. An additional regional adjustment factor (85 percent of the national square foot costs) for the Baton Rouge area was then applied to the depreciated cost per square foot. The square footage for each of the individual structures was multiplied by the most-likely depreciated cost per square foot for each non-residential occupancy to obtain a total depreciated cost. Table G:2-2 shows the average depreciated replacement value for residential and non-residential structures by category and occupancy type.

Table G:2-2. Residential and Non-residential Structure Inventory (2024 Price Level, $1000s)

Category	Occupancy Type	Number	Average Depreciated Replacement Value
Residential	One-Story Slab	148,175	$230.6
	One-Story Pier	8,169	$218.0
	Two-Story Slab	50,221	$169.1
	Two-Story Pier	2,805	$163.1
	Mobile Home	21,750	$64.2
Commercial	Eating and Recreation	2,121	$1,411.6
	Professional	14,073	$1,087.1
	Repair and Home Use	2,490	$929.8
	Retail and Personal Services	18	$4,106.7
	Grocery and Convenience	2,608	$1,191.6
	Multi-Family Occupancy	1,661	$1,436.2
Public	Public and Semi-Public	2,234	$2,308.2
Industrial	Warehouse	6,561	$690.7
Total Residential		231,120	$169.0
Total Non-residential		31,766	$1,645.2

Structure Value Uncertainty. A triangular probability distribution based on the depreciated replacement costs was used to represent the uncertainty surrounding the residential structure values in each occupancy category. The most-likely depreciated value for residential structures was based a 20 percent depreciation rate (consistent with an estimated age of a 20-year old structure in average condition), the minimum value was based on a 45 percent depreciation rate (consistent with an estimated age of a 30-year old structure in poor condition), and the maximum value was based on a 7 percent depreciation rate (consistent with an estimated age of a 10-year old structure in good condition). These values were then converted to a percentage of the most-likely value with the most-likely value equal to 100 percent of the average value for each occupancy category. The triangular probability distributions were entered into the HEC-FDA model to represent the uncertainty surrounding the structure values in each residential occupancy category.

A triangular probability distribution based on the depreciated replacement costs was used to represent the uncertainty surrounding the non-residential structure values in each occupancy category. The most-likely depreciated value for non-residential structures was based a 25 percent depreciation rate (consistent with an observed age of a 20-year old masonry on wood structure), the minimum value was based on a 40 percent depreciation rate (consistent with an observed age of a 30-year old frame structure), and the maximum value was based on an 8 percent depreciation rate (consistent with an observed age of a 10-year old masonry on masonry or steel structure). These values were then converted to a percentage of the most-likely value with the most-likely value equal to 100 percent of the average value for each occupancy category. The triangular probability distributions were entered into the HEC-FDA model to represent the uncertainty surrounding the structure values in each non-residential occupancy category. Table G:2-3 shows the minimum and maximum percentages of the most-likely structure values assigned to the various structure categories.

Table G:2-3. Structure Value Uncertainty Parameters

Category	Occupancy Type	Structrue Value Error	
		Lower (%)	Upper (%)
Residential	One-Story Slab	69	116
	One-Story Pier	69	116
	Two-Story Slab	69	116
	Two-Story Pier	67	116
	Mobile Home	69	116
Commercial	Eating and Recreation	80	123
	Professional	80	123
	Repair and Home Use	80	123
	Retail and Personal Services	80	123
	Grocery and Convenience	80	123
	Multi-Family Occupancy	80	123
Public	Public and Semi-Public	80	123
Industrial	Warehouse	80	123

2.2.2 Residential and Non-Residential Content-to-Structure Value Ratios

The content-to-structure value ratios (CSVRs) applied to the residential and non-residential structure occupancies were taken from an extensive survey of owners in coastal Louisiana for three large CSRM evaluations. These interviews included a sampling from residential and non-residential content categories from each of the three evaluation areas.

Since only a limited number of property owners participated in the field surveys and the participants were not randomly selected, statistical bootstrapping was performed to address the potential sampling error in estimating the mean and standard deviation of the CSVR values. Statistical bootstrapping uses re-sampling with replacement to improve the estimate of a population statistic when the sample size is insufficient for straightforward statistical inference. The bootstrapping method has the effect of increasing the sample size and accounts for distortions caused by a specific sample that may not be fully representative of the population.

2.2.3 Content-to-Structure Value Ratio Uncertainty

For each of the residential and non-residential occupancies, a mean CSVR and a standard deviation was calculated and entered into the HEC-FDA model. A normal probability density function was used to describe the uncertainty surrounding the CSVR for each content category. The expected CSVR percentage values and standard deviations for each of the residential and non-residential occupancies are shown in Table G:2-4.

Table G:2-4. Content-to-Structure Value Ratios (CSVRs) and Standard Deviations (SDs) by Occupancy

Category	Occupancy Type	CSVR (%)	SD (%)
Residential	One-Story Slab	69	37
	One-Story Pier	69	37
	Two-Story Slab	67	35
	Two-Story Pier	67	35
	Mobile Home	114	79
Commercial	Eating and Recreation	170	293
	Professional	54	54
	Repair and Home Use	236	295
	Retail and Personal Services	119	105
	Grocery and Convenience	134	78
	Multi-Family Occupancy	28	17
Public	Public and Semi-Public	55	80
Industrial	Warehouse	207	325

2.2.4 First-floor Elevations

Topographical data based on Light Detection and Ranging (LiDAR) data using the North American Vertical Datum of 1988 (NAVD 88) were used to assign ground elevations to structures and vehicles in the study area. The assignment of ground elevations and the placement of structures were based on a digital elevation model (DEM) with a 2-foot by 2-foot grid resolution developed by the United States Geological Survey (USGS), which was resampled at a 40-foot by 40-foot resolution. This ground elevation raster was obtained from the HEC-RAS hydraulic model to avoid continuity errors between the engineering and economic inputs. The ground elevation was added to the height of the foundation of the structure above the ground in order to obtain the first-floor elevation of each structure in the study area. Vehicles were assigned to the ground elevation of the adjacent residential structures.

Sampling of Foundation Heights Above Ground. The foundation heights of the residential and non-residential structures above the ground were determined using statistical random sampling procedures. Sampling was necessary due to varying types of structure foundations (slab on grade and pier/pile) and the large variation in the heights of these foundations above the ground elevation. Statistical formulas were used to account for the estimated variation, acceptable error, and level of confidence and to determine a statistically significant number of structures to be surveyed. A focused Agency Technical Review (ATR) was conducted in on this process in April of 2017 to confirm the adequacy of the sampling techniques used to develop the results.

The East Baton Rouge portion of the study area was divided into 58 neighborhoods, which were used to stratify the sample and ensure the entire area was sampled from. A total of 347 residential and non-residential structures were randomly selected for the sample in East Baton Rouge Parish. If a selected structure had been demolished or razed, then an adjacent structure was surveyed in its place. The survey team used Google Earth to collect the required information including the height of the foundation above ground (measured from the bottom of the front door to adjacent ground), the foundation type (slab or pier), and the number of stories (1-story, and 2 or more stories). This information was used to develop the average height above ground of slab on grade and pier/pile foundation structures in each neighborhood, the proportion of slab on grade foundations and pier/pile foundations, and the proportion of 1-story and 2-story structures in each neighborhood.

The mean foundation height and proportions of sampled residential 1-story and 2-story pile foundation structures and residential 1-story and 2-story slab foundation structures were applied to all the unsampled residential structures in each East Baton Rouge neighborhood. The mean foundation height and proportions of the sampled commercial 1-story and 2-story pile foundation structures and commercial 1-story and 2-story slab foundation structures were randomly applied to the unsampled commercial structures in each neighborhood. Since the commercial depth-damage relationships are only provided for commercial 1-story structures, all the commercial structures were treated as 1-story structures.

The remainder of the study area was stratified by the occupancy and foundation types provided in the National Structure Inventory. A total of 357 residential and non-residential structures were randomly selected for the sample outside of East Baton Rouge Parish. If a selected structure had been demolished or razed, then an adjacent structure was surveyed in its place. The survey team used Google Earth to collect the required information including the height of the foundation above ground (measured from the bottom of the front door to adjacent ground) and the foundation type (slab or pier). This information was used to develop the average height above ground of slab on grade and pier/pile foundation structures and the proportion of slab on grade foundations and pier/pile foundations.

The mean foundation height and proportions of sampled residential 1-story and 2-story pile foundation structures and residential 1-story and 2-story slab foundation structures were applied to all the unsampled residential structures outside East Baton Rouge Parish. The mean foundation height and proportions of the sampled commercial 1-story and 2-story pile foundation structures and commercial 1-story and 2-story slab foundation structures were randomly applied to the unsampled commercial structures. Since the commercial depth-damage relationships are only provided for commercial 1-story structures, all the commercial structures were treated as 1-story structures.

2.2.5 Uncertainty Surrounding Elevations

There are two sources of uncertainty surrounding the first-floor elevations: the use of the LiDAR data for the ground elevations, and the methodology used to determine the structure foundation heights above ground elevation. The error surrounding the LiDAR data was determined to be plus or minus 0.5895 feet at the 95 percent level of confidence. This uncertainty was normally distributed with a mean of zero and a standard deviation of 0.3 feet.

The uncertainty surrounding the foundation heights for the residential and commercial structures was estimated by calculating the standard deviations surrounding the sampled mean values for the combined inventory. An overall weighted average standard deviation for the four structure groups was computed for each structure category. The standard deviation was calculated to be 0.75 feet for residential pier foundation structures and 0.25 feet for slab foundation structures. The standard deviation for non-residential structures was calculated to be 0.64 feet.

The standard deviations for the ground elevations and foundation heights were combined, which resulted in a 0.81 feet standard deviation for residential pier foundation structures and 0.439 for slab foundation structures. For non-residential structures, the combined standard deviation was calculated to be 0.71 feet. Table G:2-5 displays the calculations used to combine the uncertainty surrounding the ground elevations with uncertainty surrounding the foundation height to derive the uncertainty surrounding the first-floor elevations of residential and non-residential structures. Table G:2-6 displays the average foundation heights and standard deviations by occupancy type.

Table G:2-5. First-floor Stage Uncertainty Standard Deviation (SD) Calculation

Ground - LiDAR	
(conversion cm to inches to feet)	
+/- 18 cm @ 95% confidence	18cm
	x 0.393
z = (x - u)/ std. dev.	7.074in
	÷ 12
1.96 = (0.5895 - 0)/ std.dev.	0.5895ft
0.3007 = std.dev.	

Foundation Height (shown in feet)			
Residential		Commercial	Industrial
Pier	Slab	All	All
0.75	0.25	0.64	0.64

Combined First Floor (shown in feet)				
Residential		Commercial	Industrial	
Pier	Slab	All	All	
0.30	0.30	0.30	0.30	ground std. dev.
0.09	0.09	0.09	0.09	ground std. dev. Squared
0.75	0.25	0.64	0.64	1st floor std. dev.
0.56	0.06	0.41	0.41	1st floor std. dev. squared
0.65	0.15	0.50	0.50	Sum of Squared
0.81	**0.39**	**0.71**	**0.71**	**Square Root of Sum of Squared = Combined Std. Dev.**

Note 1: Mobile Homes are assigned the same uncertainty as Residential Pier.
Note 2: Autos do not have foundations, so only ground uncertainty is used.

Table G:2-6. Average Foundation Heights and Standard Deviations (SD) by Occupancy Type (feet)

Category	Occupancy Type	Average Foundation Height	Standard Deviations		
			Ground Stage SD	Foundation Height SD	First Floor SD
Residential	One-Story Slab	0.58	0.30	0.25	0.39
	One-Story Pier	2.17	0.30	0.75	0.81
	Two-Story Slab	0.63	0.30	0.25	0.39
	Two-Story Pier	1.93	0.30	0.75	0.81
	Mobile Home	3.14	0.30	0.75	0.81
Commercial	Eating and Recreation	0.65	0.30	0.64	0.71
	Professional	0.64	0.30	0.64	0.71
	Repair and Home Use	0.64	0.30	0.64	0.71
	Retail and Personal Services	0.5	0.30	0.64	0.71
	Grocery and Convenience	0.65	0.30	0.64	0.71
	Multi-Family Occupancy	0.62	0.30	0.64	0.71
Public	Public and Semi-Public	0.51	0.30	0.64	0.71
Industrial	Warehouse	0.64	0.30	0.64	0.71

2.2.6 Depth-Damage Relationships

The depth-damage relationships, developed by a panel of building and construction experts for the Lower Atchafalaya and Morganza to the Gulf, Louisiana feasibility studies, were used in the economic analysis. These relationships were deemed appropriate because the two study areas are geographically close and have similar structure categories and occupancies. Because the ART study area is mainly impacted by riverine and rainfall flooding, the short-duration freshwater (less than 24 hours) depth-damage curves were selected.

Depth-damage relationships indicate the percentage of the total structure and content value that would be damaged at various depths of flooding. For residential structures, damage percentages were provided at each 1-foot increment from 2 feet below the first-floor elevation to 16 feet above the first-floor elevation for the structural components and the content components. Damage percentages were determined for each 0.5- foot increment from 0.5-foot below first-floor elevation to 2 feet above first-floor, and for each 1-foot increment from 2 feet to 15 feet above first-floor elevation for non-residential structures.

2.2.7 Uncertainty Surrounding Depth-Damage Relationships

A triangular probability density function was used to determine the uncertainty surrounding the damage percentage associated with each depth of flooding for all occupancy types. A minimum, maximum, and most-likely damage estimate was provided by a panel of experts for each depth of flooding. The specific range of values regarding probability distributions for the depth-damage curves can be found in the final report dated May 1997 entitled *Depth-Damage Relationships for Structures, Contents, and Vehicles and Content-to-Structure Value Ratios (CSVRs) in Support of the Lower Atchafalaya Reevaluation and Morganza to the Gulf, Louisiana Feasibility Studies.* The specific range of values regarding probability distributions for the debris depth-damage curves can be found in the final report dated March 2012 entitled *Development of Depth-Emergency Cost and Infrastructure Damage Relationships for Selected South Louisiana Parishes.*

2.3 ENGINEERING INPUTS TO THE HEC-FDA MODEL

2.3.1 Stage-Probability Relationships

Stage-probability relationships were provided for the existing condition (2026) without-project and future without project conditions (2076). Water surface profiles were provided for eight annual exceedance probability (AEP) events: 0.50 (2-year), 0.20 (5-year), 0.10 (10-year), 0.04 (25-year), 0.02 (50-year), 0.01 (100-year), 0.005 (200-year), and 0.002 percent (500-year). The ART experiences flooding from riverine rainfall events and coastal storm surge. Due to these circumstances, the water surface profiles were based on predominant condition hydraulics. Relative sea level rise was evaluated and documented in the H&H appendix for the areas impacted by storm surge. A sensitivity analysis of sea level rise impacts to economic evaluation will be performed on the recommended plan after TSP.

2.3.2 Uncertainty Surrounding the Stage-Probability Relationships

A 50-year equivalent record length was used to quantify the uncertainty surrounding the stage-probability relationships for each study area reach. Based on this equivalent record length, the HEC-FDA model calculated the confidence limits surrounding the stage-probability functions.

SECTION 3

National Economic Development (NED) Flood Damage and Benefit Calculations

3.1 HEC-FDA MODEL CALCULATIONS

The HEC-FDA model was utilized to evaluate flood damages using risk-based analysis. Damages were reported at the index location for each of the 136-study area reaches and sub-reaches for which a structure inventory had been created. A range of possible values, with a maximum and a minimum value for each economic variable (first-floor elevation, structure and content values, and depth-damage relationships), was entered into the HEC-FDA model to calculate the uncertainty or error surrounding the elevation-damage, or stage-damage, relationships. The model also used the number of years that stages were recorded at a given gage to determine the hydrologic uncertainty surrounding the stage-probability relationships.

The possible occurrences of each variable were derived through the use of Monte Carlo simulation, which used randomly selected numbers to simulate the values of the selected variables from within the established ranges and distributions. For each variable, a sampling technique was used to select from within the range of possible values. With each sample, or iteration, a different value was selected. The number of iterations performed affects the simulation execution time and the quality and accuracy of the results. This process was conducted simultaneously for each economic and hydrologic variable. The resulting mean value and probability distributions formed a comprehensive picture of all possible outcomes.

3.1.1 Stage-Damage Relationships with Uncertainty

The HEC-FDA model used the economic and engineering inputs to generate a stage-damage relationship for each structure category in each study area reach under base year (2026) conditions and the future without project (2076) conditions. The possible occurrences of each economic variable were derived through the use of Monte Carlo simulation. A total of 1,000 iterations were executed in the model for the stage-damage relationships. The sum of all sampled values was divided by the number of samples to yield the expected value for a specific simulation. A mean and standard deviation was automatically calculated for the damages at each stage.

3.1.2 Stage-Probability Relationships with Uncertainty

The HEC-FDA model used an equivalent record length (50 years) for each study area reach to generate a stage-probability relationship with uncertainty for the without-project condition under base year (2026) conditions and future without project (2076) conditions through the use of graphical analysis. The model used the eight stage-probability events together with the equivalent record length to define the full range of the stage-probability functions by interpolating between the data points. Confidence bands surrounding the stages for each of the probability events were also provided.

3.1.3 Without-Project Expected Annual Damages

The model used Monte Carlo simulation to sample from the stage-probability curve with uncertainty. For each of the iterations within the simulation, stages were simultaneously selected for the entire range of probability events. The sum of all damage values divided by the number of iterations run by the model yielded the expected value, or mean damage value, with confidence bands for each probability event. The probability-damage relationships are integrated by weighing the damages corresponding to each magnitude of flooding (stage) by the percentage chance of exceedance (probability). From these weighted damages, the model determined the expected annual damages (EAD) with confidence bands (uncertainty). For the without-project Plan, the EAD were totaled for each study area reach to obtain the total without-project EAD under base year (2026) conditions and future without project (2076) conditions.

Tables G:3-1 and G:3-2 show the number of structures and total damage, respectively, at each of the annual exceedance probability (AEP) events in the base year and the future year without project condition by category.

Table G:3-1 Structures Damaged Without Project by Probability Event

Annual Chance Exceedance (ACE) Event	Residential	Commercial	Industrial	Public	Total
Base Year 2026					
0.50 (2 yr)	-	-	-	-	-
0.20 (5 yr)	-	-	-	-	-
0.10 (10 yr)	4,868	300	277	27	5,445
0.04 (25 yr)	8,082	537	436	47	9,055
0.02 (50 yr)	12,240	874	674	74	13,788
0.01 (100 yr)	18,204	1,363	917	108	20,484
0.005 (200 yr)	25,508	2,100	1,168	181	28,776
0.002 (500 yr)	35,956	3,185	1,534	286	40,675
Future Year 2076					
0.50 (2 yr)	-	-	-	-	-
0.20 (5 yr)	-	-	-	-	-
0.10 (10 yr)	7,185	435	462	38	8,082
0.04 (25 yr)	11,564	830	732	70	13,126
0.02 (50 yr)	16,207	1,282	947	107	18,436
0.01 (100 yr)	23,217	1,901	1,198	158	26,316
0.005 (200 yr)	29,124	2,474	1,419	222	33,017
0.002 (500 yr)	39,551	3,413	1,784	325	44,748

Table G:3-2 Structure Damage Without Project by Probability Event (2024 Price Level; $1000s)

Annual Chance Exceedance (ACE) Event	Residential	Commercial	Industrial	Public	Total
Base Year 2026					
0.50 (2 yr)	-	-	-	-	-
0.20 (5 yr)	-	-	-	-	-
0.10 (10 yr)	$342,333	$47,870	$41,003	$10,579	$431,206
0.04 (25 yr)	$658,857	$96,640	$83,877	$23,136	$839,374
0.02 (50 yr)	$1,118,695	$186,027	$151,083	$39,535	$1,455,806
0.01 (100 yr)	$1,842,667	$382,785	$250,767	$85,340	$2,476,220
0.005 (200 yr)	$2,759,383	$684,133	$372,783	$136,691	$3,816,299
0.002 (500 yr)	$4,278,138	$1,357,116	$581,354	$304,466	$6,216,608
Future Year 2076					
0.50 (2 yr)	-	-	-	-	-
0.20 (5 yr)	-	-	-	-	-
0.10 (10 yr)	$595,949	$86,594	$85,760	$18,354	$768,303
0.04 (25 yr)	$1,089,241	$184,856	$169,056	$52,938	$1,443,152
0.02 (50 yr)	$1,709,650	$368,787	$278,946	$79,383	$2,357,383
0.01 (100 yr)	$2,603,172	$632,318	$397,241	$142,511	$3,632,731
0.005 (200 yr)	$3,445,718	$1,052,054	$540,719	$262,417	$5,038,492
0.002 (500 yr)	$4,929,996	$1,723,931	$779,927	$397,545	$7,433,854

3.1.4 Expected and Equivalent Annual Damages and Benefits for the Final Array of Plans

The HEC-FDA model used linear interpolation for the years between 2026 and 2076 to obtain the stream of expected annual damages over the 50-year period of analysis. The FY 2024 Federal interest rate of 2.75 percent was used to discount the stream of expected annual damages and benefits occurring after the base year to calculate the total present value of the damages over the period of analysis. The present value of the expected annual damages was then amortized over the period of analysis using the Federal interest rate to calculate the equivalent annual damages. Expected and equivalent annual damages for the final array are shown by structure category in Table G:3-3. Expected and equivalent annual damages and benefits for the final array are shown in Table G:3-4. Table G:3-5 shows the probability benefits for each of the plans exceeds the values indicated at the 0.75, 0.50 and 0.25 confidence levels.

Table G:3-3 Expected and Equivalent Annual Damage by Plan and Category (2024 Price Level; FY24 Federal Discount Rate; $1000s)

Plan	Commercial	Industrial	Public	Residential	Total
Base Year 2026					
No action	$36,954	$26,553	$6,903	$126,147	$196,557
Plan 2	$30,148	$20,136	$5,730	$82,125	$138,139
Plan 3	$30,105	$20,141	$5,729	$81,395	$137,370
Plan 4	$30,000	$20,106	$5,729	$80,652	$136,487
Future Year 2076					
No action	$56,728	$44,840	$10,456	$179,891	$291,914
Plan 2	$50,164	$39,062	$9,526	$131,168	$229,921
Plan 3	$50,119	$39,067	$9,526	$130,426	$229,137
Plan 4	$50,009	$39,030	$9,525	$129,668	$228,233
Equivalent at 2.75% FY24 Interest Rate					
No action	$44,474	$33,508	$8,255	$146,587	$232,824
Plan 2	$37,760	$27,335	$7,174	$100,778	$173,046
Plan 3	$37,717	$27,339	$7,173	$100,043	$172,272
Plan 4	$37,610	$27,303	$7,173	$99,294	$171,381

Table G:3-4 Expected and Equivalent Annual Damages and Benefits by Plan (2024 Price Level; FY24 Federal Discount Rate; $1000s)

Plan	Damages	Benefits
Base Year 2026		
No action	$196,557	$0
Plan 2	$138,139	$58,418
Plan 3	$137,370	$59,187
Plan 4	$136,487	$60,070
Future Year 2076		
No action	$291,914	$0
Plan 2	$229,921	$61,993
Plan 3	$229,137	$62,777
Plan 4	$228,233	$63,681
Equivalent at 2.75% FY24 Interest Rate		
No action	$232,824	$0
Plan 2	$173,046	$59,778
Plan 3	$172,272	$60,552
Plan 4	$171,381	$61,444

Table G:3-5 Expected and Equivalent Annual Damages and Benefits by Plan and Probability (2024 Price Level; FY24 Federal Discount Rate; $1000s)

Plan	Probability Benefits Exceeds Values Inidcated		
	0.75	**0.50**	**0.25**
Base Year 2026			
Plan 2	$44,013	$55,563	$71,124
Plan 3	$44,535	$56,275	$72,087
Plan 4	$45,042	$57,080	$73,267
Base Year 2076			
Plan 2	$47,793	$60,168	$74,669
Plan 3	$48,324	$60,898	$75,649
Plan 4	$48,840	$61,727	$76,864
Equivalent at 2.75% FY24 Interest Rate			
Plan 2	$45,447	$57,308	$72,466
Plan 3	$45,973	$58,027	$73,435
Plan 4	$46,483	$58,841	$74,629

SECTION 4
Project Costs of the TSP

4.1 NONSTRUCTURAL COSTS – ELEVATION & FLOODPROOFING

Nonstructural cost estimates for the final array were developed through a joint effort between the New Orleans District Economics and Cost Engineering Branches. A 32 percent contingency was applied to all nonstructural cost estimates to represent the uncertainty regarding the cost and schedule risk of these measures. The contingency amount was computed during a detailed cost risk analysis performed for the South-Central Coastal Louisiana Feasibility Study and was applied to this study after reviewing the associated risks and concluding they were similar for both studies. Due to uncertainty surrounding Planning, Engineering, and Design costs there is a range of costs displayed in Section 5.

4.1.1 Residential Structures

The estimate of the cost to elevate all residential structures was computed once model execution was completed. Elevation costs were based on the difference in the number of feet between the original first-floor elevation and the target elevation (the future condition 100-year stage, including sea level rise) for each structure in the HEC-FDA module. The number of feet that each structure was raised was rounded to the closest 1-foot increment, with the exception that structures less than 1 foot below the target elevation were rounded-up to 1 foot. Elevation costs by structure were summed to yield an estimate of total structure elevation costs.

The cost per square foot for raising a structure was based on data obtained during interviews in 2008 with representatives of three major metropolitan New Orleans area firms that specialize in the structure elevation. Composite costs were derived for residential structures by type: slab and pier foundation, 1- story and 2- story configuration, and for mobile homes. These composite unit costs also vary by the number of feet that structures may be elevated. Table G:4-1 displays the costs for each of the five residential categories analyzed and by the number of feet elevated.

The cost per square foot to raise an individual structure to the target height was multiplied by the footprint square footage of each structure to compute the costs to elevate the structure. The footprint square footage for each structure was determined by applying the average square footage estimated for each residential structure. Added to the elevation cost was the cost of performing an architectural survey, which is associated with cultural resources concerns. The total costs for all elevated structures were annualized over the 50-year period of analysis of the project using the FY 2024 Federal discount rate of 2.75 percent. The square foot costs for elevation were price indexed to FY23 price levels using RSMeans cost catalog.

Table G:4-1. Nonstructural Elevation Costs for Residential Structures (2023 Price Level; $/Sq ft)

Height (ft)	1-Story Pier	1-Story Slab	2-Story Pier	2-Story Slab	Mobile Home
1	61	99	50	78	80
2	61	99	50	78	80
3	62	103	52	81	83
4	65	107	55	84	86
5	68	110	58	87	88
6	71	115	60	91	91
7	92	130	77	102	104
8	97	135	82	106	110
9	98	140	83	110	113
10	105	145	89	114	118
11	110	149	92	118	121
12	113	155	94	122	125
>=13	117	158	100	126	129

4.1.2 Non-residential Structures

The floodproofing measures were applied to all non-residential structures. Separate cost estimates were developed to floodproof non-residential structures based on their relative square footage. Table G:4-2 shows a summary of square footage costs for floodproofing. These costs were developed for the Draft Nonstructural Plans Feasibility Study, Donaldsonville, LA to the Gulf evaluation (September 14, 2012) by contacting local contractors and were adopted for this study due to the similarity in the structure types between the two study areas. Added to the floodproofing cost was the cost of performing an architectural survey, which is associated with cultural resources concerns. Again, final cost estimates are expressed at a 2024 price level.

Table G:4-2. Nonstructural Floodproofing Costs for Non-residential Structures (2023 Price Level)

Structure Square Footage	Total Cost
up to 20,000	$179,334
20,001 to 109,999	$447,469
110,000 or more	$1,072,242

4.1.3 Annual Project Costs

The initial construction costs (first costs) were used to determine the interest during construction and gross investment cost at the end of the installation period (2026). Interest during construction was calculated in accordance with PB 2019-03 guidance for calculating interest during construction on a nonstructural project. The construction schedule for each of the ART nonstructural plans was assumed to be 3 months. The FY 2024 Federal interest rate of 2.75 percent was used to discount the costs to the base year and then amortize the costs over the 50-year period of analysis using midyear discounting. Cost engineering provided both a low estimate with a 10 percent PED cost and a high estimate with an 18 percent PED cost. The annualization of both these estimates are provided for each plan of the final array in Table G:4-3.

Table G:4-3 Summary of Project Costs for Final Array (2024 Price Level; FY24 Federal Discount Rate; $1000s)

Final Array	Plan 2		Plan 3		Plan 4	
	Low	High	Low	High	Low	High
Construction First Cost	$1,469,853	$1,560,803	$1,510,378	$1,603,866	$1,561,330	$1,657,967
Interest During Construction	$4,993	$5,302	$5,131	$5,448	$5,304	$5,632
Total Construction Cost	$1,474,846	$1,566,105	$1,515,509	$1,609,314	$1,566,634	$1,663,599
Average Annual Total Construction Cost	$54,630	$58,010	$56,136	$59,610	$58,030	$61,621

SECTION 5

Results of the Economic Analysis

5.1 NET BENEFIT ANALYSIS

5.1.1 Calculation of Net Benefits

The equivalent annual benefits were compared to the annual costs to develop a benefit-to-cost ratio for each of the plans in the final array. The net benefits for the Plans were calculated by subtracting the annual costs from the base year equivalent annual benefits. Table G:5-1 shows the average annual costs, benefits, net benefits, and benefit-to-cost ratios for the plans in the final array. The National Economic Development (NED) plan is the plan that reasonably maximizes net benefits. This analysis found Plan 2 to be the NED plan and Plan 4 to be the Tentatively Selected Plan (TSP).

Table G:5-1 Annual Costs and Benefits Summary (2024 Price Level; FY24 Discount Rate; $1000s)

Final Array	Plan 2 (NED)		Plan 3		Plan 4 (TSP)	
	Low Cost	High Cost	Low Cost	High Cost	Low Cost	High Cost
Construction First Cost	$1,469,853	$1,560,803	$1,510,378	$1,603,866	$1,561,330	$1,657,967
Interest During Construction	$4,993	$5,302	$5,131	$5,448	$5,304	$5,632
Total Construction Cost	$1,474,846	$1,566,105	$1,515,509	$1,609,314	$1,566,634	$1,663,599
Average Annual Construction Cost	$54,630	$58,010	$56,136	$59,610	$58,030	$61,621
Equivalent Annual Benefits	$59,778		$60,552		$61,444	
Annual Net Benefits	$5,148	$1,768	$4,416	$942	$3,414	-$178
Benefit-to-Cost Ratio (BCR)	1.094	1.030	1.079	1.016	1.059	0.997

5.2 RISK ANALYSIS

5.2.1 Benefit Exceedance Probability Relationship

The HEC-FDA model incorporates the uncertainty surrounding the economic and engineering inputs to generate results that can be used to assess the performance of proposed plans. The HEC-FDA model was used to calculate expected annual without-project and with-project damages and the damages reduced for each of the plans in the final array. Table G:5-2 shows the benefit exceedance probability relationship for each of the plans compared to the point estimate of the average annual cost. As benefits exceeding costs translates to a benefit-to-cost ratio 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.

Table G:5-2. Probability Annual Benefits Exceed Annual Costs for Low and High Cost Estimates (2024 Price Level; FY24 Federal Discount Rate; $1000s)

Plan	Probability Benefits Exceeds Indicated Values			Low Annual Costs	Probability Benefits Exceed Low Cost
	75%	50%	25%		
Plan 2 (NED)	$45,447	$57,308	$72,466	$54,630	50% to 75%
Plan 3	$45,973	$58,027	$73,435	$56,136	50% to 75%
Plan 4 (TSP)	$46,483	$58,841	$74,629	$58,030	50% to 75%
Plan	**Probability Benefits Exceeds Indicated Values**			**High Annual Costs**	**Probability Benefits Exceed High Cost**
	75%	**50%**	**25%**		
Plan 2 (NED)	$45,447	$57,308	$72,466	$58,010	25% to 50%
Plan 3	$45,973	$58,027	$73,435	$59,610	25% to 50%
Plan 4 (TSP)	$46,483	$58,841	$74,629	$61,621	25% to 50%

5.2.2 Residual Risk

The ART study area is impacted by riverine flooding and coastal storm surge. The ART study is authorized as a flood risk reduction study, therefore nonstructural Plans were developed using riverine water surface elevation. This excludes structures impacted solely by coastal storm surge from inclusion in the final array. Table G:5-3 shows the number of structures with first-floor flooding by flood source and frequency. The final array of plans, developed using riverine water surface elevations, reduces approximately 30 percent of the existing condition damages.

Table G:5-3 Number of Structures with First-floor Flooding Based on Source of Flooding

Annual Exceedance Probability	Structures with first-floor flooding from predominantly…	
	Rainfall (currently included in analysis)	Coastal Storm Surge (currently not included in analysis)
0.1 (10 year)	2985	2970
0.04 (25 year)	4340	5801
0.02 (50 year)	6100	8791

Nonstructural measures are voluntary, and this analysis assumes 100 percent participation. A participation rate sensitivity analysis will be performed after TSP.

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, smoothing of hydraulic data between 1D and 2D model boundaries, and inclusion of saltwater depth-damage relationships for structures predominately impacted by coastal surge. 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.

SECTION 6
Regional Economic Development

6.1 RECONS ANALYSIS

6.1.1 Background

The U.S. Army Corps of Engineers (USACE) Institute for Water Resources developed a regional economic impact modeling tool, Regional Economic Systems (RECONS), that provides estimates of jobs and other economic measures such as labor income, value-added, and sales that are supported by USACE programs, projects, and activities. 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. There are three categories of economic impacts that RECONS outputs including the direct effects, indirect effects, and induced effects. Direct effects represent the proportions of USACE expenditure that flows to material and service providers within a given impact area. Indirect effects are the backward-linked suppliers for goods and services used by the directly affected activities. Lastly, induced effects come from household expenditures that are associated with the direct and indirectly affected workers. These measures are collectively identified as secondary effects which include number of jobs, employment earnings, sales, and value added. RECONS allows the USACE to evaluate the regional economic impact and contribution associated with USACE expenditures, activities, and infrastructure.

In order to interpret the results, a description of the metrics is provided:

- Output: The total transactions resulting from the construction project. This includes both the value added and intermediate goods purchased in the economy.
- Labor Income: All forms of employment income including employee compensations (wages and benefits) and proprietor income.
- Value Added: This is also known as the Gross Regional Product and represents the value-added output of the study regions. It captures all final goods and services produced in the study areas due to the project. One dollar of a final good or service can have multiple transactions.
- Jobs: The estimated worker-years of labor required to build the project.

The input-output analysis is based on the following set of assumptions:

1. The production functions of industries have constant returns to scale, so if the output increases, inputs will increase in the same proportion.

2. Industries face no supply constraints; they have access to all the materials they can use.
3. Industries have a fixed commodity input structure; they will not substitute any commodities or services used in the output production in response to price changes.
4. Industries produce their commodities in fixed proportions; therefore, an industry will only increase the production of a commodity if it increases production in every other commodity it produces.
5. Industries are assumed to use the same technology to produce all their commodities.

6.1.2 Results

The expenditures associated with the Nonstructural NED Plan in Baton Rouge, Louisiana are estimated to be $1,560,787,745. The spending profile percentages were adjusted to better characterize a nonstructural project. More specifically, construction of buildings and residential structures became more heavily weighted as well as the amount of cement materials used. Lastly, private sector labor was more heavily weighted in comparison to the architectural, design, and engineering services. Of this total expenditure, $1,216,348,366 will be captured within the local impact area. The remainder of the expenditures will be captured within the state impact area and the nation. These direct expenditures generate additional economic activity, often called secondary or multiplier effects. The direct and secondary impacts are measured in output, jobs, labor income, and gross regional product (value added). The regional economic effects are shown for the local, state, and national impact areas. In summary, the expenditures $1,560,787,745 support a total of 14,524.3 full-time equivalent jobs, $1,088,217,997 in labor income, $1,391,463,839 in the gross regional product, and $2,160,209,177 in economic output in the local impact area. More broadly, these expenditures support 23,627.4 full-time equivalent jobs, $1,736,532,656 in labor income, $2,401,503,673 in the gross regional product, and $3,989,244,014 in economic output in the nation. A summary of the results for Plan 2 can be found in Table G:6-1.

Table G:6-1. Plan 2: Nonstructural NED Plan Overall Summary

Area	Local Capture	Output	Jobs*	Labor Income	Value Added
Local					
Direct Impact		$1,216,348,366	9,361.9	$785,725,840	$851,512,231
Secondary Impact		$943,860,811	5,162.3	$302,492,157	$539,951,608
Total Impact	$1,216,348,366	$2,160,209,177	14,524.3	$1,088,217,997	$1,391,463,839
State					
Direct Impact		$1,308,758,568	10,431.2	$825,344,685	$909,988,594
Secondary Impact		$1,073,907,227	5,863.3	$333,659,723	$601,542,313
Total Impact	$1,308,758,568	$2,382,665,795	16,294.4	$1,159,004,409	$1,511,530,907
US					
Direct Impact		$1,502,926,045	12,480.2	$943,669,425	$1,043,021,062
Secondary Impact		$2,486,317,969	11,147.3	$792,863,231	$1,358,482,611
Total Impact	$1,502,926,045	$3,989,244,014	23,627.4	$1,736,532,656	$2,401,503,673

** Jobs are presented in full-time equivalence (FTE)*

The expenditures associated with the Nonstructural NED + OSE Increment 1 plan in Baton Rouge, Louisiana are estimated to be $1,603,850,324. More specifically, construction of buildings and residential structures became more heavily weighted as well as the amount of cement materials used. Lastly, private sector labor was more heavily weighted in comparison to the architectural, design, and engineering services. Of this total expenditure, $1,249,907,764 will be captured within the local impact area. The remainder of the expenditures will be captured within the state impact area and the nation. These direct expenditures generate additional economic activity, often called secondary or multiplier effects. The direct and secondary impacts are measured in output, jobs, labor income, and gross regional product (value added). The regional economic effects are shown for the local, state, and national impact areas. In summary, the expenditures $1,603,850,324 support a total of 14,925.0 full-time equivalent jobs, $1,118,242,242 in labor income, $1,429,854,723 in the gross regional product, and $2,219,809,964 in economic output in the local impact area. More broadly, these expenditures support 24,279.3 full-time equivalent jobs, $1,784,444,087 in labor income, $2,467,761,844 in the gross regional product, and $4,099,308,395 in economic output in the nation. A summary of results for Plan 3 can be found in Table G:6-2.

Table G:6-2. Plan 3: Nonstructural NED + OSE Increment 1

Area	Local Capture	Output	Jobs*	Labor Income	Value Added
Local					
Direct Impact		$1,249,907,764	9,620.2	$807,404,240	$875,005,696
Secondary Impact		$969,902,200	5,304.8	$310,838,002	$554,849,026
Total Impact	$1,249,907,764	$2,219,809,964	14,925.0	$1,118,242,242	$1,429,854,723
State					
Direct Impact		$1,344,867,590	10,719.0	$848,116,181	$935,095,439
Secondary Impact		$1,103,536,634	6,025.0	$342,865,490	$618,139,037
Total Impact	$1,344,867,590	$2,448,404,224	16,744.0	$1,190,981,671	$1,553,234,476
US					
Direct Impact		$1,544,392,203	12,824.5	$969,705,533	$1,071,798,310
Secondary Impact		$2,554,916,191	11,454.8	$814,738,554	$1,395,963,534
Total Impact	$1,544,392,203	$4,099,308,395	24,279.3	$1,784,444,087	$2,467,761,844

** Jobs are presented in full-time equivalence (FTE)*

The expenditures associated with the Nonstructural NED + OSE Increment 1 plan in Baton Rouge, Louisiana are estimated to be $1,657,950,796. More specifically, construction of buildings and residential structures became more heavily weighted as well as the amount of cement materials used. Lastly, private sector labor was more heavily weighted in comparison to the architectural, design, and engineering services. Of this total expenditure, $1,292,069,179 will be captured within the local impact area. The remainder of the expenditures will be captured within the state impact area and the nation. These direct expenditures generate additional economic activity, often called secondary or multiplier effects. The direct and secondary impacts are measured in output, jobs, labor income, and gross regional product (value added). The regional economic effects are shown for the local, state, and national impact areas. In summary, the expenditures $1,657,950,796 support a total of 15,428.5 full-time equivalent jobs, $1,155,962,366 in labor income, $1,478,086,040 in the gross regional product, and $2,294,687,753 in economic output in the local impact area. More broadly, these expenditures support 25,098.3 full-time equivalent jobs, $1,844,636,279 in labor income, $2,551,003,451 in the gross regional product, and $4,237,584,712 in economic output in the nation. A summary of the results for Plan 4 can be found in Table G:6-3.

Table G:6-3. Plan 4: Nonstructural NED + OSE Increment 2

Area	Local Capture	Output	Jobs*	Labor Income	Value Added
Local					
Direct Impact		$1,292,069,179	9,944.8	$834,639,294	$904,521,057
Secondary Impact		$1,002,618,574	5,483.7	$321,323,072	$573,564,984
Total Impact	$1,292,069,179	$2,294,687,753	15,428.5	$1,155,962,366	$1,478,086,040
State					
Direct Impact		$1,390,232,154	11,080.5	$876,724,514	$966,637,724
Secondary Impact		$1,140,760,713	6,228.3	$354,430,899	$638,989,868
Total Impact	$1,390,232,154	$2,530,992,867	17,308.8	$1,231,155,413	$1,605,627,592
US					
Direct Impact		$1,596,487,056	13,257.1	$1,002,415,273	$1,107,951,805
Secondary Impact		$2,641,097,656	11,841.2	$842,221,006	$1,443,051,647
Total Impact	$1,596,487,056	$4,237,584,712	25,098.3	$1,844,636,279	$2,551,003,451

** Jobs are presented in full-time equivalence (FTE)*

SECTION 7
Other Social Effects

7.1 BACKGROUND

According to the memorandum for the Comprehensive Documentation of Benefits, 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 ART Plans are evaluated based on their performance across applicable subthemes, including Social Vulnerability & Resiliency, Health & Safety, Economic Vitality, Social Connectedness, Participation, Leisure & Recreation, and Environmental Justice Considerations.

7.1.1 Basic Social Statistics

Population

The ART study area is home to nearly 800,000 residents spanning from the Mississippi-Louisiana state line at St. Helena Parish in the north, to St. James and St. John the Baptist Parishes in the south. The majority of the population impacted by the ART study is located in East Baton Rouge Parish. Table G:7-1 provides a breakdown of population in the area estimated out to 2045. Table G:7-2 provides a breakdown by number of households in the area estimated out to 2045 and Table G:7-3 provides a breakdown by per capita income in the area estimated out to 2045.

Table G:7-1. Population (2000 - 2045) by Parish/County

Parish	2000	2010	2017	2025	2045
Ascension	76,627	107,215	122,948	136,988	161,973
East Baton Rouge	412,852	440,171	446,268	441,495	415,720
East Feliciana	21,360	20,267	19,412	18,140	15,910
Iberville	33,320	33,387	33,027	31,166	27,428
Livingston	91,814	128,026	138,228	150,306	166,260
St. Helena	10,525	11,203	10,363	9,681	8,592
St. James	21,201	22,006	21,790	22,599	23,727
St. John the Baptist	43,248	45,621	44,078	45,713	47,995

Sources: 2000, 2010, 2017 from U.S. Census Bureau; 2025, 2045 from Moody's Analytics (ECCA) Forecast

Households

Table G:7-2. Households (2000 - 2045) by Parish/County

Parish	2000	2010	2017	2025	2045
Ascension	26,995	38,050	44,890	51,815	66,244
East Baton Rouge	156,740	172,440	179,910	184,008	186,082
East Feliciana	6,694	6,996	6,922	6,752	6,411
Iberville	10,697	11,075	11,229	11,137	10,643
Livingston	32,997	46,297	52,184	57,891	69,149
St. Helena	3,890	4,323	4,116	3,995	3,810
St. James	7,002	7,691	7,945	8,561	9,727
St. John the Baptist	14,381	15,875	16,005	17,249	19,602

Sources: 2000, 2010 from U.S. Census Bureau; 2017, 2025, 2045 from Moody's Analytics (ECCA) Forecast

Income

Table G:7-3. Per Capita Income ($) by Parish/County

Parish/County	2000	2010	2017	2025
Ascension	24,052	39,416	47,628	60,180
East Baton Rouge	27,228	39,651	48,120	60,048
East Feliciana	20,049	33,122	39,908	53,331
Iberville	18,681	32,342	38,960	50,288
Livingston	21,521	32,621	39,883	51,341
St. Helena	16,821	34,136	41,273	55,046
St. James	18,722	38,421	45,219	60,576
St. John the Baptist	20,002	33,894	41,505	57,423

7.2 OTHER SOCIAL EFFECTS – EXISTING CONDITION

7.2.1 Social Vulnerability & Resiliency

Social vulnerability is described by 09-R-4 (IWR) as the capacity to be disproportionately damaged or impacted by hazardous events. Certain characteristics relating to a community's population are indicators as to whether a community is more socially vulnerable. The term resiliency refers specifically to a community's ability to cope and recover from hazards or impacts.

Center for Disease Control's Social Vulnerability Index

The CDC's Social Vulnerability Index (SVI) uses American Community Survey (BOC) to quantify a community's ability to respond and cope with a hazardous event. Figure G:7-1 displays the overall vulnerability of the ART Study Area. Within the overall SVI, there are four subthemes that are incorporated, which include Socioeconomic Status, Household Characteristics, Racial & Ethnic Minority Status, and Housing Type & Transportation. In order to identify areas experiencing social vulnerability, a 90th percentile threshold was applied across the four themes in addition to the overall vulnerability. Out of 191 Louisiana Census Tracts within the ART study area, there were 46 that were identified as experiencing social vulnerability.

In order to incorporate social vulnerability into economic benefit analysis, economic subunits, or reaches, were delineated based on the same criteria shown in Figure G:7-1. Structures in these areas are within the 90th percentile or higher for any of the CDC's Social Vulnerability Index themes. Through this process, an additional 46 areas were identified as socially vulnerable reaches.

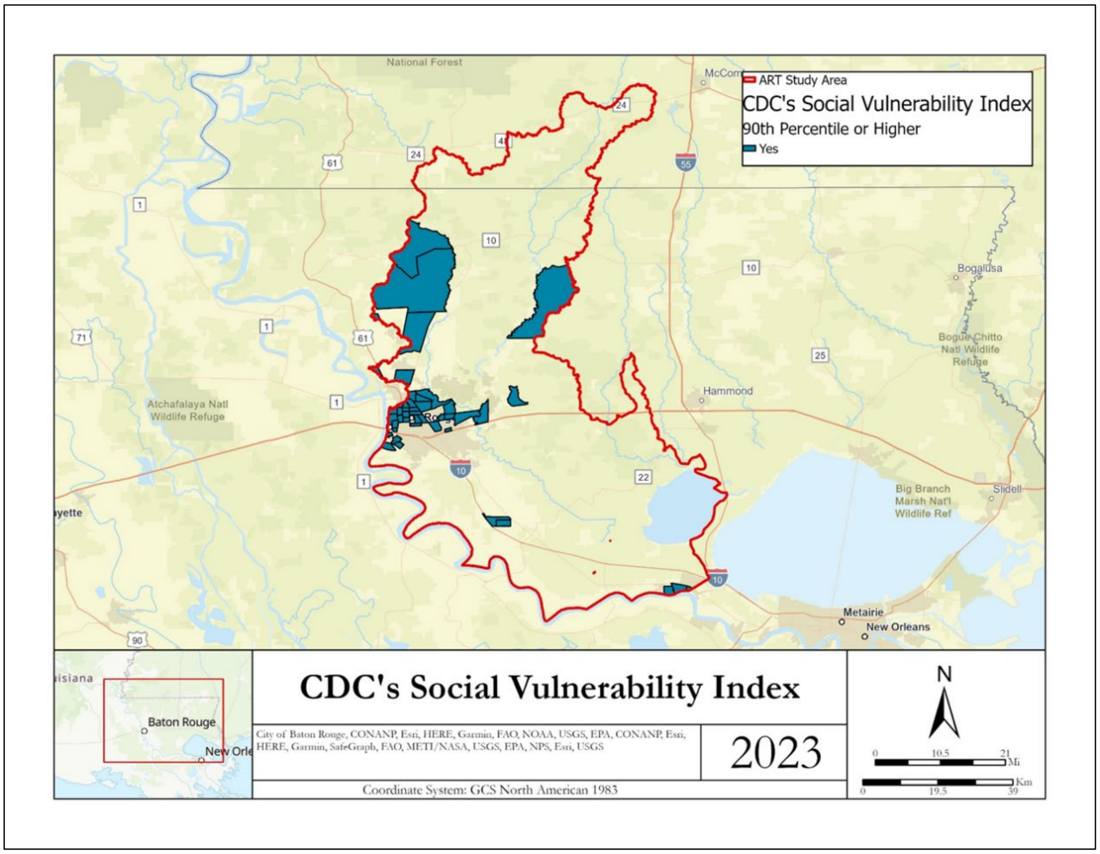


Figure G:7-1. Social Vulnerability in the ART Study Area

7.2.2 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 ART study area, have an increased risk of adverse effects on health and safety.

<u>*Life Safety*</u>

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 ART study area was evaluated using submergence criteria assumptions from the LifeSim technical manual, future without project hydraulic depth grids, and the ART structure inventory. Submergence is defined as a water level at a structure that can affect probability of survival. Submergence criteria are used to define the threshold between high hazard and low hazard conditions when people are trapped in a flooded structure (USACE 2020). Three hydraulic events (0.04 AEP, 0.01

AEP, and 0.02 AEP) were analyzed for their potential high hazard conditions on structures. Structures were considered to be experiencing ‘high hazard conditions’ if the first-floor elevation at the structure exceeded thresholds in any of the three high hazard conditions defined in Table G:7-4. The number of structures in high hazard conditions is are listed in Table G:7-5.

Table G:7-4. Submergence Criteria (LifeSim Technical Manual)

Submergence criteria	Description	Applied to	Default Values
A. High hazard depth from floor	If depth from floor is above the threshold, then people will be place in the high hazard zone.	Limited mobility occupants	4-6 feet, triangular distribution with 5ft best estimate
B. High hazard depth from ceiling	If depth from top of ceiling is above the threshold, then people will be placed in the high hazard zone.	Able-bodied occupants	0.5 - 1.5 feet, Triangular distribution with 1 ft best estimate
C. High hazard depth on roof	If depth over the roof is greater than the threshold, then people caught on roof will be placed in the high hazard zone.	Able-bodied occupants	3-5 feet, Triangular distribution with 4ft best estimate

Table G:7-5. Number of Structures in High Hazard Conditions

Future Without Project Conditions (2076) Number of Structures in High Hazard Conditions			
	0.04 AEP	**0.01 AEP**	**0.02 AEP**
High Hazard - Limited Mobility	600	2793	8260
High Hazard - Depth from Ceiling	32	280	2182
High Hazard - Depth on Roof	3	11	22

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 G:7-2 represents critical infrastructure situated within the ART study area.

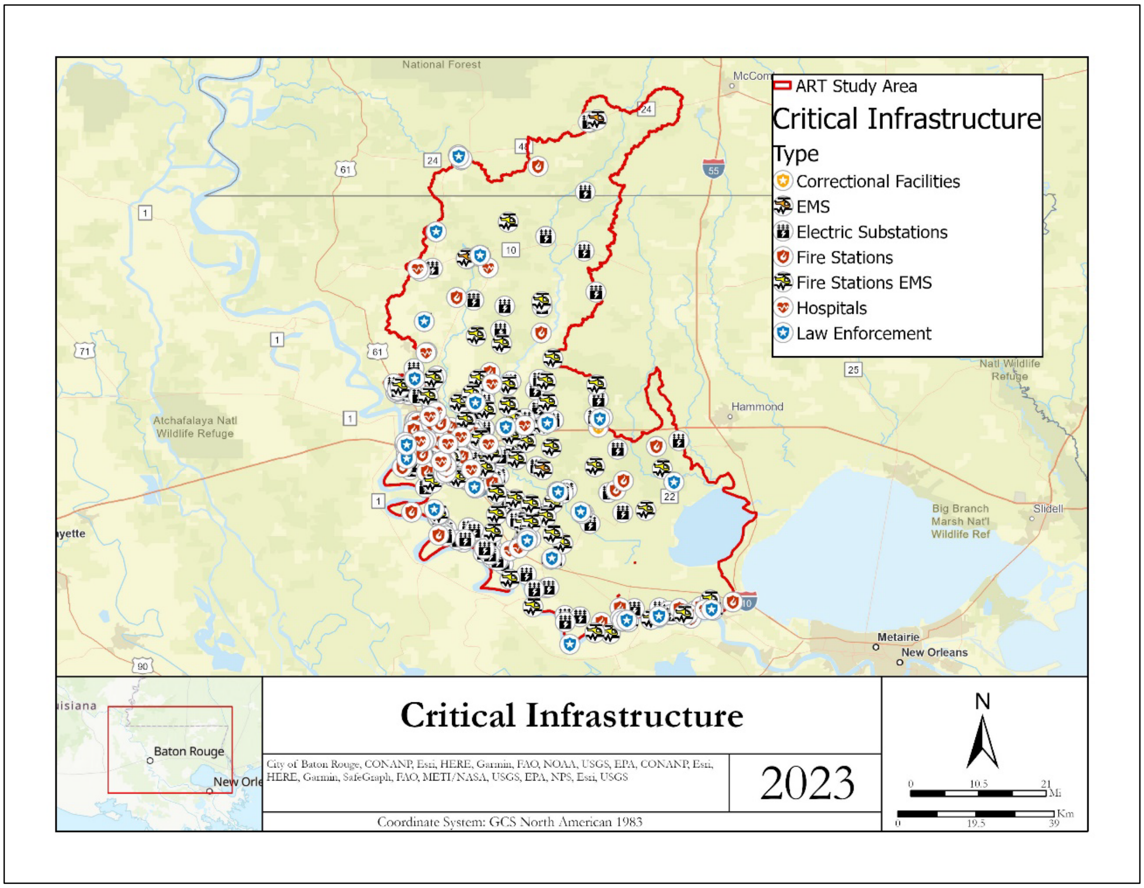


Figure G:7-2. Critical Infrastructure in ART Study Area

Food Insecurity

The Food Access Research Atlas from the US Department of Agriculture details census tracts that are determined to be low income and low access to fresh food and grocers. In communities where residents to not have grocers within a reasonable distance, for urban areas, 1 mile, there is often a surplus of convenient stores and gas stations that are present to try and fill some nutritional needs. These locations are typically less healthy and more expensive.

Figure G:7-3 details the census tracts in the ART study area that are low income and low access. During inundation events, there would be additional strain on the grocers that are within a walking or commutable distance as a result of increased inundation on roadways as well as damages to grocery structures themselves.

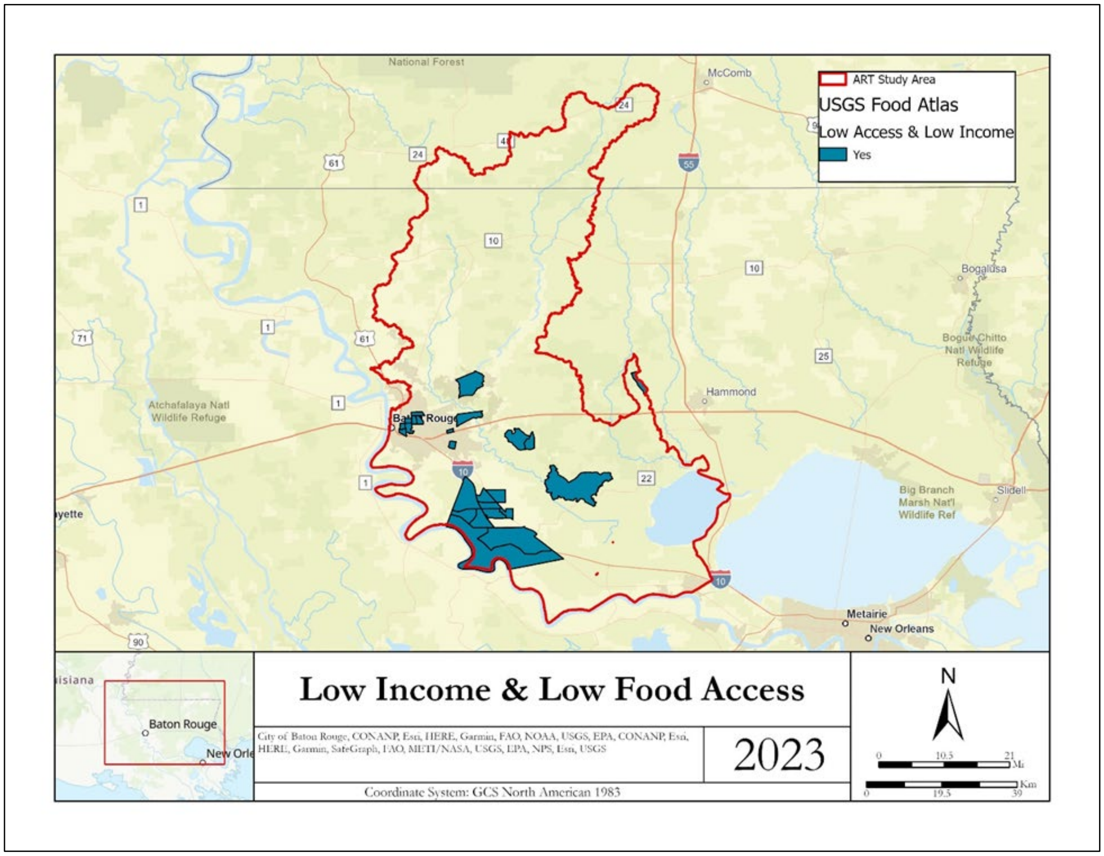


Figure G:7-3. Food Insecurity in the ART Study Area

7.2.3 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. There are several factors within the ART study area that exemplify a lower-than-average quality of life.

Employment Activity

Employment activity indicates how efficiently a community can respond to hazardous events and is an overall indicator for economic health. Figure G:7-4 shows the aggregated employment between all of the counties within the ART study area. Following 1990, the largest employment industry shifted from manufacturing to trade, transportation, and utilities. Between 1990 and 2000, local government surpassed that of manufacturing to become the second largest industry for employment.

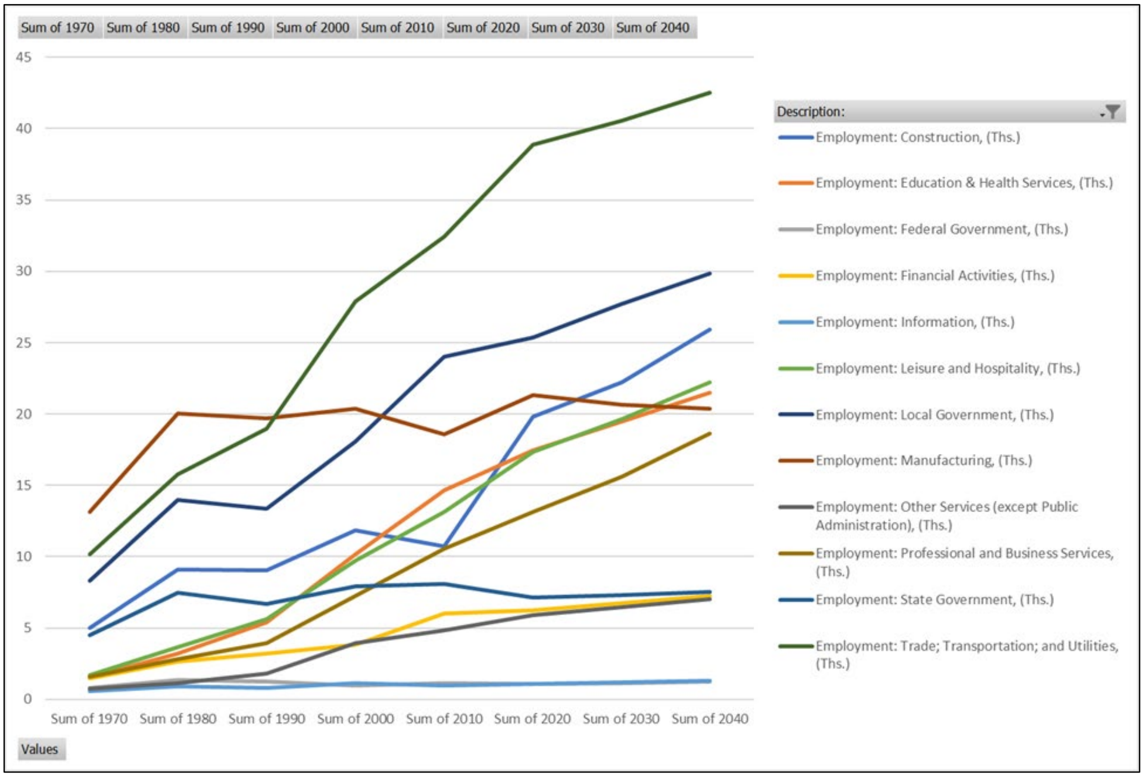


Figure G:7-4. Employment by Industry (1970 - 2045)

7.2.4 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.

Civic Infrastructure

Figure G:7-5 shows a map of physically located civic infrastructure, which includes places of worship, community centers, and parks that receive any inundation in the 1 percent event in the without project condition. 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.

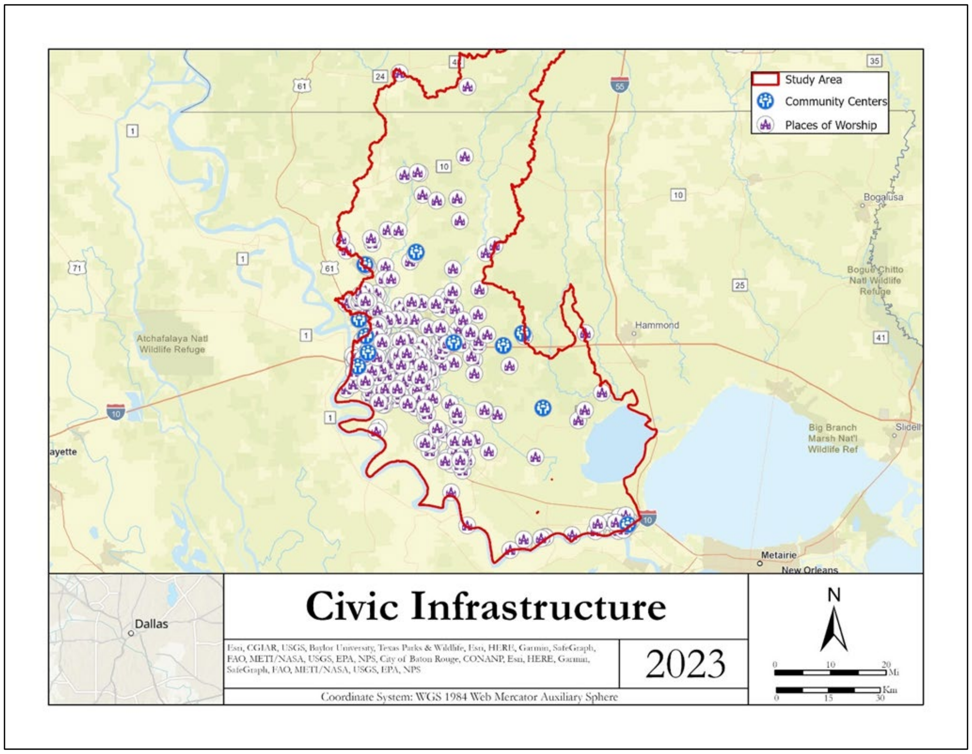


Figure G:7-5. Civic Infrastructure in the ART Study Area

7.2.5 Participation

According to 09-R-04, The Handbook on Applying Other Social Effects, 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.

<u>*Public Involvement*</u>

Public involvement in the study process is essential in evaluation of nonstructural plans. After release of the draft report, documentation of all opportunities for affected groups to voice their concerns and/or support for plans, with special emphasis on those areas of Environmental Justice concerns, will occur here. This section will address availability of public documents, meetings, and the ability to influence the outcome of events and actions pertinent to community member.

7.2.6 Environmental Justice

Environmental Justice was first addressed in water resource planning via Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations[1]. The EO directs federal agencies to “identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations.” These concepts are addressed in the Environmental Justice Section of the Main Report, section 3.2.3.3.

Executive Order 14008, issued in January of 2021, further addressed environmental justice in federal agency planning, creating a goal where 40 percent of overall benefits of certain Federal Investments flow to economically disadvantaged[2] communities that are marginalized, underserved, and overburdened by pollution.

Justice40 Initiative

The Council on Environmental Quality (CEQ) developed the Climate and Economic Justice Screening Tool (CEJST) to assist in identifying economically disadvantaged communities. The CEJST utilizes several burdens that qualify a census tract as disadvantaged. Burden categories in CEJST include housing, health, climate change, energy, legacy pollution, transportation, water/wastewater infrastructure, and workplace development. In order for a tract to be considered disadvantaged, it must be at or above the 90th percentile in one or more burdens and be at or above the 65th percentile for low income. Detailed methodology can be found on the CEJST website.

[1] Executive Order 12898 utilizes the terms “minority” and “low income.” Recent Executive Orders use a broader term, “disadvantaged,” which includes communities that are historically and currently marginalized, underserved, and overburdened by pollution.
[2] The phase “economically disadvantaged” is used in addition to “low-income.” Note that EJ SCREEN tools specifically use “low-income” in their demographic indicators.

Figure G:7-6 represents those census tracts that are considered to be areas of environmental justice concern as reported by CEJST. Out of 146 census tracts in the ART study area, 57 are historically burdened by a CEJST burden category. These identified communities would be impacted disproportionately by inundation events as they may not have the resources to recover from the impacts or be able to properly mitigate prior to the event.

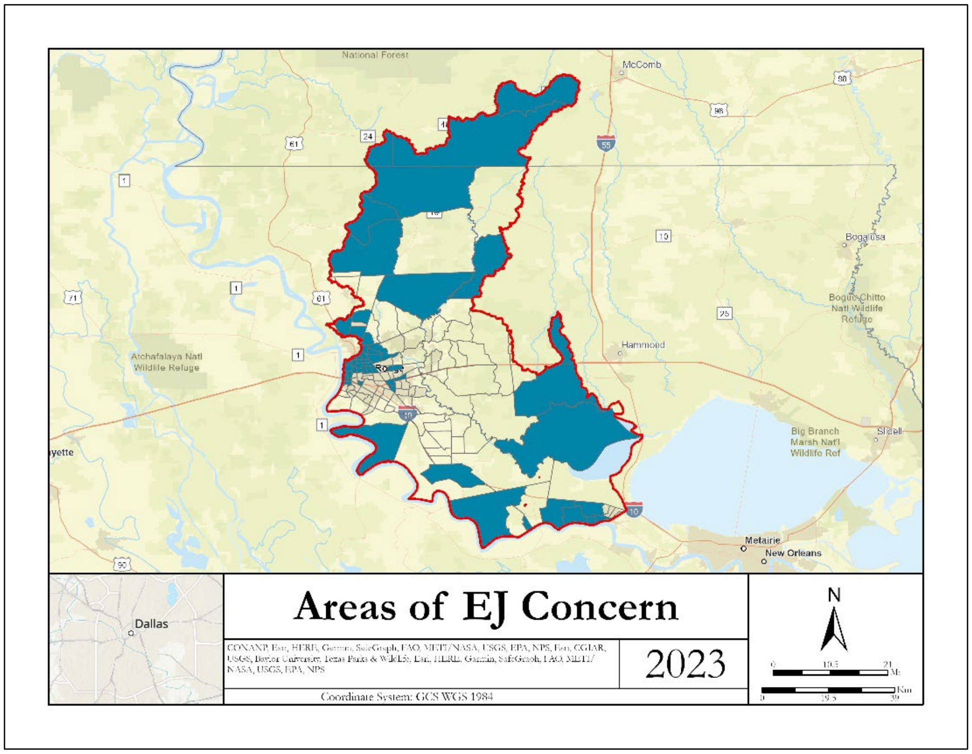


Figure G:7-6. Areas of Environmental Justice Concern (CEJST) in the ART Study Area

7.3 IMPACT ANALYSIS: FINAL ARRAY

7.3.1 Impact of Plans on Other Social Effects Themes

Table G:7-6 provides a summary of the “other social effects themes.”

Table G:7-6. Other Social Effects Theme Summary Table

OSE Theme	Indicator	Plan 2	Plan 3	Plan 4
Social Vulnerability & Resiliency	Structures included in SV Areas	+	++	++
Health & Safety	Life Safety	+	+	+
	Critical Infrastructure	+	+	+
	Food Insecurity	+	++	++
Economic Vitality	Employment Activity	+	+	+
Social Connectedness	Civic Infrastructure	+	+	+
Participation	Public Involvement	*Evaluated Post-Draft Report Outreach*		
Environmental Justice	Structures included in Areas of EJ concern	+	++	++

Legend:

(+): Minor Positive Benefits

(++): Moderate Positive Benefits

(+++): Significant Positive Benefits

7.3.2 Social Vulnerability & Resiliency

Table G:7-7 presents a summary of benefits to areas experiencing social vulnerability.

Table G:7-7. Summary of Benefits to Areas Experiencing Social Vulnerability

	Plan 2	Plan 3	Plan 4
Structures included in areas experiencing social vulnerability	235	307	392
Total Structures included	3,117	3,189	3,298
Total Benefits (Millions)	$55.1	$55.9	$56.6
% of Benefits in areas experiencing social vulnerability	11.7%	12.8%	14.0%

Plan 2: Nonstructural NED Plan

Plan 2 optimized the number of eligible structures based on the net benefits of the entire reporting reach. These reporting reaches did not specifically incorporate the social vulnerability characteristics and were included as a part of the reporting reach. In this plan, there were total benefits of around $55.1 million dollars. This plan, while not specifically formulated with considerations of social vulnerability, did attribute $6.4 million dollars to structures that are in areas experiencing social vulnerability as stated in section 7.2.1 of this appendix. Therefore, this plan provides 11.7 percent of total benefits to socially vulnerable areas. 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 experiencing social vulnerability 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 3: Nonstructural NED + OSE Increment 1

Plan 3 optimized the number of eligible structures based on the net benefits of reporting reaches in addition to their subset of identified socially vulnerable areas. To capture additional mitigation for communities that experience social vulnerability, reaches that had social vulnerability incorporated into them were evaluated at the next cumulative AEP above the optimized level for which positive net benefits were still identified. For example, if a reach was optimized (received the largest net benefits) at the 10 year event, but still had positive, but decreasing, net benefits at the 25 year, then the 25 year eligibility was included in plan 3.

Through this eligibility process, an additional 157 structures were identified and included in the plan. In this plan, there were $55.9 million dollars of benefits achieved overall and $7.2 million were attributed to areas experiencing social vulnerability. Therefore, this plan provides 12.8 percent of total benefits to socially vulnerable reaches. 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 experiencing social vulnerability 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 4: Nonstructural NED + OSE Increment 2

Plan 4 utilizes the Social Vulnerability Index threshold to increase cumulative floodplain eligibility, regardless of net benefits, if the reach meets the determined threshold for social vulnerability – 90th percentile or higher for any of the four themes or the overall theme. For example, if a socially vulnerable reach had the largest net benefits at the 10 year cumulative floodplain, it incorporated the structures eligible in the 25 year cumulative flood plain, regardless of what the net benefits were in the 25 year flood plain.

Under this plan, $56.6 million dollars of benefits were achieved overall and $7.9 million were attributed to areas experiencing social vulnerability. Therefore, this plan provides 14.0 percent of total benefits to those socially vulnerable reaches. 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 experiencing social vulnerability via decreased recovery time and their related expenditures, as well as increased safety of their home, and decreased flood insurance premiums from hazard mitigation.

7.3.3 Health & Safety

Life Safety

Plan 2: Nonstructural NED Plan

Plan 2 is a nonstructural only plan that includes the elevation of 2,748 residential structures and dry floodproofing 369 commercial and industrial structures. Table G:7-8 shows the number of structures no longer experiencing high hazard conditions with the construction of nonstructural measures in Plan 2. Nonstructural measures included in Plan 2 are voluntary, and this analysis assumes 100 percent participation.

Nonstructural measures included in Plan 2 do not mitigate life safety risk on roadways. High flood depths and velocities associated with hazardous driving conditions will remain with the construction of Plan 2.

Table G:7-8. Plan 2: Number of Structures in High Hazard Conditions

	Number of Structures Remaining in High Hazard Conditions			**Number of Structures removed from High Hazard Conditions**		
	0.04 AEP	**0.01 AEP**	**0.02 AEP**	**0.04 AEP**	**0.01 AEP**	**0.02 AEP**
HH Limited Mobility	15	919	6139	585	1874	2121
HH Depth from Ceiling	2	12	431	30	268	1751
HH Depth on Roof	1	1	1	2	10	21

Plan 3: Nonstructural NED + OSE Increment 1

Plan 3 is a nonstructural only plan that includes the elevation of 2,815 residential structures and dry floodproofing 374 commercial and industrial structures. Table G:7-9 shows the number of structures no longer experiencing high hazard conditions with the construction of nonstructural measures in Plan 2. Nonstructural measures included in Plan 3 are voluntary, and this analysis assumes 100 percent participation.

Nonstructural measures included in Plan 2 do not mitigate life safety risk on roadways. High depths and velocities associated with hazardous driving conditions would remain with the construction of Plan 3.

Table G:7-9: Plan 3: Number of Structures in High Hazard Conditions

	Number of Structures Remaining in High Hazard Conditions			Number of Structures removed from High Hazard Conditions		
	0.04 AEP	**0.01 AEP**	**0.02 AEP**	**0.04 AEP**	**0.01 AEP**	**0.02 AEP**
HH Limited Mobility	11	901	6121	589	1892	2139
HH Depth from Ceiling	2	8	417	30	272	1765
HH Depth on Roof	1	1	1	2	10	21

Plan 4: Nonstructural NED + OSE increment 2

Plan 4 is a nonstructural only plan that includes the elevation of 2,918 residential structures and dry floodproofing 380 commercial and industrial structures. Table G:7-10 shows the number of structures no longer experiencing high hazard conditions with the construction of nonstructural measures in Plan 4. Nonstructural measures included in Plan 4 are voluntary, and this analysis assumes 100 percent participation.

Nonstructural measures included in Plan 4 do not mitigate life safety risk on roadways. High depths and velocities associated with hazardous driving conditions would remain with the construction of Plan 3.

Table G:7-10. Plan 4: Number of Structures in High Hazard Conditions

	Number of Structures Remaining in High Hazard Conditions			Number of Structures with Reduced Risk from High Hazard Conditions		
	0.04 AEP	**0.01 AEP**	**0.02 AEP**	**0.04 AEP**	**0.01 AEP**	**0.02 AEP**
HH Limited Mobility	11	900	6118	589	1893	2142
HH Depth from Ceiling	2	8	416	30	272	1766
HH Depth on Roof	1	1	1	2	10	21

Critical Infrastructure

Critical infrastructure receiving benefits is shown on Figure G:7-7.

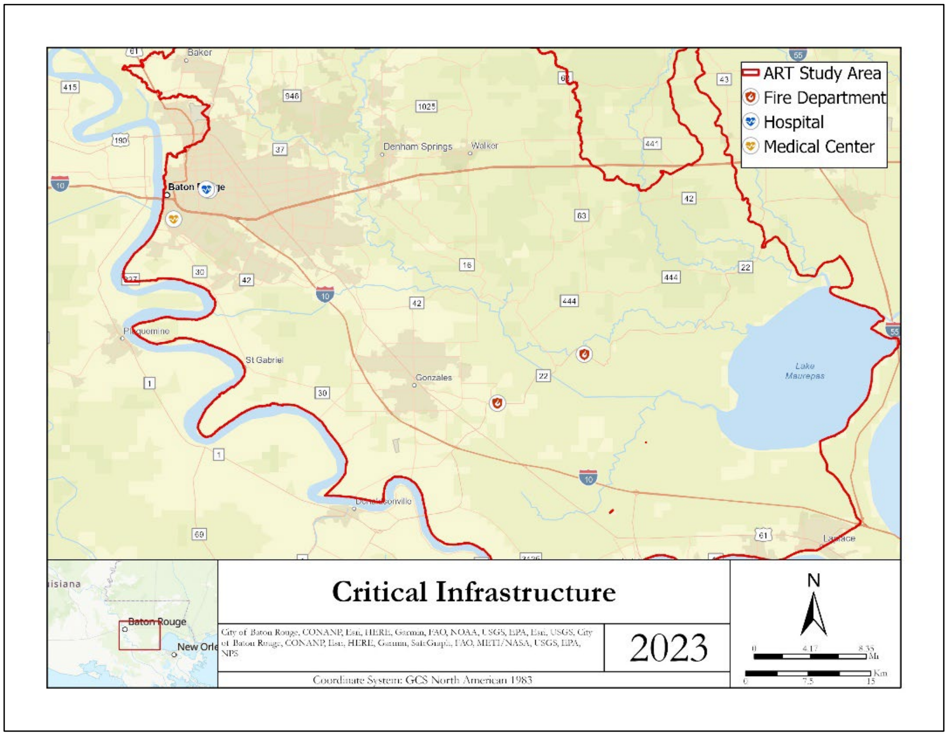


Figure G:7-7. Critical Infrastructure Receiving Benefits

Plan 2: Nonstructural NED Plan

Under plan 2, there are five critical infrastructure facilities included for floodproofing mitigation. Two of these facilities are medical centers, two of them are fire departments, and the remaining is a hospital. 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. Reference Figure G:7-7 for the physical location of mitigated critical infrastructure.

Plan 3: Nonstructural NED + OSE Increment 1

Plan 3 does not present any additional protection to critical infrastructure facilities than is presented in plan 1. The five facilities would experience a shorter pause on operation, allowing services and assistance to be resumed for community members. Reference Figure G:7-7 for the physical location of mitigated critical infrastructure.

Plan 4: Nonstructural NED + OSE Increment 2

Plan 4 does not present any additional protection to critical infrastructure facilities than is presented in plan 1. The five facilities would experience a shorter pause on operation, allowing services and assistance to be resumed for community members. Reference Figure G:7-7 for the physical location of mitigated critical infrastructure.

Food Insecurity

Plan 2: Nonstructural – Optimized NED Plan

In the with project condition of plan 2, there are 14 grocery stores that are included. Two of these grocery stores are within areas that are considered low access and low income according the USGS Food Atlas. Figure G:7-8 shows where the identified grocery stores are located in proximity to areas experiencing food insecurity. Increased protection from inundation damages for these grocery stores would lead to a shorter recovery period, allowing community members to access fresh food and grocers following an inundation event.

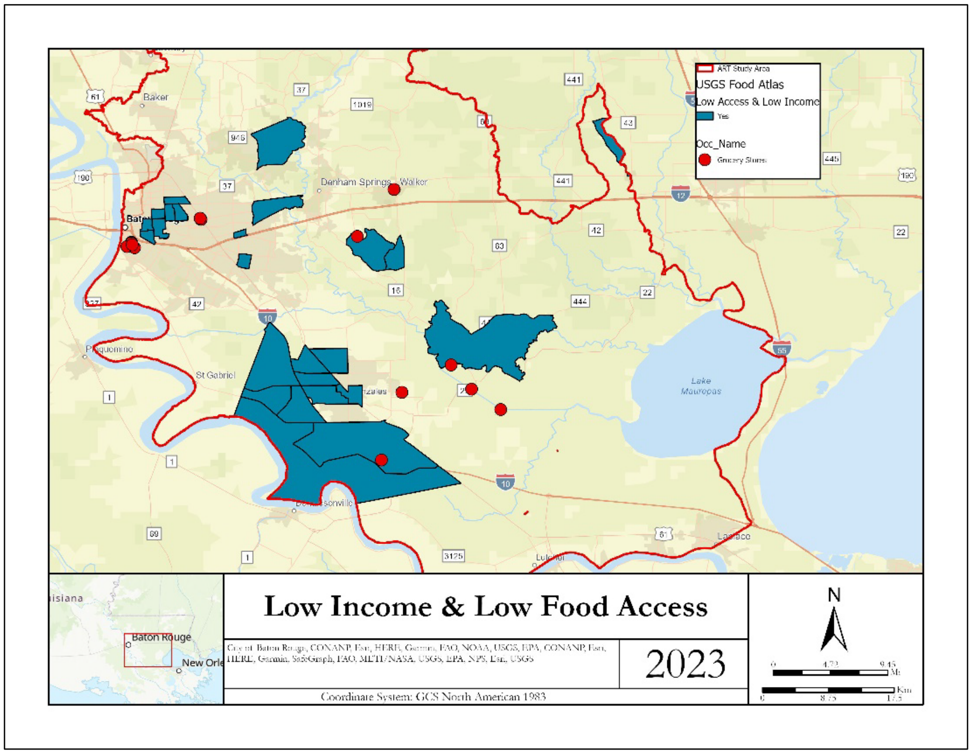


Figure G:7-8. Benefits to Food Insecurity

Plan 3: Nonstructural - NED Plan + OSE Increment 1

In the with project condition of plan 3, there is one additional grocery store that is included as a part of the plan, mitigating for a total of 15 grocery stores, with increased risk reduction for an additional facility in an area that experiences social vulnerability. Two stores remain included in areas identified as low income and low access according to the USGS Food Atlas. Impacts of these measures would include a shorter recovery period following inundation in several areas within the ART study area, but specifically allow accessibility to communities that are experiencing food insecurity. Figure G:7-8 represents identified grocery stores for mitigation and their proximity to communities experiencing food insecurity.

Plan 4: Nonstructural NED + OSE Increment 2

The with project condition of plan 4 does not provide additional impacts to areas experiencing food insecurity in accordance with the USGS Food Atlas from what is provided in plan 2. The same grocers would benefit and be able to resume service to community members that have limited geographical access to fresh food. Figure G:7-8 represents identified grocery stores for mitigation and their proximity to communities experiencing food insecurity.

7.3.4 Economic Vitality

Plan 2: Nonstructural – Optimized NED Plan

Under plan 2, 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 369 commercial 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 2.

Plan 3: Nonstructural - NED Plan with increased eligibility for positive net benefits

Under Plan 3, the number of commercial structures included in commercial mitigation increases to 374. 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 4: Nonstructural – NED Plan with increased eligibility for all SV reaches

Under Plan 4, the number of commercial structures included in commercial mitigation increases to 380. 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.

7.3.5 Social Connectedness

Plan 2: Nonstructural – Optimized NED Plan

Under plan 2, there are eight civic infrastructure facilities included. Three of them are community centers situated among the area and five of them are places of worship. In this 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. Reference Figure G:7-9 for the location of civic infrastructure included in all three of the plans in the final array.

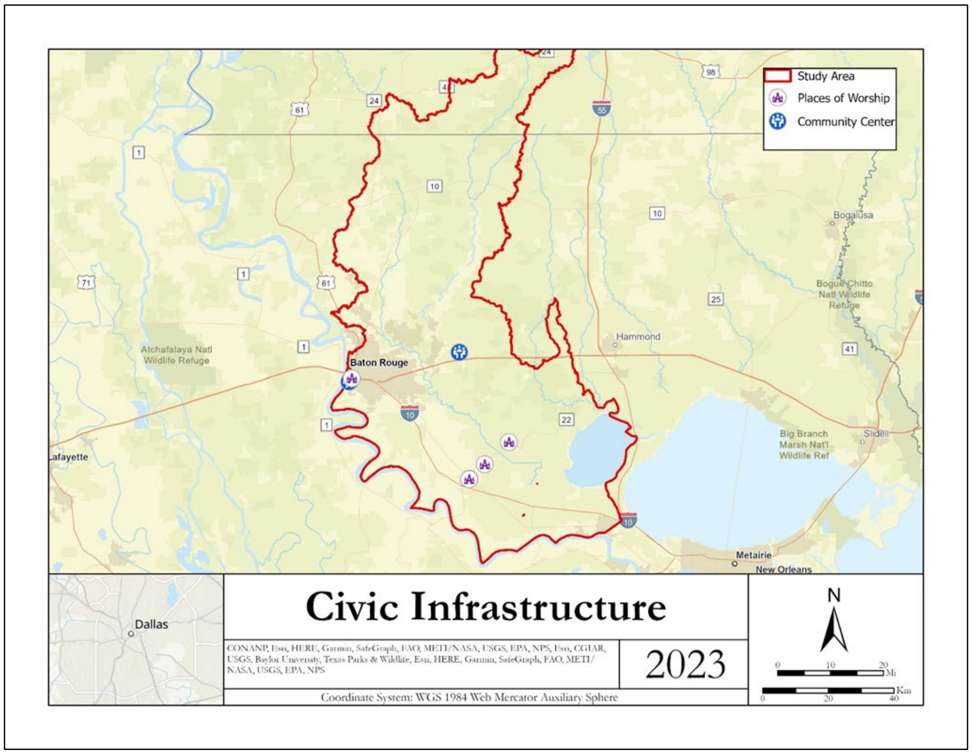


Figure G:7-9. Civic Infrastructure Receiving Benefits

Plan 3: Nonstructural - NED + OSE Increment 1

Under Plan 3, there would not be any additional positive or negative impacts to social connectedness from what is included in Plan 2. This plan would present the same level of opportunity for community cohesion and gathering. Reference Figure G:7-9 for the location of civic infrastructure included in all three of the plans in the final array.

Plan 4: Nonstructural – NED + OSE Increment 2

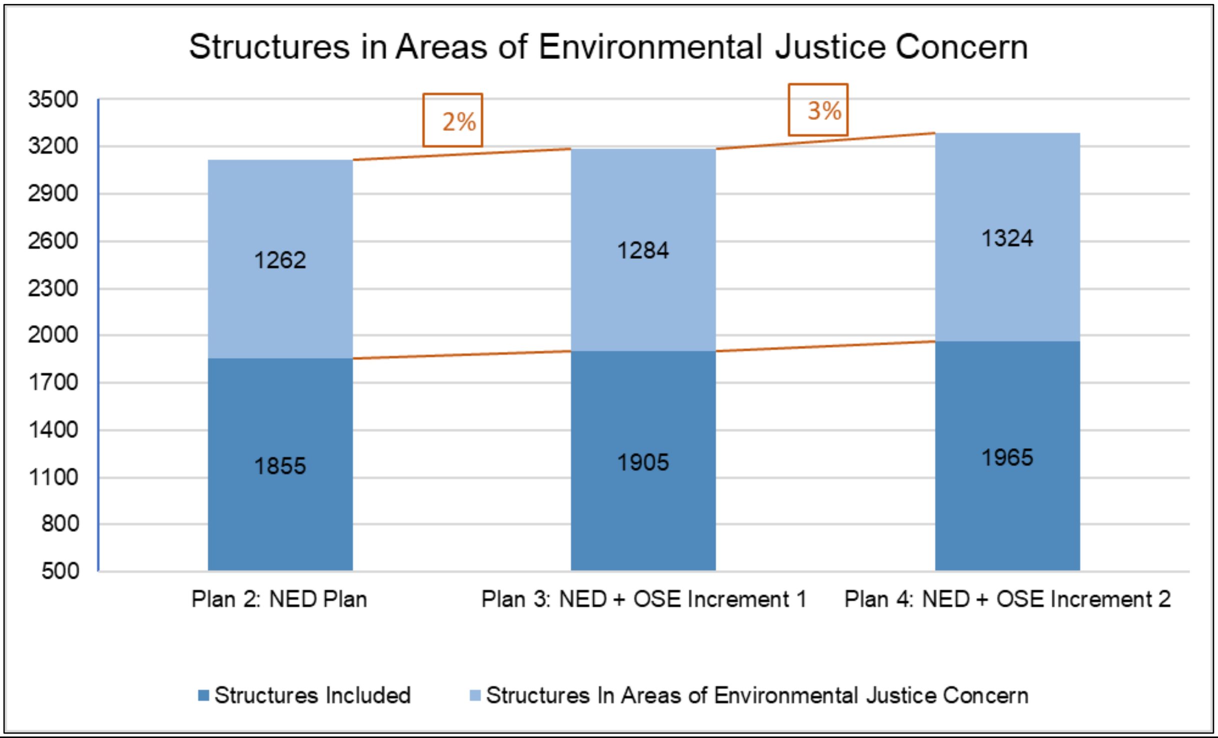
Under Plan 4, there would not be any additional positive or negative impacts to social connectedness from what is included in Plan 2. This plan would present the same level of opportunity for community cohesion and gathering. Reference Figure G:7-9 for the location of civic infrastructure included in all three of the plans in the final array.

7.3.6 Participation – *To be evaluated post-draft public meetings.*

7.3.7 Environmental Justice

Table G:7-11 presents a list of the benefits to historically disadvantaged communities and Figure G:7-10 shows the number of structures included in areas of environmental concern for Plan 2, Plan 3, and Plan 4.

Table G:7-11. Benefits to Historically Disadvantaged Communities



	Plan 2	Plan 3	Plan 4
Structures Included	1,262	1,284	1,324
% of Benefits to Disadvantaged Communities	40%	40%	40%

Figure G:7-10. Structures Included in Areas of Environmental Concern

Plan 2: Nonstructural – Optimized NED Plan

Plan 2 includes 3,117 structures in the nonstructural plan for mitigation. Of these structures, 1,262, or 40 percent, of structures are in disadvantaged communities. Mitigation in this area would positively impact community members as historically overburdened and disadvantaged communities.

Plan 3: Nonstructural - NED + OSE Increment 1

Plan 3 includes 3,189 structures in the nonstructural mitigation plan. Of these structures, 1,284, or 40 percent of structures are located in disadvantaged communities. Structures located in disadvantaged communities encompass 22 of the 72 structures incrementally increased from Plan 2. Figure G:7-10 graphically represents the additional structures included in this plan.

Plan 4: Nonstructural – NED + OSE Increment 2

Plan 4 includes 3,289 structures in the nonstructural mitigation plan. Of these structures, 1,324 or 40 percent of structures are located in disadvantaged communities. Structures located in disadvantaged communities encompass 40 of the increase in 100 structures from Plan 3, and therefore include 62 of the of the 172 structures that increased from plan 2. Figure G:7-10 graphically represents the additional structures included in this plan.

Mississippi River Valley Division
Regional Planning and Environmental Division South

Amite River and Tributaries East of the Mississippi River, Louisiana

Appendix H-1: Hydrologic and Hydraulic Models

December 2023

CONTENTS

LIST OF TABLES

LIST OF FIGURES

1.0 GENERAL DESCRIPTION OF WORK

The US Army Corps of Engineers (USACE), New Orleans District (MVN), Hydraulics, Hydrology, and Coastal Engineering Branch (HH&C) performed hydrologic and hydraulic modeling for the Amite River and Tributaries (AR&T) Flood Risk Management (FRM) project. The purpose of this hydrologic and hydraulic analysis was to estimate water surface elevations to design non-structural flood mitigation measures in the AR&T basin. Hydrologic and hydraulic models of the Amite River Basin were provided by the Louisiana Department of Transportation and Development (LADOTD) and modified by HH&C for use in modeling this watershed. These models were originally built by Dewberry Engineers, Inc. The Dewberry Report is referenced several times in this appendix and should be referred to for more background about the model development (Dewberry Engineers Inc., 2019 [1]). Hydrologic and hydraulic modeling was performed for the 10%, 4%, 2%, 1%, 0.5%, and 0.2% annual exceedance probability (AEP) rainfall events for existing conditions (year 2026) and future conditions (year 2076). Originally, the Tentatively Selected Plan (TSP) was a proposed dam located in Darlington, LA for a 0.01 Annual Exceedance Probability (AEP). This was changed to a non-structural plan due to low benefit-cost ratio (BCR). To assess residual risk, hydraulic modeling was also performed for coastal storm events by setting downstream boundary conditions in Lake Maurepas equal to storm surge elevations calculated by ADCIRC modeling for the same annual exceedance probabilities. The coastal models were run with negligible rainfall to isolate the effects of storm surge. The maximum water surface elevation (WSE) was calculated for all rainfall and coastal only model runs. In addition to the rainfall and coastal only model results, HH&C provided a predominant water surface elevation for each AEP event for both existing and future conditions. To determine the predominant WSE for each respective AEP, the rainfall and coastal modeling results were calculated in ArcGIS Pro, and the higher value WSE at each raster cell from the two models became the output raster. The WSE raster files were provided to the Project Delivery Team (PDT) for use in economic, environmental, and engineering analyses. The horizontal and vertical datums for all georeferenced files in this study are the NAD 1983 and NAVD 1988 (Geoid 12B) datums respectively.

2.0 SUMMARY OF PREVIOUS WORK

The Amite Rivers & Tributaries study was funded by the Bipartisan Budget Act of 2018, H. R. 1892—13, Title IV, Corps Of Engineers—Civil, Department Of The Army, Investigations, where funds are being made available for the expenses related to the completion, or initiation and completion, of flood and storm damage reduction, including shore protection studies, which are currently authorized or which are authorized after the date of enactment of this act, to reduce risk from future floods and hurricanes.

The hydrologic and hydraulic models used in this study were provided by the Louisiana Department of Transportation and Development (LA DOTD). They contracted Dewberry Engineers Inc. (Dewberry) for this project to develop the suite of modeling tools, referred to as the Amite River Basin Numerical Model (ARBNM), to simulate hydrology and hydraulics within the Amite River Basin (ARB), and to quantify the potential consequences of floods simulated with the tools. Forte & Tablada, Inc. and FTN Associates, Ltd supported Dewberry on this project. Forte & Tablada, Inc. provided survey services, and FTN Associates, Ltd provided independent quality control, stakeholder engagement and hydraulic modeling support.

The ARBNM suite was utilized by USACE to evaluate the following alternatives: Future Without Project (FWOP), Baseline, Darlington Dam, Lily Bayou, Bluff Creek, and Darlington Creek Dry Detention Ponds (Alternative 8A), Sandy Creek Dry Detention Pond (Alternative 8C), Spanish Lake Pump Station and Gate Operation, Highway 22, Port Vincent Bridge, Amite River Re-meandering, and Highway 16. Of these, five (5) alternatives were selected for modeling: FWOP, Baseline, Alternative 8A, Alternative 8C, and Darlington Dam. The descriptions for all alternatives and the results of the 5 selected alternatives that were modeled are presented in a former draft of the appendix in Annex H-6 “Appendix G: Hydrologic and Hydraulic Models.”

During review, the Darlington Dam Alternative as the Tentatively Selected Plan (TSP) was identified to have extensive technical and policy concerns, which found the dam was constrained by site conditions that made it in-feasible as designed and potentially increased life safety risk. With removal of the Dry Dam alternative from further consideration, the next highest NED Plan and likely the only economically justified alternative is the nonstructural plan.

3.0 SOFTWARE

3.1 HEC-HMS 4.5

Version 4.5 of the Hydraulic Engineering Center’s Hydrologic Modeling System (HEC-HMS) was used to calculate rainfall runoff estimates.

3.2 HEC-RAS 5.0.7

Version 5.0.7 of the HEC’s River Analysis System (HEC-RAS) was used to calculate hydraulic routing as well as flooding due to coastal storm surge.

4.0 MODEL DEVELOPMENT

The hydrologic and hydraulic models of the Amite River Basin were provided to the MVN HH&C Branch by the LADOTD. Development, calibration, and validation of the models was done by Dewberry Engineers. Those steps are discussed in the Amite River Basin Numerical Model Project Report (Dewberry Report). This appendix includes descriptions of the changes made to the models after the Dewberry Report. Figure H-1 shows the model geometry for the HMS and RAS models.

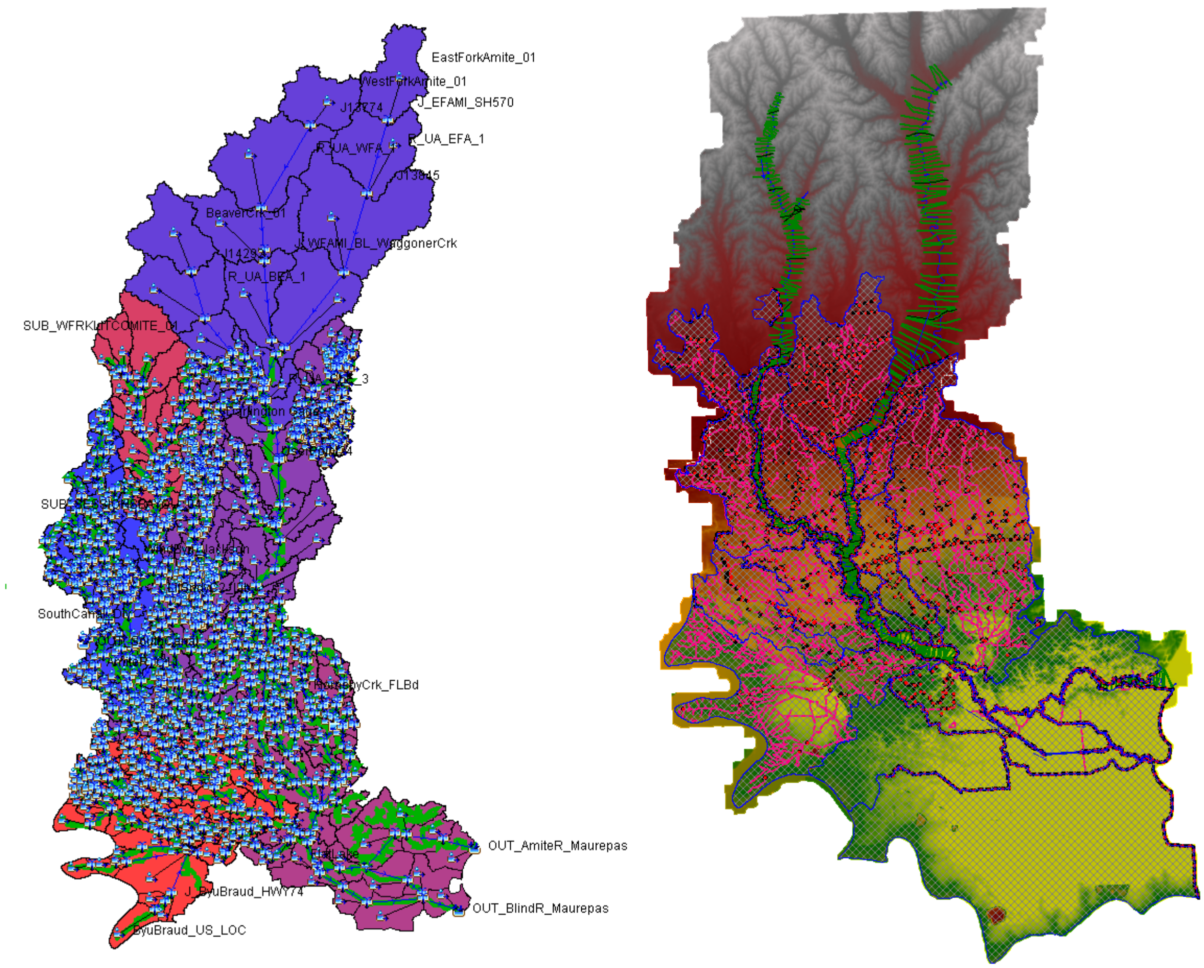


Figure H-1 HEC-HMS Model Geometry (left) and HEC-RAS Model Geometry (right)

4.1 HYDROLOGIC MODELING

4.1.1 Basin Hydrology

The Amite River Basin covers approximately 2,200 square miles in Mississippi and Louisiana. The Amite River runs for approximately 117 miles in a mostly southerly direction through Mississippi and Louisiana. The Amite River begins with an East Fork and a West Fork in southwest Mississippi. These forks are the steepest portions of the Amite River, both starting at elevations of over 450 feet and dropping to approximately 200 feet with lengths of approximately 49 miles. The forks merge just south of Mississippi's border with Louisiana. The middle portion of the Amite River runs for approximately 61 miles and drops approximately 180 feet between the confluence of the upper forks and the confluence with the Comite River. The Comite River, a right bank tributary that meets the Amite River near Denham Springs, is the Amite's largest tributary. The lower portion of the Amite River runs for approximately 54 miles and discharges into Lake Maurepas. This is the flattest portion of the Amite River, dropping from approximately 20 feet to nearly sea level. Near French Settlement, downstream of Port Vincent, the Amite River Diversion Canal splits off from the Amite River, sending a portion of the river's water southwest to the Blind River, which also flows into Lake Maurepas. Lake Maurepas is connected to Lake Pontchartrain via Pass Manchac and marshes. Lake Pontchartrain is connected to the Gulf of Mexico via The Rigolets and Chef Menteur Pass, as well as marshes. Through this connection of Lake Maurepas to the Gulf of Mexico, there is some tidal influence in Lake Maurepas. Figure H-2 shows the boundary of the Amite River Basin.

Figure H-2 Amite River Basin in Louisiana and Mississippi

4.1.2 Precipitation and Runoff

Six precipitation events were evaluated: the 10-year, 25-year, 50 -year, 100-year, 200-year, and 500-year average recurrence interval as 96-hour duration events. Precipitation hyetographs were developed for each event based on rainfall intensities from the National Oceanic and Atmospheric Administration's (NOAA) Atlas 14 Point Precipitation Frequency Estimates. In the original storm formulation performed by Dewberry, the storms were designed as concentric elliptical isohyets, with a maximum rain depth falling at the storm center near Olive Branch, Louisiana. This storm location and orientation was adjusted during the modeling of the Darlington Dam, and these changes were maintained in the non-structural alternative modeling. The location and orientation of the isohyets are shown in figure H-3. The isohyet precipitation scaling was applied using the HMS gage weight method, where each subbasin has a scaling factor between 0 and 1 that dampens the rainfall volume. As the subbasins do not fit perfectly into the isohyets, area-weighted averages were used to estimate gage weights for each subbasin.

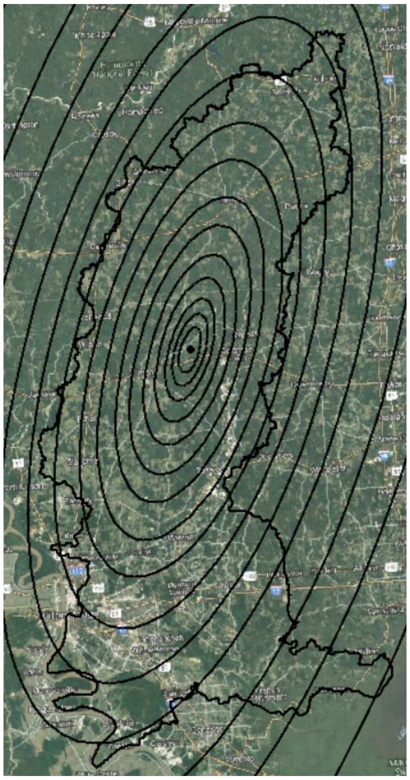


Figure H-3 Design Storm Location and Isohyets

Figure H-4 shows estimates of precipitation intensity for different durations and annual exceedance probabilities in the Amite River Basin from NOAA Atlas 14. The total depth falling on the center of the isohyet ellipse for each design storm was 11.29, 13.75, 15.72, 17.79, 20.00, and 23.11 inches respectively. When the rainfall is averaged across the gage weights and area for each isohyet, the total rainfall is equivalent to the median values provided by Atlas 14 for the respective storm intensities.

AMS-based precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Annual exceedance probability (1/years)								
	1/2	1/5	1/10	1/25	1/50	1/100	1/200	1/500	1/1000
5-min	**0.565** (0.458-0.689)	**0.708** (0.572-0.865)	**0.819** (0.658-1.00)	**0.969** (0.751-1.22)	**1.08** (0.822-1.39)	**1.20** (0.880-1.57)	**1.32** (0.928-1.77)	**1.49** (1.00-2.04)	**1.61** (1.06-2.24)
10-min	**0.828** (0.671-1.01)	**1.04** (0.838-1.27)	**1.20** (0.963-1.47)	**1.42** (1.10-1.79)	**1.59** (1.20-2.03)	**1.76** (1.29-2.30)	**1.94** (1.36-2.59)	**2.18** (1.47-2.98)	**2.36** (1.55-3.28)
15-min	**1.01** (0.818-1.23)	**1.26** (1.02-1.55)	**1.46** (1.17-1.79)	**1.73** (1.34-2.18)	**1.94** (1.47-2.47)	**2.15** (1.57-2.80)	**2.36** (1.66-3.16)	**2.66** (1.79-3.64)	**2.88** (1.89-4.00)
30-min	**1.52** (1.23-1.86)	**1.91** (1.54-2.33)	**2.20** (1.77-2.70)	**2.61** (2.02-3.29)	**2.92** (2.21-3.73)	**3.24** (2.37-4.23)	**3.57** (2.50-4.77)	**4.01** (2.70-5.49)	**4.35** (2.85-6.04)
60-min	**2.05** (1.66-2.50)	**2.55** (2.06-3.11)	**2.94** (2.36-3.60)	**3.46** (2.69-4.37)	**3.88** (2.94-4.95)	**4.30** (3.14-5.60)	**4.72** (3.31-6.32)	**5.31** (3.57-7.27)	**5.76** (3.77-7.98)
2-hr	**2.58** (2.11-3.12)	**3.19** (2.60-3.87)	**3.67** (2.97-4.46)	**4.32** (3.38-5.40)	**4.83** (3.69-6.12)	**5.35** (3.94-6.92)	**5.88** (4.15-7.80)	**6.60** (4.48-8.97)	**7.16** (4.73-9.86)
3-hr	**2.90** (2.38-3.49)	**3.60** (2.94-4.34)	**4.14** (3.37-5.01)	**4.89** (3.85-6.09)	**5.47** (4.20-6.90)	**6.07** (4.50-7.83)	**6.69** (4.75-8.84)	**7.54** (5.14-10.2)	**8.19** (5.43-11.2)
6-hr	**3.47** (2.88-4.14)	**4.37** (3.61-5.22)	**5.09** (4.18-6.11)	**6.10** (4.85-7.56)	**6.90** (5.35-8.65)	**7.73** (5.78-9.90)	**8.60** (6.16-11.3)	**9.79** (6.74-13.2)	**10.7** (7.17-14.6)
12-hr	**4.06** (3.40-4.80)	**5.27** (4.40-6.25)	**6.26** (5.19-7.45)	**7.66** (6.16-9.46)	**8.80** (6.90-11.0)	**9.99** (7.55-12.7)	**11.3** (8.14-14.7)	**13.0** (9.03-17.4)	**14.4** (9.71-19.5)
24-hr	**4.68** (3.96-5.49)	**6.22** (5.24-7.31)	**7.48** (6.26-8.83)	**9.30** (7.56-11.4)	**10.8** (8.53-13.4)	**12.4** (9.42-15.6)	**14.0** (10.2-18.2)	**16.4** (11.5-21.8)	**18.2** (12.4-24.4)
2-day	**5.38** (4.59-6.26)	**7.15** (6.08-8.33)	**8.61** (7.27-10.1)	**10.7** (8.78-13.0)	**12.4** (9.92-15.3)	**14.2** (11.0-17.9)	**16.2** (11.9-20.8)	**18.9** (13.3-24.9)	**21.1** (14.4-28.0)
3-day	**5.86** (5.02-6.77)	**7.72** (6.60-8.95)	**9.26** (7.86-10.8)	**11.4** (9.43-13.8)	**13.2** (10.6-16.2)	**15.1** (11.7-18.9)	**17.1** (12.6-21.9)	**19.9** (14.1-26.1)	**22.1** (15.2-29.3)
4-day	**6.26** (5.39-7.21)	**8.16** (7.00-9.43)	**9.72** (8.29-11.3)	**11.9** (9.87-14.4)	**13.7** (11.1-16.7)	**15.6** (12.1-19.5)	**17.6** (13.1-22.5)	**20.4** (14.5-26.7)	**22.6** (15.6-29.9)
7-day	**7.32** (6.35-8.37)	**9.23** (7.98-10.6)	**10.8** (9.26-12.4)	**13.0** (10.8-15.5)	**14.8** (12.0-17.8)	**16.6** (13.0-20.6)	**18.6** (13.9-23.6)	**21.4** (15.3-27.8)	**23.6** (16.4-31.0)
10-day	**8.25** (7.20-9.39)	**10.2** (8.86-11.6)	**11.8** (10.2-13.5)	**14.0** (11.7-16.7)	**15.8** (12.9-19.0)	**17.7** (13.9-21.8)	**19.7** (14.8-24.9)	**22.5** (16.2-29.1)	**24.8** (17.3-32.4)
20-day	**10.9** (9.59-12.3)	**13.2** (11.6-15.0)	**15.1** (13.2-17.2)	**17.7** (14.9-20.7)	**19.7** (16.2-23.5)	**21.9** (17.3-26.6)	**24.1** (18.2-30.0)	**27.1** (19.6-34.7)	**29.5** (20.7-38.2)
30-day	**13.2** (11.7-14.8)	**16.0** (14.1-18.0)	**18.1** (15.9-20.5)	**21.1** (17.8-24.5)	**23.3** (19.2-27.5)	**25.6** (20.3-30.8)	**27.9** (21.2-34.5)	**31.0** (22.6-39.4)	**33.4** (23.6-43.1)
45-day	**16.2** (14.5-18.1)	**19.6** (17.4-22.0)	**22.2** (19.6-24.9)	**25.4** (21.6-29.2)	**27.9** (23.1-32.5)	**30.2** (24.1-36.1)	**32.6** (24.8-40.0)	**35.6** (26.0-44.9)	**37.8** (26.9-48.5)
60-day	**18.9** (16.9-21.0)	**22.9** (20.4-25.5)	**25.7** (22.8-28.8)	**29.2** (24.8-33.3)	**31.7** (26.3-36.8)	**34.1** (27.3-40.5)	**36.4** (27.8-44.4)	**39.1** (28.7-49.1)	**41.1** (29.3-52.6)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of annual maxima series (AMS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and annual exceedance probability) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Figure H-4 Point Precipitation Frequency Estimates from NOAA Atlas 14 for the Amite River Basin

A 96-hour precipitation duration was used for each design storm. This duration was used since it maximized the stage in the Darlington Dam when the dam was the tentatively selected plan (TSP). After the TSP was changed to a fully non-structural plan, the 96-hour rainfall duration was kept, since the without project conditions had been validated with the 96-hour rainfall duration.

Forecasts of the Amite River Basin over the project life predict an increase in urban development. Urban development correlates with an increase in impervious area, which leads to increases in runoff. A forecast of urban growth provided by the project delivery team showed an expected 35% increase over the project life. HH&C utilized this forecast to increase the impervious area percentages by 35% for future conditions (2076), which impacts the hydrologic loss calculations. The total impervious area in the AR&T Basin models is 5.1% and 6.9% for 2026 and 2076 respectively. Annex H-5 at the end of this report provides of a summary of the infiltration values used in the HMS model.

4.1.3 HEC-HMS Model Methodology

Hydrologic modeling was performed using the HEC-HMS model provided by the LADOTD. The hydrologic model domain covers the entire Amite River Basin, from southern Mississippi to southeast Louisiana. The Modified Clark (ModClark) transform method was chosen for the subbasins, which uses a gridded method to give refined travel times to the outlet of a subbasin based on starting location in the subbasin. The ModClark method utilizes the Clark parameters of time of concentration and storage. In some of the marshy areas at the downstream end of the watershed, short times of concentration were used, in conjunction with large storage coefficients. This allowed those subbasins to drain slowly, in accordance with the standard hydrology of marshy regions. Hydrologic losses were calculated in the model using the Green and Ampt loss method. This method uses five parameters to estimate loss in a subbasin: initial water content, saturated water content, wetted suction front, hydraulic conductivity, and percentage impervious. Discussion of those parameters can be found in the Dewberry Report. The percent impervious data was updated with the 2019 USGS National Land Cover Dataset data. Figure H-5 shows the geometry of the hydrologic model.

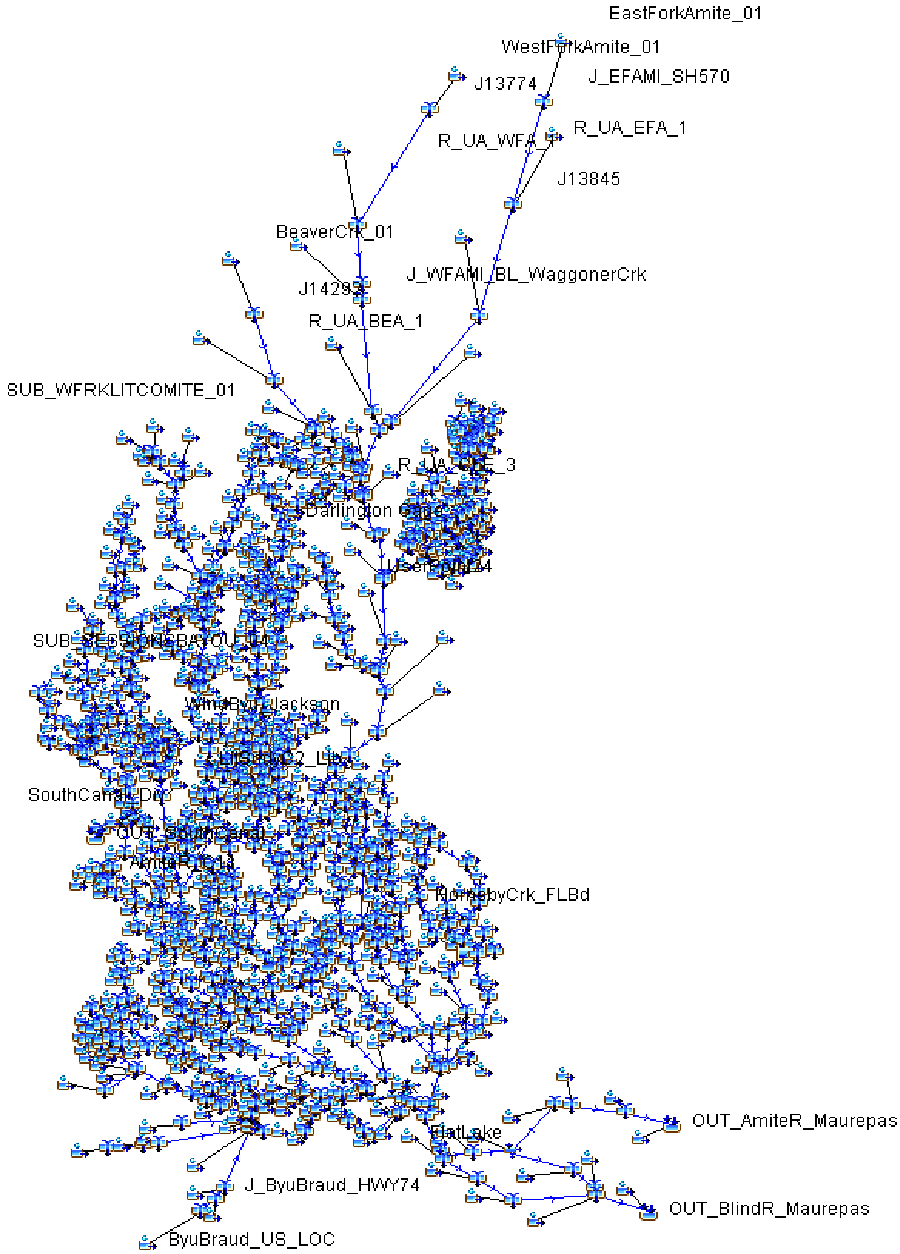


Figure H-5 Hydrologic Model Domain

Hydrologic routing calculations were performed using the Lag, Muskingum, and Modified Puls methods. All reaches that used the lag methods had lag parameters equal to zero, which instantaneously routed runoff through the respective reaches. The Muskingum method routs runoff using two parameters, X and K, that represent flow and channel characteristics. The Modified Puls method uses reach geometry, slope, and roughness to estimate flow in a reach. However, the HEC-RAS model was linked directly to the subbasin outflow at 422 riverine output locations. These 422 output locations were utilized as unsteady inflow boundary conditions in the hydraulic model. Therefore, the routing between HMS subbasins described above does not significantly impact the hydraulic modeling results. Nevertheless, the routing methods should be noted in case of future use of the model. Figure H-6 shows the sub-basins and junctions for Claycut Bayou, a tributary of the Amite River. A portion of those hydrologic nodes are used as model output locations.

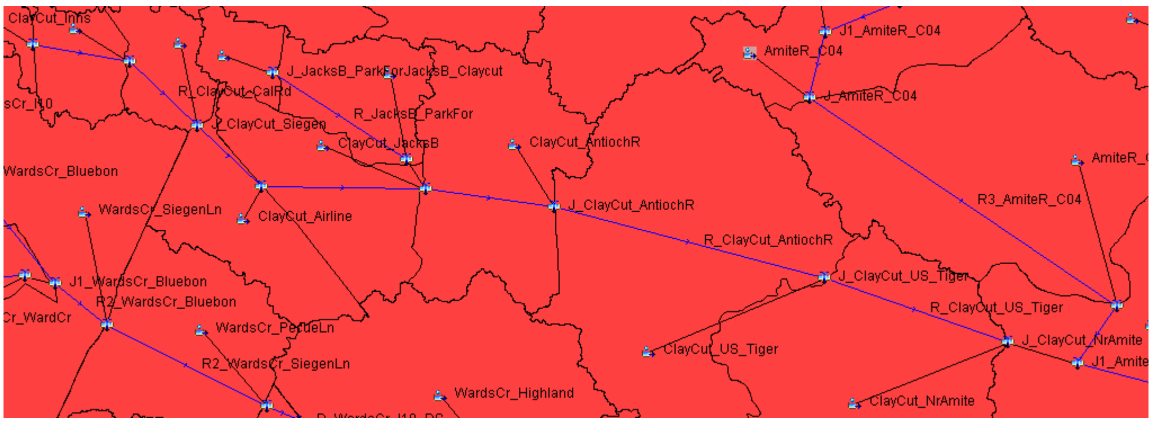


Figure H-6 Example Hydrologic Nodes for Claycut Bayou

4.1.4 HMS Calibration

The HMS model was calibrated using Stage IV historic gridded rainfall events, which is described in detail in the Dewberry report. The calibration targeted observed excess precipitation percentage to match the model to. The observed excess precipitation percentage was calculated based on observed hydrograph volumes, baseflow volumes, and basin averaged precipitation volumes for several gages in the AR&T Basin.

4.1.5 Modeling the Design Storms

Each of the 96-hour AEP precipitation events was applied to the entire Amite River Basin in the HMS model. This was done with the existing model for the baseline year (2026), and with the adjusted imperviousness percentages for the future conditions (2076). The isohyet precipitation scaling was applied using the HMS gage weight method, where each subbasin has a scaling factor between 0 and 1 that dampens the rainfall volume. As the subbasins do not fit perfectly into the isohyets, area-weighted averages were used to estimate gage weights for each subbasin.

Each HMS model run created a .dss file output of flow hydrographs at the subbasin stations in the HMS basin model. These hydrographs are used as input for the HEC-RAS model. Figure H-7 shows the 100-year precipitation hyetograph and flow output hydrograph for Sandy Creek near Mahoney Road.

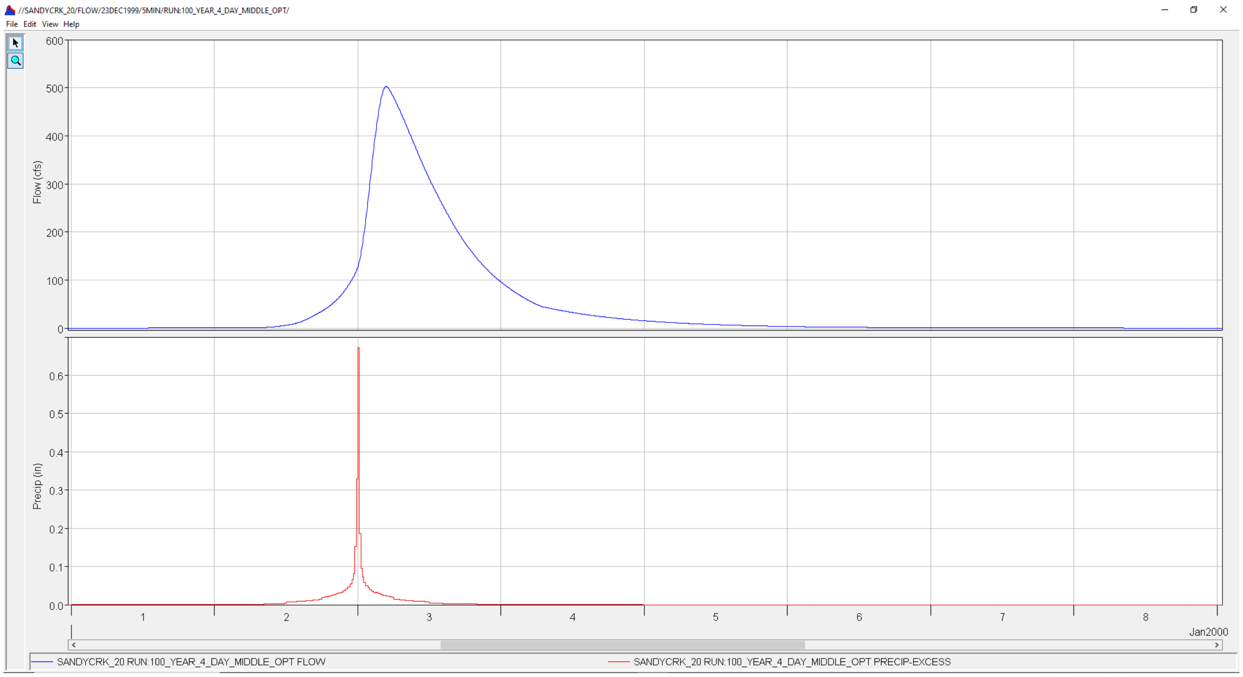


Figure H-7 Example Precipitation Hyetograph and Flow Output Hydrograph

4.2 HYDRAULIC MODELING

4.2.1 Overview

Hydraulic modeling was performed using the HEC-RAS model obtained from the LADOTD. The model is a one-dimensional/two-dimensional (1D/2D) unsteady flow hydraulic model. The model covers the Amite River Basin near the Louisiana/Mississippi border to the outlet of Amite River at Lake Maurepas. The hydraulic model does not cover the portion of the Amite River Basin that is north of the state border. The datum of the model is NAVD 1988 (Geoid 12B). Detailed discussion of model development and parameter selection can be found in the Dewberry Report.

4.2.2 Model Geometry

The model geometry is representative of the Amite River Basin existing conditions. That geometry was used for both existing conditions and future conditions. Distinguishing hydraulic features between existing and future conditions are the stage boundary conditions at Lake Maurepas, which are discussed in the Stage Boundary Conditions section. Figure H-8 shows the model geometry.

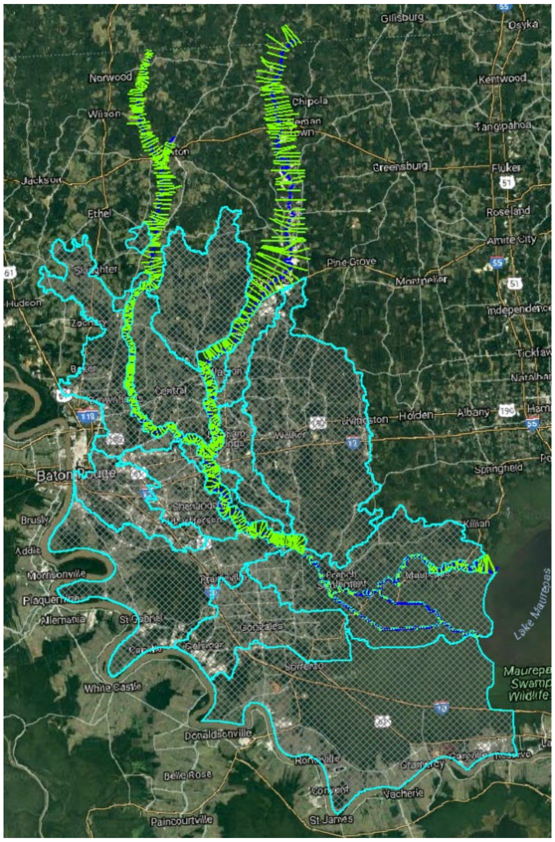


Figure H-8 Model Geometry for 2026 and 2076 Conditions

The Amite and Comite Rivers are modeled as one-dimensional reaches, while smaller tributaries and overland flow areas are modeled as two-dimensional regions. This was done to achieve finer details in the Amite and Comite Rivers, where more detailed information was known about channel cross sections and hydraulic structures, and where more detailed results were desired. Less detailed results were required in overland flow areas and in tributaries, and thus two-dimensional modeling was deemed reasonable for those regions. Two-dimensional cells ranged from areas of 100x100 to 1000x1000 square feet, with smaller cells in regions of complex topography and where higher levels of flooding detail were necessary. Also, near model features such as culverts, lateral structures, 2D area connections, and 2D inflow points, smaller cells were used to allow better model stability and accuracy.

4.2.3 Terrain and Land Cover

Topography data is used by 2D flow areas to calculate storage within and flow between 2D cells. Topography data came from a LIDAR dataset that was collected by the LADOTD in 2017. That LIDAR dataset has a spatial resolution of 2 feet. The terrain is associated with the USA Contiguous Albers Equal Area Conic USGS projection. Figure H-9 shows the LADOTD LIDAR dataset. It should be noted that the RAS terrain does not include the bathymetry for tributaries to the Amite and Comite rivers, instead setting the tributary elevation as the water surface elevation. This impacts flood levels by inducing more overbank flooding in the areas around the tributaries and reducing the amount of flow reaching the downstream sections of the model. The impact of not accounting for the full tributary channel geometries is uncertain and depends on the tributary water surface elevation at the time of the LiDAR surveys, compared to the full channel volumes. Solutions to this inaccuracy include conducting bathymetric surveys for each tributary or estimating cross sections by some other means. The error introduced by not fully resolving each tributary was deemed acceptable for this study.

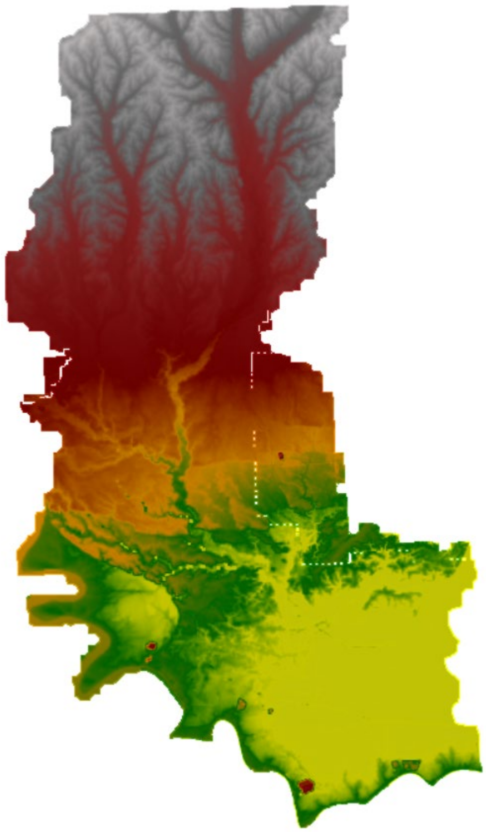


Figure H-9 LADOTD 2017 LIDAR Dataset

Land cover data is used to determine the distribution of Manning's roughness coefficients throughout the 2D flow areas. Manning's roughness coefficients are used in the calculation of flow between 2D cells. Land cover data was sourced from the 2011 National Land Cover Database. Manning's roughness coefficients were selected based on land cover type in the subbasins. Figure H-10 shows the Dewberry Report's Table 8: Summary of Manning's N Values for 2D Flow Areas.

Table 8: Summary of Manning's N Values for 2D Flow Areas

2011 NLCD Code	Description	Manning's N
11	Open Water	0.035
21	Developed, Open Space	0.09
22	Developed, Low Intensity	0.10
23	Developed, Medium Intensity	0.10
24	Developed High Intensity	0.15
31	Barren Land (Rock/Sand/Clay)	0.10
41	Deciduous Forest	0.12
42	Evergreen Forest	0.12
43	Mixed Forest	0.12
51	Shrub/Scrub	0.12
71	Grassland/Herbaceous	0.07
81	Pasture/Hay	0.09
82	Cultivated Crops	0.10
91	Woody Wetlands	0.12
95	Emergent Herbaceous Wetlands	0.12

Figure H-10 Table 8 from Dewberry Report: Summary of Manning's N Values for 2D Flow Areas

The base and future year models have the same land cover and Manning's N values. While the impervious area percentage was increased due to anticipated urbanization, anticipating specific changes in Manning's N values was deemed too uncertain to attempt since it's impossible to know which areas will become developed. Additionally, the consequence of not considering this change is uncertain, since development from low intensity to high intensity developed land cover would raise the average N value, but developing undeveloped land to low or medium intensity developments would lower the average N value.

4.2.4 Boundary Conditions

Inflow boundary conditions to the hydraulic model were imported from results of the hydrologic model. There are three types of inflow boundary conditions in this hydraulic model: 1D inflow hydrographs, lateral inflow hydrographs, and 2D inflow hydrographs. There are two types of downstream boundary conditions in this hydraulic model: 1D stage hydrographs and 2D stage hydrographs.

(1) 1D Inflow Hydrographs

The upstream boundaries of the 1D portion of the hydraulic model are the Amite River and the Comite River near the Mississippi-Louisiana border, as well as Pretty Creek approximately 3 miles upstream of the Comite River. Inflow hydrographs are applied at those locations to represent flow from the portion of their basins that are upstream of the boundaries. Figures H-11, H-12, and H-

13 show the locations of the upstream boundaries of the Amite River, Comite River, and Pretty Creek.

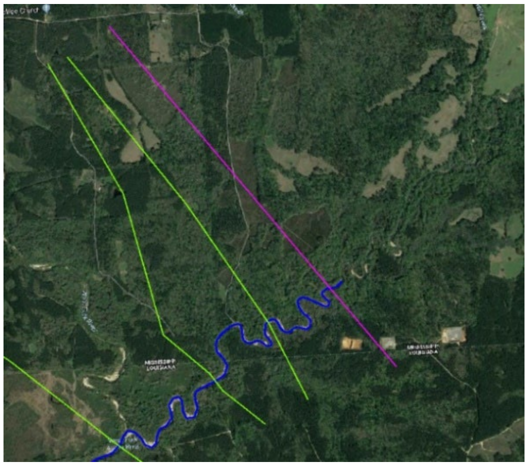


Figure H-11 Amite River Upstream Boundary Location

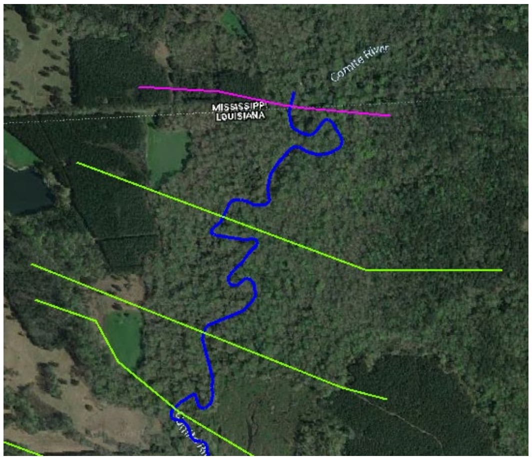


Figure H-12 Comite River Upstream Boundary Location

Figure H-13 Pretty Creek Upstream Boundary Location

(2) Lateral Inflow Hydrographs

Inflow hydrographs are applied to 1D portions of the model in the form of lateral inflow hydrographs. These hydrographs represent flow from basins that are either not included in the 2D domain or that are near intersections of the 1D and 2D domains. There are 99 lateral inflow hydrographs in the model. Figure H-14 shows the location of the lateral inflow hydrograph that represents flow from Bluff Creek into the Amite River.

Figure H-14 Lateral Inflow Location Representing Flow from Bluff Creek into the Amite River

(3) 2D Inflow Hydrographs

Inflow hydrographs are applied to the 2D portions of the model at 2D boundary condition lines. 2D boundary condition lines are located at intervals along tributaries of the Amite and Comite Rivers, as well as smaller streams that flow to those tributaries. These hydrographs represent the runoff from local rainfall, as well as rainfall from areas upstream that is not captured at another boundary condition line. There are 320 2D boundary condition lines in the model. Figure H-15 shows the location of the 2D inflow hydrograph that inputs flow to Claycut Bayou near Airline Highway.

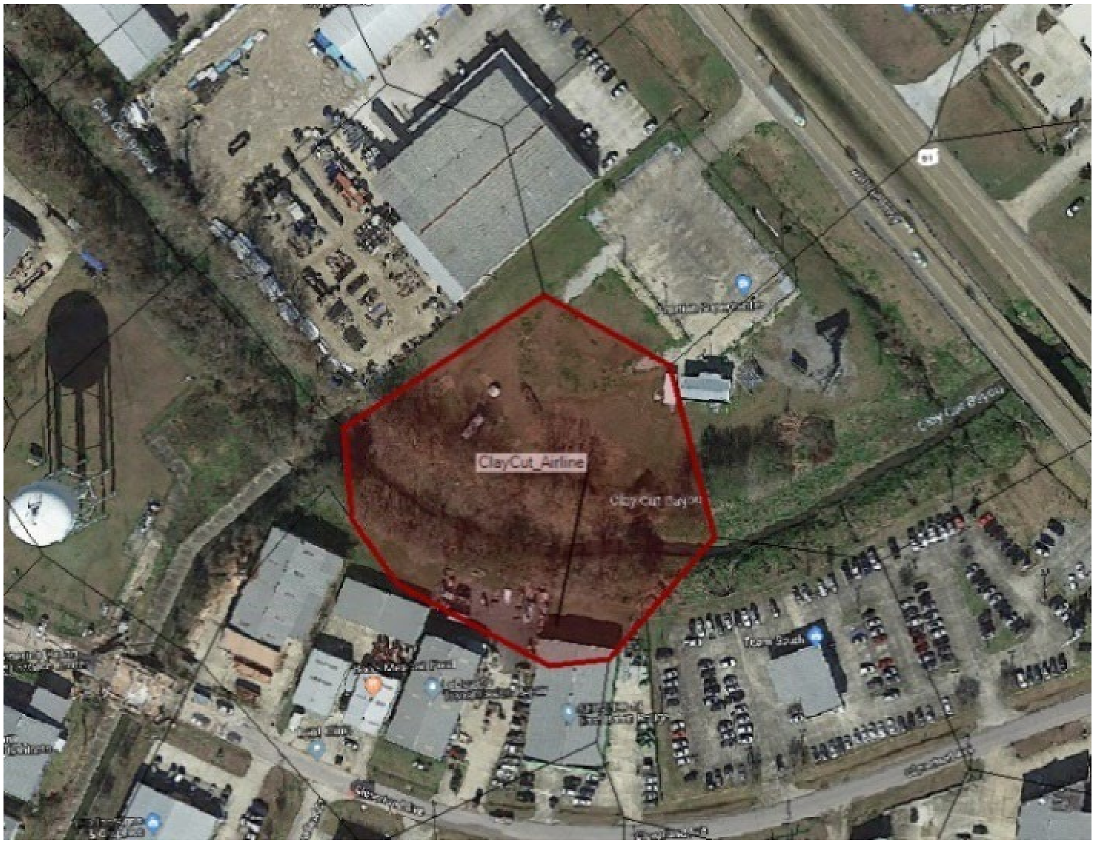


Figure H-15 2D Boundary Condition Line for Flow into Claycut Bayou near Airline Highway

(4) Stage Boundaries

The downstream boundaries of the hydraulic model are stage boundaries that represent the water surface elevation of Lake Maurepas. Stage boundaries are used where the Amite River and Blind River enter Lake Maurepas, on the lake's western end. Stage boundaries are also used where the 2D domain interacts with Lake Maurepas. A "normal high water" stage was selected as the existing conditions no storm surge boundary condition. For baseline (year 2026) model runs, this value was calculated from USACE gage 85420 Pass Manchac near Pontchatoula, which is located on the eastern end of Lake Maurepas. The stage measurements for the years 2019 and 2020 showed that the 87.5-percentile stage was approximately 2.02 feet. 0.3 feet was added to account for tidal fluctuation. 0.2 feet of sea level rise (from the intermediate sea level rise estimate from 2020 to 2026) was added to produce a stage boundary of 2.52 feet. For future conditions (2076), 2.1 feet of sea level rise (from the intermediate sea level rise estimate from 2020 to 2076) was added to the Lake Maurepas stage, resulting in a stage boundary of 4.42 feet. Figure H-16 shows the locations of the downstream stage boundaries of the 1D reaches, and figure H-17 shows the locations of the 2D stage boundary condition lines. The sea level rise calculations are described in section 6.3.

Figure H-16 Stage Boundary Locations at Lake Maurepas for Amite River (left) & Blind River (right)

Figure H-17 2D Stage Boundary Locations at Lake Maurepas

(5) Storm Surge Stage Boundaries

A set of models with higher downstream stage boundaries were run to assess the impact of storm surge on the project area. The lower portion of the Amite River Basin experiences storm surge, which propagates through the mouth of the Amite at Lake Maurepas. ADCIRC storm surge modeling was performed in 2017 for the West Shore Lake Pontchartrain (WSLP) project using a refined grid in the Lake Pontchartrain and Lake Maurepas region (West Shore Lake Pontchartrain Surge Hazard and Design Assessment, 2022 [2]). Results from that modeling for years 2020 and 2070 were used to estimate surge. The surge values located closest to the 5 stage BC locations were interpolated/extrapolated to 2026 and 2076 values, as well as adjusted for sea-level rise (SLR). The variance in ADCIRC output between the five boundary condition locations was considered negligible. To represent surge in the HEC-RAS model, a constant stage hydrograph was set at the downstream BC locations, which created backwater flooding in the lower reaches of the RAS model. The SLR-adjusted values are shown in table H-1 below. The intermediate SLR curve was used to estimate future surge values. The storm surge boundary conditions were run with a negligible rainfall timeseries, which is approximately equal to the 0.99 AEP event for the region based on the NOAA Atlas 14 precipitation estimates. The post-processing of these model outputs for economic analysis is discussed in the results section.

Table H-1 Interpolated ADCIRC Outputs for the Modeled AEP Events near the West Edge of Lake Maurepas

Return Frequency	2026 interpolated plus SLR (ft NAVD 88)	2076 interpolated plus SLR (ft NAVD 88)
0.1	5.5	7.0
0.04	6.6	8.3
0.02	7.7	9.5
0.01	8.9	10.6
0.005	10.0	11.7
0.002	11.5	13.2

4.2.5 Incorporation of Comite River Diversion, East Baton Rouge, and West Shore Lake Pontchartrain FRM Projects

Three major authorized projects in the Amite River Basin are projected to be complete or in construction prior to the baseline year of the Amite River and Tributaries FRM project (2026). Those projects are the Comite River Diversion (CRD) project, the East Baton Rouge (EBR) FRM project, and the West Shore Lake Pontchartrain project. The impacts of those projects were considered for this hydraulic modeling. The locations of the CRD and EBR projects in East Baton Rouge Parish are shown in figure H-18.

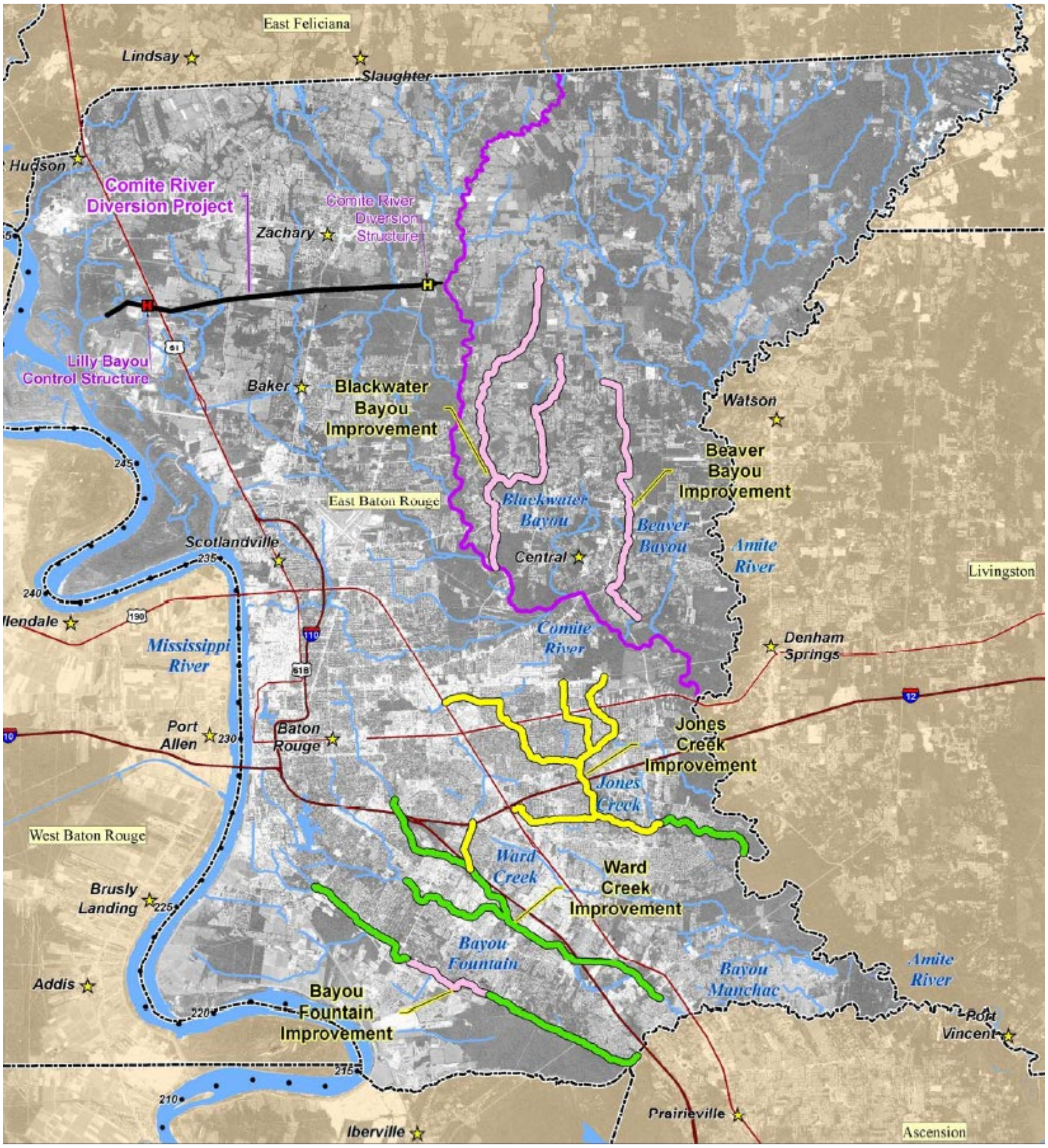


Figure H-18 Locations of CRD and EBR Projects

(1) Comite River Diversion Project

The Comite River Diversion will be located approximately 20 river miles upstream of the confluence of the Comite and Amite Rivers. Figure H-19 shows the expected location of the Comite River Diversion relative to the hydraulic model. The project will divert water from the Comite River west to the Mississippi River, between the cities of Zachary and Baker. The authorized diverted flows are based on flow rates in the Comite River immediately upstream of the diversion. To incorporate the impacts of the Comite River Diversion into this hydraulic modeling, a lateral diversion feature was implemented at the location of the diversion. The lateral diversion removes water from the Comite River based on a flow-flow rating curve. Figure H-20 shows the flow-flow rating curve. This rating curve is the only representation of the diversion in the Amite model at this time. At the time of the writing of this HH&C Appendix, construction of the Comite River Diversion project has not been completed.

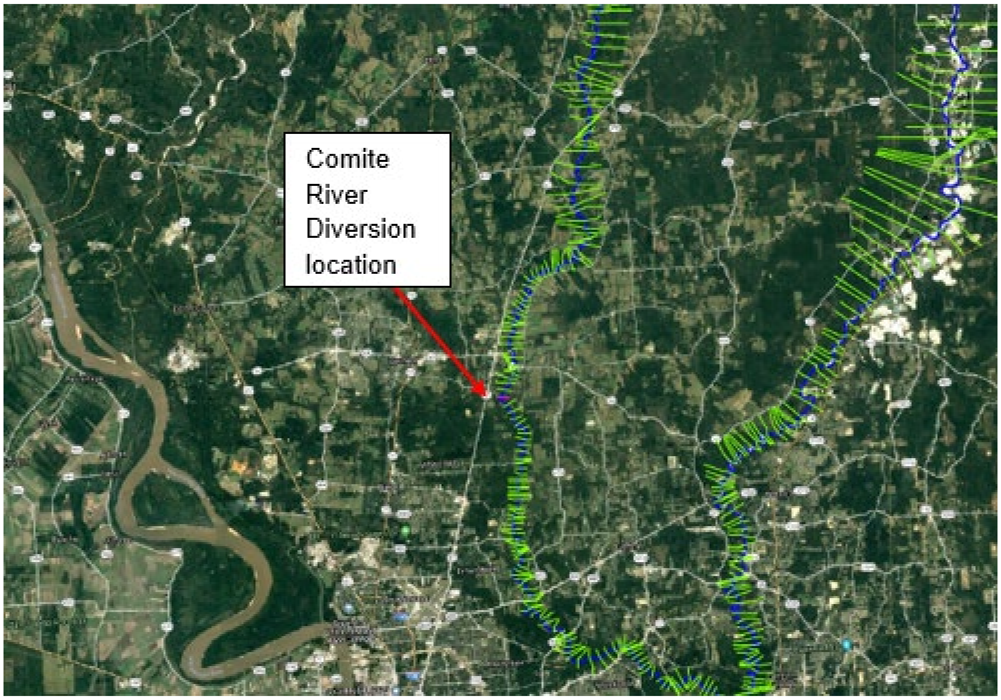


Figure H-19 Location of Incorporation of Comite River Diversion Project into Hydraulic Model

Outlet Rating Curve	
US Flow	Outlet Flow
0	0
6850	4450
10700	6150
16200	9300
22100	12700
28400	16800
37500	20800
45800	23900
50300	24900
56200	25800

Figure H-20 Authorized Flow-Flow Rating Curve for Comite River Diversion

(2) East Baton Rouge FRM Project

The authorized East Baton Rouge (EBR) FRM project includes clearing and snagging projects on five separate streams: Beaver Bayou, Blackwater Bayou, Jones Creek, Ward Creek, and Bayou Fountain.

The feasibility study for the EBR project reported flow rates that are expected at the downstream ends of the five streams with and without the authorized EBR projects in place. The EBR study prescribed low tailwater stages to represent conservative conditions and had shorter design events than the AR&T modeling. Therefore, the AR&T model could not directly incorporate EBR RAS model flow rate outputs as an inflow boundary. To estimate the impacts from the EBR project, the ratio of peak flow rates for the with versus without project was calculated at downstream locations in the EBR model. Figure H-24 shows the with and without project hydrograph at Jones Creek from the EBR model. The ratio of the peak flow rates is approximately 1.25. Therefore, the inflow hydrographs at the five EBR locations in the AR&T Basin model were multiplied by 1.25 for sensitivity testing.

Figures H-21, H-22, and H-23 show the locations where the flow multiplier for the five EBR streams were applied to the hydraulic model. Table H-2 lists the location in the AR&T hydraulic model where the flow multiplier for each EBR stream was applied. Sensitivity tests were run to see how adjusting these 5 inflow hydrographs would impact WSEs throughout the basin. These tests showed that even right next to the inflow locations, WSE increases were less than 0.02 feet for the 25-year event. Based on the outcome of the sensitivity runs, the 1.25 multiplier was not used in the main AR&T production runs. Thus, the EBR project is not represented in the AR&T model results.

Table H-2 Hydraulic Model Locations for Application of EBR Hydrographs

EBR Stream	1D River and Reach	Cross Section
Beaver Bayou	ComiteRiver Abv_AmiteR	22408.94
Blackwater Bayou	ComiteRiver Abv_AmiteR	52579.85
Jones Creek	AmiteRiver Blw_ComiteR	258117.4
EBR Stream	**2D Flow Area**	**Boundary Condition Line**
Wards Creek	BayouManchac	WardsCr_Manchac
Bayou Fountain	BayouManchac	BFount_ByuManch

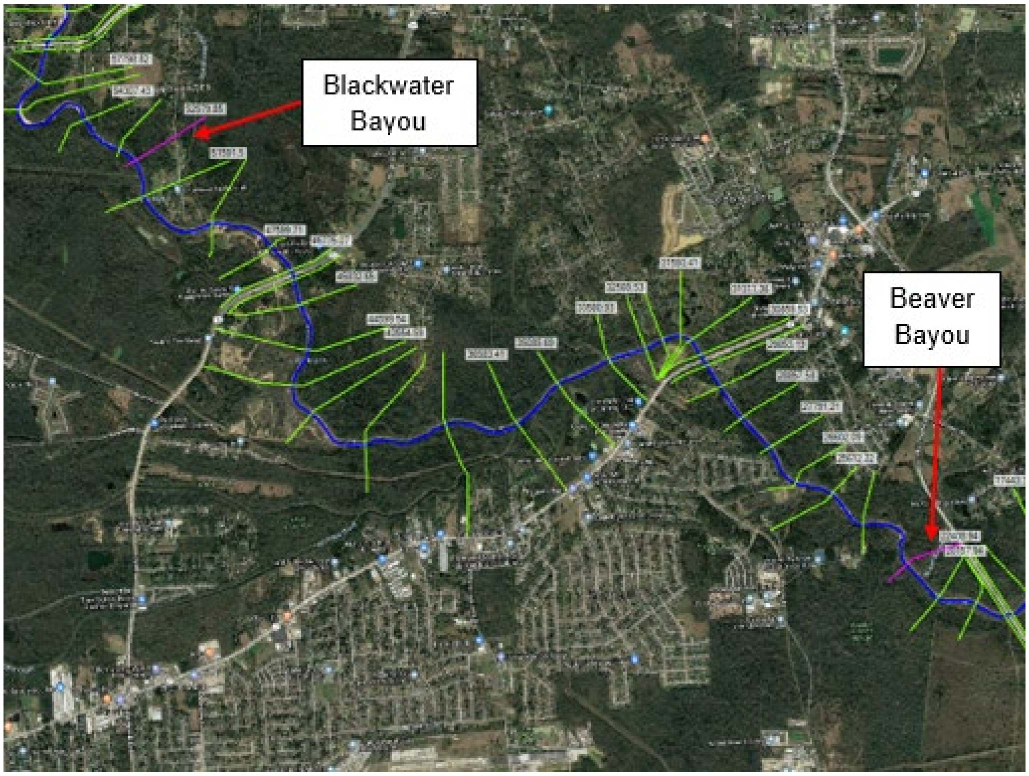


Figure H-21 Cross Sections where Blackwater Bayou and Beaver Bayou EBR Flows Were Applied

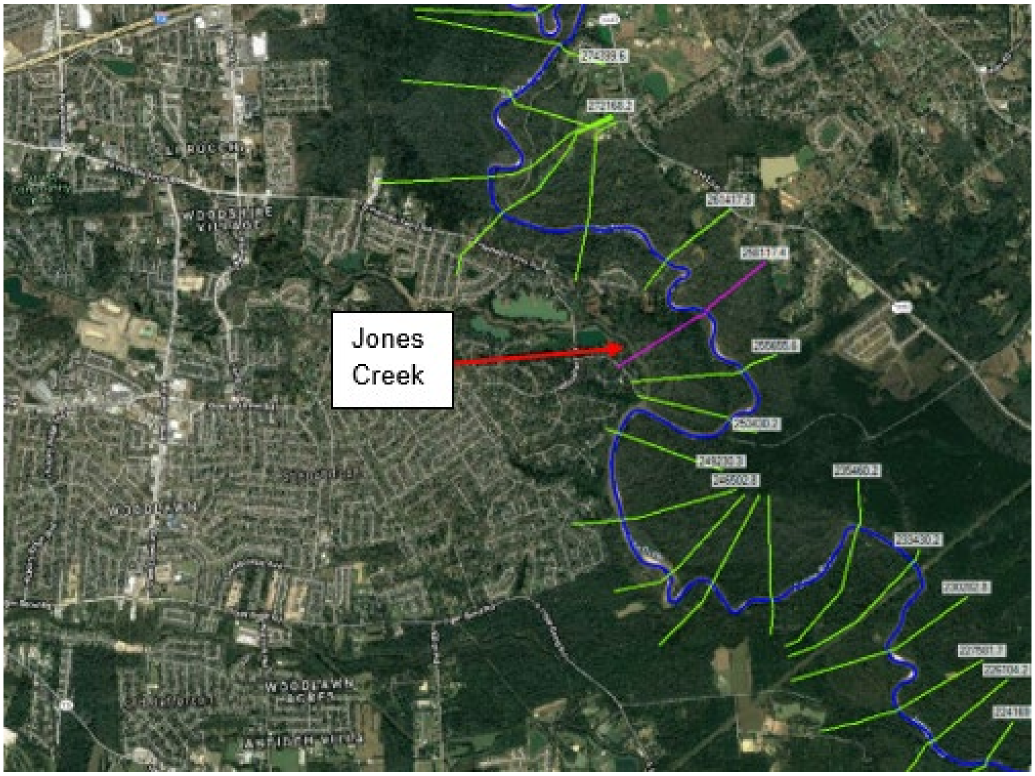


Figure H-22 Cross Section where Jones Creek EBR Flows Were Applied

Figure H-23 Cross Sections where Ward Creek and Bayou Fountain EBR Flows Were Applied

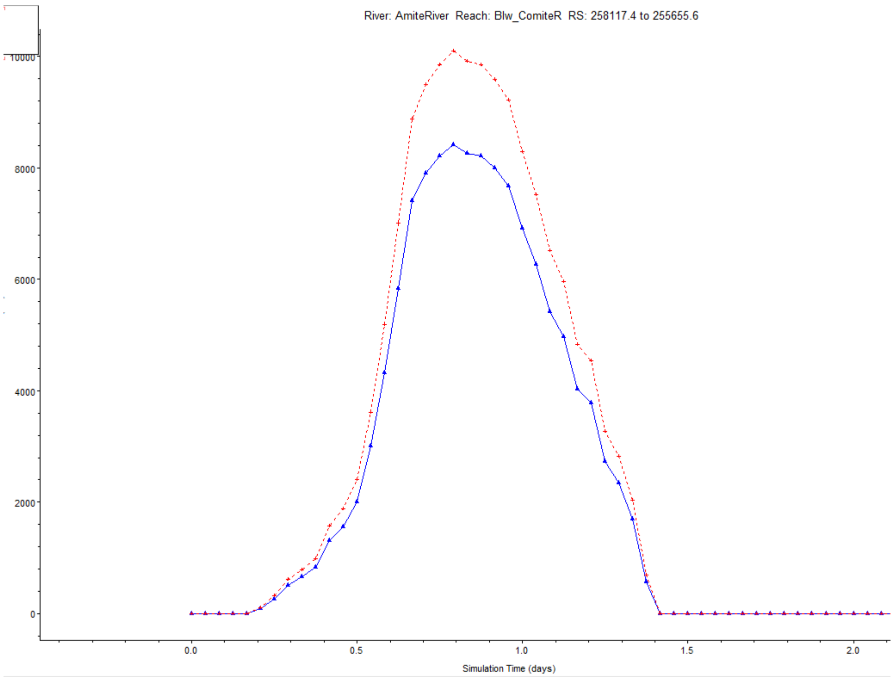


Figure H-24 25-Year EBR With Project (Red) versus Without Project (Blue) Hydrographs at Jones Creek

(3) West Shore Lake Pontchartrain FRM Project

The West Shore Lake Pontchartrain Levee Project was not included in the model geometry. The impact of the levee project on water levels in the Amite project area was determined based on ADCIRC modeling documented in the West Shore Lake Pontchartrain Surge Hazard and Design Assessment. Figure H-25 shows the modeled increase in WSE according to ADCIRC modeling comparing with and without project runs. The dark blue portion of the figure shows where the WSLP levee will protect. This figure indicates that WSE increase due to the WSLP project will be less than 0.1 feet in the AR&T project area. While there are some areas just outside of the WSLP levee that will experience higher flood levels due to the project, structures in this area are not included in the Amite non-structural plan, since eligibility for the Amite project is based on susceptibility to Amite River flooding.

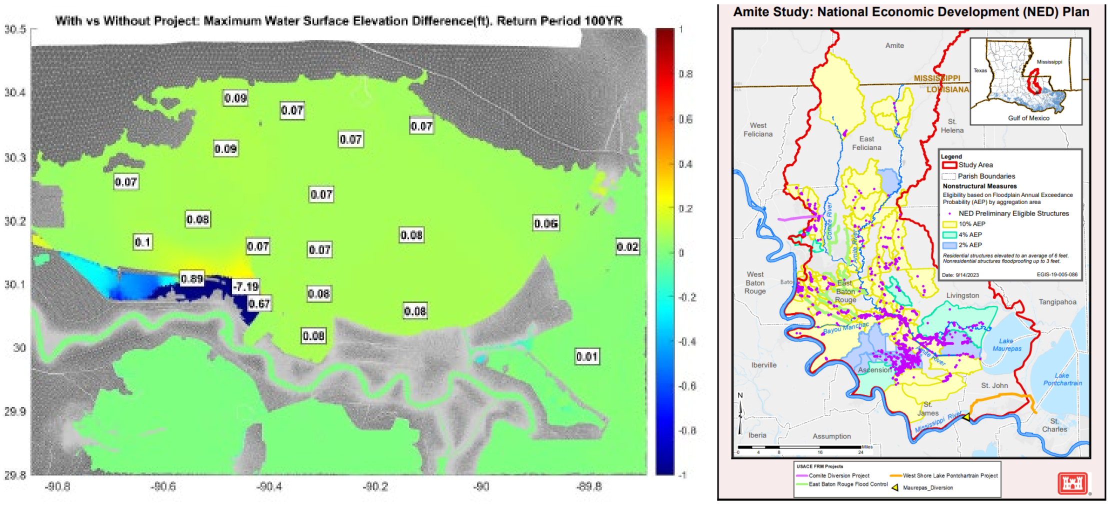


Figure H-25 West Shore Lake Pontchartrain With vs. Without Project Max WSE Difference for 100-Year Event and Amite Eligible Structure Inventory

4.2.6 Calibration

The Dewberry report describes the HEC-RAS model calibration steps. The model was calibrated using low and high flow events, with the objectives of correlating hydrograph timing, peak flows, and peak stages. The primary parameter that was adjusted during the Dewberry calibration was the Manning's roughness coefficient in the 1D channel reaches. The calibration performed by Dewberry was deemed sufficient. The PDT did not create any other historic precipitation events to validate the peak flow rates and hydrograph timing in the RAS model. This would have significantly extended the schedule and budget of the project, and the Dewberry calibration process was well documented and thorough, and used the most significant rain events on record.

Instead, MVN-EDH validated the model results for the 96-hour design storm with the updated storm center location using Bulletin 17C streamflow frequency analysis. A discharge-frequency analysis was performed at the locations of four gages on the Amite River with at least 35 years of peak annual streamflow data. That discharge-frequency analysis was performed with HEC-SSP software, using Bulletin 17C procedures. Those gages are located (from upstream to downstream) at Darlington, Magnolia, Denham Springs, and Port Vincent, which are shown as red diamonds in figure H-26. The flow frequency curves calculated at four USGS gages along the Amite River were compared to the HEC-RAS computed flows for the six AEP events. Figures H-27 through H-30 show the results of this comparison. The modeled peak flow rates are within the 90% confidence interval of the computed flow frequency curves for every event at every gage, and nearly match the expected flow rate for some of the AEP events calculated by the SSP analysis. The comparison does however show consistent overestimation of flow by the RAS model during more frequent events (0.1, 0.04 AEP), and underestimation of flow for less frequent events, with the Bulletin 17C curve showing a steeper change in flow estimates between the AEP events. One hypothesis to explain this trend is that the RAS outputs are based on rainfall frequency estimates from NOAA Atlas 14, and the Atlas 14 statistical analysis considers a larger data set of observations than the Bulletin 17C peak annual streamflow observations for each of these gauges, leading to less extreme values associated for each frequency event for the Atlas 14 analysis. Both frequency event estimating methods carry uncertainty. One way to improve the Bulletin 17C analysis would be to add synthetic streamflow data using statistical techniques or improve confidence in the RAS model using more historic storm events for calibration. As all AEP storm model outputs factor into the flood damage calculations, it is unclear what the impact of this uncertainty would be, since some AEP events are overestimated in RAS, and some AEP events are underestimated compared to Bulletin 17C. This result increases confidence that the model accurately depicts the hydraulics of the AR&T Basin.

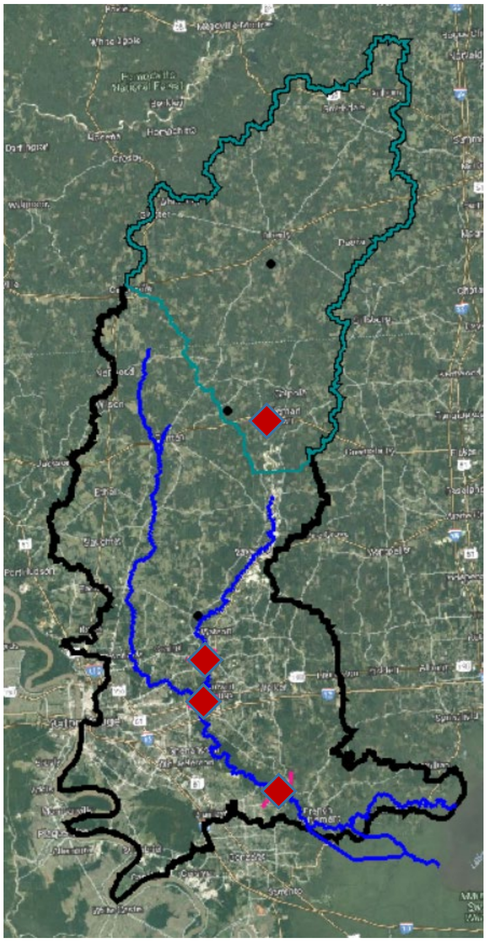


Figure H-26 USGS Gage Locations Used for Bulletin 17C Analysis (red diamonds) within AR&T Basin

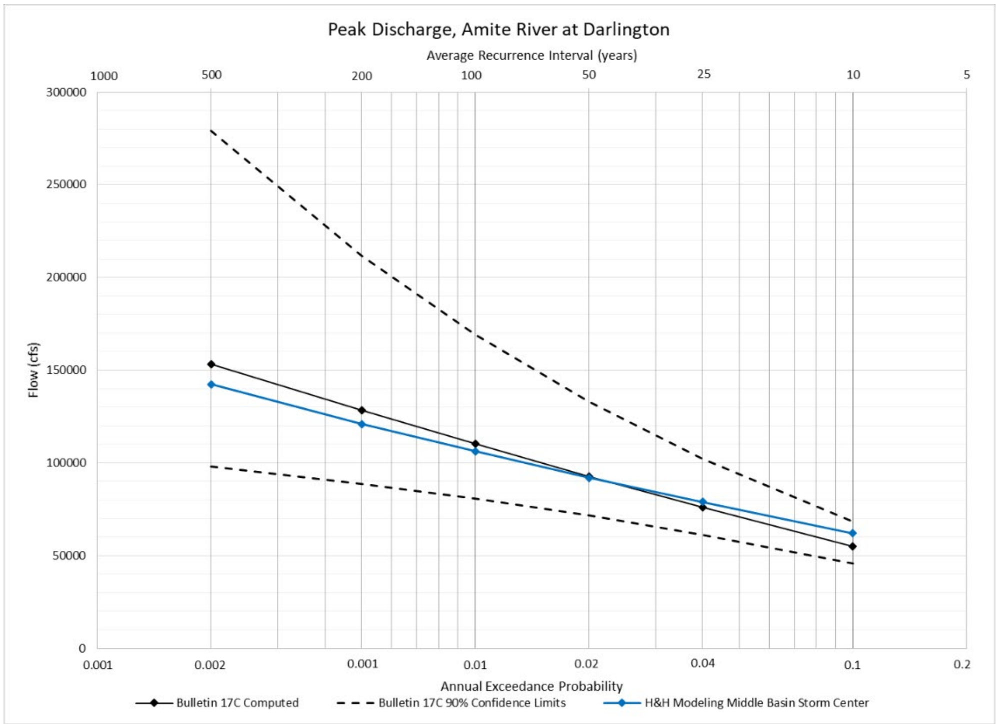


Figure H-27 Amite River at Darlington, comparison of flow-frequency analysis to H&H modeling

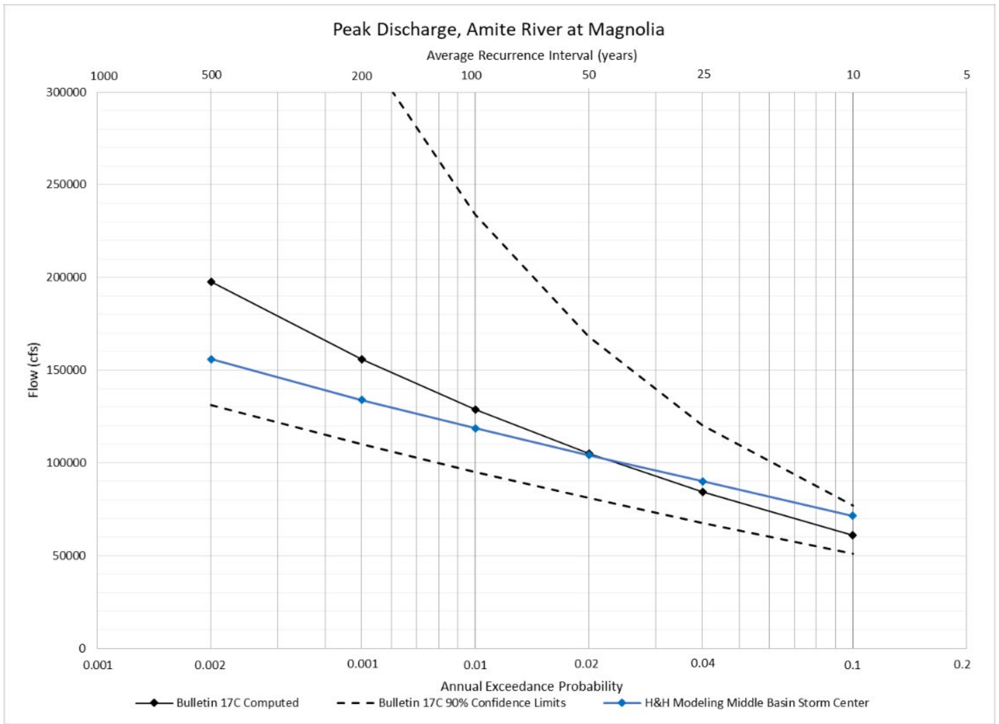


Figure H-28 Amite River at Magnolia, comparison of flow-frequency analysis to H&H modeling

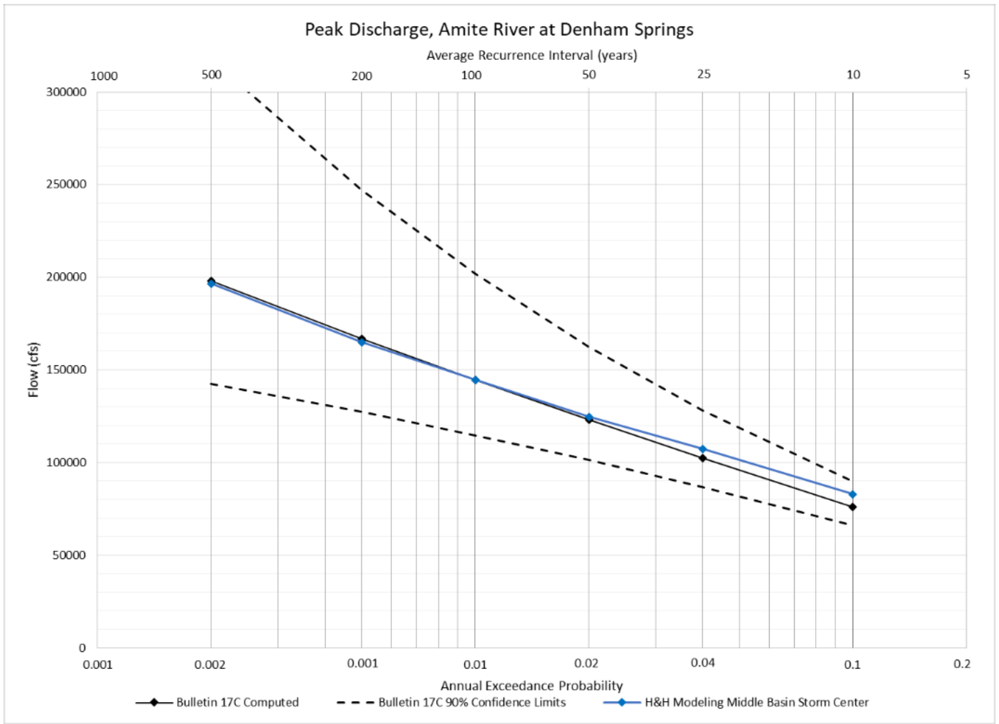


Figure H-29 Amite River at Denham Springs, comparison of flow-frequency analysis to H&H modeling

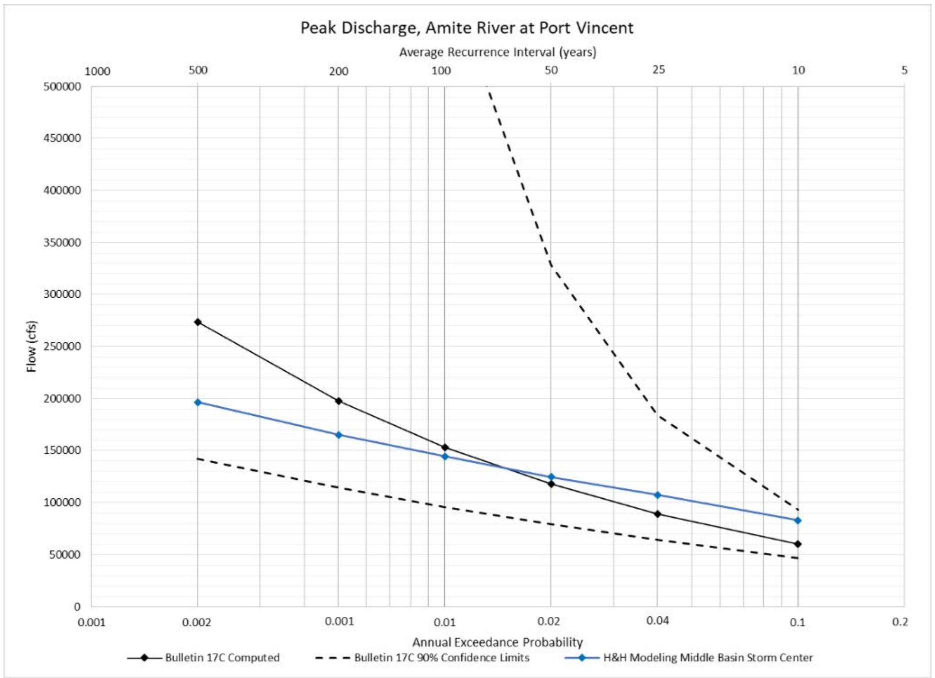


Figure H-30 Amite River at Port Vincent, comparison of flow-frequency analysis to H&H modeling

4.2.7 Compound Flooding

This study investigated the potential for compound flooding. Compound flooding is flooding that occurs due to simultaneous flood forcings, such as rainfall and storm surge. The goal of the H&H analysis is to establish the most likely maximum water surface elevation for a given recurrence interval. It is possible that the maximum water surface for a given return frequency would be caused by simultaneous river and coastal flooding, since higher tailwater stages lead to slower inland drainage. However, the rareness of simultaneous large rainfall and coastal events with basin-wide impacts may make the compound-event water surface elevation (WSE) statistically insignificant for the purpose of this study.

Compound flood analysis (CFA), as defined by EM 1110-2-1415, explores the statistical likelihood of simultaneous flooding using observed data. It starts by estimating maximum water surface profiles for fully coincident and fully independent flood events, which was done by running 3 HEC-RAS models for each recurrence interval: profile 1 (rainfall flooding, storm surge stage boundary), profile 2 (rainfall flooding, normal high water stage boundary), and profile 3 (negligible rainfall, storm surge stage boundary). Profile 4 was created by comparing profiles 2 and 3 and taking the higher of the two water surface elevations at every location in the model domain. Profile 1 represents the full coincident WSE and profile 4 represents the independent WSE. Profile 1 is referred to as the compound flood profile and profile 4 is referred to as the predominant flood profile.

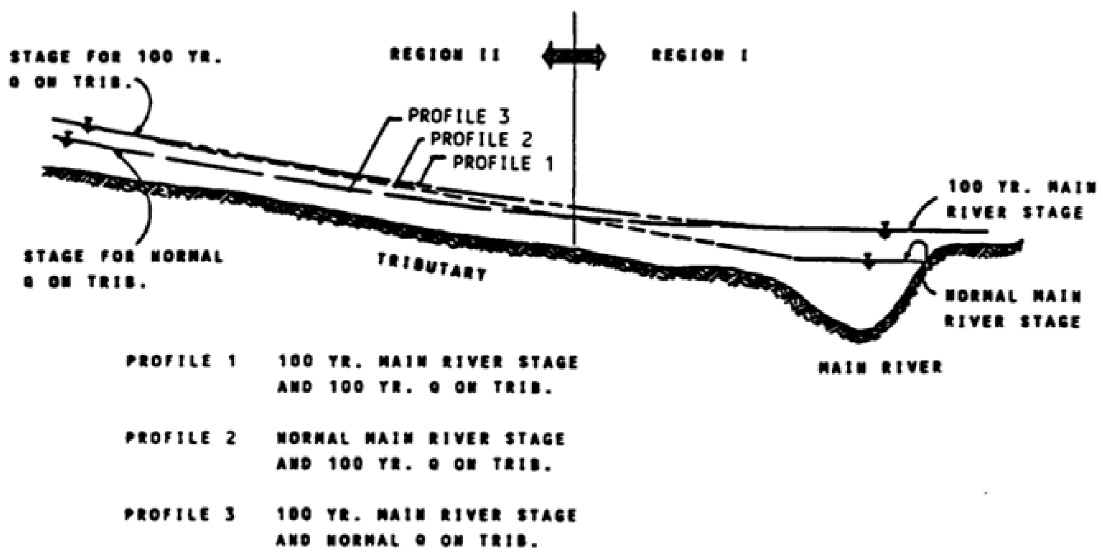


Figure H-31 Illustration of Water Surface Profiles in Coincident Frequency Analysis from EM 1110-2-1415

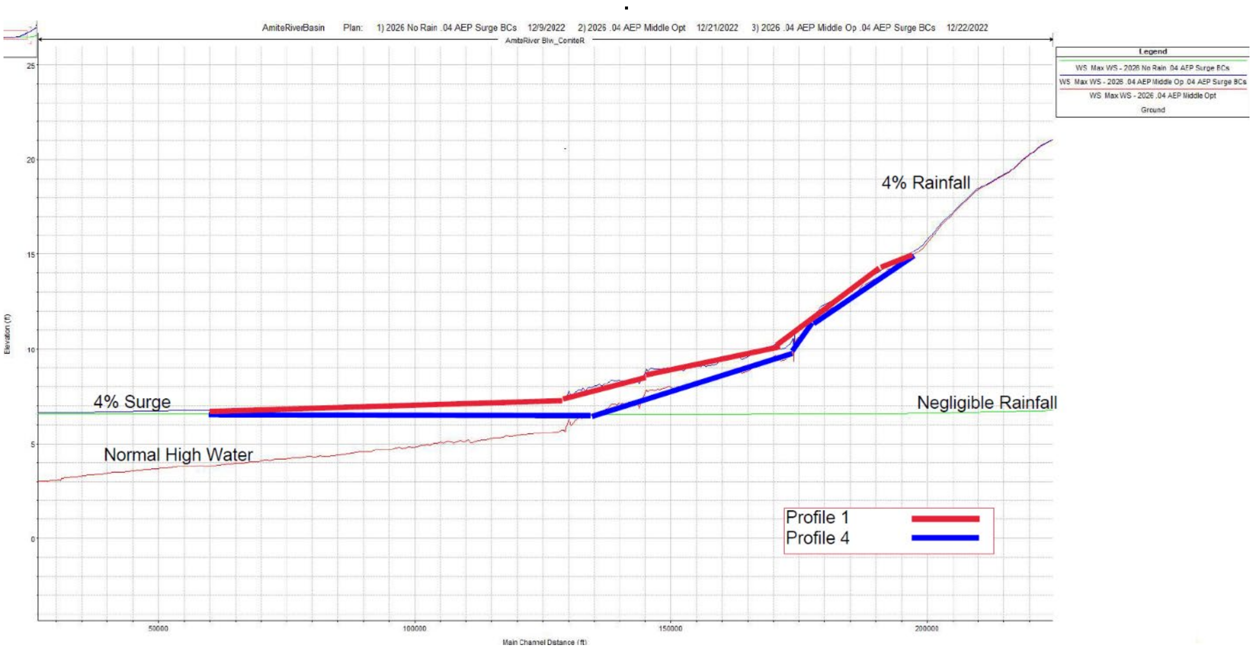


Figure H-32 RAS Profile Outputs from River Reach "Amite Below Comite"

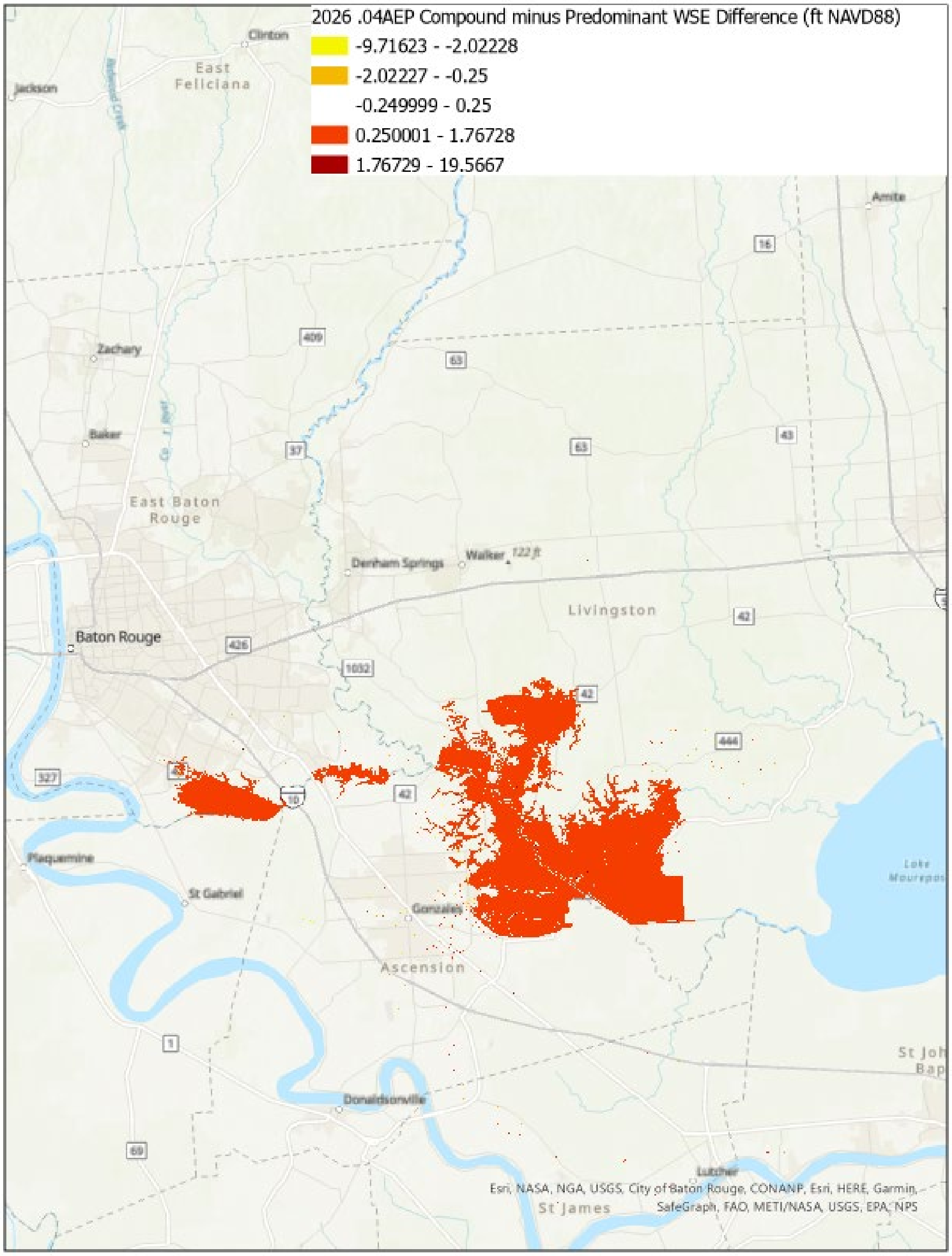


Figure H-33 Difference in maximum water surface elevations for the 2026 25-year compound and predominant events

As shown in Figure H-33, the consequences of assuming full independence versus full coincidence are felt mostly by the communities of French Settlement and Port Vincent. The difference in WSE in this area is between 0.25 and 1.75 feet. WSE changes of less than 0.25 feet (3 inches), were considered insignificant for visualization purposes. The spatial extent of the increased WSE due to full compounding is consistent for both 2026 and 2076 models, and across return frequencies. The plots for the 2076 25-year comparison, and 100-year comparisons are shown in annex H-2. The intermediate sea level rise curve was used for both models. Section 6.3 provides a more detailed discussion of considering the impacts of relative sea level rise. Damages for the 2076 25-year (0.04 AEP) and 100-year (0.01 AEP) predominant and compound events are shown in Table H-3. The terms compound and predominant are defined in the second paragraph of section 4.2.7. There is a 12 percent difference in the 0.04 AEP, and 7 percent for the 0.01 AEP.

Table H-3 Comparison of Compound and Predominant Flooding Damages

	Compound Flooding	Predominant Flooding	% Difference
2076 0.04 AEP Flood Damages	$430,000,000	$380,000,000	12%
2076 0.01 AEP Flood Damages	$1,070,000,000	$990,000,000	7%

(1) Gage Correlation

To assess the likelihood of coincident flood events, a gage correlation assessment was performed. Kim et al 2022 [reference 3] present a method to assess the correlation between high rainfall and coastal stage, using Kendall's Tau to compute the "strength of dependence" between the two variables. To do this, two data sets were assembled: the historic flows at Port Vincent with the concurrent stage at Pass Manchac, and historic stages at Pass Manchac with the concurrent flows at Port Vincent. Kendall's Tau ranges from -1 (negative correlation between variables) to 1 (positive correlation between variables), with a zero-value indicating no correlation. The tau computed between peak Port Vincent flows and Pass Manchac stages is -0.143 (n = 14) and between peak Pass Manchac stages and Port Vincent flows is 0.059 (n = 18). This analysis is summarized in Tables H-4 and H-5. Events associated with tropical storms are indicated with initials TS which stands for Tropical Storm. Those that are not associated with tropical storms are marked NTS (No Tropical Storm). Neither of the tau values are high enough to reject a hypothesis test that tau is equal to zero at a confidence level above 60%, according to a table of significant tau values provided by real-statistics.com [reference 4]. This result means that based on these gage records, the annual maximum flow rate at the Port Vincent gage does not have a strong correlation with the Pass Manchac stage, and the annual maximum stage at Pass Manchac does not have a strong correlation with the Port Vincent flow rate. Following the first few steps of Kim et al 2022, the Kendall's correlation test was also performed on the peak Manchac stage – Port Vincent flow dataset, testing the events associated with TS and non-NTS separately. Both tests produced tau values of 0.29, which was not statistically significant for the sample sizes of 10 and 8 respectively.

Table H-4 Port Vincent peak flows Kendall's Correlation with Pass Manchac stages

Date	PV Flow (cfs)	Manchac Stage (ft)	Tropical Storm
8/15/2016	199000	1.3	NTS
1/28/1990	69500	0.73	NTS
1/23/1993	48400	1.79	NTS
4/30/1997	45300	1.08	NTS
4/13/1995	44700	1.92	NTS
3/8/1992	43100	1.05	NTS
11/1/1985	42200	3.62	TS
2/24/2003	42100	0.95	NTS
3/14/2016	41700	2.59	NTS
4/4/1988	38300	2.29	NTS
1/13/2013	35200	2.05	NTS
3/17/1999	33900	0.72	NTS
2/28/1997	31800	1.33	NTS
5/18/2004	31400	2.09	NTS

n	14
C(n,2)	91
D	52
C	39
tau	-0.14286

Table H-5 Pass Manchac peak stages with Port Vincent flows

Date	Manchac Stage (ft)	PV Flow (cfs)	Tropical Storm
8/30/2012	6.54	14600	TS
8/30/2021	6.11	7650	TS
10/11/2004	4.85	8350	TS
9/4/2011	4.28	9250	TS
9/22/2020	4.04	-121	TS
10/26/2015	3.86	12800	NTS
10/10/2018	3.58	215	TS
7/13/2019	3.33	117	TS
10/8/2017	3.29	523	TS
4/18/2016	3.28	2150	NTS
2/2/2005	3.24	9770	NTS
7/1/2003	3.1	3890	TS
12/13/2009	2.72	9410	NTS
4/13/2023	2.54	3080	NTS
7/7/2010	2.54	1410	TS
11/26/2013	2.49	1320	NTS
12/20/2022	2.3	6930	NTS
5/31/2014	2.23	8990	NTS

n	18
C(n,2)	153
D	72
C	81
tau	0.058824

(2) Gage Lag Times

Table H-6 shows the lag time between peak stages at the Port Vincent and French Settlement gages in the lower Amite Basin and the peak stage at Pass Manchac during historic tropical storm events. Given the duration of the observed stage hydrographs (annex H-3), it is likely that there is influence from high downstream tailwaters on the flood levels further upstream. The two highest Port Vincent stage measurement that coincided with a tropical event occurred during Hurricane Gustav (9/6/2008, 9.72 feet) and Hurricane Hilda (10/8/1964, 9.22 feet). There are no Pass Manchac stage measurements for these events, but the storms dissipated on 9/4/2008 and 10/4/1964 respectively, so there was likely a significant lag time between the peak surge and rainfall runoff. The 3rd highest measured stage at Port Vincent that coincided with a tropical storm was during Hurricane Isaac, and Table H-6 shows 2.9 days between the peak at Manchac and the peak at Port Vincent. The time lag between the French Settlement peak stage and the Pass Manchac peak stage is only 0.6 days. One possible explanation for the difference in time lags is that French Settlement's high WSE was caused predominantly by storm surge as it is closer to Lake Maurepas, and Port Vincent's high WSE was driven by rainfall runoff.

Table H-6 Peak Stage Lag Time Analysis for Storm Events Affecting Pass Manchac

Event	Year	Pass Manchac Peak Stage (ft)	Port Vincent Lag Time, Peak Stage (days, ft)	French Settlement Lag Time, Peak Stage (days)
Hurricane Ida	2021	6.11	0.7, 6.6	0.6, 5.9
Hurricane Isaac	2012	6.54	2.9, 8.92	0.6, 6.87
Tropical Storm Lee	2011	4.28	1.0, 6.13	0.7, 5.15
Tropical Storm Beta	2020	4.04	0.7, 4.98	0.7, 4.45

The PDT made a risk-informed decision to not conduct the full compound flood analysis, as described in Kim et al 2022 and EM 1110-2-1415. The above section shows the first few steps of the analysis following Kim et al 2022 and fails to establish a statistically significant correlation in the same way that is accomplished in that paper, likely due to the smaller sample size available for the Amite Basin compared to the dataset used in the Kim et al paper. While the lower Amite Basin is susceptible to hypothetical compound flooding, a full compound flood analysis would have high uncertainty due to the sparse data, making it difficult to quantify the dependence relationship necessary to estimate design events with compound flooding accounted for. Furthermore, Table H-3 shows that the calculated damages are not highly sensitive on the level of dependence since full dependence shows increases of only 12%.

5.0 RESULTS

Hydraulic model production runs were made for six recurrence interval events for both 96-hour rainfall and coastal surge events respectively. The annual exceedance probability events that were modeled were the 0.1, 0.04, 0.02, 0.01, 0.005, and 0.002 events (10-year, 25-year, 50-year, 100-year, 200-year, and 500-year). Models were run for baseline conditions (2026) and future without project conditions (2076), with impervious percentages and downstream boundary conditions changed to represent the baseline and future years. The model runs generated water surface elevation grids. Corresponding rainfall and coastal grids for each AEP event were stitched together using ArcGIS Pro to create WSE grids that used the higher of the two events at every point, representing the predominant condition. This process was done for both the 2026 and 2076 model results. The production run modeling created 36 WSE raster files in the .tif format. The WSE raster files are associated with the USA Contiguous Albers Equal Area Conic USGS projection.

The MVN Geospatial Team conducted quality checks (QC) on the production run outputs by performing raster difference calculations on subsets of the model results. These calculations compared WSE values at every location to check that increasing event intensity, and baseline versus future condition modeling of the same event intensity, showed increasing trends. This quality check identified modeling errors that were subsequently corrected for the final set of model results. The quality checked model results were transferred to the economics team to calculate damages and benefits.

Annex H-1 contains maps of the maximum WSE results of the 3 different conditions (Rainfall, Coastal, Predominant). The maps are presented with geometrical interval classification, a type of classification scheme for classifying a range of values based on a geometric progression. In this classification scheme, class breaks are based on class intervals that have a geometrical series. This classification method is useful for visualizing data that is not distributed normally, or when the distribution is extremely skewed. For example, rainfall distribution or flooding. The geometrical intervals classification is better than quantiles for visualizing prediction surfaces, which often do not have a normal data distribution. Geometric interval works best when the data is spread over a large area and is not well distributed. In population data, for example, it is possible to show a better display and distribution of the data in a more natural way. It is possible to see the difference between the more populated areas to medium and low areas, so you can see more distribution in the area selected. This classification shows more variation on the data due to the class breaks that happen at a constant geometric increase from the interval preceding the breaks.

6.0 CLIMATE CHANGE ASSESSMENT

6.1 Climate Assessment: Hydrology Non-Stationarity

To evaluate potential impacts to project performance in the future due to climate-based changes in hydrology, the USACE Non-Stationarity Detection Tool was used. This analysis was done in compliance with ECB 2018-14. This analysis followed the directions described in the US Army Corps of Engineers Non-stationarity Detection Tool User Guide, in section 3.4, titled Monotonic Trend Analysis. The non-stationarity tests and monotonic trend analysis were conducted on the annual peak flow values at most upstream Amite River gage (at Darlington) and the most downstream (at Port Vincent).

Darlington

The non-stationarity tool detected a non-stationarity at the year 1984 at the Darlington Gage (figure H-34). Therefore, the years used in the trend analysis are 1985 – 2021. The trend analysis showed no statistically significant trend in annual peak streamflow (Figure H-35).

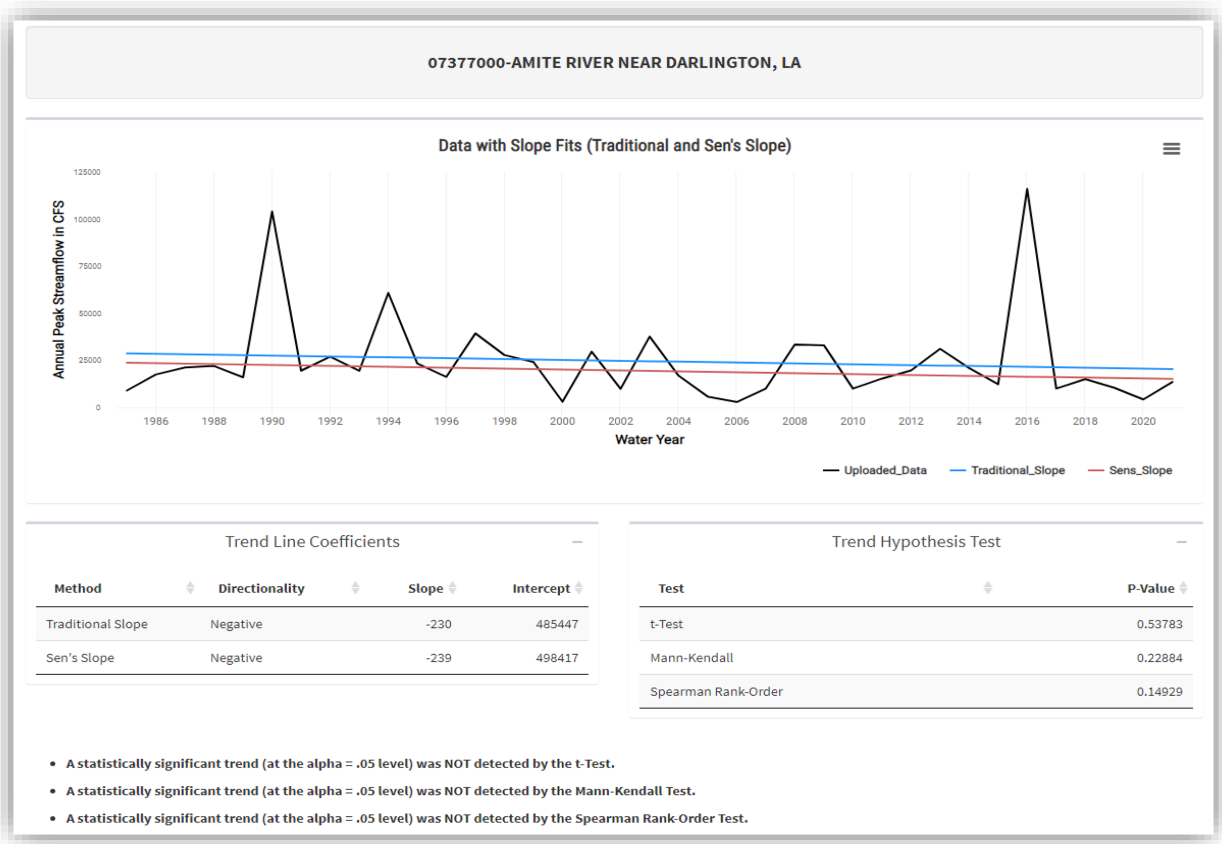


Figure H-34 Darlington Gage Non-Stationarity

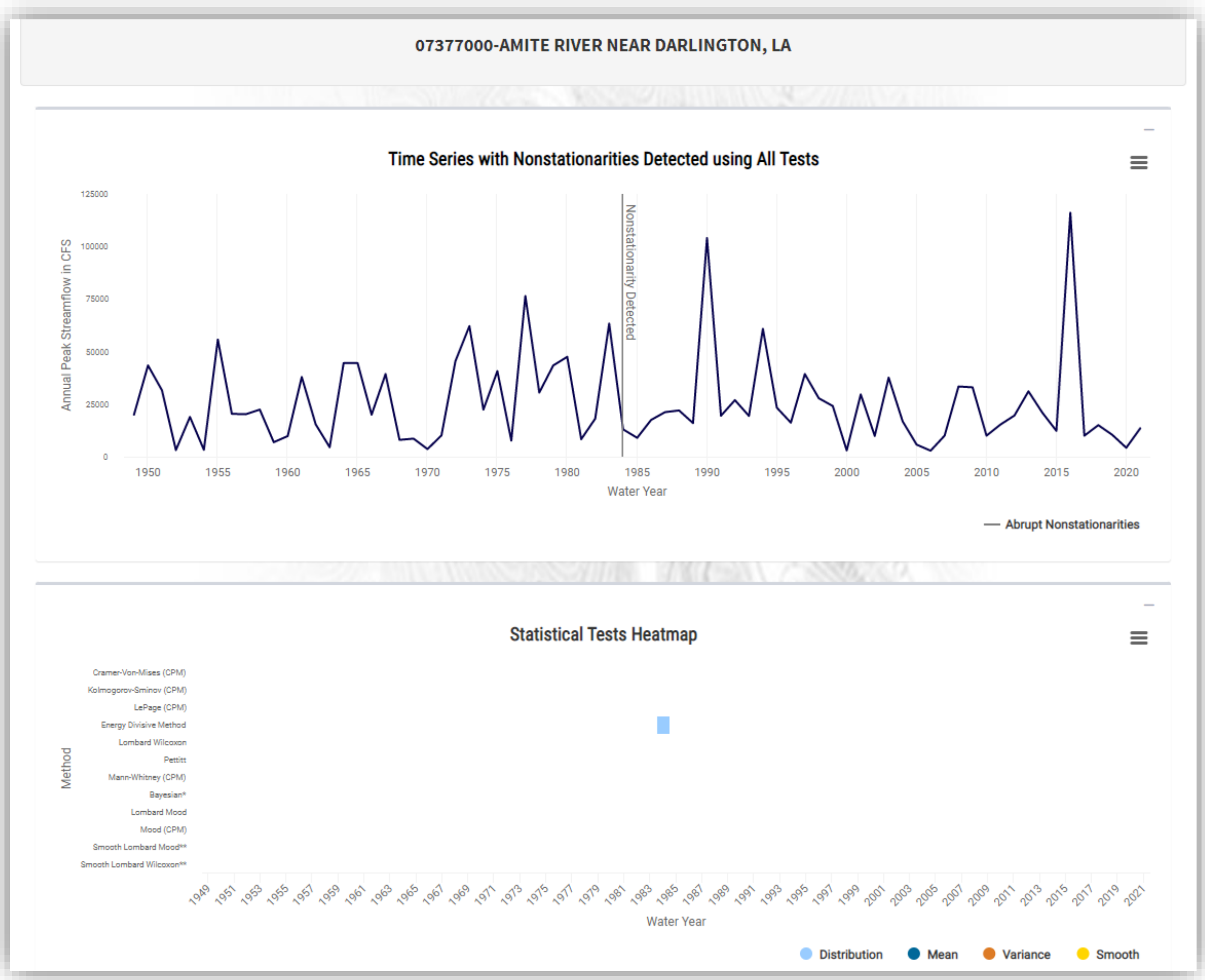
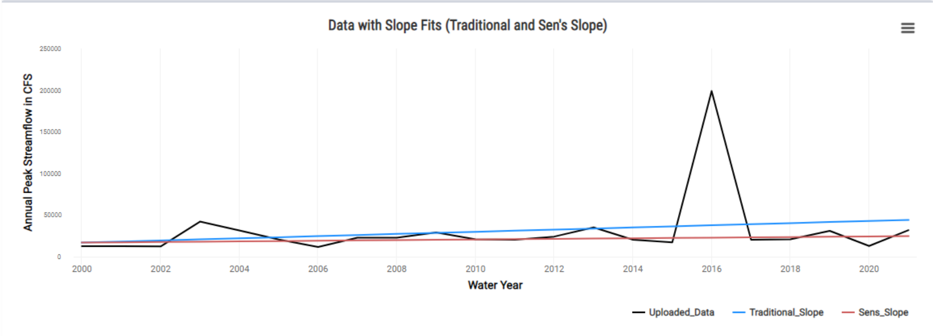


Figure H-35 Darlington Gage Trend Test

Port Vincent

The non-stationarity tool detected a non-stationarity at the year 1999 at the Port Vincent Gage (figure H-36). Therefore, the years used in the trend analysis are 2000 – 2021. The trend analysis showed no statistically significant trend in annual peak streamflow (figure H-37).

07380120-AMITE RIVER AT PORT VINCENT, LA



Trend Line Coefficients

Method	Directionality	Slope	Intercept
Traditional Slope	Positive	1301	-2584835
Sen's Slope	Positive	369	-721538

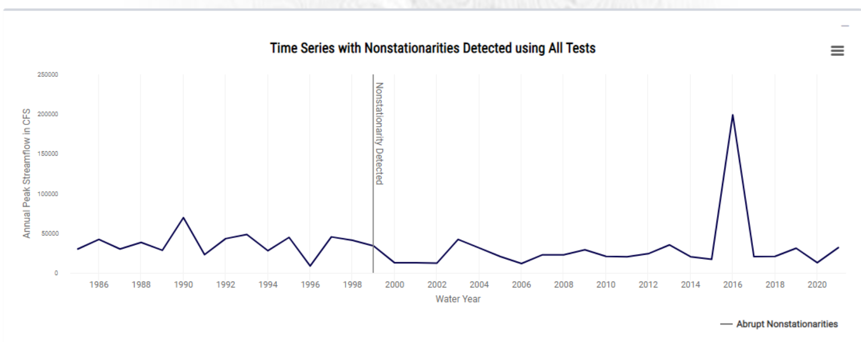
Trend Hypothesis Test

Test	P-Value
t-Test	0.32658
Mann-Kendall	0.28317
Spearman Rank-Order	0.19321

- **A statistically significant trend (at the alpha = .05 level) was NOT detected by the t-Test.**
- **A statistically significant trend (at the alpha = .05 level) was NOT detected by the Mann-Kendall Test.**
- **A statistically significant trend (at the alpha = .05 level) was NOT detected by the Spearman Rank-Order Test.**

Figure H- 36 Port Vincent Gage Non-Stationarity

07380120-AMITE RIVER AT PORT VINCENT, LA



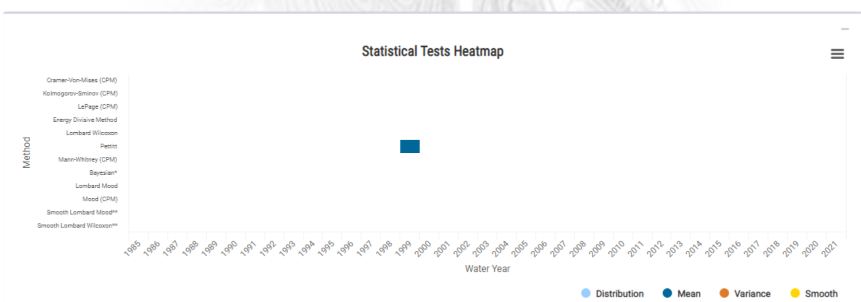


Figure H-37 Port Vincent Gage Trend Test

6.2 Climate Assessment: Climate Hydrology Assessment Tool

The Climate Hydrology Assessment Tool (CHAT) was used to estimate projected changes in the annual-maximum of mean monthly streamflow (AMMMS) and 1-day precipitation for the 4.5 W/m^2 and 8.5 W/m^2 representative concentration pathways (RCP) at Amite River stream segments 08001284 (adjacent to Baton Rouge) and 08000705 (furthest downstream). This analysis was done in compliance with ECB 2018-14. The tool projected no statistically significant trend in the AMMMS at either stream segment for the 4.5 RCP and projected statistically significant downward trends in the AMMMS for the 8.5 RCP. Figures H-38 and H-39 show the CHAT results for AMMMS.

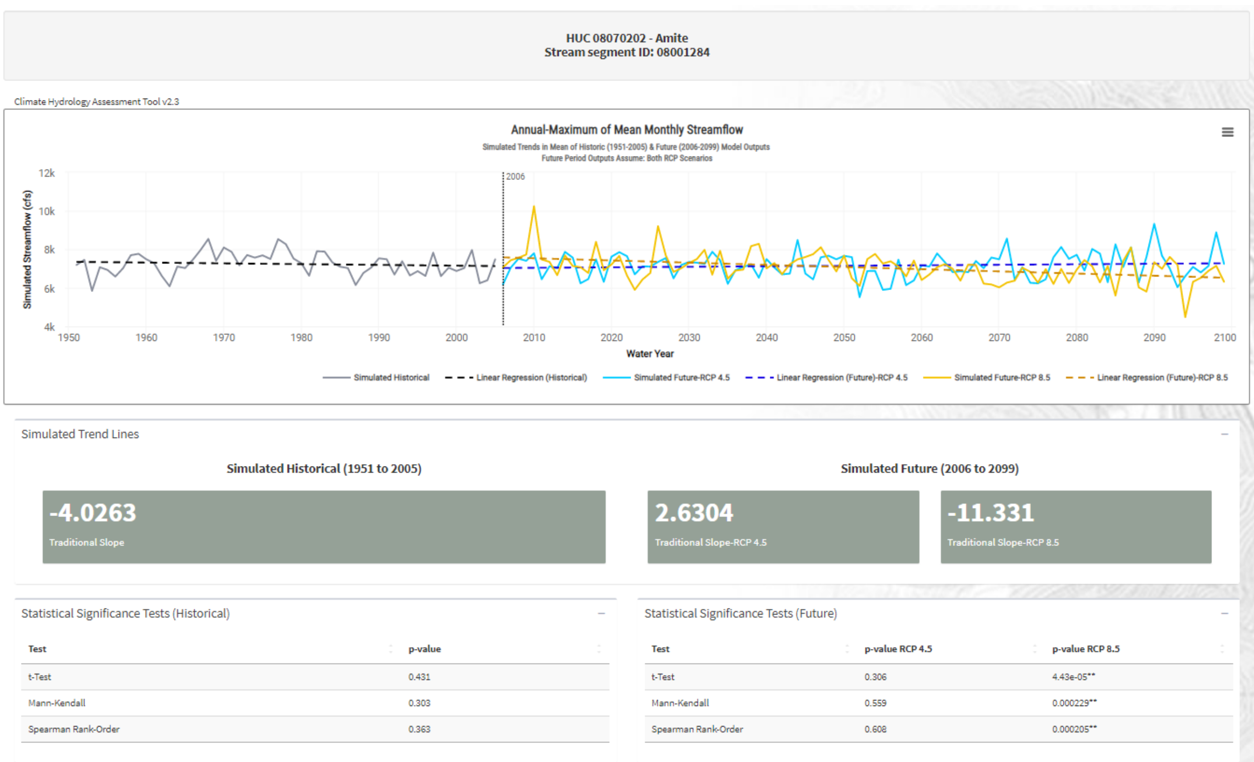


Figure H-38 Annual-maximum of mean monthly streamflow trends for stream segment 08001284 (adjacent to Baton Rouge)

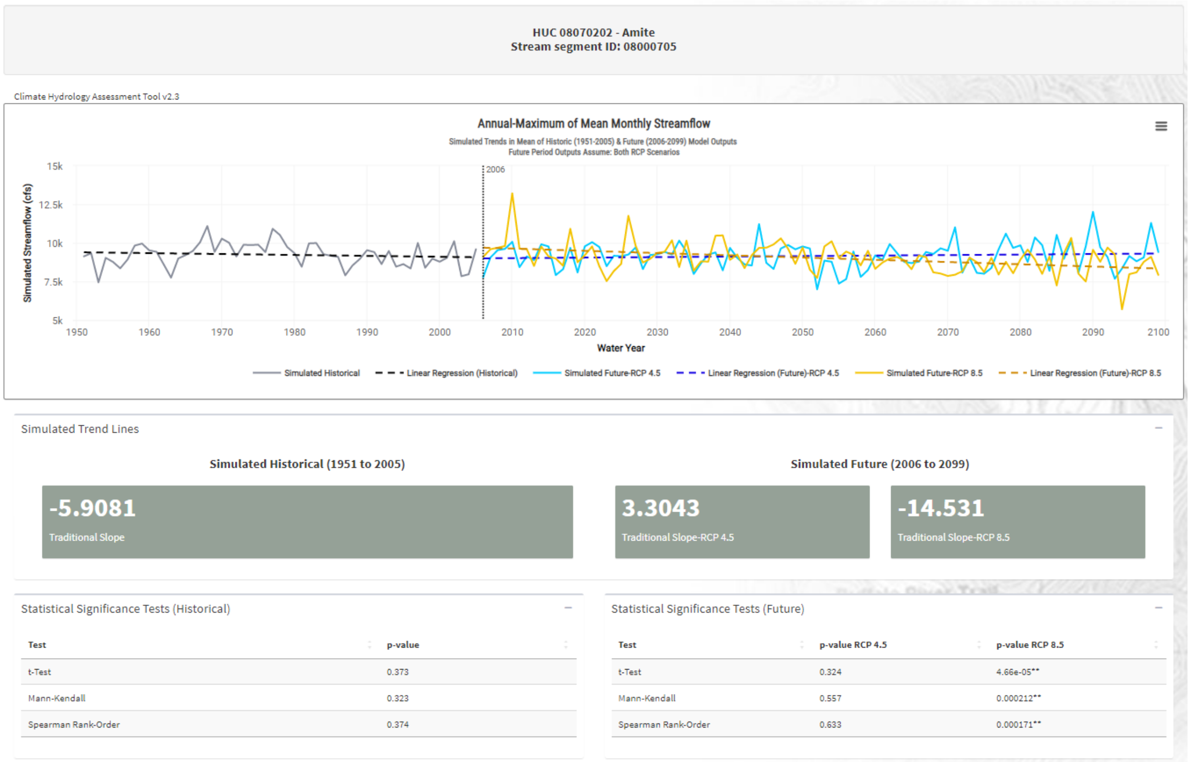


Figure H-39 Annual-maximum of mean monthly streamflow trends for stream segment 08000705 (furthest downstream)

The CHAT tool predicted statistically significant increases in 1-day annual maximum precipitation depths for the 4.5 RCP but no statistically significant trend for the 8.5 RCP (figure H-40). This prediction was identical for both stream segments. The increase in precipitation estimated by the CHAT tool is approximately 4% between 2026 and 2076. This estimate is considered qualitative and should not be used to make quantitative engineering judgements, according to ECB 2018-14. However, a 4% increase would equate to between a 0.45-to-0.92-inch increase in total rainfall depths for the range of design storms. A sensitivity test was run for the 2076 100-year event with 4% higher rainfall totals, which showed up to two feet of additional flooding with the higher rainfall.

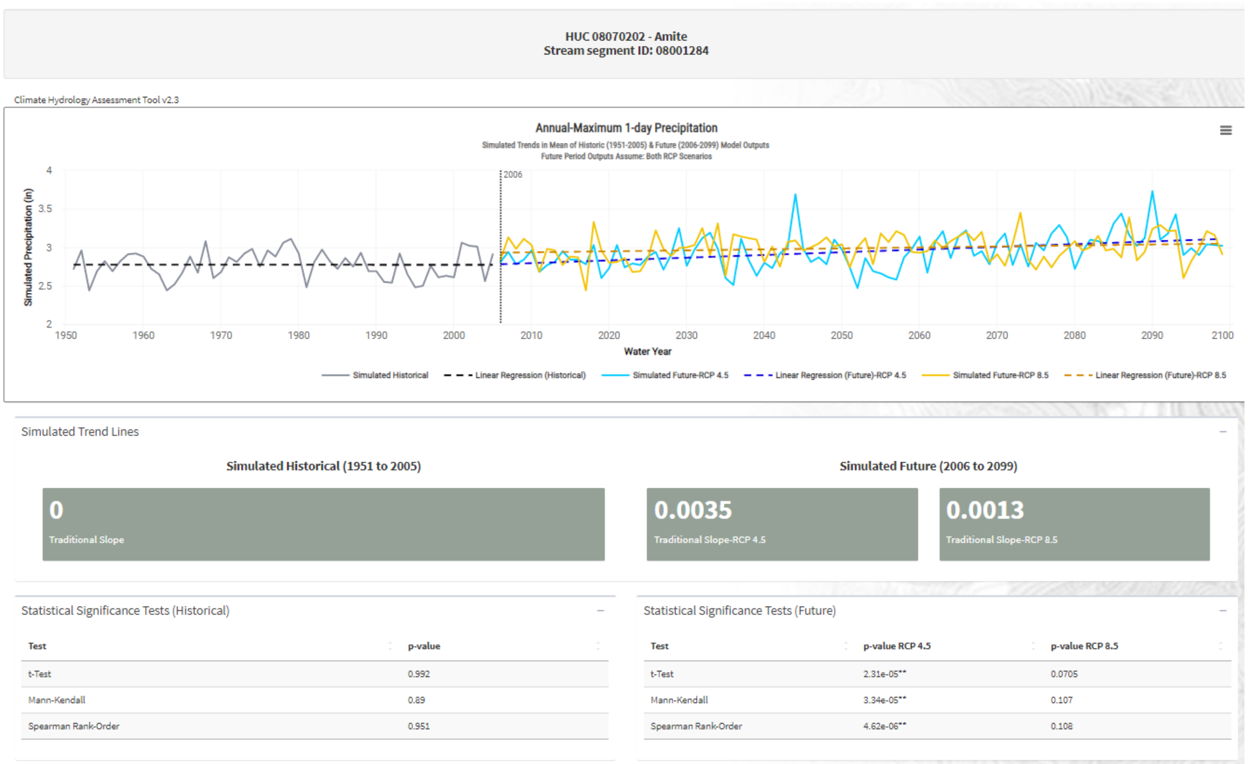


Figure H-40 CHAT-predicted precipitation trends in the Amite Basin

6.3 Climate Assessment: Sea Level Rise Analysis

Future relative sea level rise (RSLR) is expected to impact the project area due to the project area's proximity to the coastline. Higher sea levels in the future reduce the hydraulic gradient which slows the drainage of storm runoff, increasing flooding levels from the same amount of rain. SLR will also raise storm surge levels. SLR was estimated using the USACE Sea-Level Calculator for Non-NOAA Long-Term Tide Gauges (Version 2020.88). This tool was designed for coastal Louisiana and accounts for the high rates of land subsidence. ER 1100-2-8162 (2019) describes the procedure for estimating SLR using historic tide gage data and equations provided by the National Research Council. ECB 2013-27 (2013) describes how to use non-NOAA gages to estimate SLR, which is necessary for this project since there are only non-NOAA gages in the vicinity of the project area. SLR was estimated using the Lake Pontchartrain at Frenier gage record (USACE gage 85550). Between 2018 and the project baseline year (2026), the low, intermediate, and high estimates of sea level rise are 0.2 ft, 0.2 ft, and 0.4 ft, respectively. Between the project baseline year (2026) and the 50-year project life (2076), the low, intermediate, and high estimates of sea level rise are 1.37 ft, 1.90 ft, and 3.56 ft, respectively. The AR&T Project Delivery Team (PDT) determined that the intermediate rate of sea level rise should be used in this project for future conditions model runs. This was decided since the probability of which curve sea level rise will follow is highly uncertain, and the PDT determined that the middle option is the most reasonable choice for calculating the most likely future water surface. This decision is supported by the fact that the gage at the New Canal Station (8761927) has most closely tracked the intermediate SLR curve over the past decade. The TSP performance will be evaluated under all three RSLR curves to inform the residual risk of designing the TSP using the intermediate curve. The boundary conditions section describes how these curves were incorporated into the modeling effort. Figure H-41 shows the estimates of sea level rise for Lake Pontchartrain at Frenier.

USACE Curves computed using criteria in USACE EC 1165-2-212

Gauge 85550: Lake Pontchartrain at Frenier: Jan 1950 to Dec 2002 All values are in feet			
Year	USACE Low	USACE Int	USACE High
2018	0.7	0.8	1.0
2019	0.7	0.8	1.0
2020	0.8	0.8	1.1
2021	0.8	0.9	1.1
2022	0.8	0.9	1.2
2023	0.9	0.9	1.2
2024	0.9	1.0	1.3
2025	0.9	1.0	1.3
2026	0.9	1.0	1.4

USACE Curves computed using criteria in USACE EC 1165-2-212

Gauge 85550: Lake Pontchartrain at Frenier: Jan 1950 to Dec 2002 All values are in feet			
Year	USACE Low	USACE Int	USACE High
2026	0.94	1.04	1.37
2031	1.07	1.21	1.64
2036	1.21	1.38	1.93
2041	1.35	1.56	2.24
2046	1.49	1.75	2.57
2051	1.63	1.94	2.92
2056	1.76	2.13	3.28
2061	1.90	2.32	3.67
2066	2.04	2.53	4.07
2071	2.18	2.73	4.49
2076	2.31	2.94	4.93

Figure H-41 Estimated Sea Level Change from Sea-Level Calculator for Lake Pontchartrain at Frenier

Sensitivity analysis results from model runs for the 2076 100-year events with high SLR added at the downstream boundary are shown in annex H-4. These results will be transmitted to the economics team to quantify residual flood risk. EP 1100-2-1 (Procedures to Evaluate Sea Level Change) states that PDTs must estimate a “future affected area” by estimating the floodplain for 100 years from the baseline year using the high sea level rise curve. The guidance states that with this information, “if the level of risk is shown to be high, later stages of the study may improve on the quality or quantity of data in order to better capture the risks associated with project area vulnerability.” Annex H-4 also shows the floodplain for the 2126 .01 AEP predominant event.

6.4 Climate Assessment: Literature Review

6.4.1 USACE Climate Change Literature Review

In response to climate policy requirements enacted in 2011 and 2014, the USACE Institute for Water Resources conducted a literature synthesis on climate and hydrologic trends in each region of the United States. The report for the Lower Mississippi River (LMR) Region 08 covers an area that includes the Amite River and Tributaries project area [reference 5]. Its findings are summarized below. The report for region 08 focuses on 6 climate variables: mean temperature, minimum temperature, maximum temperature, average precipitation, extreme precipitation events, and mean stream-flows. For each variable, the report compiles studies on observed trends, as well as studies estimating future changes.

(1) Temperature

The report found no studies on observed temperature trends specific to the LMR region. Instead, nationwide studies were referenced showing, one of which showed a slight cooling trend in mean temperatures for region 08 (Westby et al., 2013). Other studies show that more recent observed data may have a slight increasing trend in mean temperature (Liu et al. 2012). In one study, the one-day extreme minimum temperatures showed increasing trends, whereas the one-day extreme maximum temperatures showed no statistical trend (Grundstein and Dowd, 2011). Overall, observed temperature trends are not strong in region 08. The report focused on studies that incorporated global climate models (GCMs) to estimate future temperature trends. Strong consensus exists in the literature that projected temperature will dramatically increase in the next century.

(2) Precipitation

For the observed record, one study found significant increases in winter and fall, along with decreases in spring and summer precipitation (Palecki et al., 2005). Other studies observed overall increases in annual precipitation as well as soil moisture measurements (Grundstein, 2009). The report also mentions studies that show increases in the frequency of the 20-year rainfall event (Wang and Zhang, 2008). Other studies observed the frequency of occurrence of heavy rainfall and found that most of the gages included that fell within region 08 showed no significant trend, though some stations did show statistically significant increasing trends (Villarini et al., 2013). This report also looks at the trends in droughts, identifying a decrease in drought frequency (Chen et al., 2012). Overall, the observed record shows slight precipitation increases, though the consensus is not strong. Future precipitation was estimated in many studies using GCMs. There was generally low consensus between studies on future precipitation patterns. One study concluded that there would be dryer summers in future years, whereas another projected significant springtime increases in precipitation (Liu et al., 2011).

(3) Streamflow

Several studies have looked at observed streamflow trends. The report distinguishes between Mississippi River streamflow trends and smaller tributary trends within the region, noting that the MS River stream-flows are largely driven by inflows from other regions further upstream. Nevertheless, most of the studies for both the MS River and smaller rivers such as the Amite detected increasing trends in streamflow. Many studies projected future stream-flows by combining GCMs with macro-hydrologic models. One study compared two GCMs, combined with one hydrologic model, and found that the two GCMs produced opposite results, with one increasing water yield, and the other decreasing water yield, for the same set of inputs (Thomson et atl., 2005). Another study concluded that the uncertainty associated with the hydrologic models was as great or greater than the GCMs (Hagemann et al., 2013). Most of these studies indicate a decreasing trend in stream-flows for region 08.

6.4.2 4th National Climate Assessment

The 4th National Climate Assessment (NCA) provides another overview of regional trends due to climate change. The NCA assesses multi-state regions of the United States. The Amite River and Tributaries project area is within the Southeast region of the assessment [reference 6]. The report analyzes historical trends and projects future trends for maximum temperatures, extreme precipitation, and other climate variables. The report states that under the representative concentration pathway (RCP) 8.5, which "most closely tracks with our current consumption of fossil fuels," daytime maximum and nighttime minimum temperatures in the Southeast will increase significantly. The report also highlights the observed and projected increase in coastal flooding due to sea level rise, stating that "annual occurrences of high tide coastal flooding have increased 5- to 10- fold since the 1960s." The NCA estimates that global sea level is "very likely to rise by… 0.5 to 1.2 feet by 2050." The NCA states that there is "high confidence" in the increase in frequency and intensity of extreme rainfall events, using the August 2016 Baton Rouge floods as an example of the impacts of such events. The report also describes the March 2016 flooding in northern Louisiana as an example of similar impacts. Overall, the NCA is consistent with the findings of the USACE climate analysis, often providing more details on real world examples and impacts.

6.4.3 Other Climate Literature Relating to the Amite River Basin

Colten et al 2021 focus on the post-2016 efforts in the Amite River Basin to improve flood drainage, highlighting the impact on downstream communities by the growing urban area around Baton Rouge [reference 7]. Johnson et al 2015 use SWAT modeling combined with regional climate models used to forecast meteorological inputs for the SWAT modeling. The forecasted variables include total precipitation, precipitation above/below 70th percentile, air temperature, relative humidity, surface downwelling shortwave radiation, and wind speed. This study reports that temperature in the Amite Basin will rise, but that there is less certainty in the trends for precipitation and total streamflow. The study does however estimate that peak stream-flows will rise, and minimum stream-flows will fall in future scenarios [reference 8]. Cowles, 2021 investigates the sensitivity of the Dewberry HMS and RAS models to imperviousness changes, which are forecasted to rise in the future. Cowles concluded that the AR&T Basin was not particularly sensitive to changes in impervious area [reference 9].

6.5 Climate Assessment: Climate Vulnerability

Climate vulnerability was assessed to determine if the USACE's mission of flood risk management is vulnerable to climate change in the Amite River Basin. USACE's Screening-Level Climate Change Vulnerability Assessment Tool at the Watershed Scale, which assesses vulnerabilities to climate change for USACE's missions, was used for this assessment. For the Lower Mississippi-Lake Maurepas watershed (hydrologic unit code-4 (HUC-4) watershed 0807), which includes the Amite River basin, no vulnerability to Flood Risk Reduction was found. The only vulnerability found for HUC-4 watershed 0807 was for the Recreation business line for the Dry – 2085 scenario & Epoch, as shown in Figure H-42.

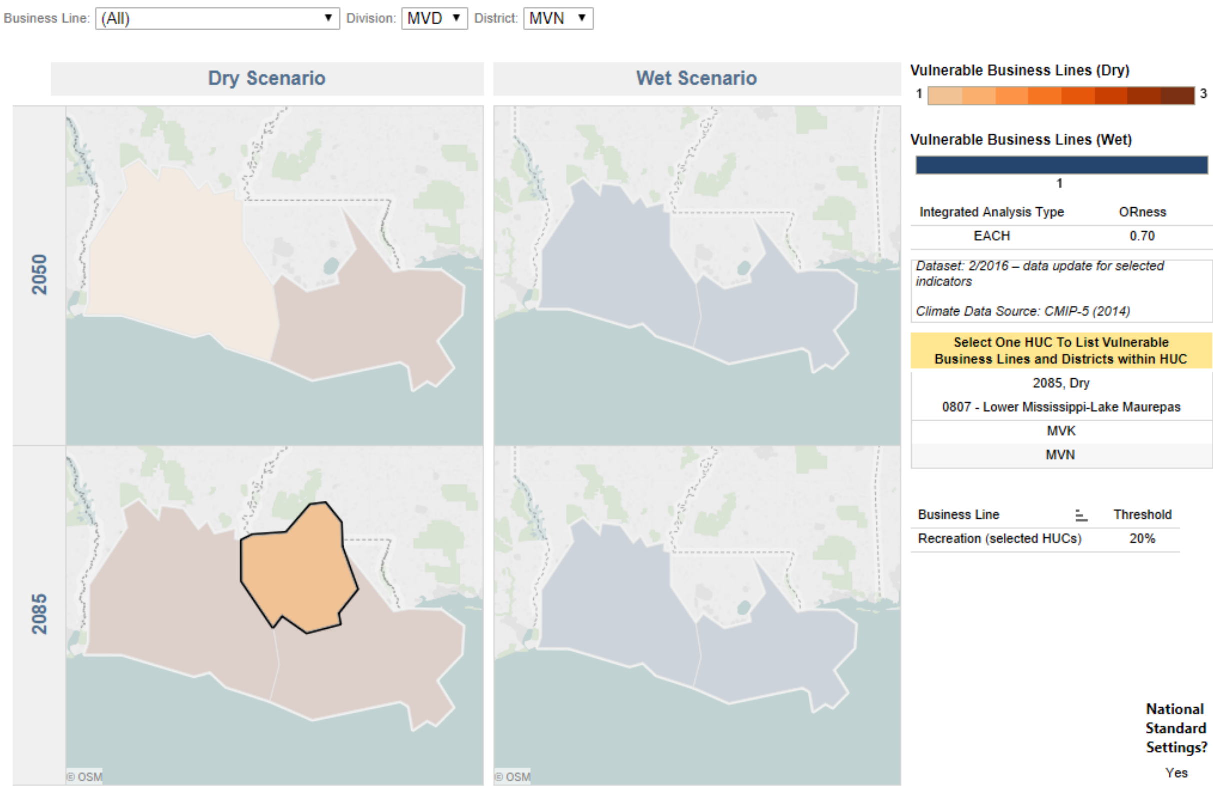


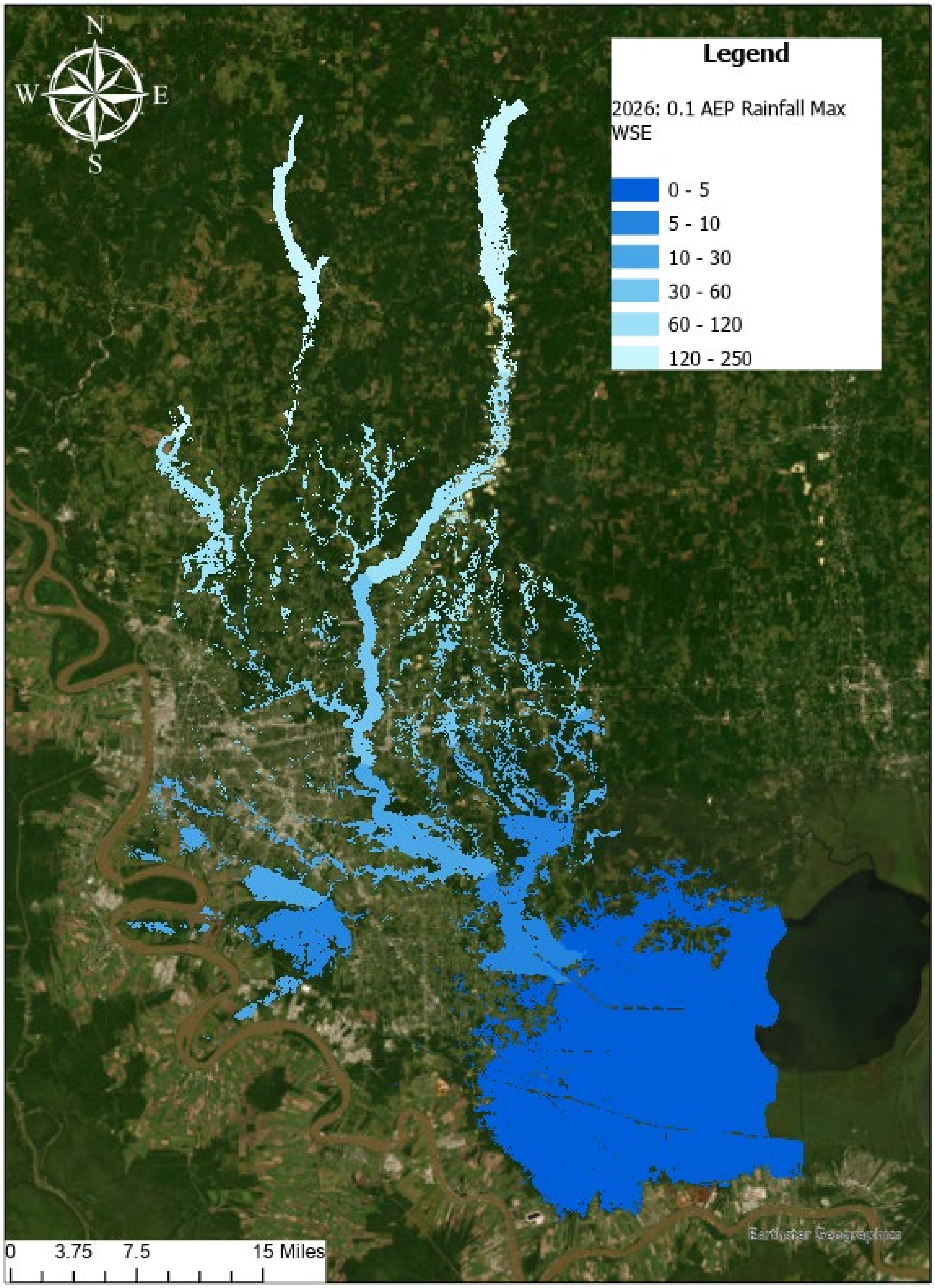
Figure H-42 Scenario Comparison Over Time map for MVN. The only vulnerability shown for HUC-4 watershed 0807 is for recreation.

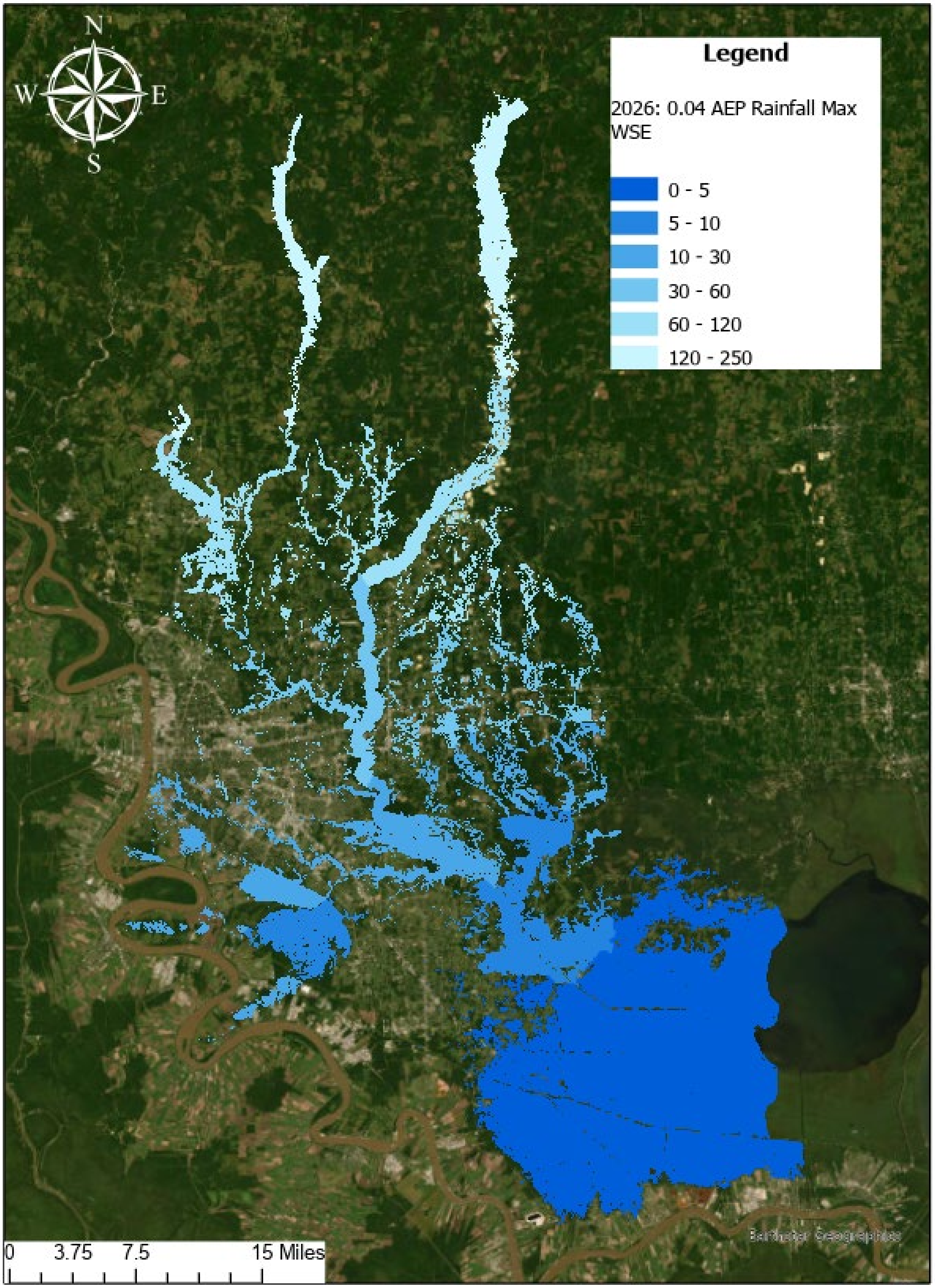
7.0 REFERENCES

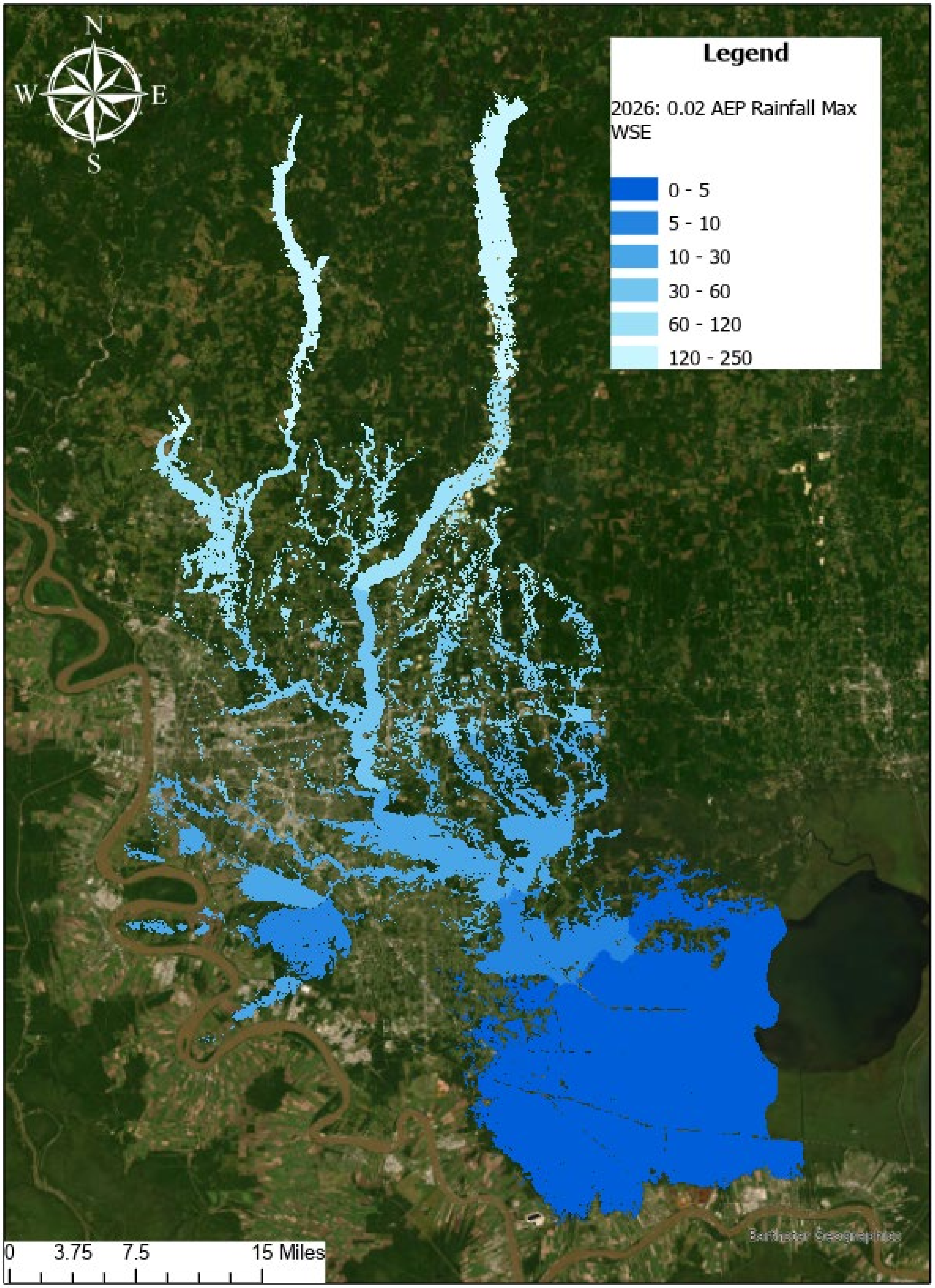
1. Dewberry Engineers Inc., Louisiana Department of Transportation and Development, *Amite River Basin Numerical Model*, 2019
2. USACE-MVN, *West Shore Lake Pontchartrain Surge Hazard and Design Assessment*, 2022
3. Kim et al., *On the generation of high-resolution probabilistic design events capturing the joint occurrence of rainfall and storm surge in coastal basins*, 2022
4. Charles Zaiontz, *Kendall's Tau* Table, https://real-statistics.com/statistics-tables/kendalls-tau-table/, 2021
5. White et al, *Recent US Climate Change and Hydrology Literature Applicable to US Army Corps of Engineers Missions Lower Mississippi River Region 08*, 2015
6. Terando et al, *Impacts, Risks, and Adaptation in the United States - Fourth National Climate Assessment, Volume II - Chapter 19*, 2018 *Southeasthttps*://nca2018.globalchange.gov/chapter/19/
7. Colten, Craig E., *As Inland Becomes Coastal: Shifting Equity and Flood Risk in the Amite River Basin (USA)*, https://www.ingentaconnect.com/content/whp/ge/2021/00000014/00000003/art00005, 2021
8. Johnson et al, *Modeling Streamflow and Water Quality Sensitivity to Climate Change and Urban Development in 20 U.S. Watersheds*, https://onlinelibrary.wiley.com/doi/full/10.1111/1752-1688.12308, 2015
9. Cowles, Alexandre G.H., *EFFECTS OF HISTORICAL LAND-USE CHANGE ON SURFACE RUNOFF AND FLOODING IN THE AMITE RIVER BASIN, LOUISIANA, USA USING COUPLED 1D/2D HEC-RASHEC-HMS HYDROLOGICAL MODELING*, 2021

8.0 ANNEXES

8.1 Annex H-1: Production Run WSE Maps




N
W
E
S
Legend
2026: 0.04 AEP Rainfall Max WSE
0 - 5
5 - 10
10 - 30
30 - 60
60 - 120
120 - 250
0 3.75 7.5 15 Miles


N
W
E
S
Legend
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0 - 5
5 - 10
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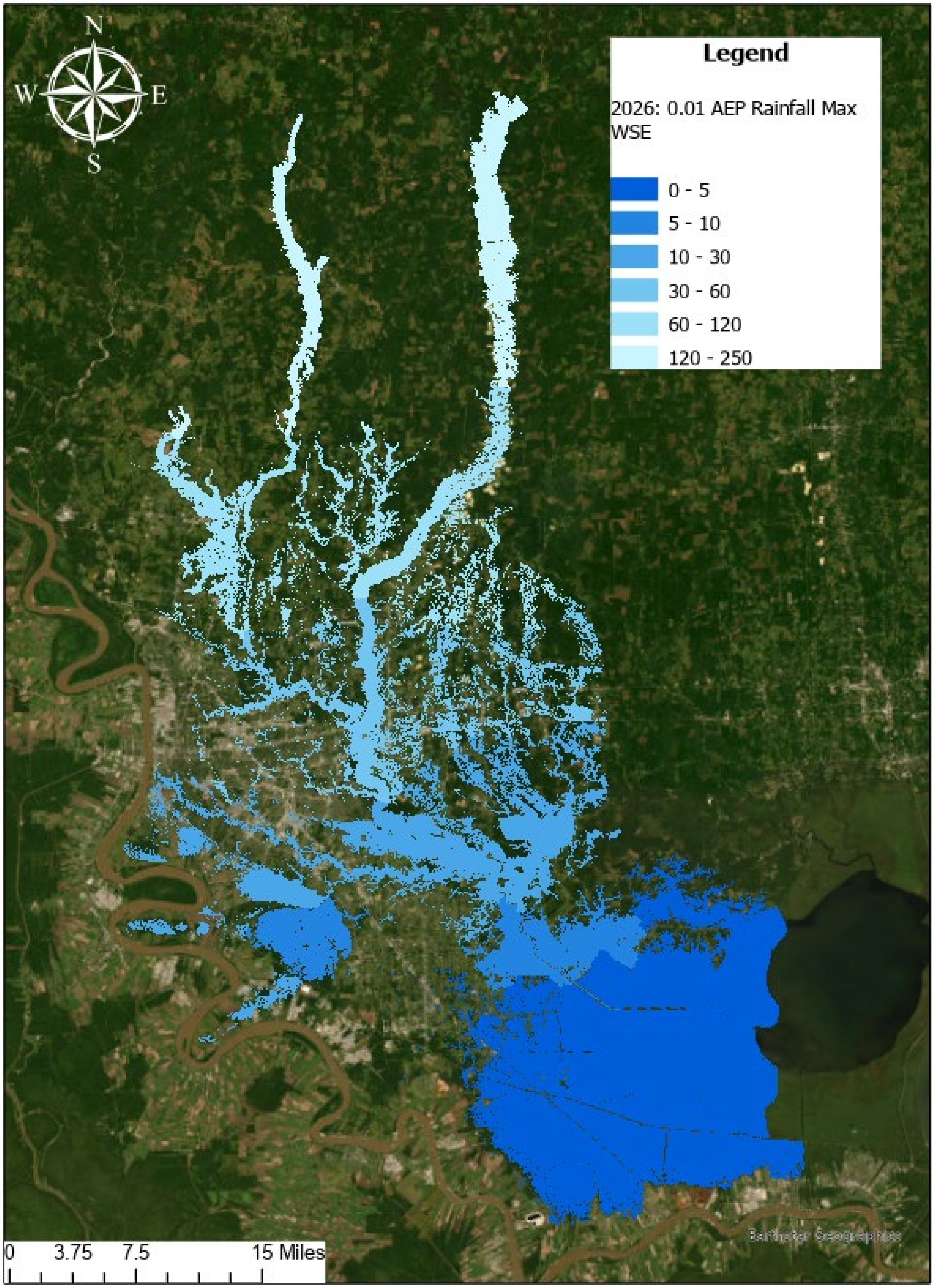
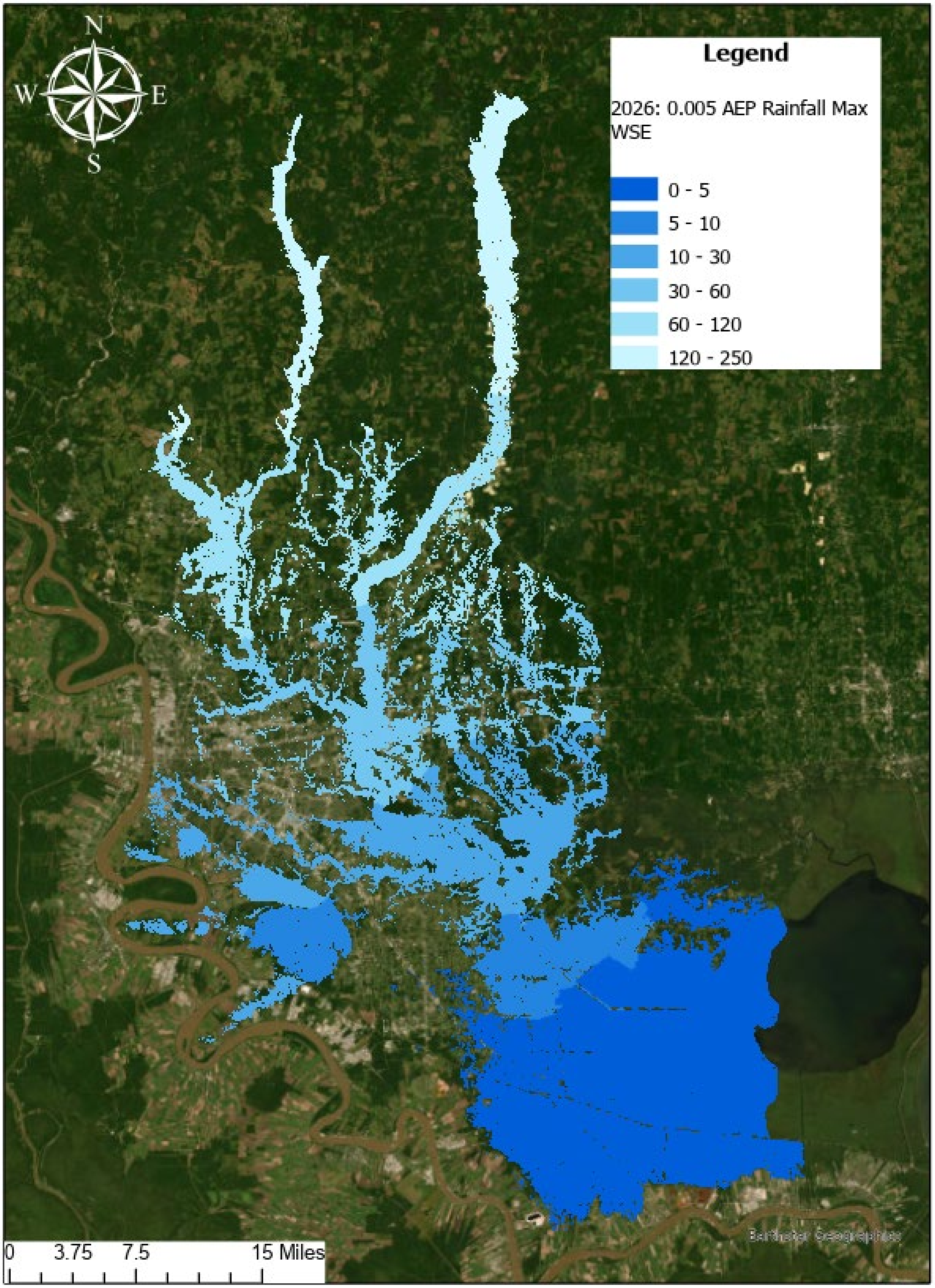
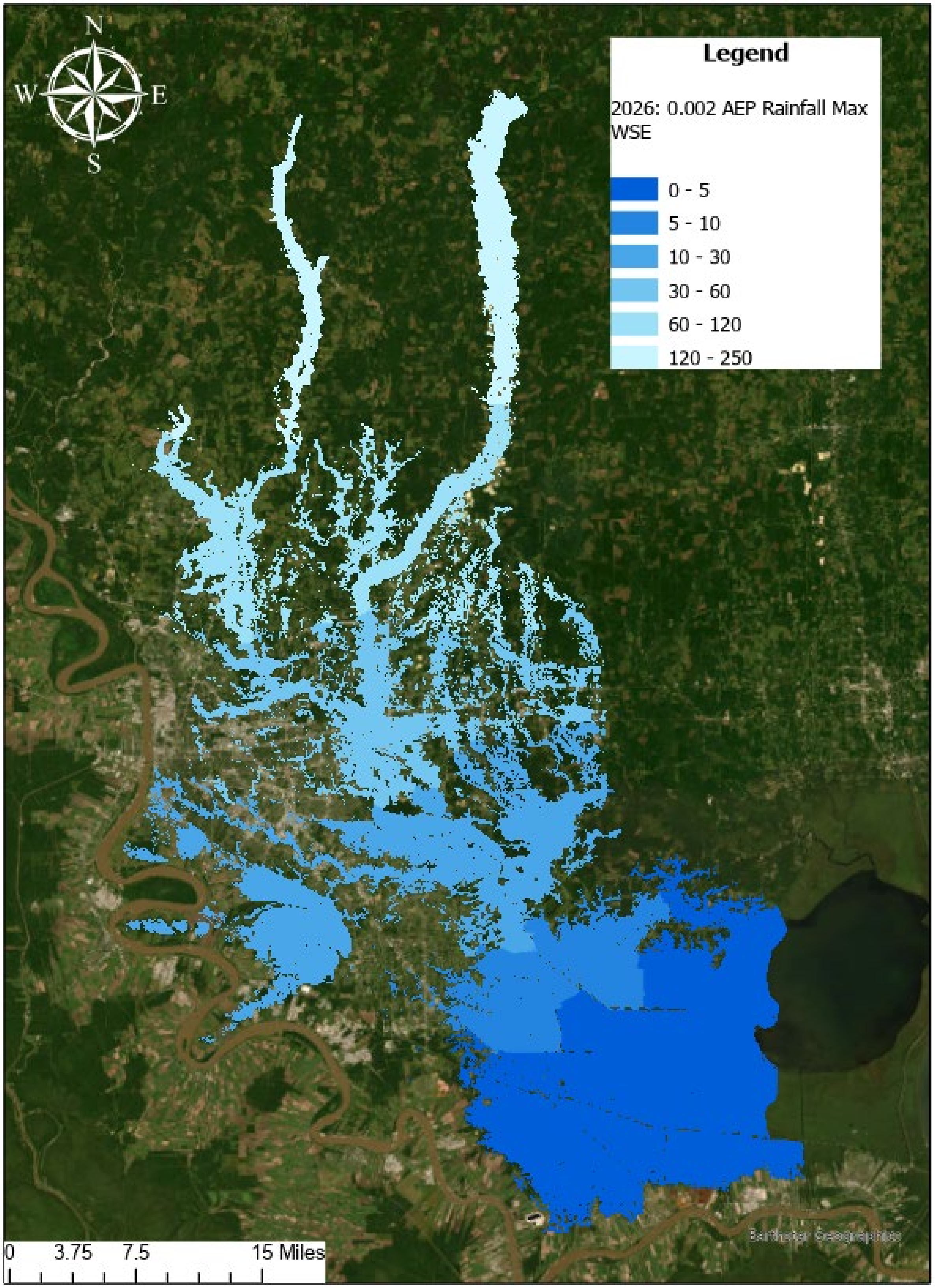
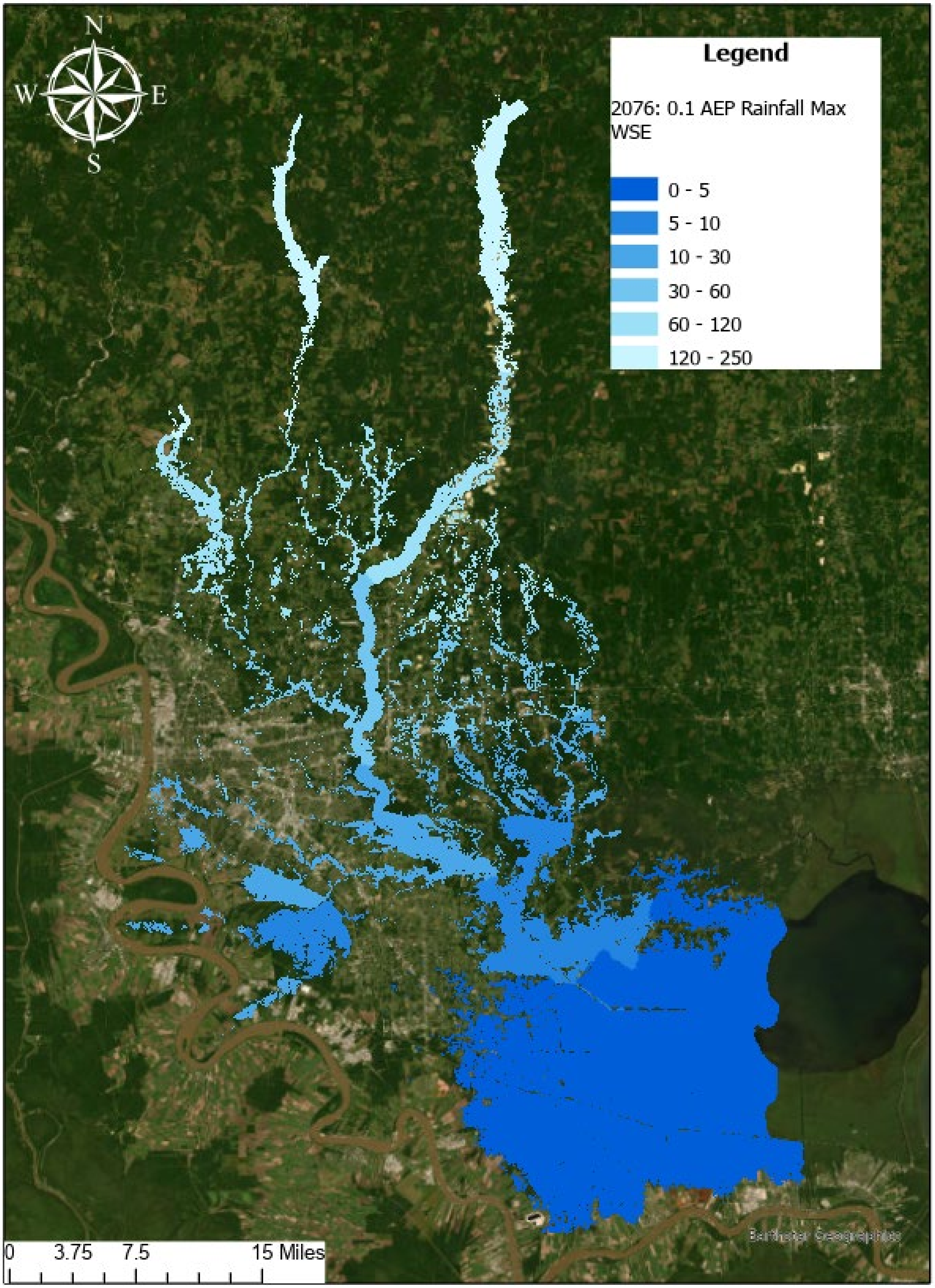
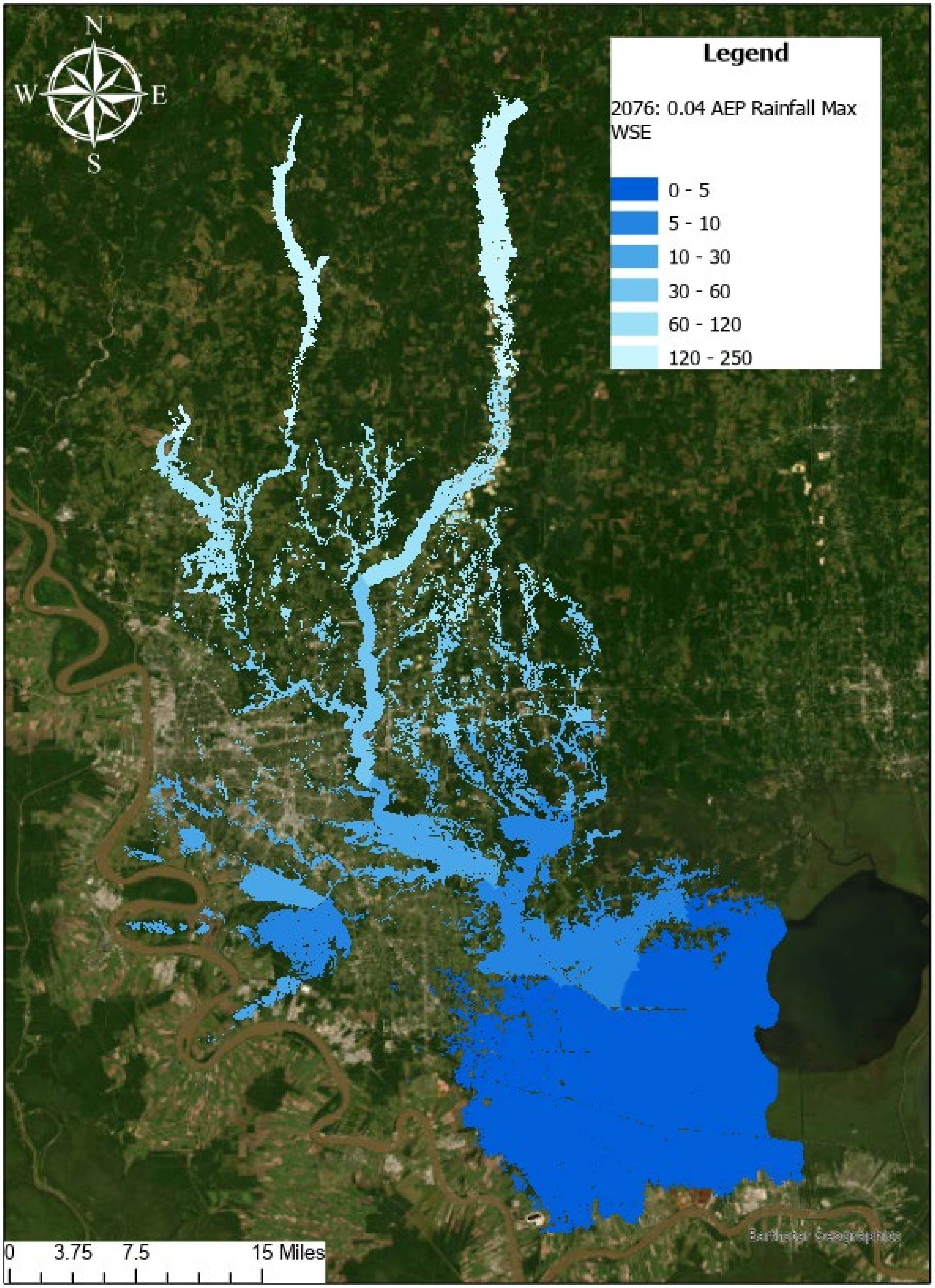
30 - 60
60 - 120
120 - 250
0 3.75 7.5 15 Miles


N
W
E
S
Legend
2026: 0.01 AEP Rainfall Max WSE
0 - 5
5 - 10
10 - 30
30 - 60
60 - 120
120 - 250
0
3.75
7.5
15 Miles
Earthstar Geographics


N
W
E
S
Legend
2026: 0.005 AEP Rainfall Max WSE
0 - 5
5 - 10
10 - 30
30 - 60
60 - 120
120 - 250
0
3.75
7.5
15 Miles
Earthstar Geographics


N
W
E
S
Legend
2026: 0.002 AEP Rainfall Max WSE
0 - 5
5 - 10
10 - 30
30 - 60
60 - 120
120 - 250
0 3.75 7.5 15 Miles
Earthstar Geographics


N
W
E
S
Legend
2076: 0.1 AEP Rainfall Max WSE
0 - 5
5 - 10
10 - 30
30 - 60
60 - 120
120 - 250
0 3.75 7.5 15 Miles


N
W
E
S
Legend
2076: 0.04 AEP Rainfall Max WSE
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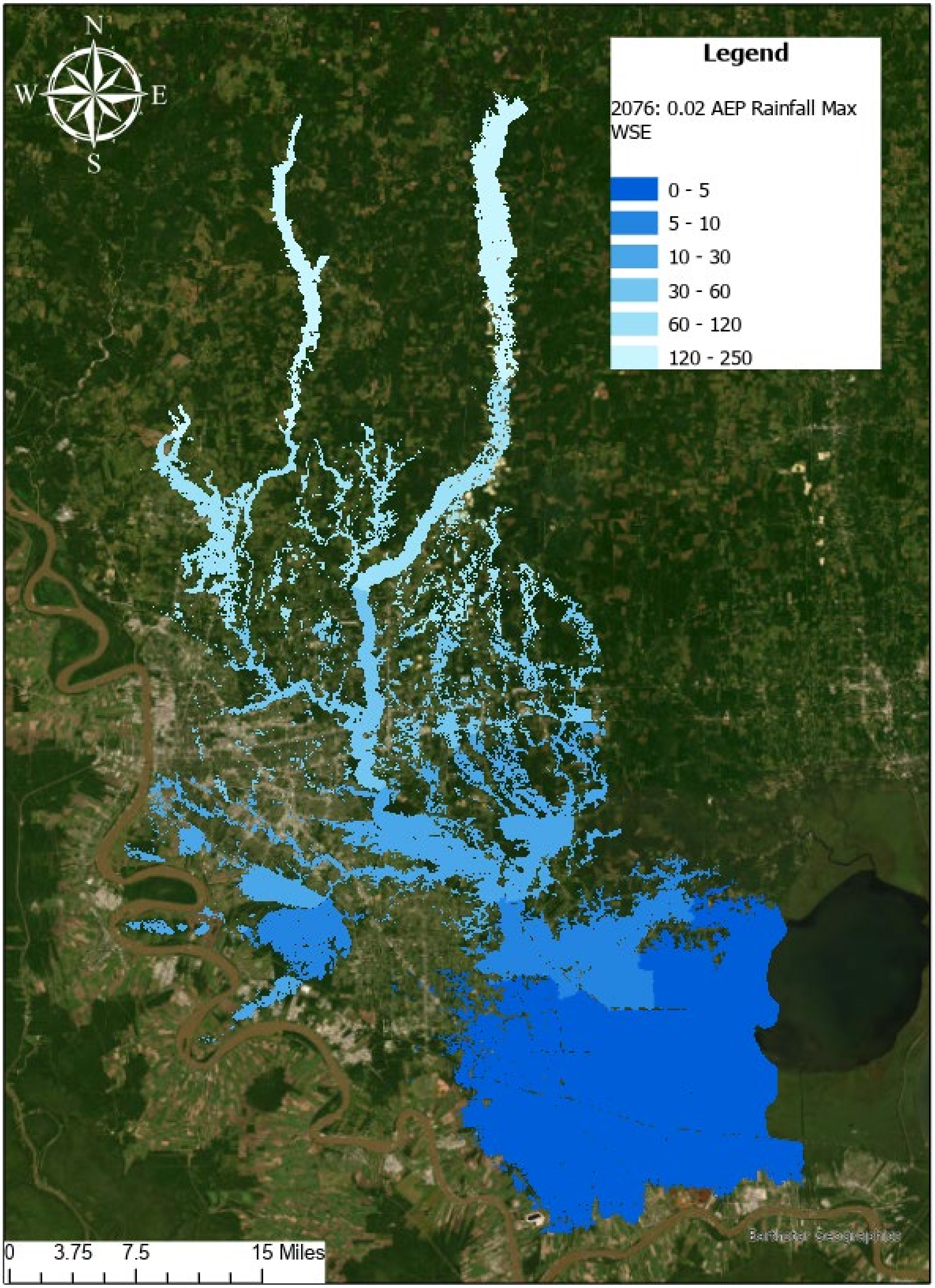
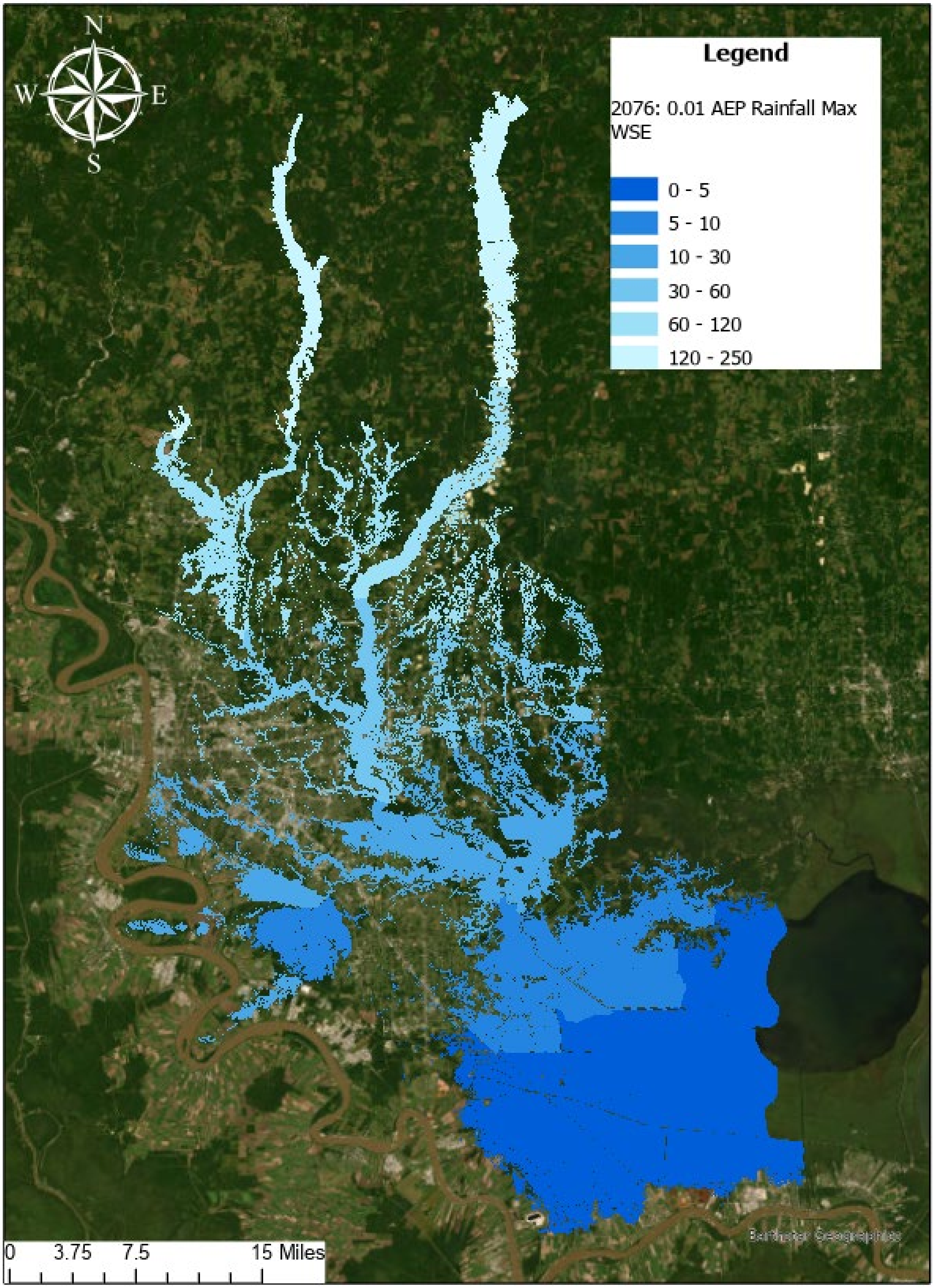
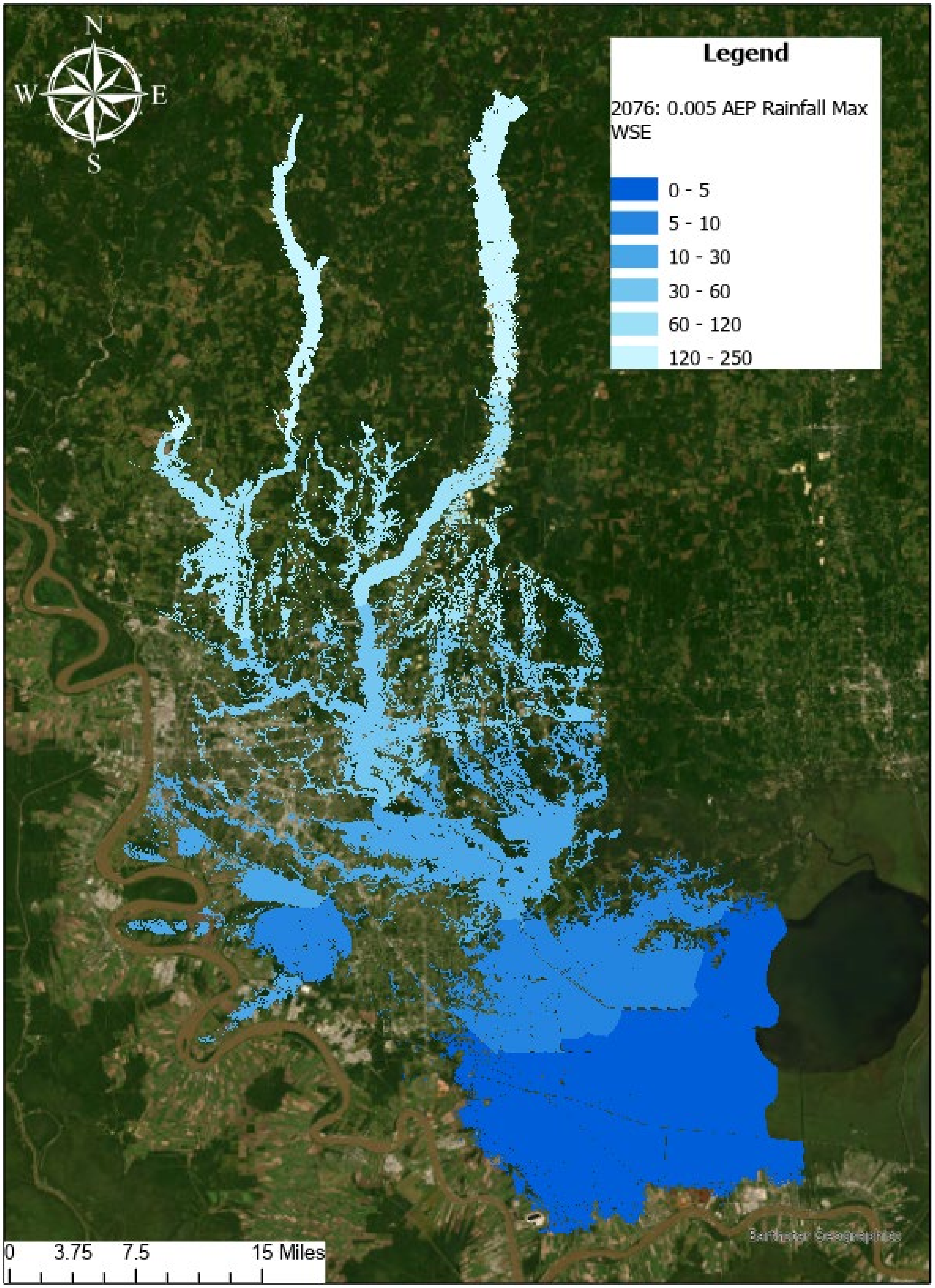
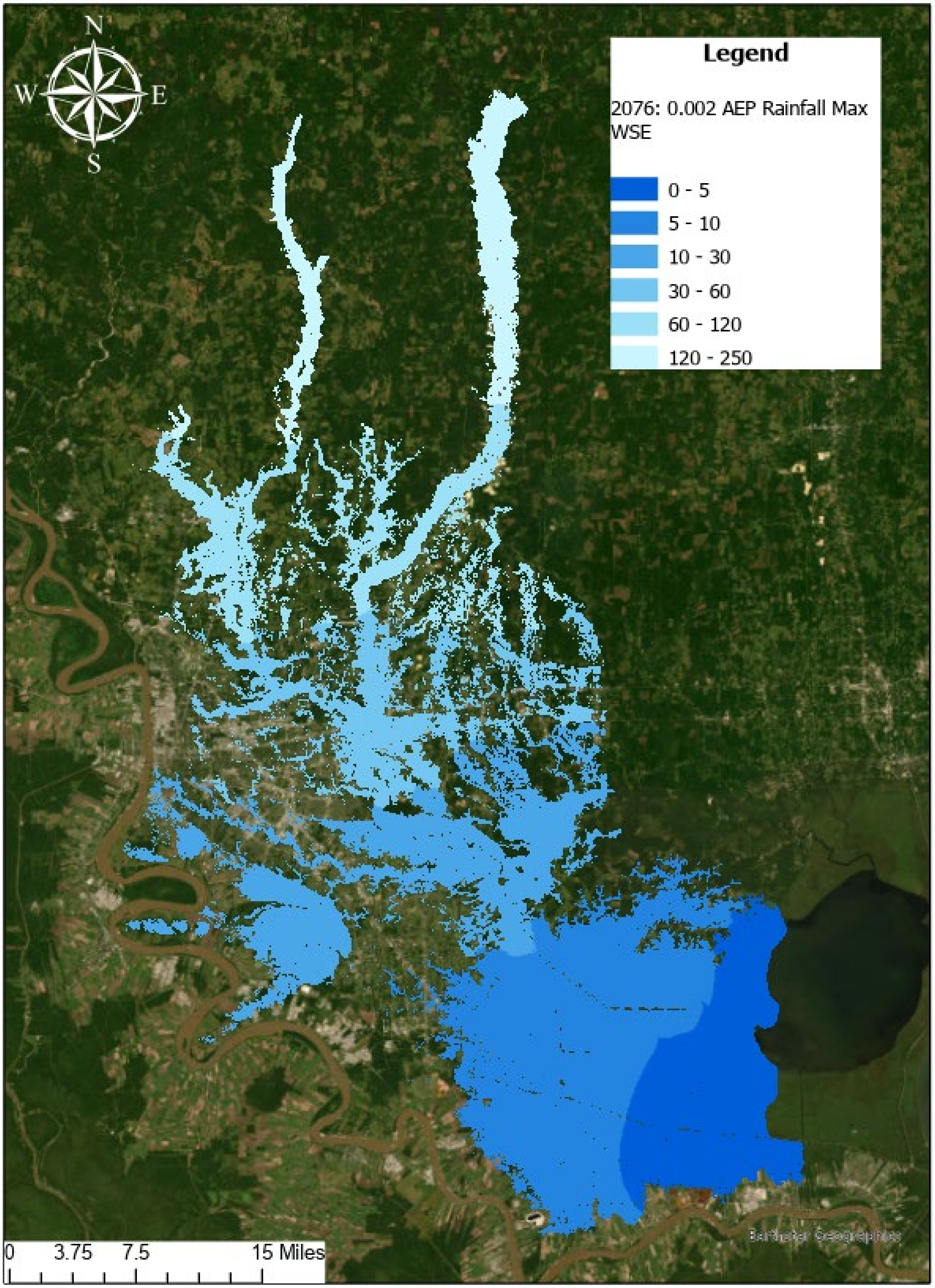
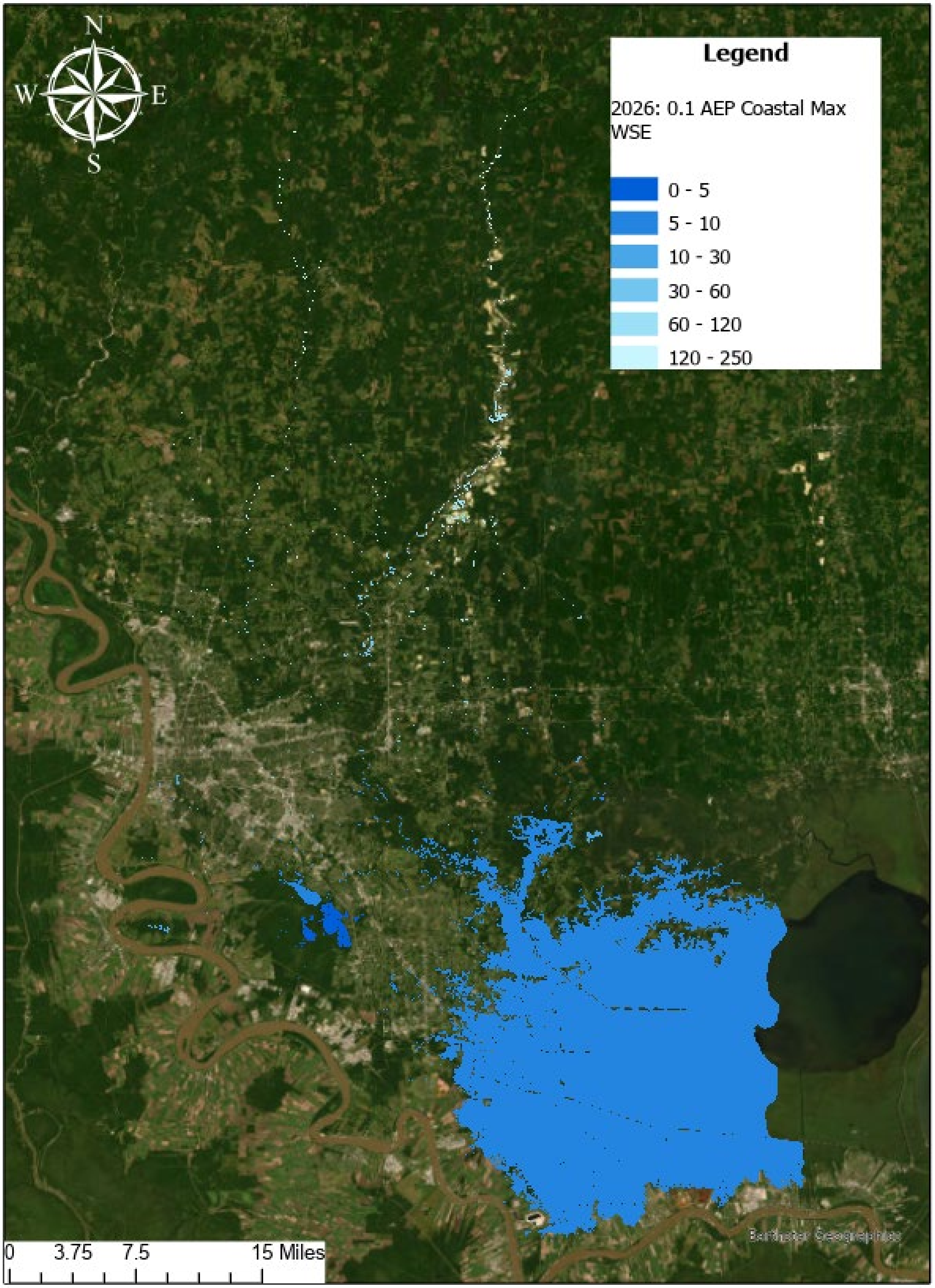
5 - 10
10 - 30
30 - 60
60 - 120
120 - 250
0
3.75
7.5
15 Miles
Earthstar Geographics

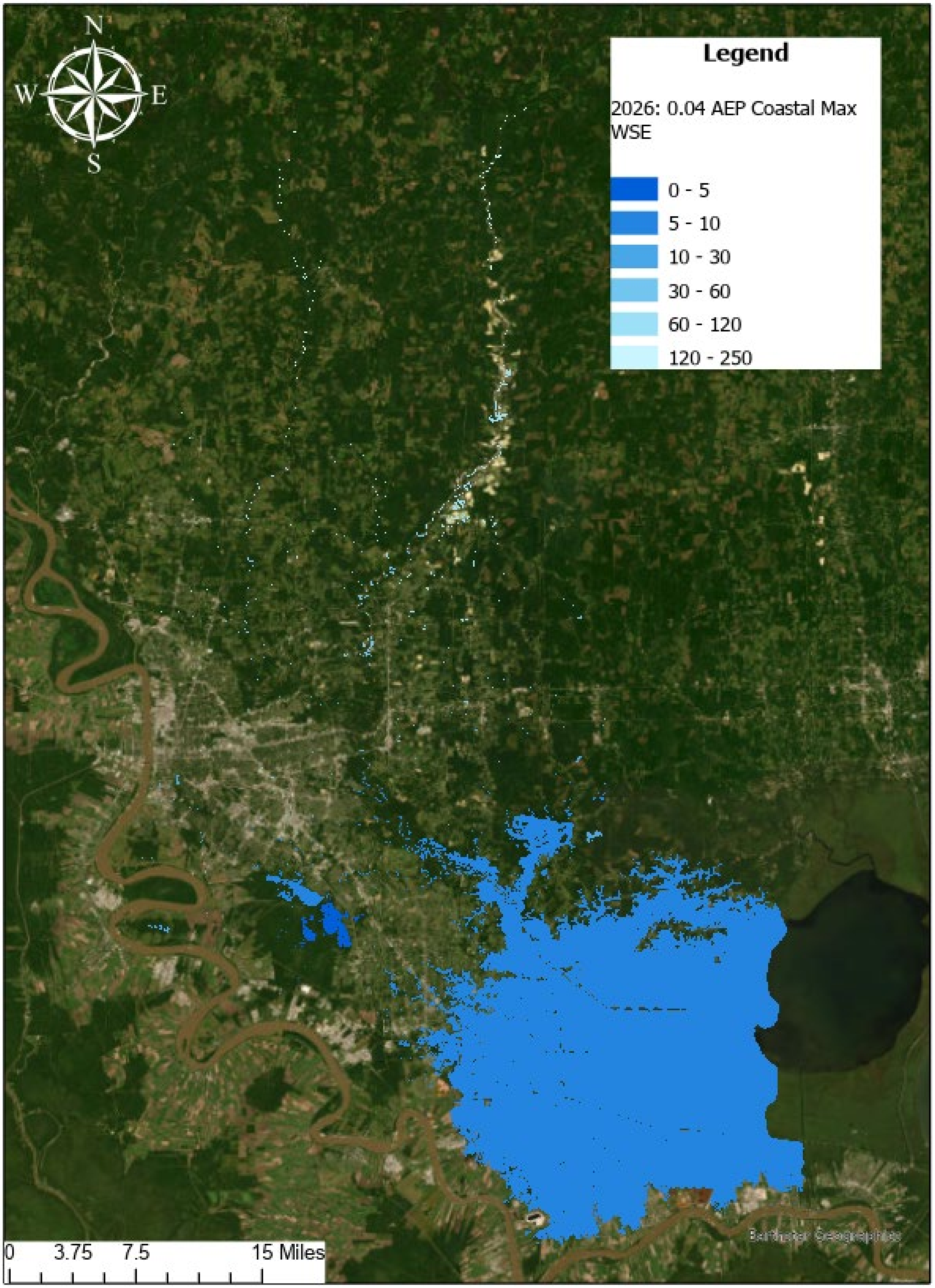

N
W
E
S
Legend
2076: 0.02 AEP Rainfall Max WSE
0 - 5
5 - 10
10 - 30
30 - 60
60 - 120
120 - 250
0
3.75
7.5
15 Miles

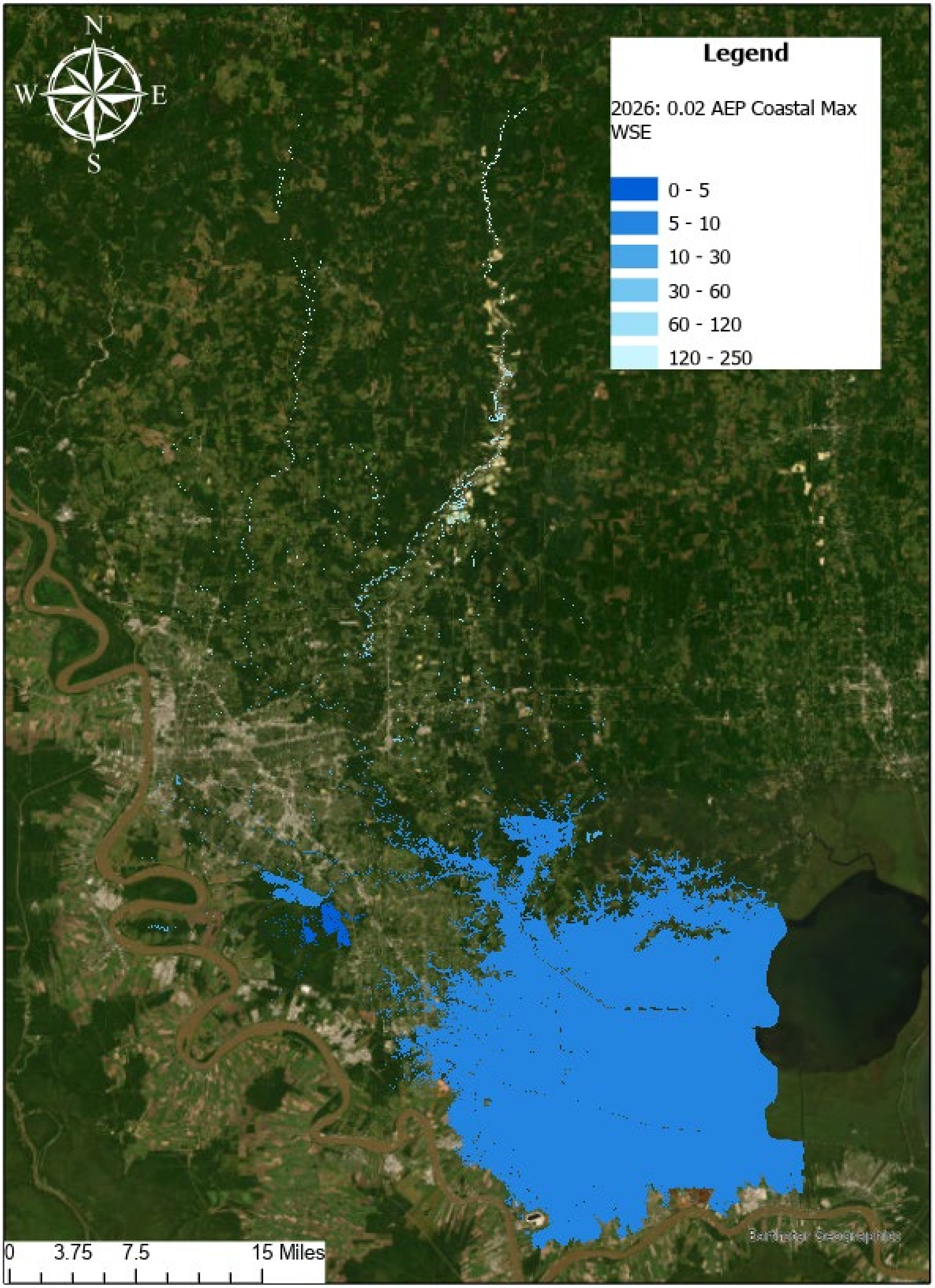

N
S
W
E
Legend
2076: 0.01 AEP Rainfall Max WSE
0 - 5
5 - 10
10 - 30
30 - 60
60 - 120
120 - 250
0
3.75
7.5
15 Miles

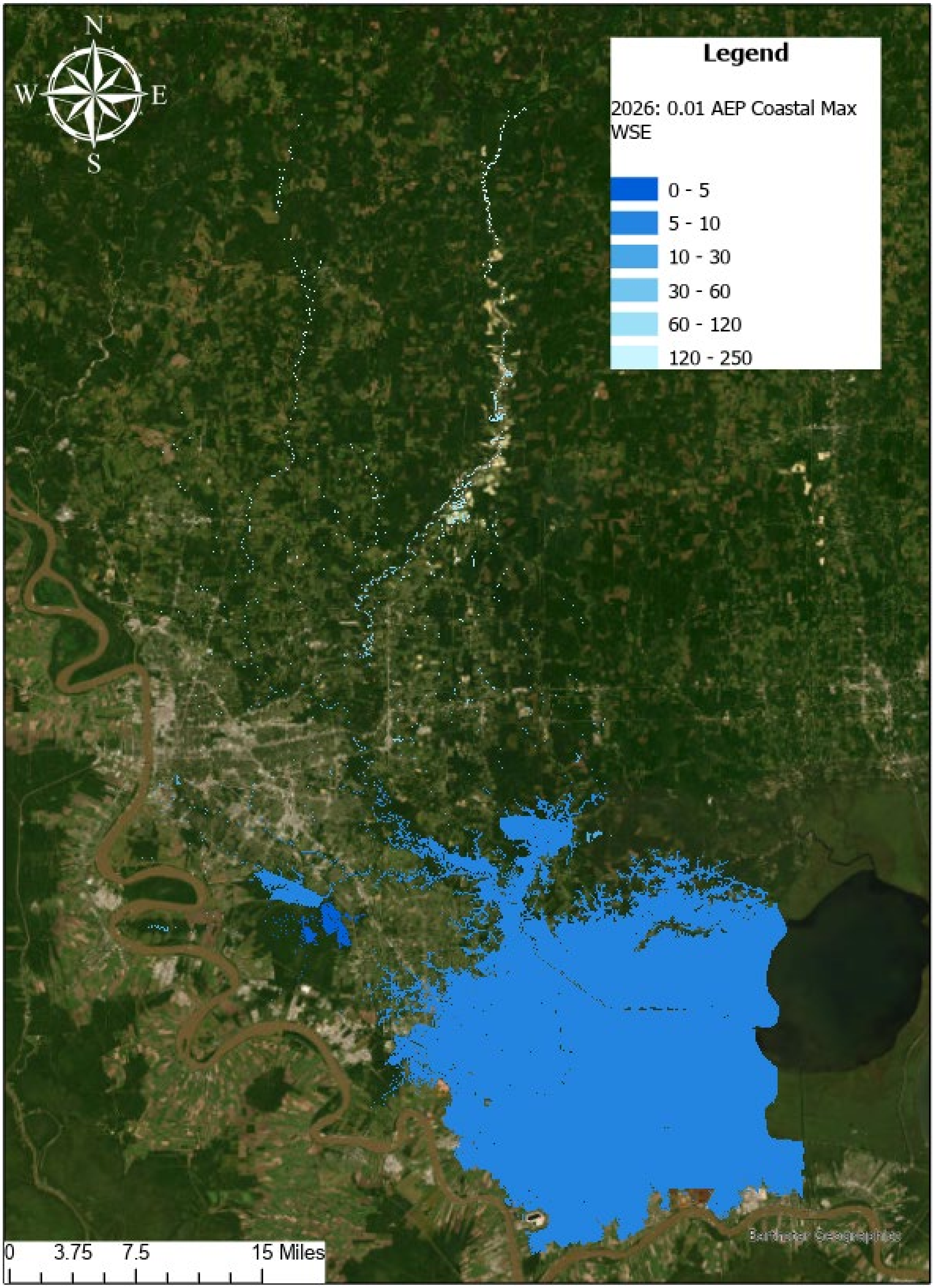

N
W
E
S
Legend
2076: 0.005 AEP Rainfall Max WSE
0 - 5
5 - 10
10 - 30
30 - 60
60 - 120
120 - 250
0
3.75
7.5
15 Miles
Earthstar Geographics

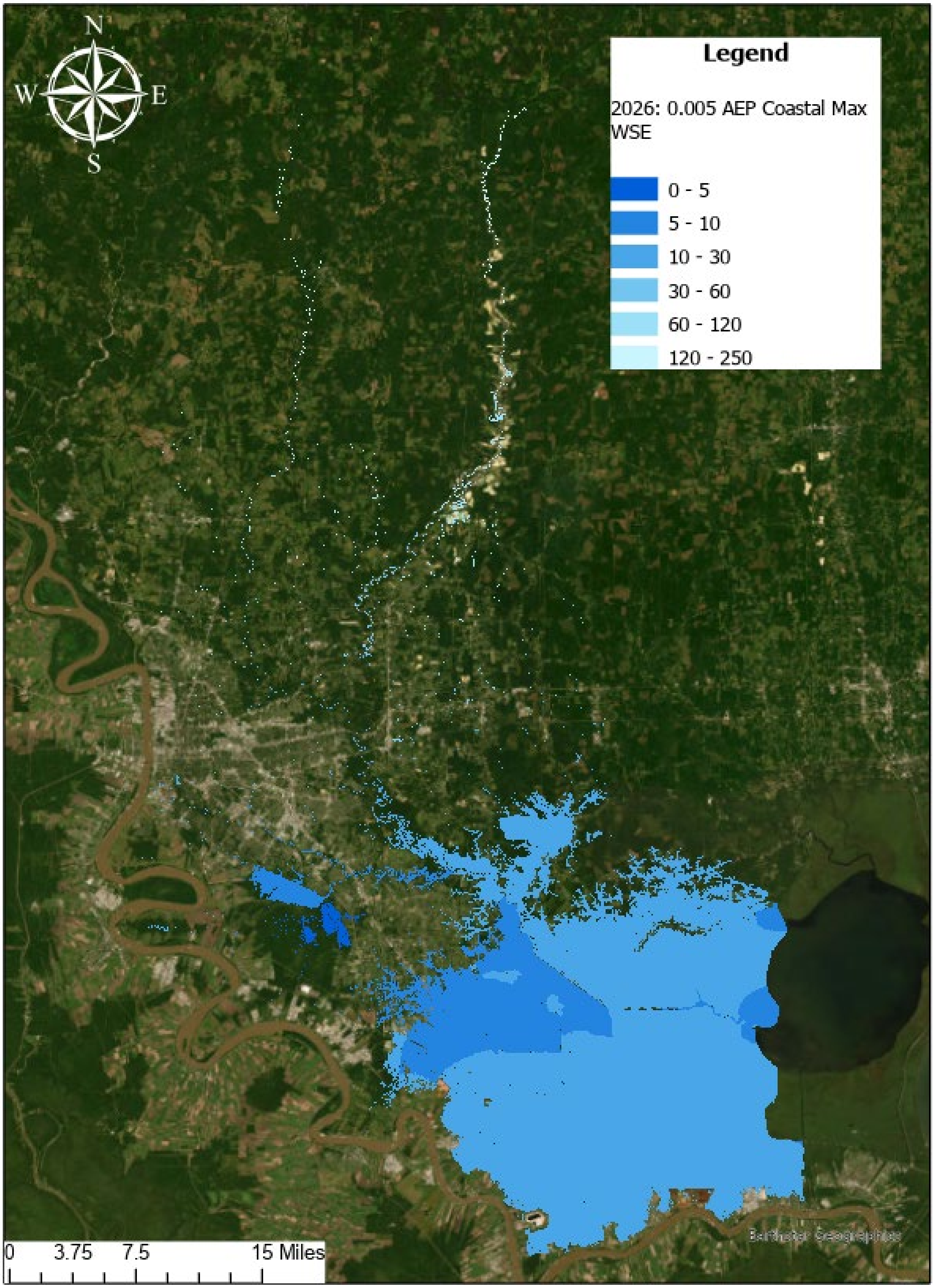

N
W
E
S
Legend
2076: 0.002 AEP Rainfall Max WSE
0 - 5
5 - 10
10 - 30
30 - 60
60 - 120
120 - 250
0 3.75 7.5 15 Miles
Earthstar Geographics

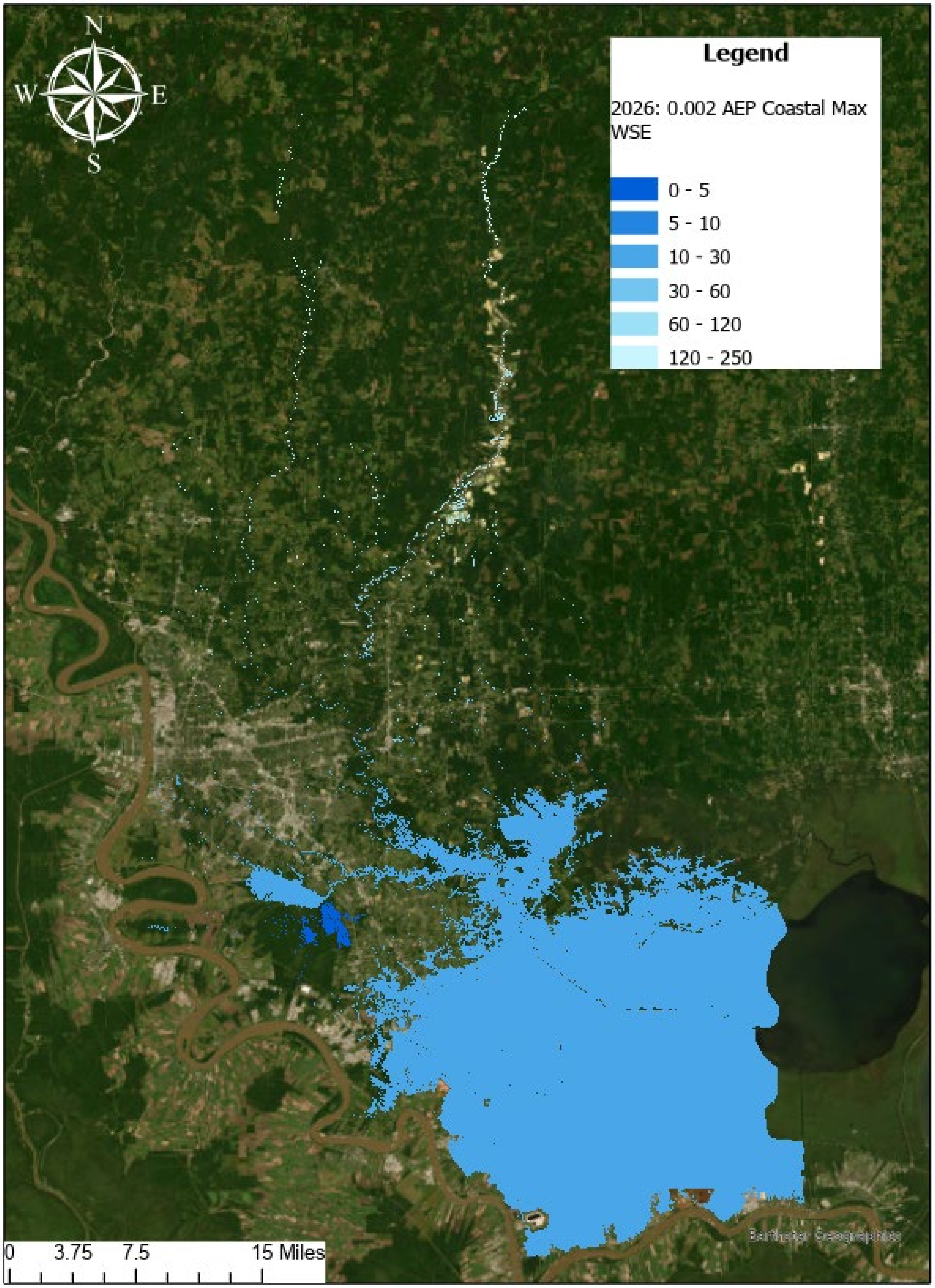

N
W
E
S
Legend
2026: 0.1 AEP Coastal Max WSE
0 - 5
5 - 10
10 - 30
30 - 60
60 - 120
120 - 250
0
3.75
7.5
15 Miles
Earthstar Geographics

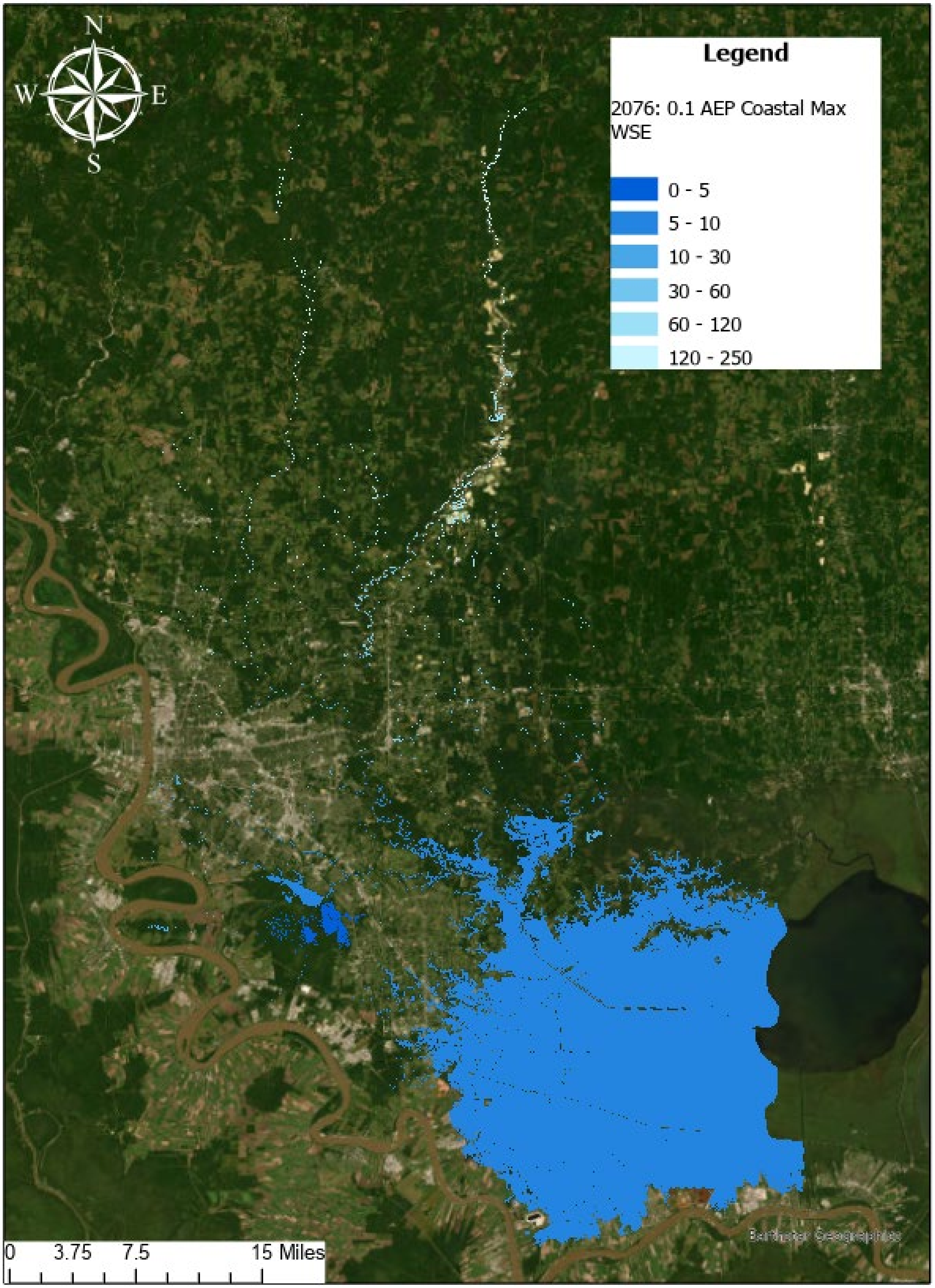

N
W
E
S
Legend
2026: 0.04 AEP Coastal Max WSE
0 - 5
5 - 10
10 - 30
30 - 60
60 - 120
120 - 250
0
3.75
7.5
15 Miles

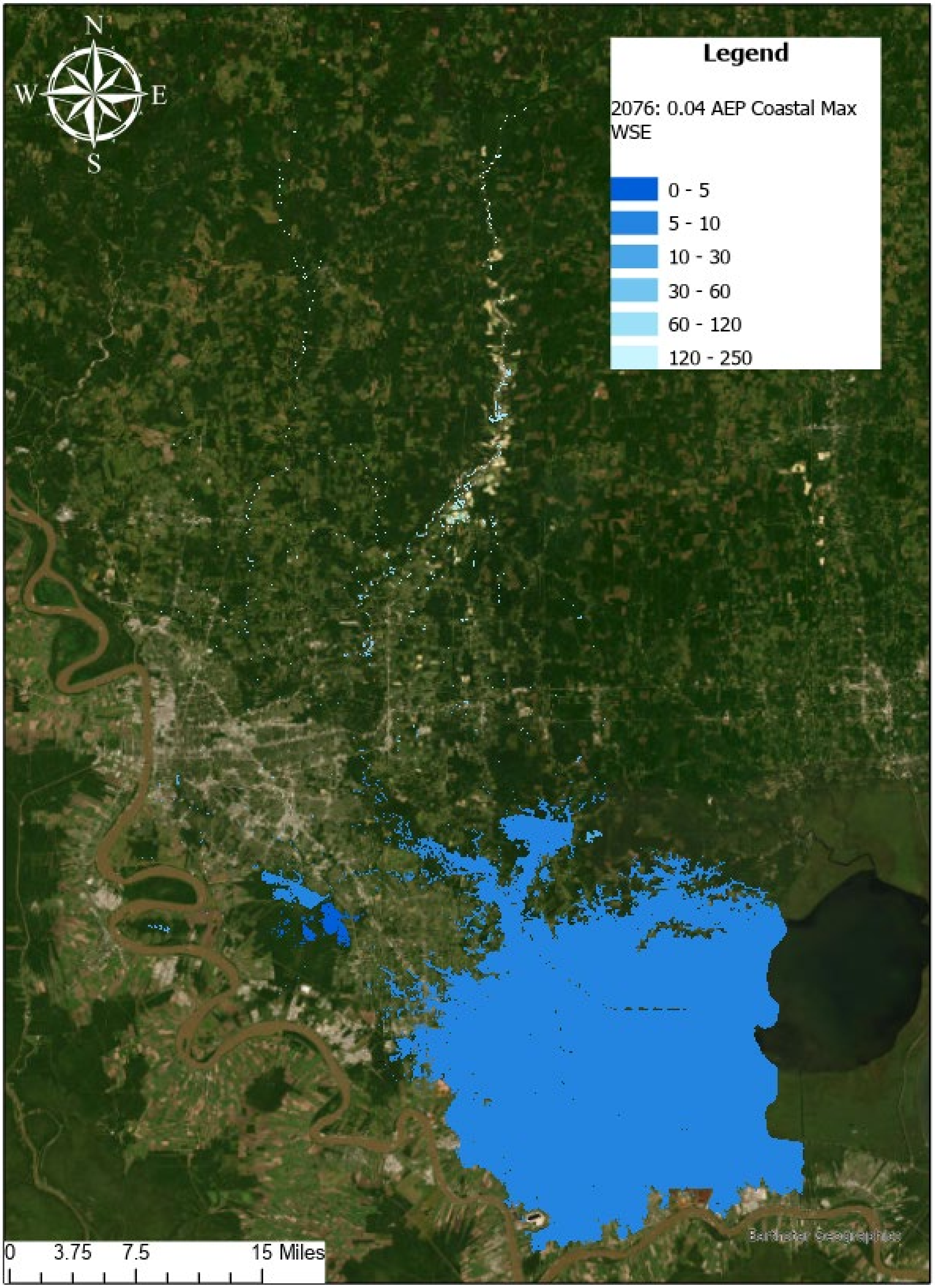

N
W
E
S
Legend
2026: 0.02 AEP Coastal Max WSE
0 - 5
5 - 10
10 - 30
30 - 60
60 - 120
120 - 250
0
3.75
7.5
15 Miles

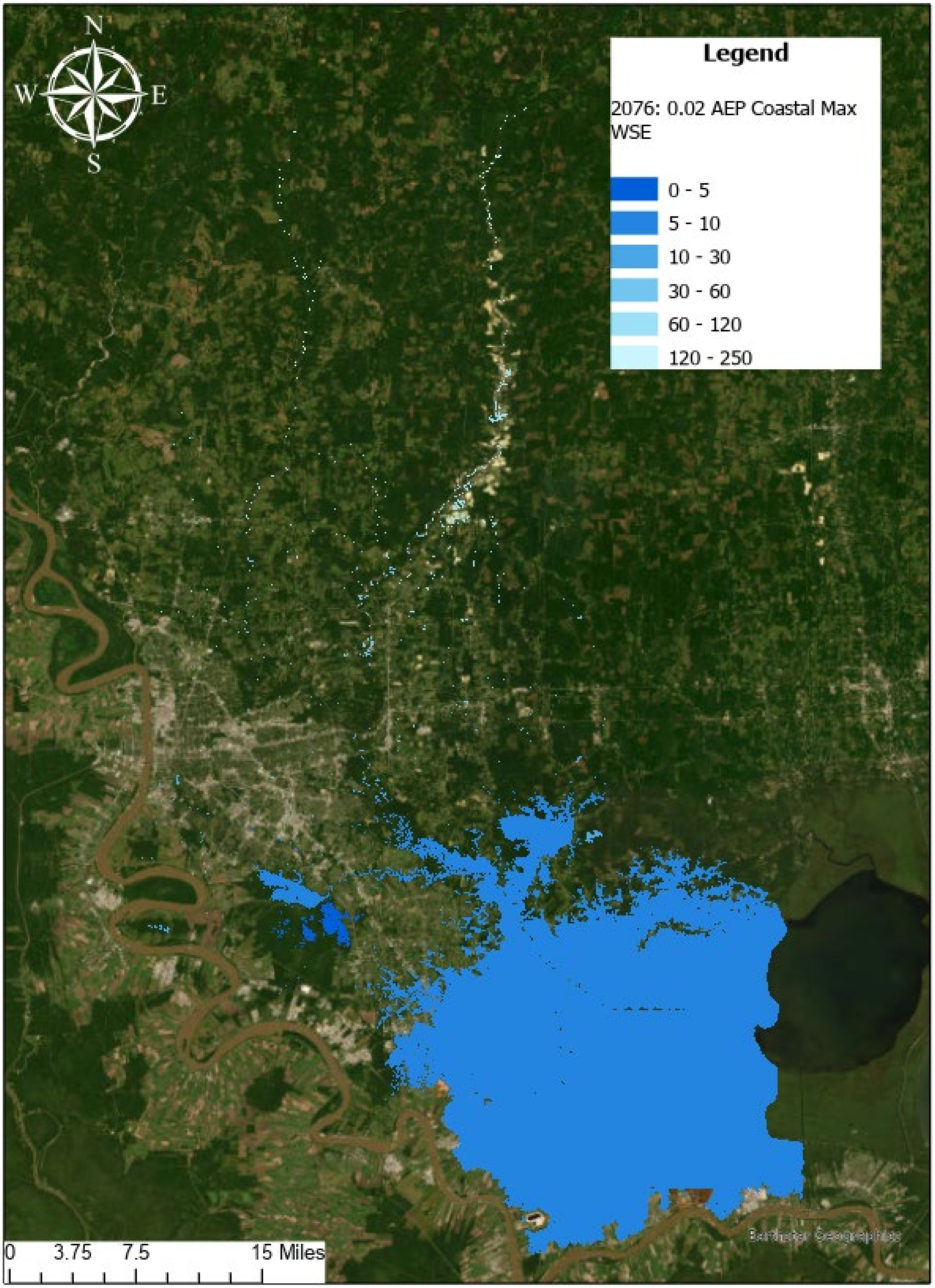

N
W
E
S
Legend
2026: 0.01 AEP Coastal Max WSE
0 - 5
5 - 10
10 - 30
30 - 60
60 - 120
120 - 250
0
3.75
7.5
15 Miles

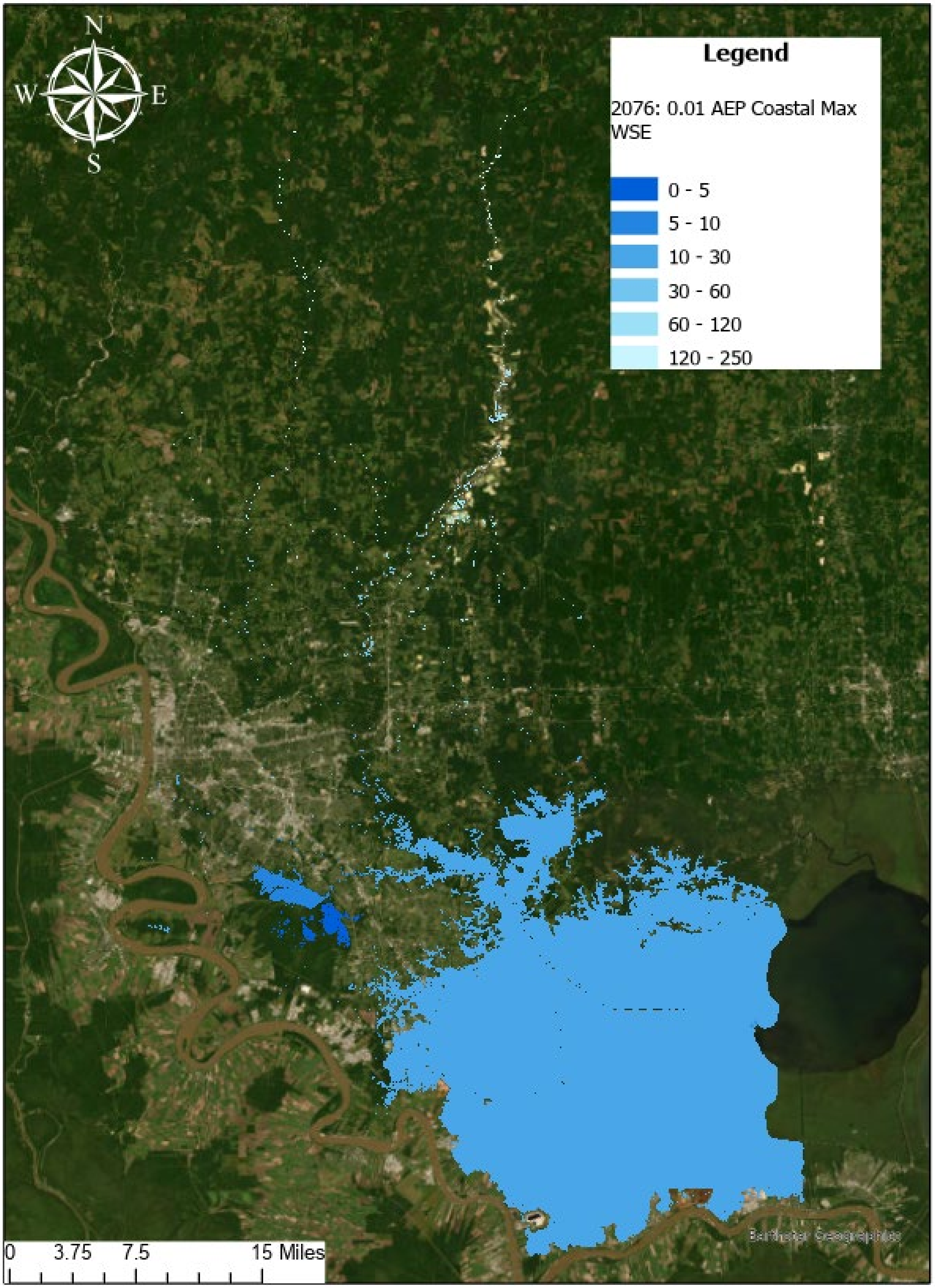

N
W
E
S
Legend
2026: 0.005 AEP Coastal Max WSE
0 - 5
5 - 10
10 - 30
30 - 60
60 - 120
120 - 250
0
3.75
7.5
15 Miles
Earthstar Geographics

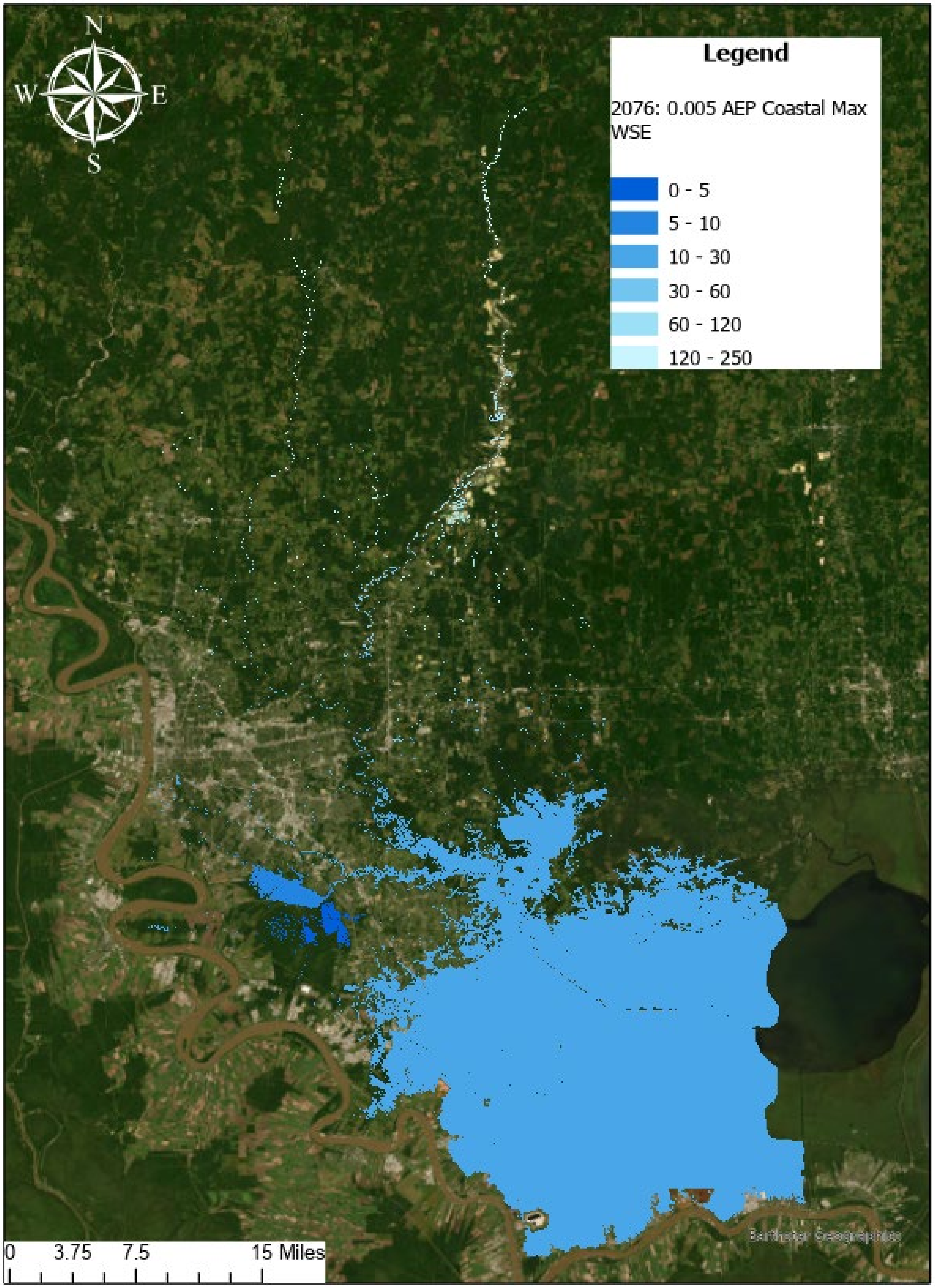

N
S
E
W
Legend
2026: 0.002 AEP Coastal Max WSE
0 - 5
5 - 10
10 - 30
30 - 60
60 - 120
120 - 250
0 3.75 7.5 15 Miles
Earthstar Geographics

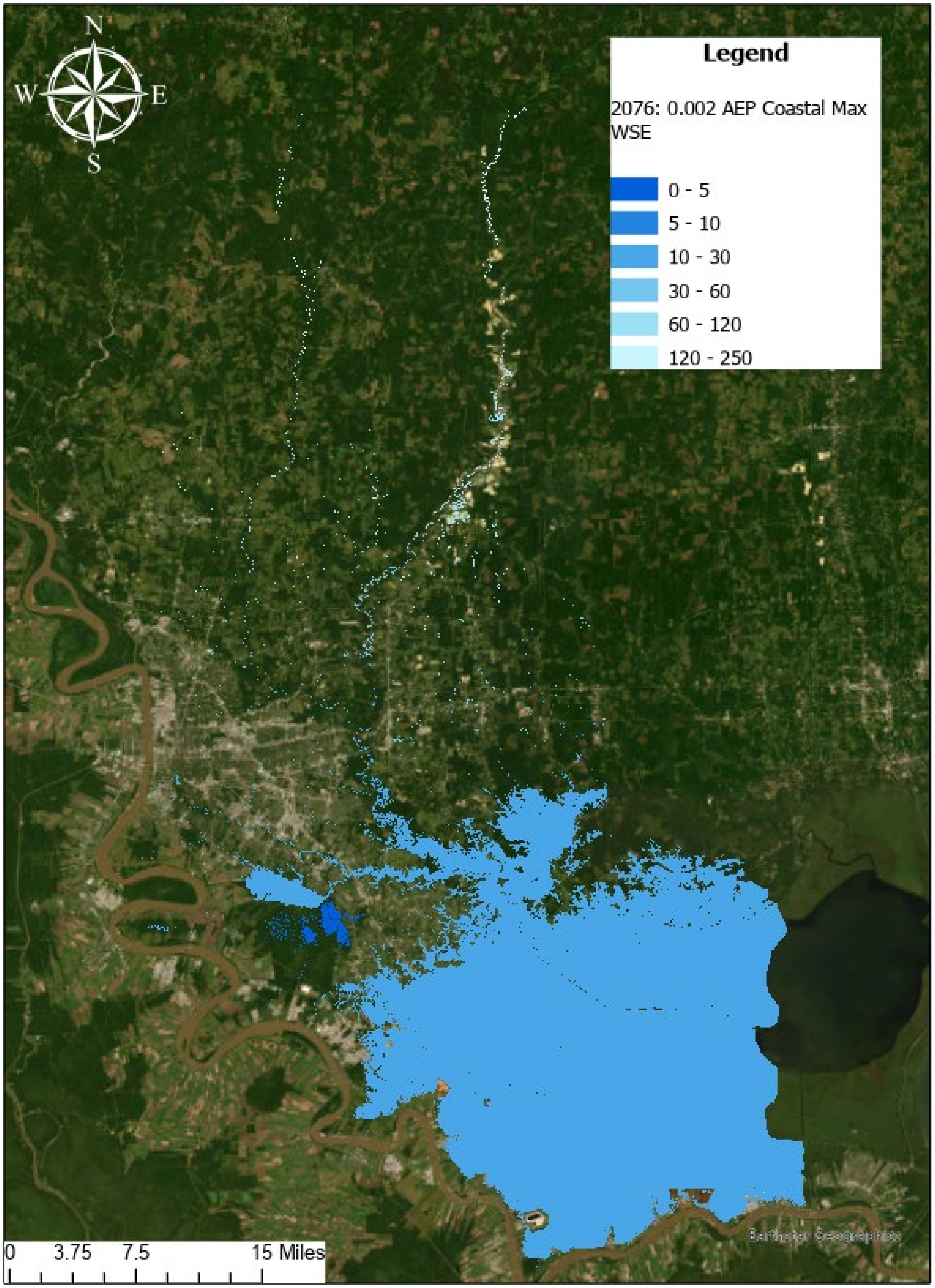

N
W
E
S
Legend
2076: 0.1 AEP Coastal Max WSE
0 - 5
5 - 10
10 - 30
30 - 60
60 - 120
120 - 250
0 3.75 7.5 15 Miles
Earthstar Geographics

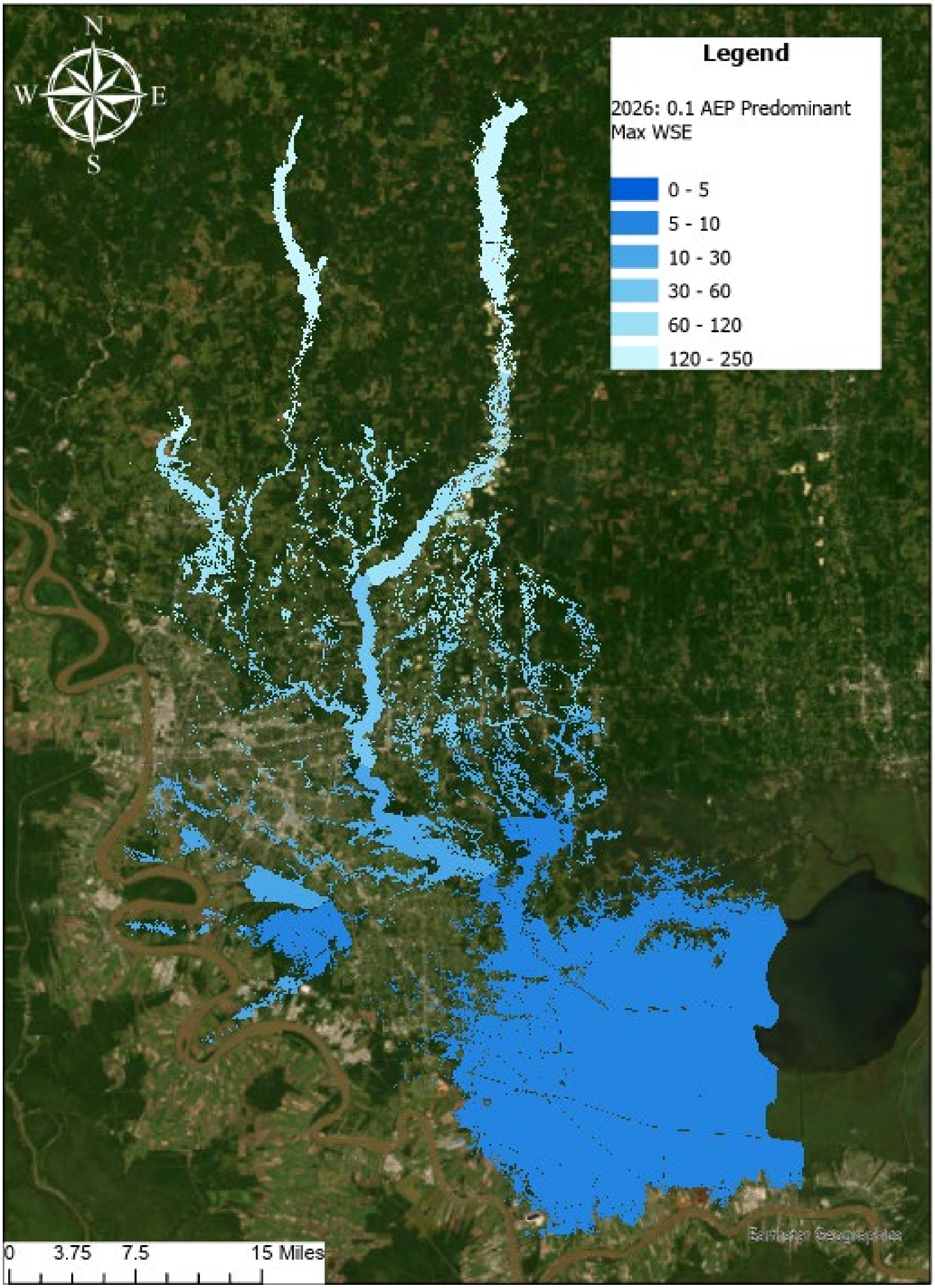

N
W
E
S
Legend
2076: 0.04 AEP Coastal Max WSE
0 - 5
5 - 10
10 - 30
30 - 60
60 - 120
120 - 250
0
3.75
7.5
15 Miles
Earthstar Geographics

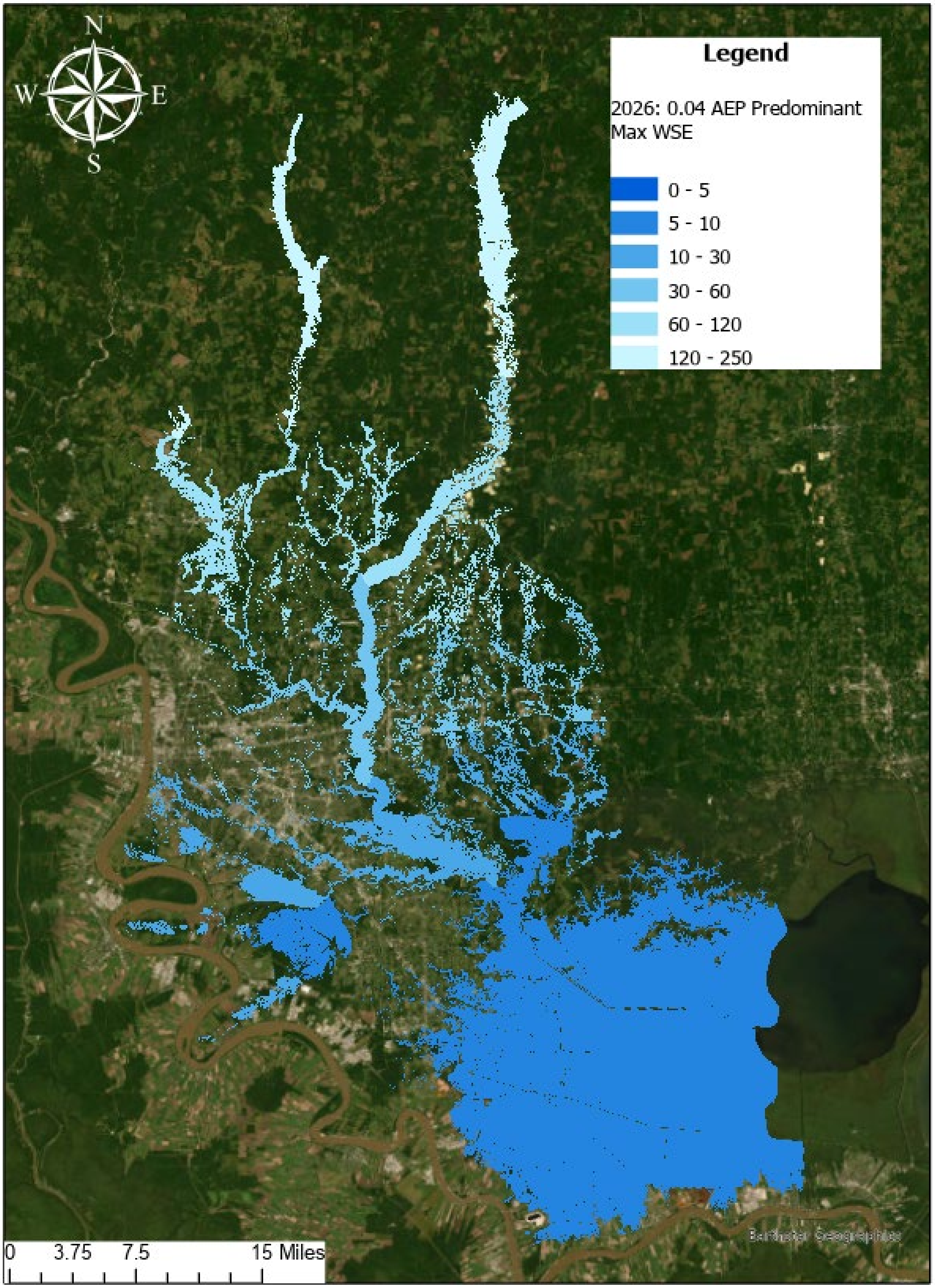

N
S
W
E
Legend
2076: 0.02 AEP Coastal Max WSE
0 - 5
5 - 10
10 - 30
30 - 60
60 - 120
120 - 250
0
3.75
7.5
15 Miles
Earthstar Geographics

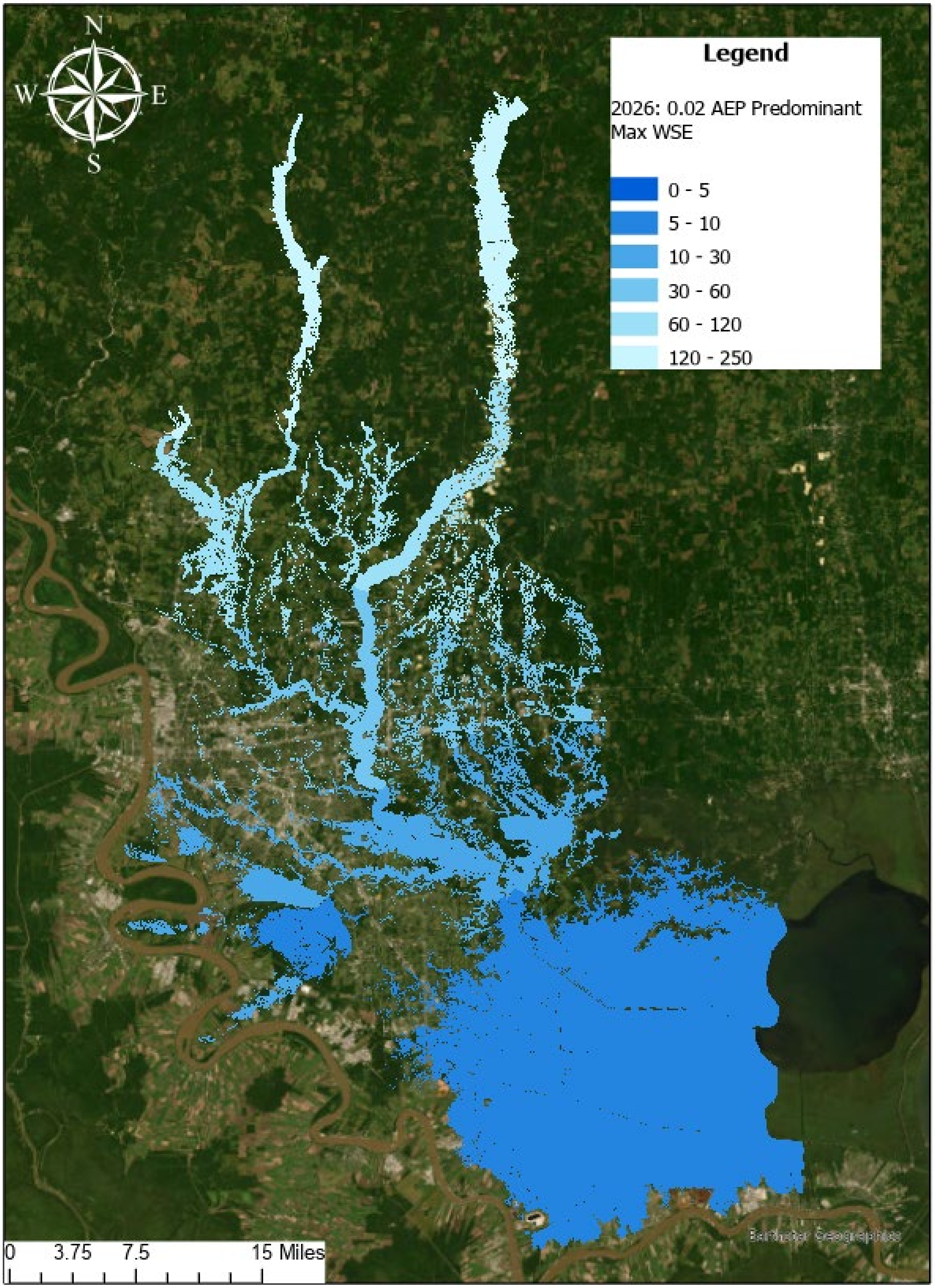

N
S
W
E
Legend
2076: 0.01 AEP Coastal Max WSE
0 - 5
5 - 10
10 - 30
30 - 60
60 - 120
120 - 250
0 3.75 7.5 15 Miles

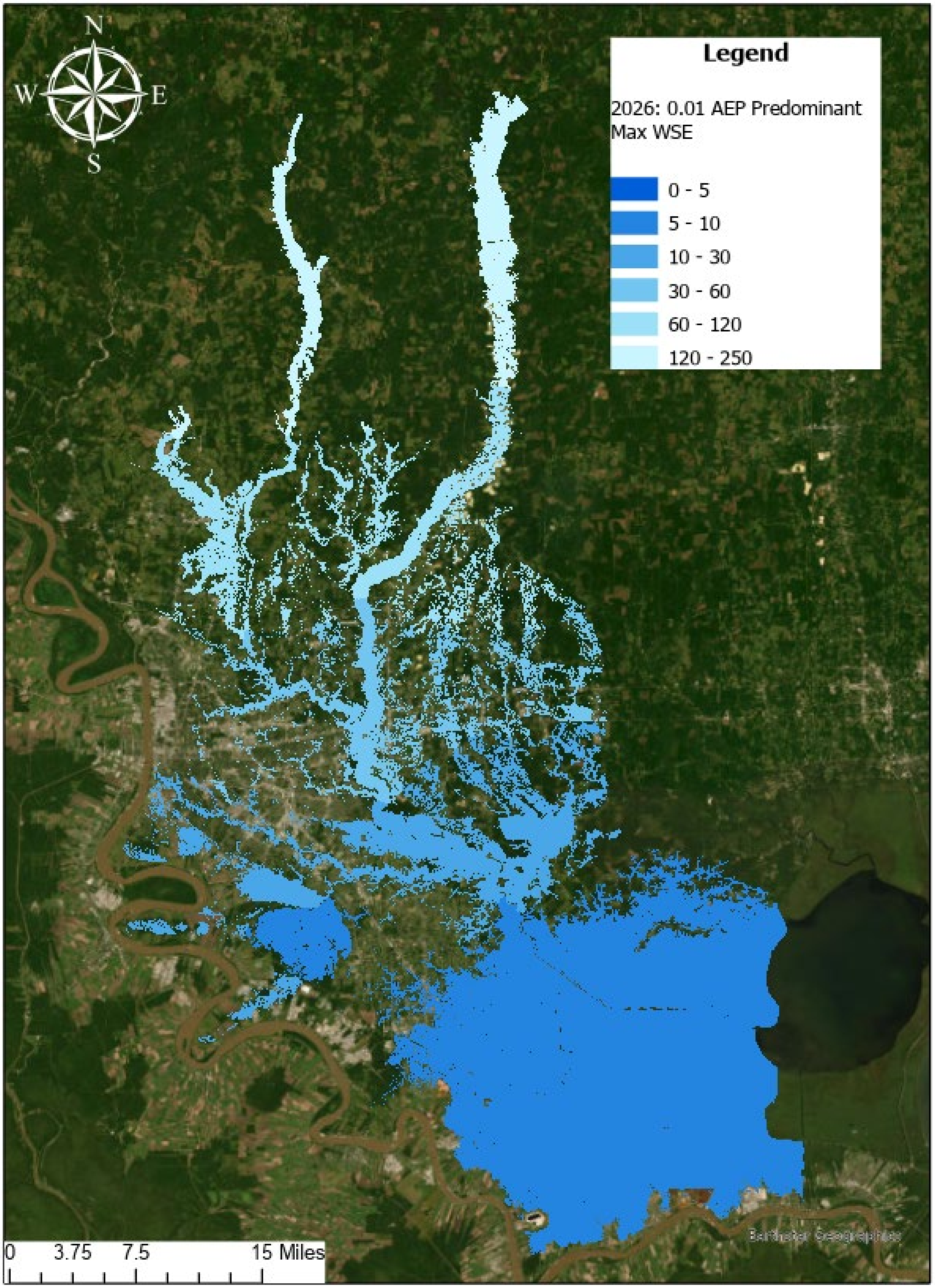

N
W
E
S
Legend
2076: 0.005 AEP Coastal Max WSE
0 - 5
5 - 10
10 - 30
30 - 60
60 - 120
120 - 250
0 3.75 7.5 15 Miles

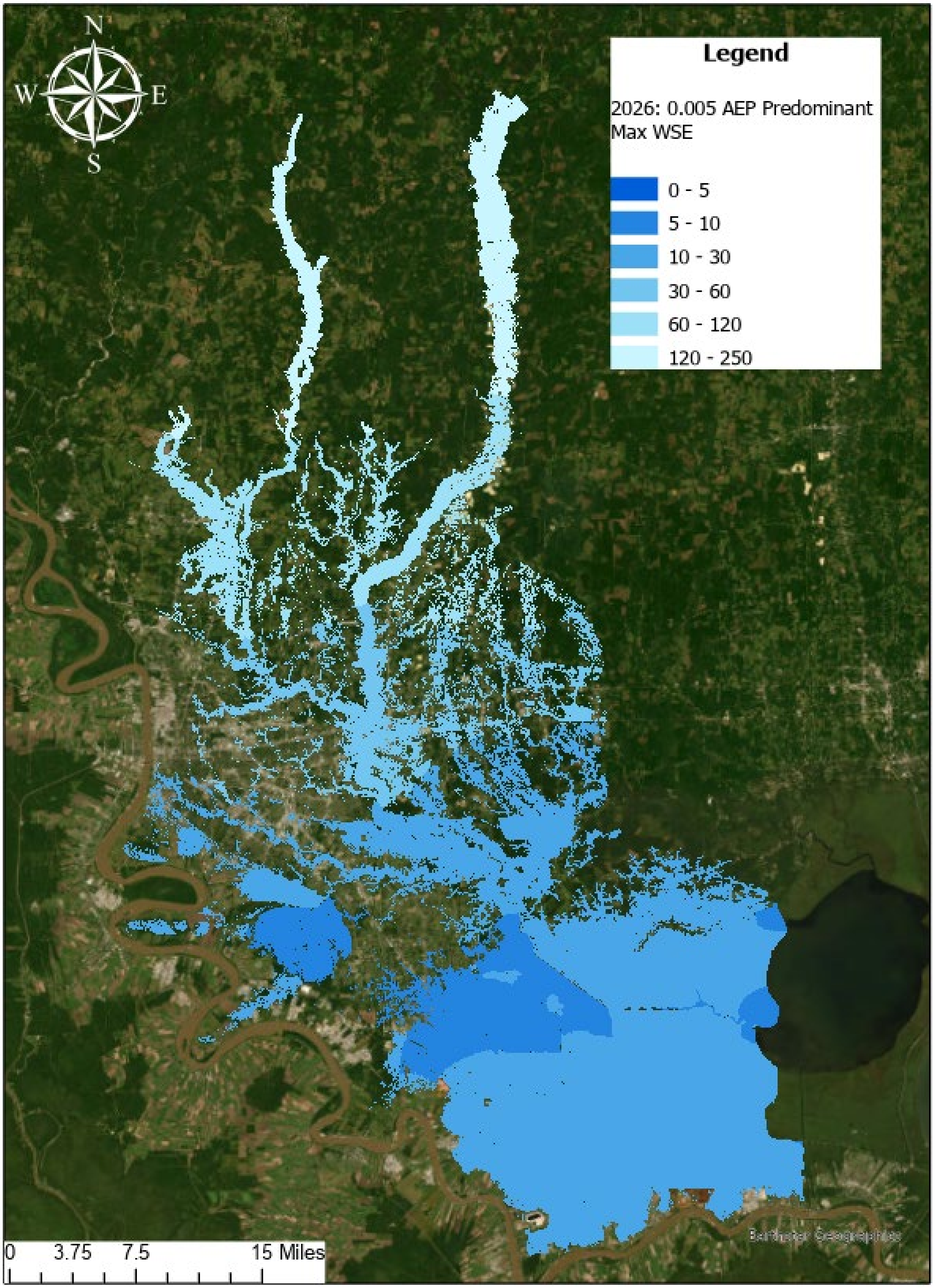

N
W
E
S
Legend
2076: 0.002 AEP Coastal Max WSE
0 - 5
5 - 10
10 - 30
30 - 60
60 - 120
120 - 250
0 3.75 7.5 15 Miles

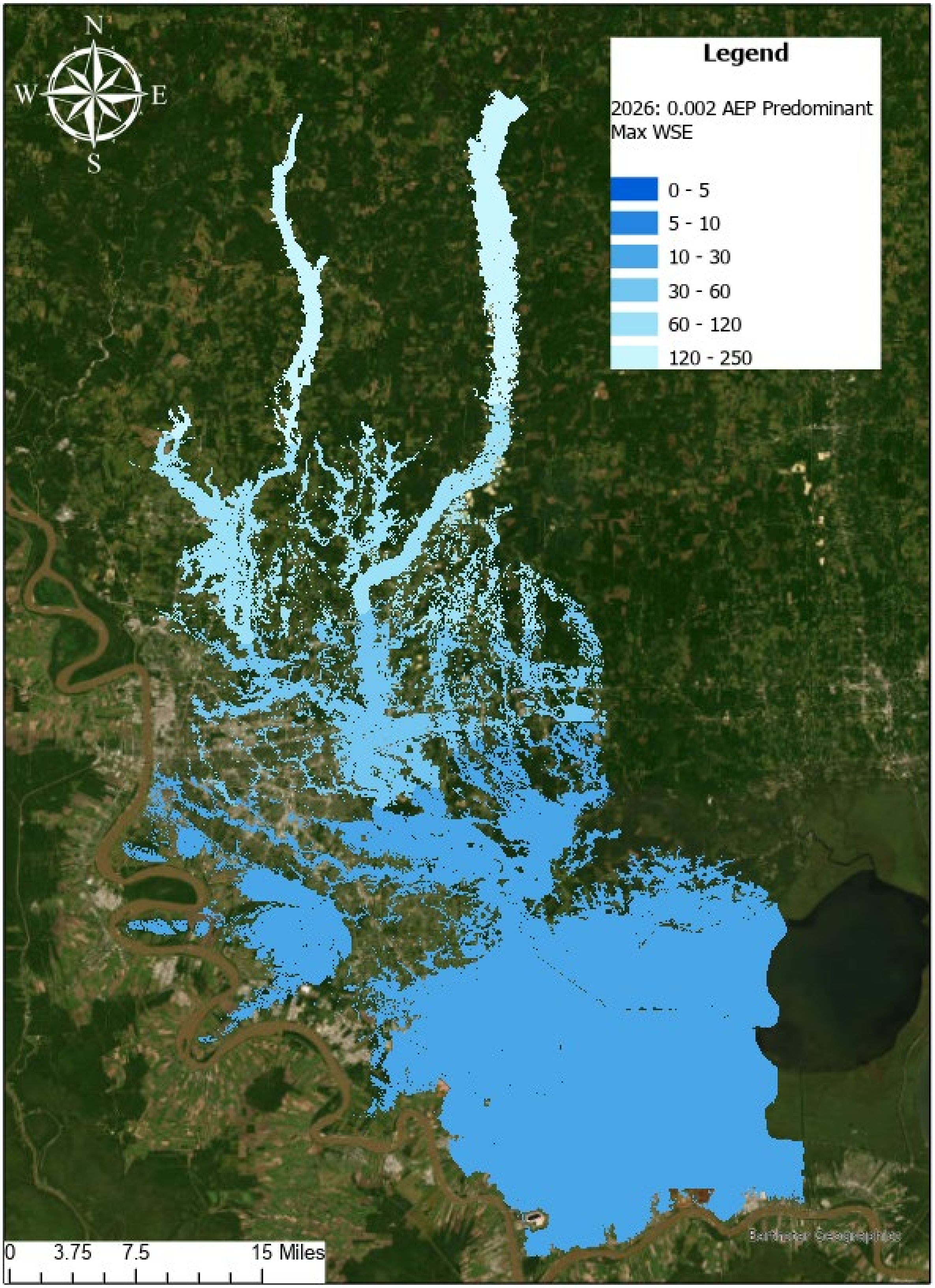

N
S
W
E
Legend
2026: 0.1 AEP Predominant Max WSE
0 - 5
5 - 10
10 - 30
30 - 60
60 - 120
120 - 250
0
3.75
7.5
15 Miles
Earthstar Geographics

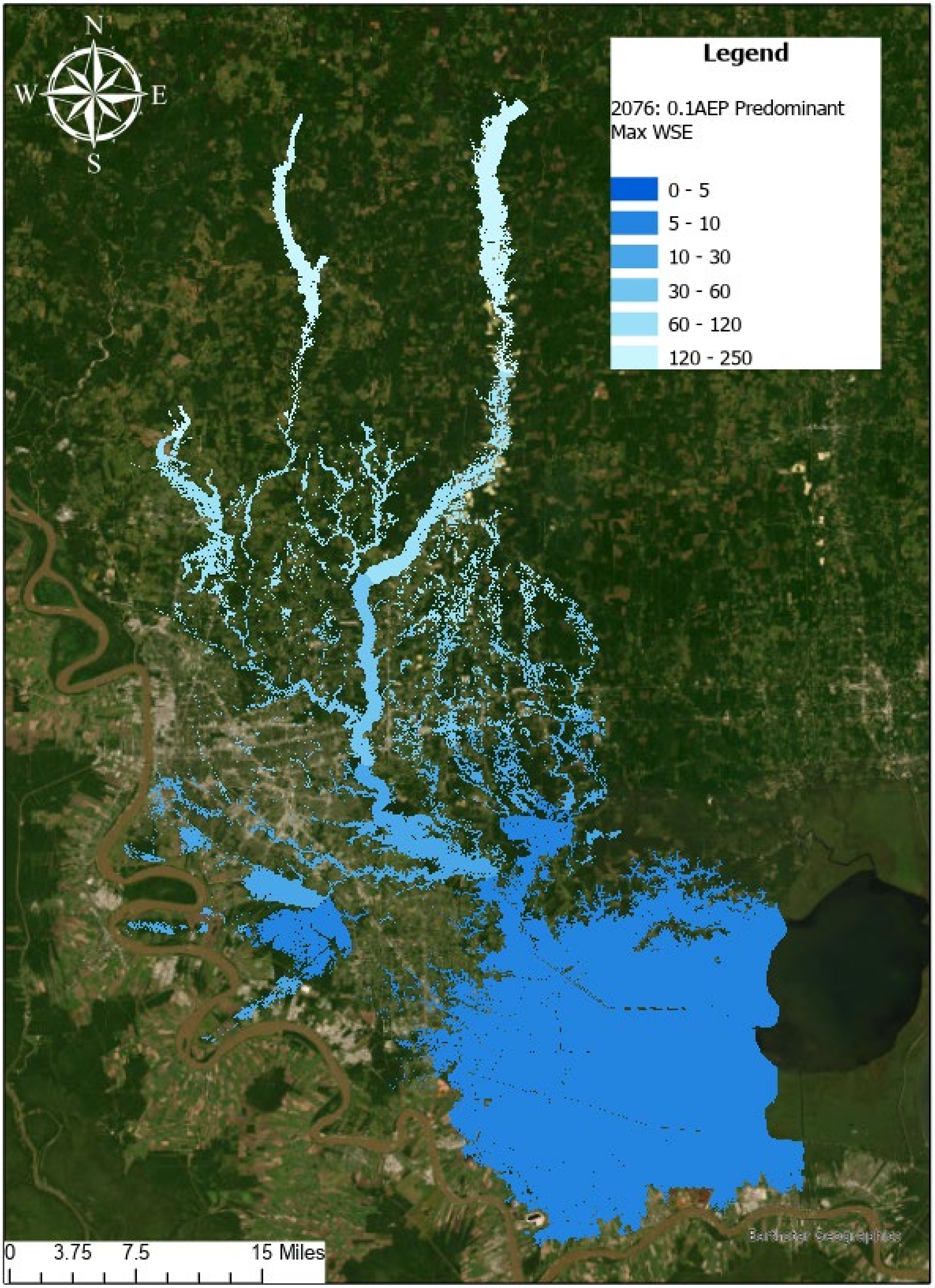

N
W
E
S
Legend
2026: 0.04 AEP Predominant Max WSE
0 - 5
5 - 10
10 - 30
30 - 60
60 - 120
120 - 250
0 3.75 7.5 15 Miles

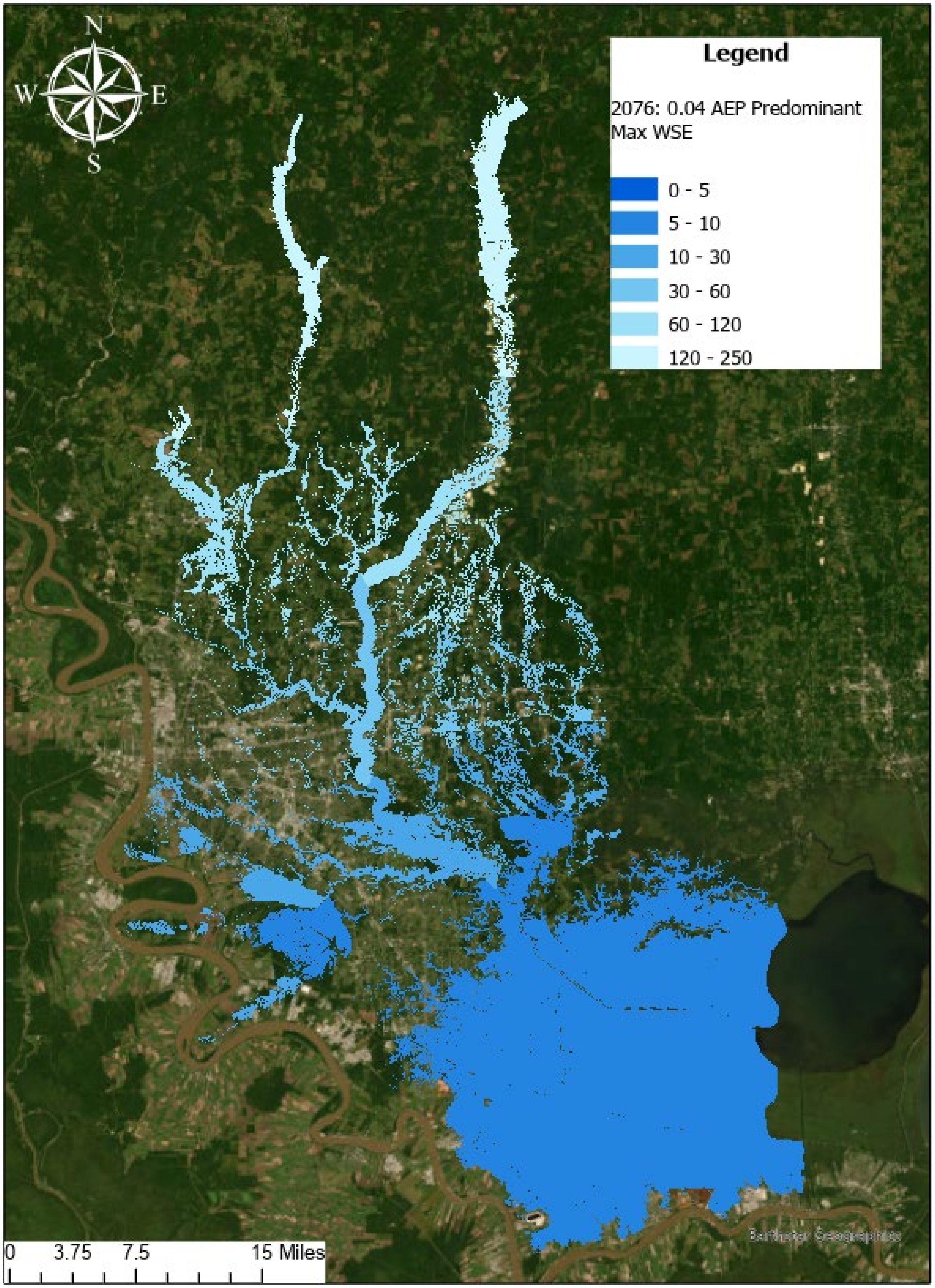

N
S
E
W
Legend
2026: 0.02 AEP Predominant Max WSE
0 - 5
5 - 10
10 - 30
30 - 60
60 - 120
120 - 250
0 3.75 7.5 15 Miles

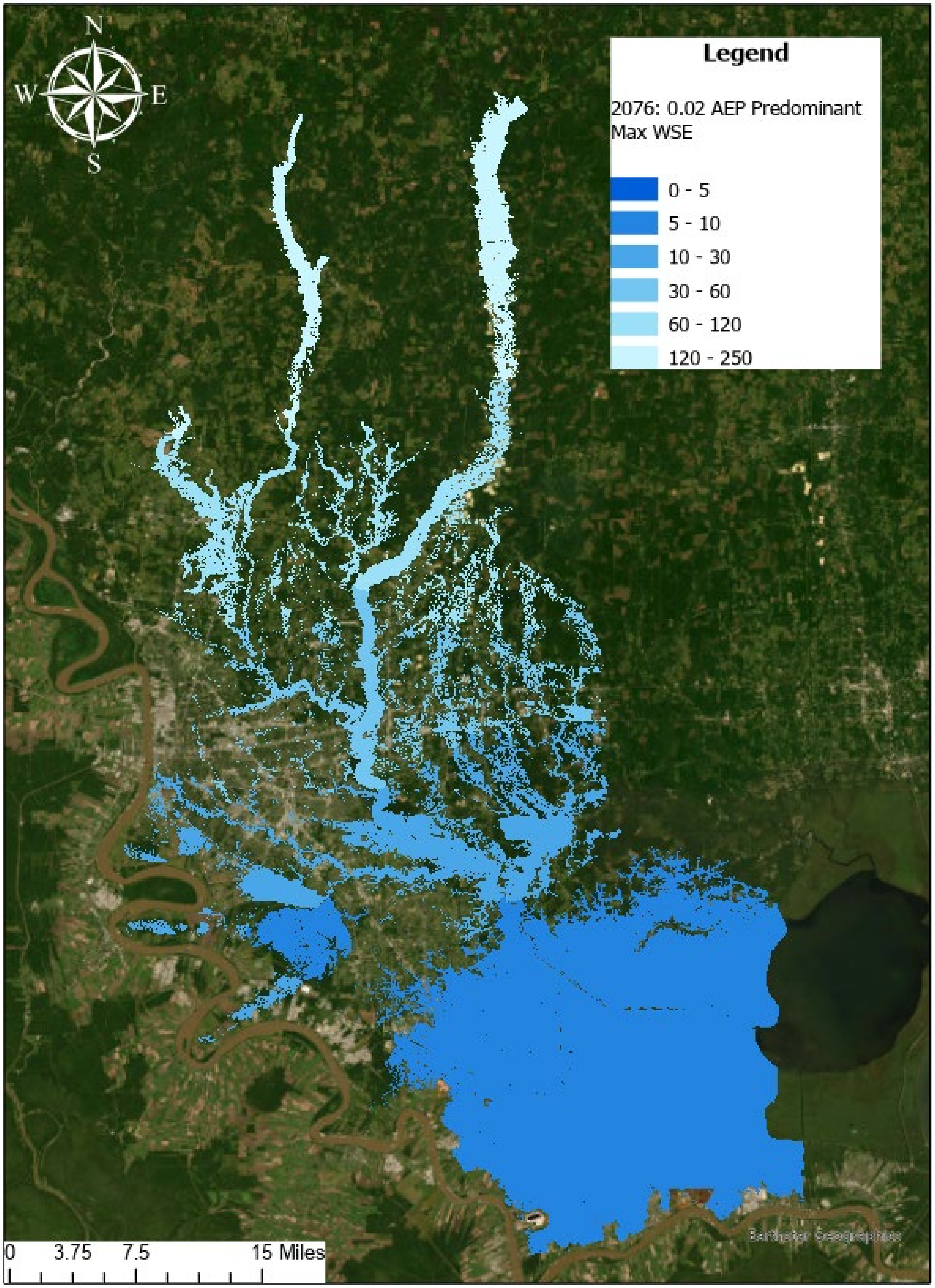

N
W
E
S
Legend
2026: 0.01 AEP Predominant Max WSE
0 - 5
5 - 10
10 - 30
30 - 60
60 - 120
120 - 250
0 3.75 7.5 15 Miles
Earthstar Geographics

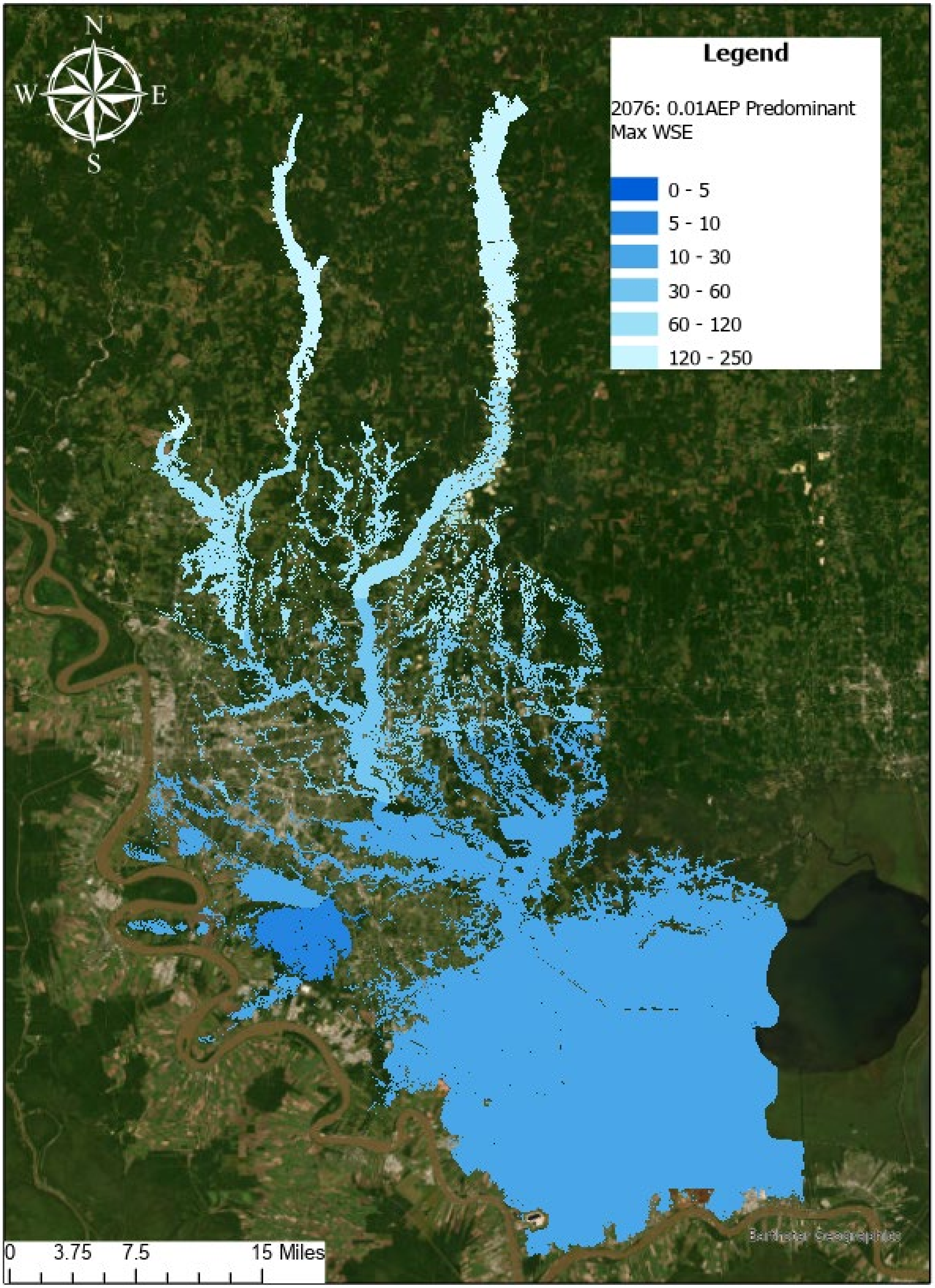

N
S
W
E
Legend
2026: 0.005 AEP Predominant Max WSE
0 - 5
5 - 10
10 - 30
30 - 60
60 - 120
120 - 250
0
3.75
7.5
15 Miles

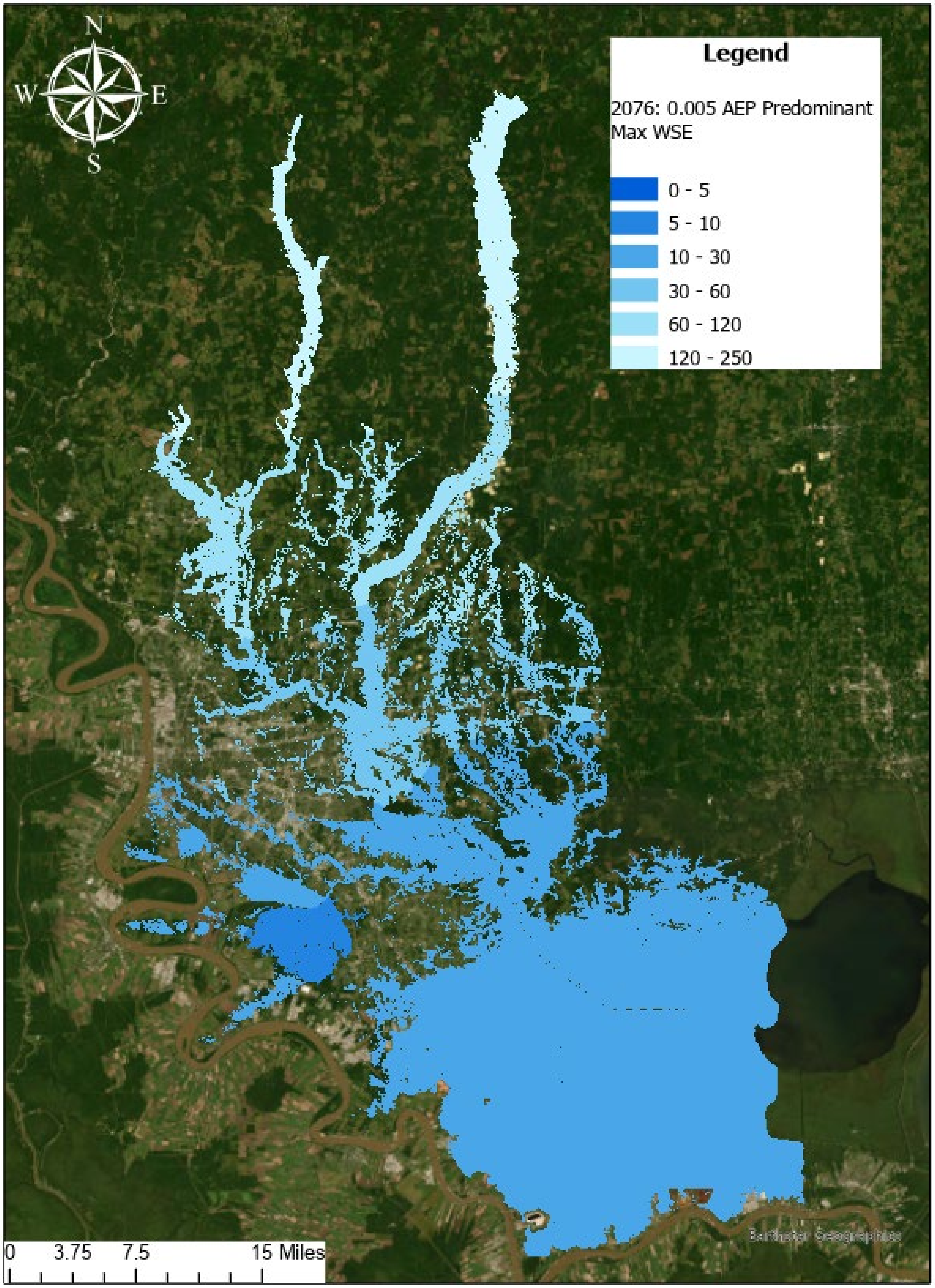

N
W
E
S
Legend
2026: 0.002 AEP Predominant Max WSE
0 - 5
5 - 10
10 - 30
30 - 60
60 - 120
120 - 250
0
3.75
7.5
15 Miles

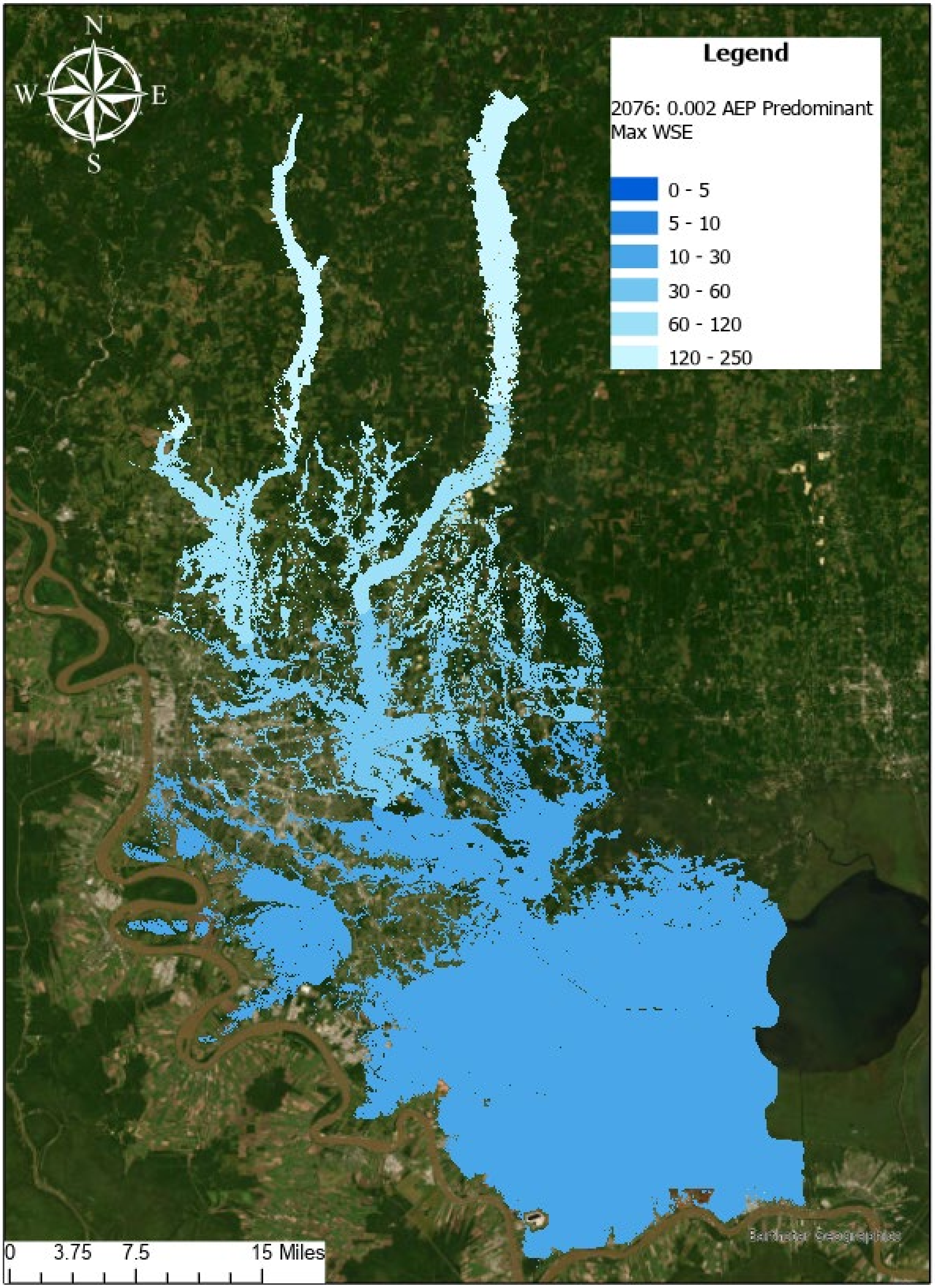

N
S
W
E
Legend
2076: 0.1AEP Predominant Max WSE
0 - 5
5 - 10
10 - 30
30 - 60
60 - 120
120 - 250
0
3.75
7.5
15 Miles


N
W
E
S
Legend
2076: 0.04 AEP Predominant Max WSE
0 - 5
5 - 10
10 - 30
30 - 60
60 - 120
120 - 250
0 3.75 7.5 15 Miles
Earthstar Geographics

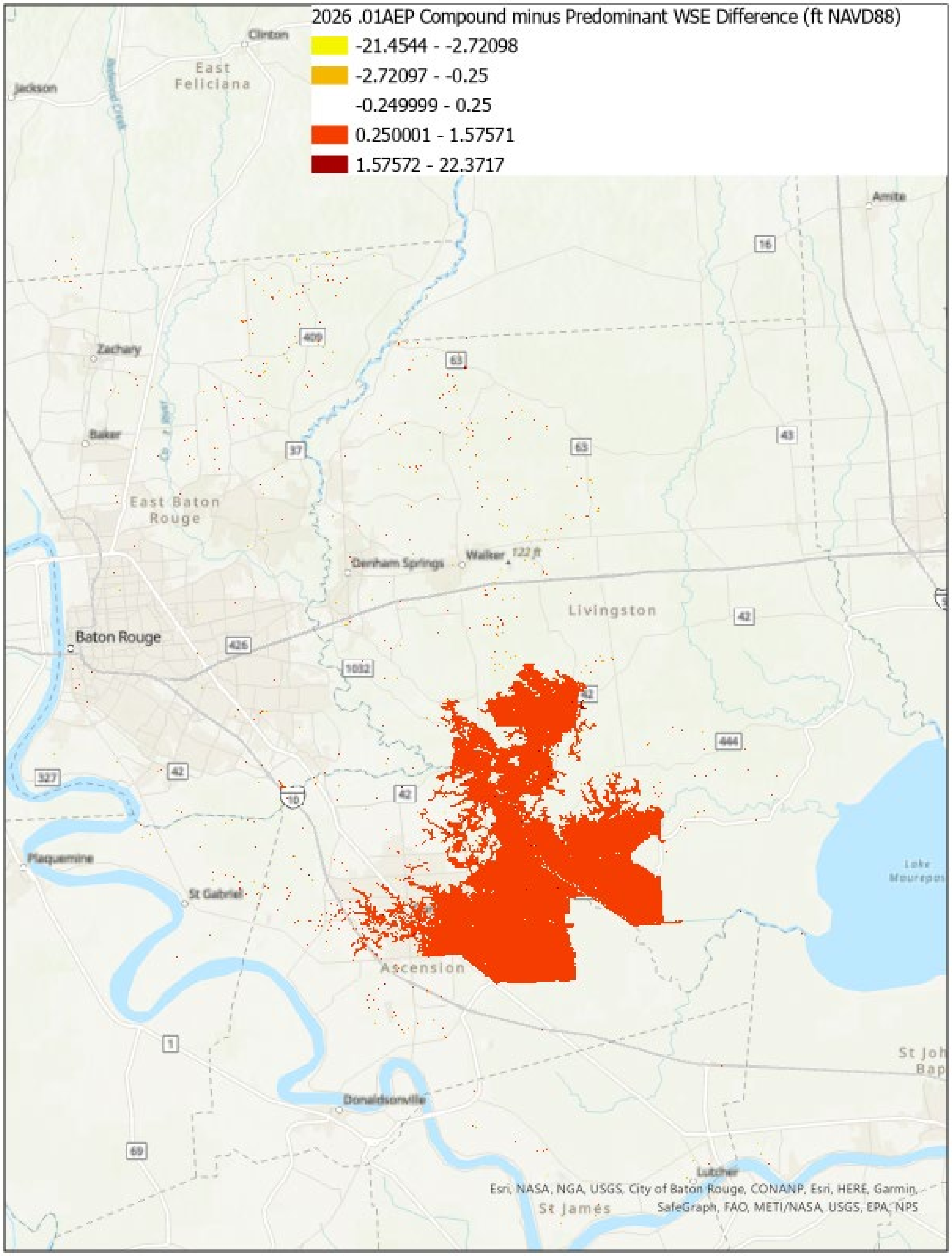

N
W
E
S
Legend
2076: 0.02 AEP Predominant Max WSE
0 - 5
5 - 10
10 - 30
30 - 60
60 - 120
120 - 250
0 3.75 7.5 15 Miles
Earthstar Geographics

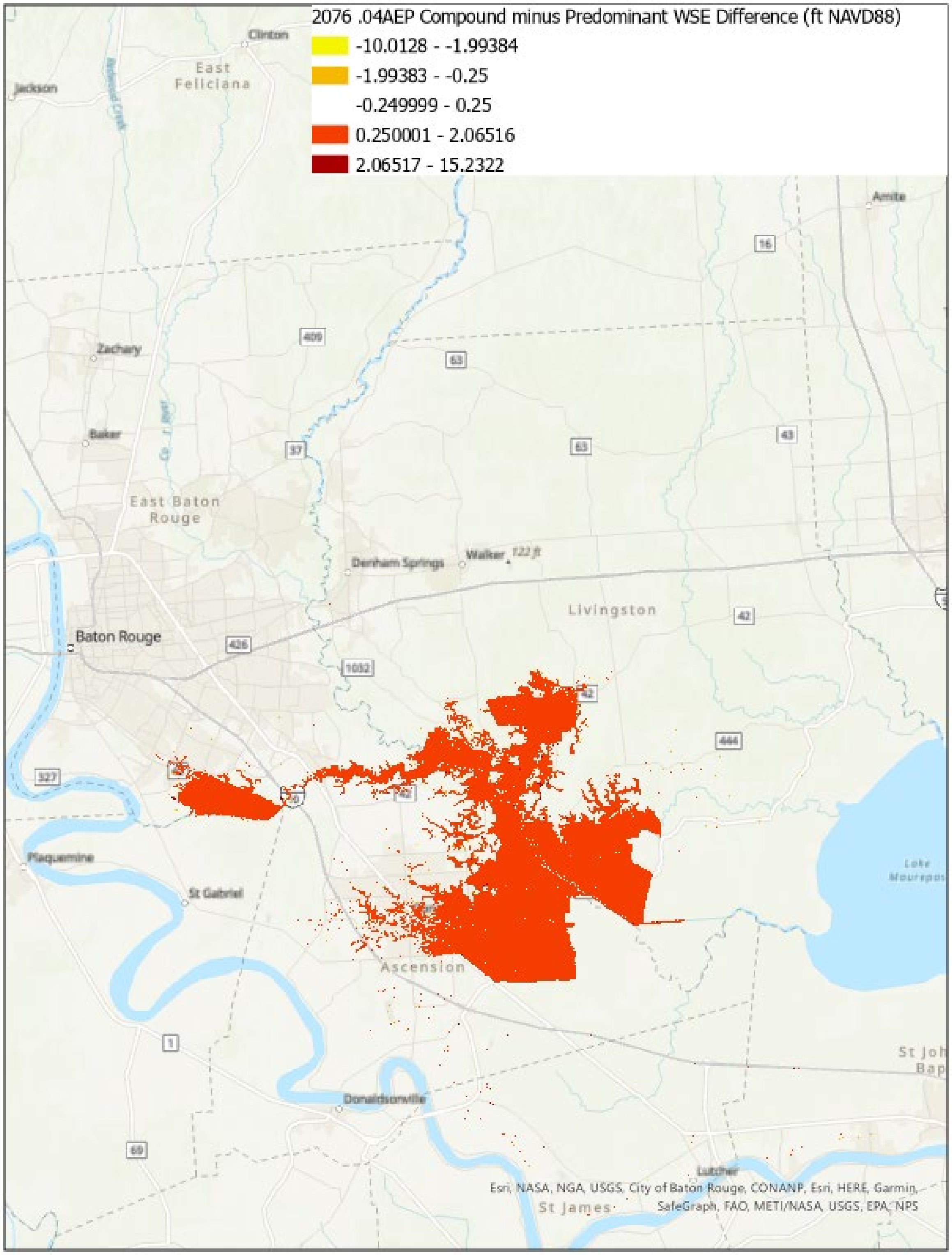

N
S
E
W
Legend
2076: 0.01AEP Predominant Max WSE
0 - 5
5 - 10
10 - 30
30 - 60
60 - 120
120 - 250
0 3.75 7.5 15 Miles
Earthstar Geographics

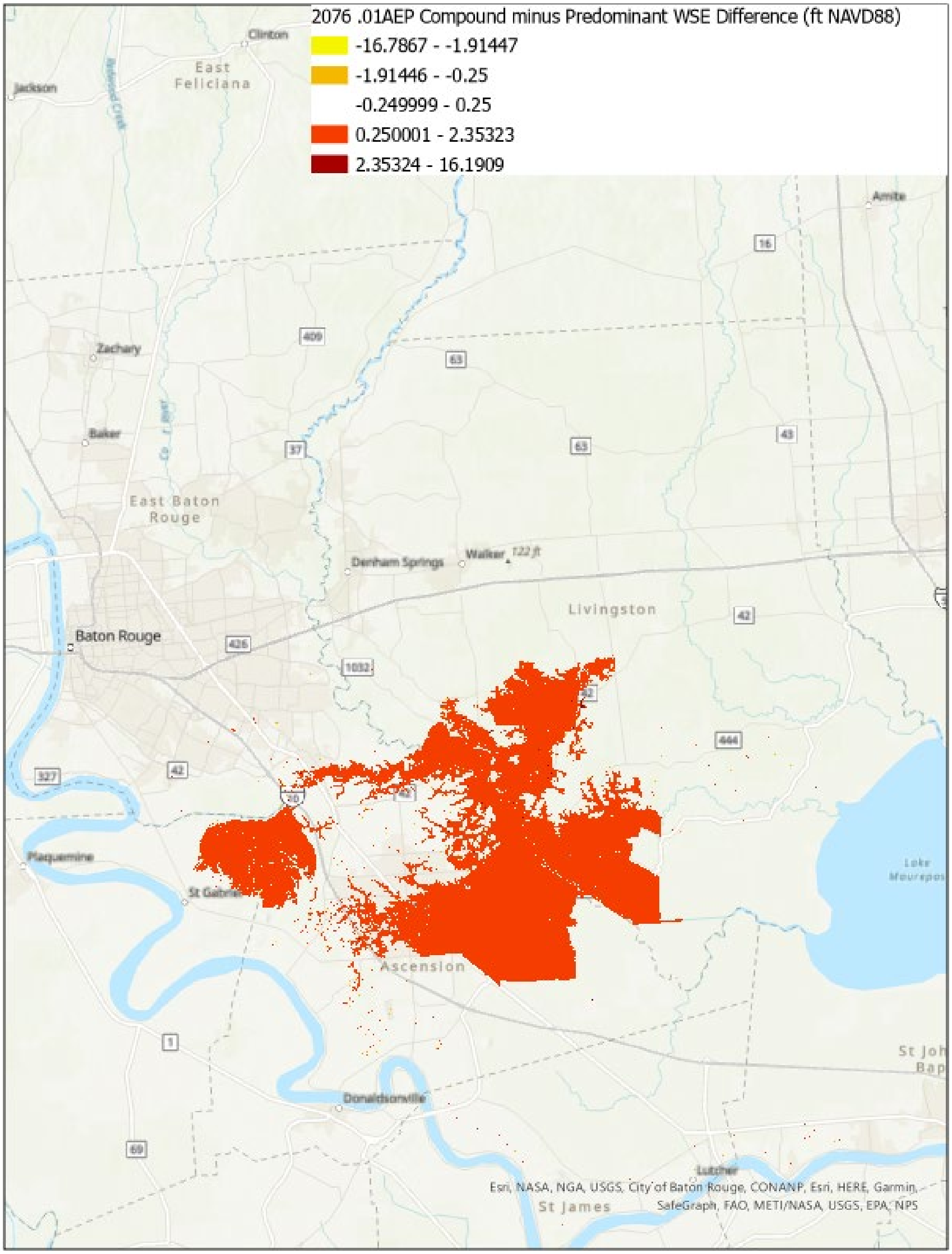

N
W
E
S
Legend
2076: 0.005 AEP Predominant Max WSE
0 - 5
5 - 10
10 - 30
30 - 60
60 - 120
120 - 250
0 3.75 7.5 15 Miles
Earthstar Geographics


N
S
W
E
Legend
2076: 0.002 AEP Predominant Max WSE
0 - 5
5 - 10
10 - 30
30 - 60
60 - 120
120 - 250
0 3.75 7.5 15 Miles

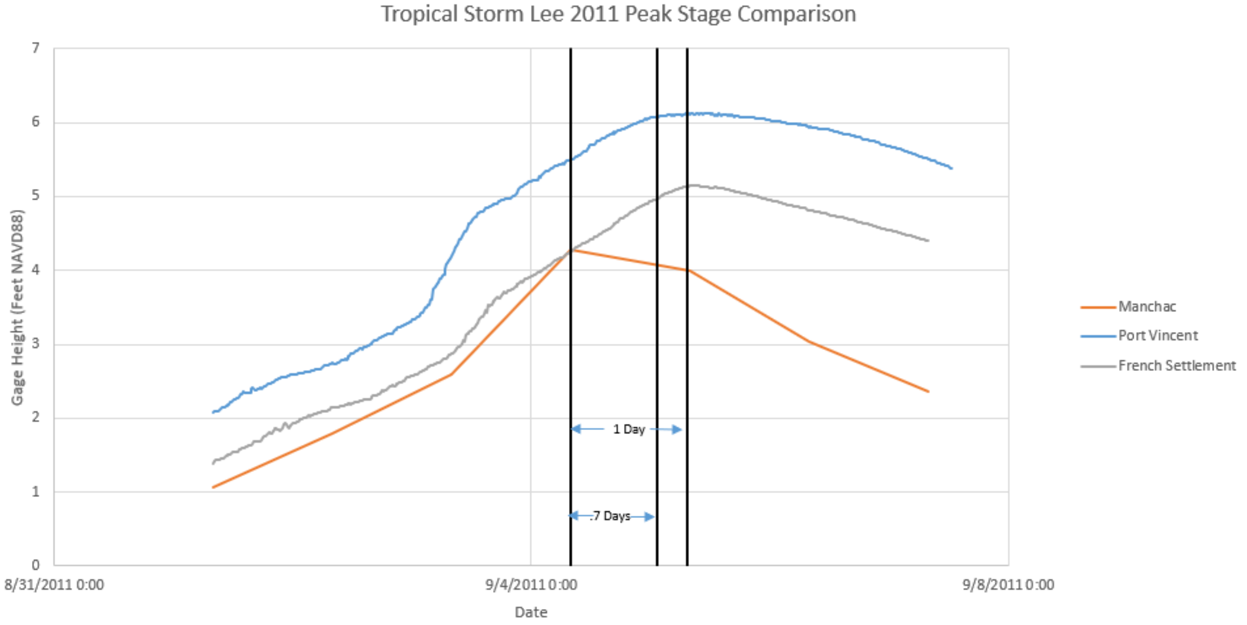
8.2 Annex H-2: Predominant versus Compound Flood Comparison Figures

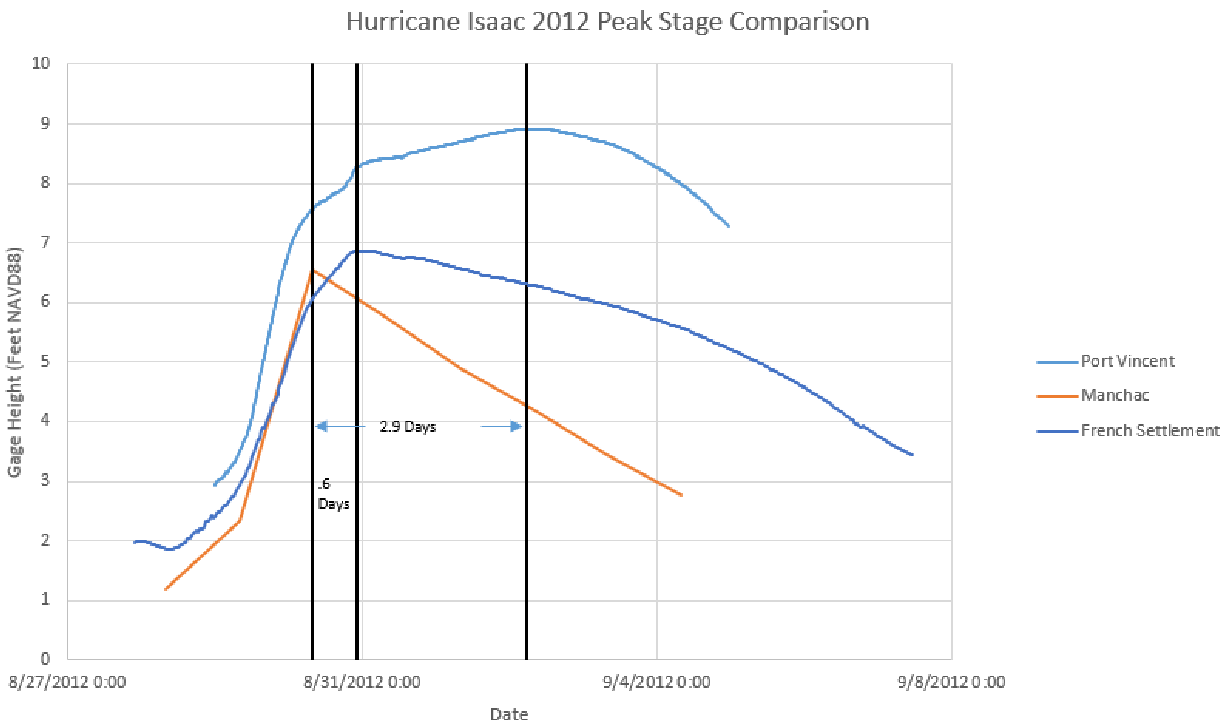


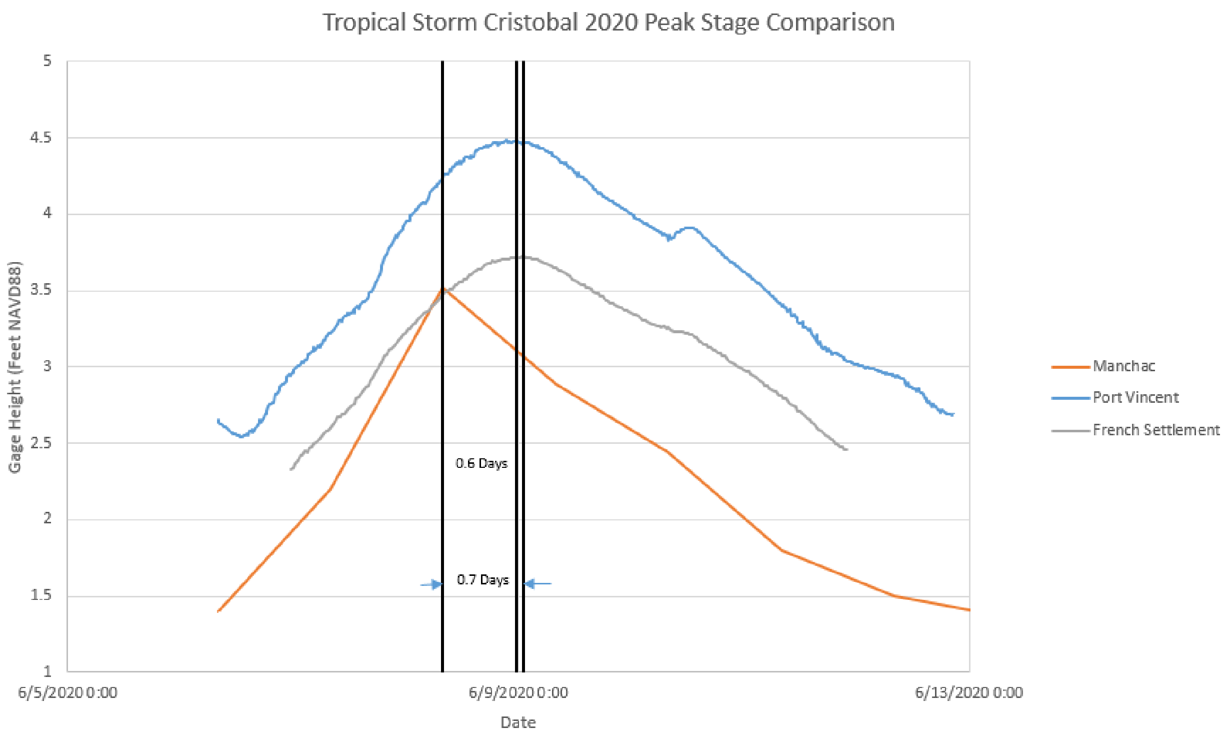

2076 .04AEP Compound minus Predominant WSE Difference (ft NAVD88)
-10.0128 - -1.99384
-1.99383 - -0.25
-0.249999 - 0.25
0.250001 - 2.06516
2.06517 - 15.2322
Clinton
East Feliciana
Jackson
Amite
Zachary
Baker
East Baton Rouge
Denham Springs
Walker
Livingston
Baton Rouge
Plaquemine
St Gabriel
Ascension
Donaldsonville
Lutcher
St James
Esri, NASA, NGA, USGS, City of Baton Rouge, CONANP, Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS

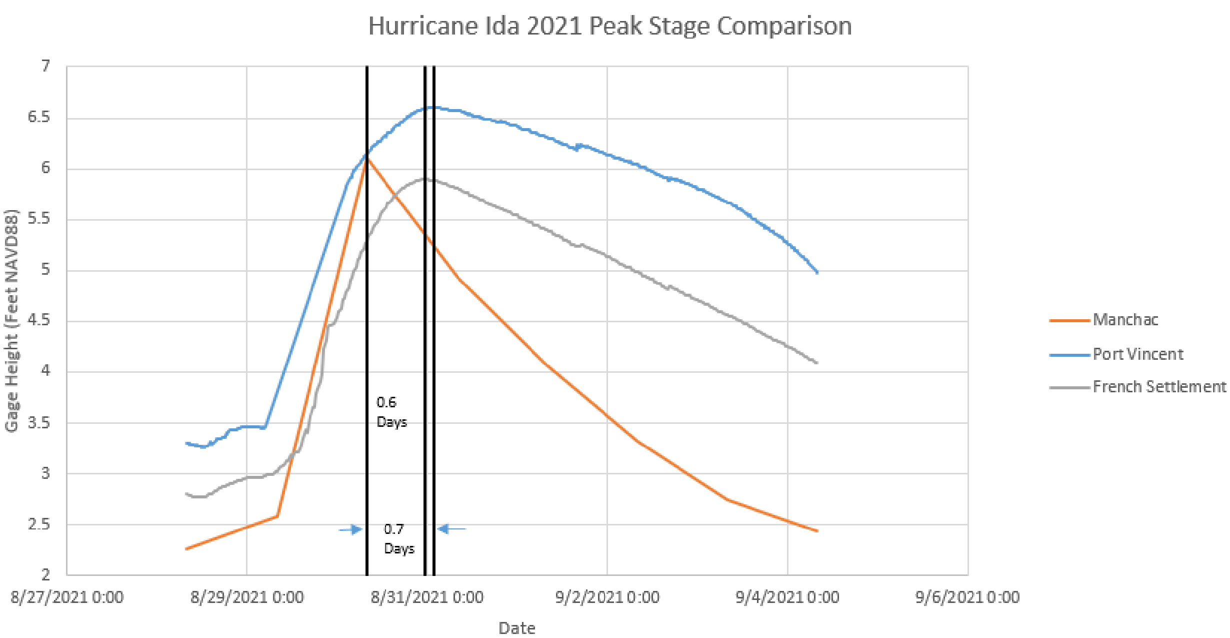

2076 .01AEP Compound minus Predominant WSE Difference (ft NAVD88)
-16.7867 - -1.91447
-1.91446 - -0.25
-0.249999 - 0.25
0.250001 - 2.35323
2.35324 - 16.1909
Clinton
East Feliciana
Jackson
Zachary
Baker
East Baton Rouge
Baton Rouge
Denham Springs
Walker
Livingston
Amite
Plaquemine
St Gabriel
Ascension
Donaldsonville
Lutcher
St James
Esri, NASA, NGA, USGS, City of Baton Rouge, CONANP, Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS

8.3 Annex H-3: Compound Flood Analysis - Gage Lag Time Plots

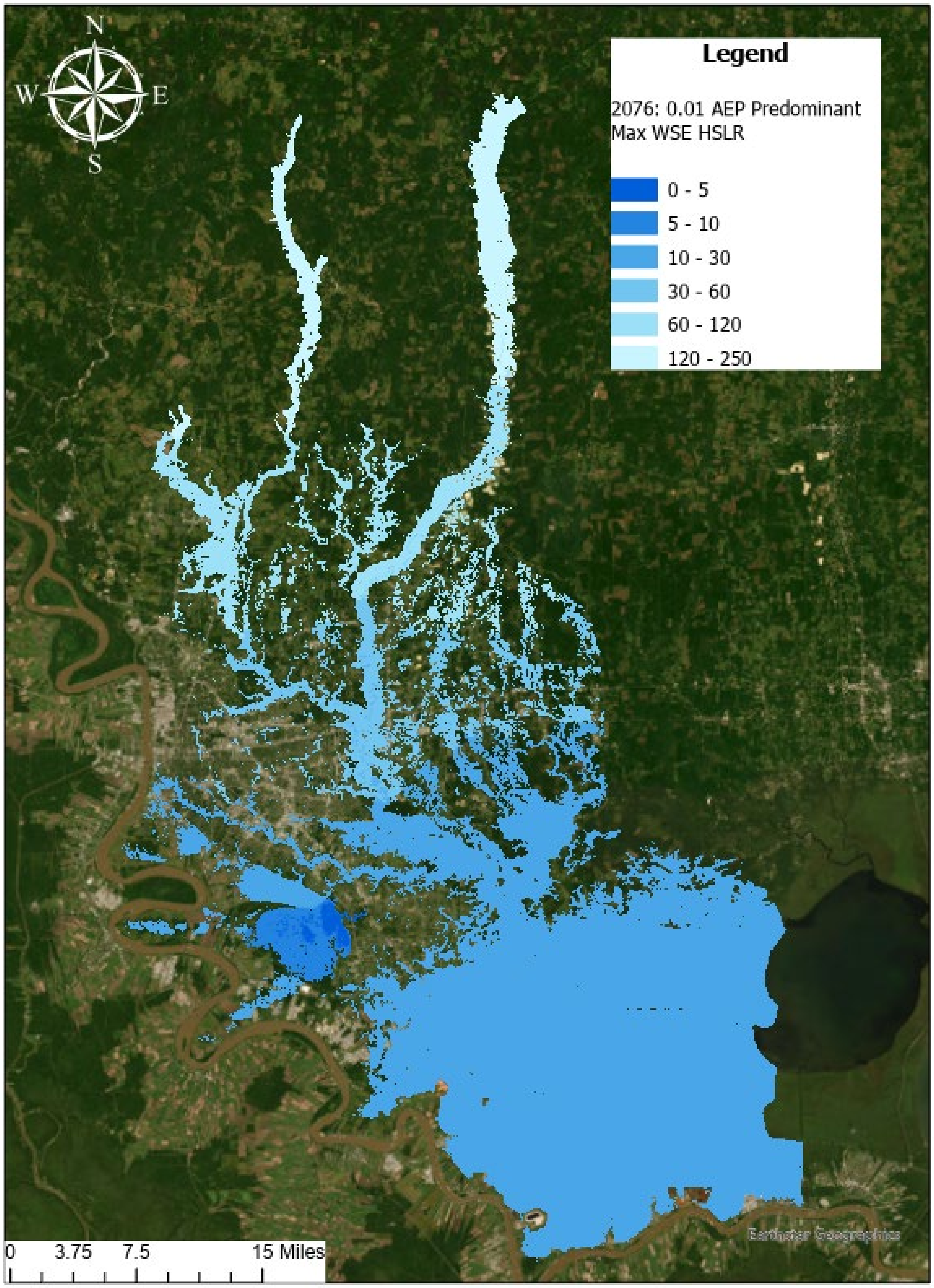


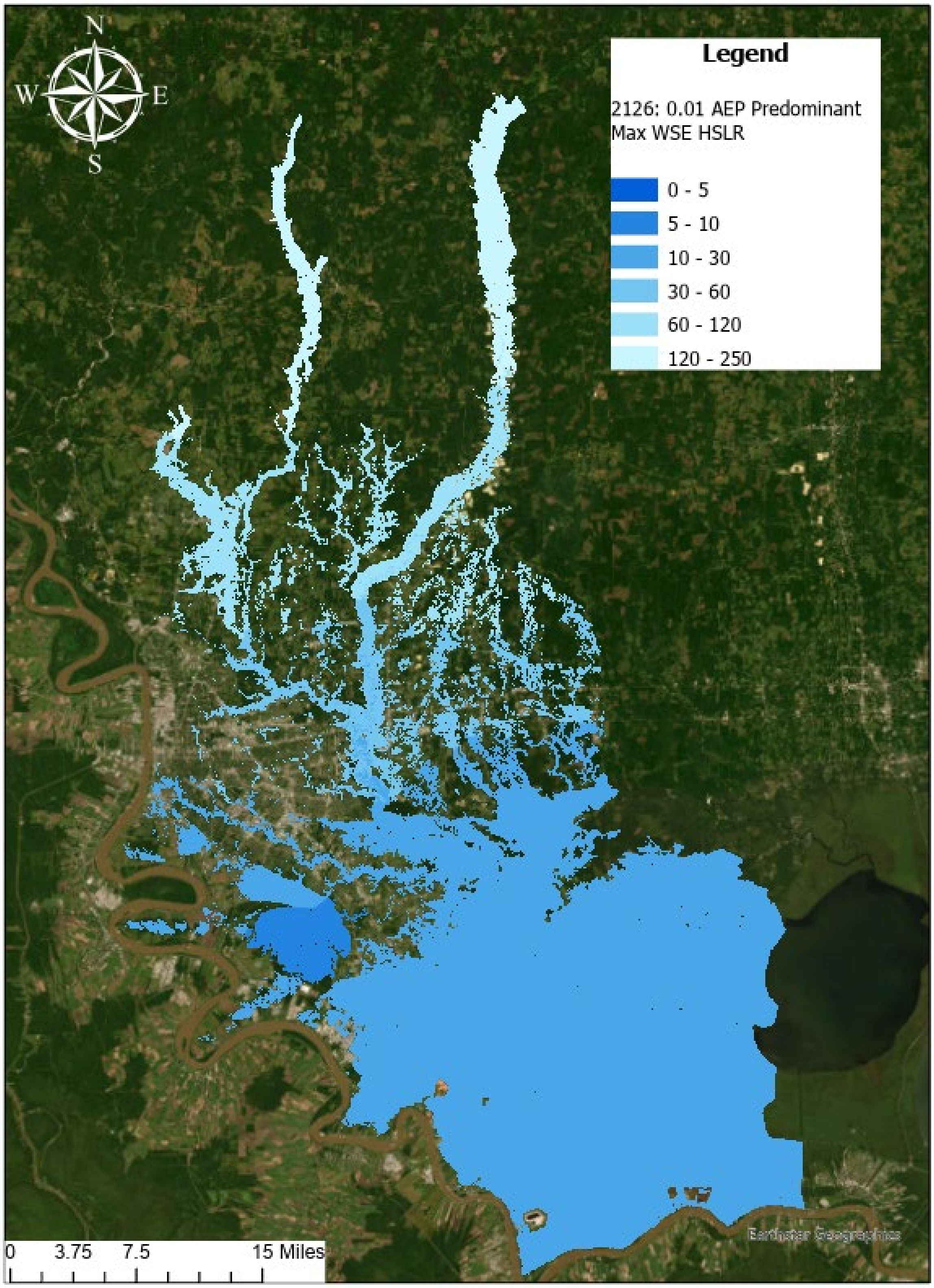



Tropical Storm Cristobal 2020 Peak Stage Comparison
Gage Height (Feet NAVD88)
5
4.5
4
3.5
3
2.5
2
1.5
1
0.6 Days
0.7 Days
6/5/2020 0:00
6/9/2020 0:00
6/13/2020 0:00
Date
Manchac
Port Vincent
French Settlement


Hurricane Ida 2021 Peak Stage Comparison
Gage Height (Feet NAVD88)
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
0.6 Days
0.7 Days
8/27/2021 0:00
8/29/2021 0:00
8/31/2021 0:00
9/2/2021 0:00
9/4/2021 0:00
9/6/2021 0:00
Date
Manchac
Port Vincent
French Settlement

8.4 Annex H-4: WSE Outputs for High Sea Level Rise Sensitivity Runs




N
W
E
S
Legend
2126: 0.01 AEP Predominant
Max WSE HSLR
0 - 5
5 - 10
10 - 30
30 - 60
60 - 120
120 - 250
Earthstar Geographics
0
3.75
7.5
15 Miles

8.5 Annex H-5: Hydrologic Parameters

Hydrologic Parameters for Baseline Conditions Year 2026

Subbasin	Initial Content	Saturated Content	Suction	Conductivity	Impervious %
AllenByu_HWY1032	0.24	0.34	6.55	0.042	14.723
AlligatorT_Bluff	0.25	0.35	6.99	0.034	24.689
AmiteDivCnl_C01	0.21	0.29	11.09	0.008	0.32278
AmiteDivCnl_C02	0.19	0.26	10.59	0.012	1.9516
AmiteDivC_HWY22	0.19	0.27	8.42	0.026	5.0764
AmiteRT34_HWY16	0.23	0.32	6.12	0.048	18.7578473
AmiteR_BarbByu	0.24	0.34	7.59	0.037	0.59844
AmiteR_BeaverCrk	0.24	0.33	6.45	0.043	0.31386
AmiteR_BluffCrk	0.22	0.31	7.29	0.082	0.98757
AmiteR_ChaneyBr	0.27	0.38	8.4	0.018	1.9461
AmiteR_ChinqCan	0.24	0.33	8.23	0.027	2.5637
AmiteR_ClearCrk	0.24	0.34	5.51	0.056	0.73317
AmiteR_ColBay	0.2	0.29	6.96	0.025	3.5710
AmiteR_C01	0.23	0.32	6.31	0.041	0.69007
AmiteR_C02	0.21	0.3	5.91	0.038	2.3832
AmiteR_C03	0.23	0.32	6.22	0.046	0.72344
AmiteR_C04	0.22	0.32	6.18	0.039	7.1112
AmiteR_C05	0.23	0.32	6.25	0.047	5.4095
AmiteR_C06	0.23	0.33	6.76	0.032	8.6628
AmiteR_C07	0.23	0.32	6.32	0.041	5.1488
AmiteR_C08	0.23	0.33	6.31	0.041	19.699
AmiteR_C09	0.23	0.32	6.31	0.054	2.9932
AmiteR_C10	0.23	0.32	6.3	0.041	13.018
AmiteR_C11	0.25	0.35	7.42	0.03	12.184
AmiteR_C12	0.23	0.32	6.43	0.041	14.810
AmiteR_C13	0.22	0.31	6.21	0.04	4.2200
AmiteR_C14	0.23	0.32	6.31	0.053	1.9264
AmiteR_C15	0.24	0.34	7.04	0.029	3.4939
AmiteR_DarlingCrk	0.24	0.33	6.45	0.049	0.79697
AmiteR_HendByu	0.16	0.22	8.77	0.02	7.8905
AmiteR_HWY16	0.21	0.3	9.06	0.021	2.5172
AmiteR_HWY22	0.25	0.35	8.87	0.027	0.83423
AmiteR_KingGByu	0.24	0.34	8.88	0.027	1.5132
AmiteR_L03	0.24	0.34	6.37	0.041	27.497
AmiteR_Magnolia	0.24	0.34	7.03	0.06	12.071
AmiteR_Maurepas	0.26	0.36	10.43	0.016	0.86512
AmiteR_PigeonCrk	0.21	0.3	7.73	0.06	0.74927
AmiteR_PtVincent	0.21	0.29	6.27	0.033	4.5773
AmiteR_RockyCrk	0.21	0.3	7.45	0.055	0.66443
AmiteR_R03	0.26	0.36	6.85	0.039	34.110
AmiteR_StateHwy10	0.21	0.3	6.58	0.047	0.49325
AmiteR_StateHwy37	0.2	0.28	7.2	0.06	0.65396
AmiteR_StateHwy432	0.22	0.31	6.58	0.041	0.56963
AmiteR_US_Div	0.04	0.05	3.77	0.004	2.4739
AmiteR_WhittenCrk	0.23	0.32	7.2	0.052	1.0736
AmiteR_17	0.24	0.34	6.86	0.06	1.1705
AmiteR_18	0.26	0.37	7.4	0.033	0.56497
AntiochC_LeeMrtn	0.25	0.35	6.56	0.042	1.1370
BeaverBr_CnMkt	0.23	0.32	6.55	0.042	13.484
BeaverBr_DuffRd	0.23	0.32	6.55	0.042	8.2960
BeaverBr_RR	0.23	0.32	6.55	0.042	6.6681
BeaverByuNP_Hoop	0.23	0.33	6.53	0.041	14.739

BeaverByuNP_US	0.22	0.31	6.56	0.042	10.364
BeaverByu_Denham	0.22	0.31	6.56	0.041	3.0422
BeaverByu_French	0.25	0.35	6.94	0.036	17.338
BeaverByu_GrnSp	0.24	0.33	6.51	0.04	23.236486
BeaverByu_Hooper	0.22	0.31	6.52	0.041	6.0753
BeaverByu_US_LOC	0.23	0.32	6.57	0.041	2.2699
BeaverByu_Wax	0.23	0.32	6.55	0.039	9.2804
BeaverCrk_01	0.28	0.39	6.12	0.049	1.3090
BeaverCrk_02	0.27	0.38	6.18	0.048	0.48949
BeaverCrk_03	0.27	0.38	5.98	0.05	0.49493
BeaverCrk_04	0.26	0.37	6.21	0.046	0.28041
BeaverCrk_05	0.24	0.34	6.12	0.047	0.48243
BeaverCrk_06	0.22	0.3	6.21	0.041	0.26139
BeaverCrk_07	0.22	0.31	6.35	0.041	0.32677
BeaverC2_CnMkt	0.22	0.32	6.55	0.042	17.116
BeaverC2_ForeRd	0.22	0.32	6.57	0.042	10.3381436
BeaverC2_HWY16	0.23	0.32	6.44	0.043	20.842
BeaverC2_Magnol	0.23	0.33	6.47	0.043	26.513
BeaverC2_Sprgfld	0.23	0.32	6.56	0.042	25.043
BeaverC3_DS_Pear	0.22	0.31	7.22	0.041	0.38158
BeaverC3_Jackson	0.25	0.36	7.31	0.042	1.0266
BeaverC3_LSandy	0.23	0.32	7.02	0.042	0.23095
BeaverC3_Milldal	0.25	0.35	6.75	0.042	0.73204
BeaverC3_Peairs	0.23	0.32	6.85	0.042	0.80608
BeaverC3_US_LOC	0.25	0.35	7.03	0.042	0.77363
BeaverPondByu_DS	0.23	0.32	6.44	0.039	0.30185
BeaverPondByu_US	0.25	0.35	6.56	0.041	0.27816
BFountainNP	0.23	0.33	6.79	0.039	27.468
BFountNBr_Boyd	0.3	0.42	11.83	0.011	72.1858883
BFountNBr_Lee	0.24	0.33	11.34	0.015	32.0528194
BFountSBr_BF	0.2	0.29	12.02	0.009	17.297
BFountSBr_Gour	0.23	0.32	12.27	0.008	45.999
BFountSBr_US	0.31	0.44	10.21	0.02	53.402
BFountT1_DS	0.22	0.32	7.22	0.035	16.7117172
BFountT1_Highlnd	0.24	0.34	6.66	0.041	37.865
BFount_BFSBr	0.2	0.28	12.41	0.007	52.696
BFount_Bluebon	0.21	0.29	8.42	0.034	35.483
BFount_Burbank	0.27	0.39	12.14	0.009	34.035
BFount_BurbankDr	0.22	0.31	7.58	0.034	34.082
BFount_ByuManch	0.19	0.26	11.15	0.015	6.2996
BFount_ElbowByu	0.17	0.23	11.01	0.016	31.328
BFount_Nich_DS	0.15	0.22	12.2	0.01	29.420
BFount_Nich_US	0.34	0.48	11.96	0.01	72.902
BFount_US_Trib	0.17	0.23	10.49	0.02	7.4834
BirchCrk_01	0.25	0.35	4.72	0.069	1.2671
BlackCrk_01	0.25	0.35	4.93	0.066	0.0019691
BlackCrk_02	0.2	0.29	6.39	0.048	0.37477
BlackCrk_03	0.25	0.35	5.18	0.062	1.0179
BlackCrk_04	0.25	0.35	4.94	0.065	1.1032
BlackCrk_05	0.23	0.32	5.6	0.057	0.19161
BlackCrk_06	0.21	0.3	6.62	0.043	1.1174
BlackCrk_07	0.21	0.29	6.42	0.046	0.35036
BlackCrk_08	0.24	0.33	6.04	0.05	1.5068
BlackCrk_09	0.24	0.33	5.71	0.058	1.3245
BLACKCR_CMB	0.26	0.37	6.45	0.041	0.34810
BLACKCR_HWY412	0.26	0.36	6.55	0.042	0.30503
BlackwtrBT1_BB	0.23	0.33	6.55	0.042	9.1557
BlackwtrBT1_Core	0.23	0.32	6.57	0.042	2.4212

BlackwtrBT1_Mcul	0.22	0.31	6.55	0.041	3.1923
BlackwtrBT2_BB	0.23	0.32	6.53	0.042	1.7124
BlackwtrBT2_DW	0.23	0.32	6.56	0.042	1.3900
BlackwtrBT3_US	0.23	0.32	6.46	0.043	2.2482
BlackwtrB_BBT1	0.23	0.32	6.59	0.041	2.0121
BlackwtrB_BBT2	0.22	0.31	6.56	0.042	1.7963
BlackwtrB_Comite	0.23	0.33	6.57	0.041	12.772
BlackwtrB_McCull	0.22	0.31	6.56	0.042	6.2855
BlackwtrB_US	0.22	0.31	6.48	0.041	0.54737
BlackwtrT3_DS	0.22	0.31	6.53	0.043	1.4630
BluffCrk_AmiteR	0.23	0.32	6.54	0.044	0.73484
BluffCrk_01	0.24	0.33	6.85	0.039	0.65580
BluffCrk_02	0.22	0.31	7.15	0.037	0.52837
BluffCrk_03	0.19	0.27	7.63	0.033	0.75950
BluffCrk_04	0.2	0.28	7.43	0.035	0.17941
BluffCrk_05	0.2	0.28	7.41	0.035	0.40574
BluffCrk_06	0.2	0.28	7.36	0.035	0.64808
BluffCrk_07	0.21	0.3	7.22	0.036	0.59503
BluffSwamp_Gage	0.23	0.32	7.92	0.027	30.022
ByuBraud_HWY30	0.13	0.19	10.83	0.019	16.177
ByuBraud_HWY74	0.11	0.15	12.24	0.01	20.580
ByuBraud_US_LOC	0.18	0.25	10.15	0.029	9.9852
ByuDuplant_LeeDr	0.28	0.39	8.81	0.025	23.718
ByuDuplant_NrDaw	0.26	0.37	8.13	0.03	21.230
ByuManch_Airline	0.21	0.3	6.76	0.038	30.314
ByuManch_BFount	0.19	0.27	9.48	0.022	9.6016
ByuManch_Cotton	0.22	0.32	6.44	0.039	8.3104
ByuManch_Gator	0.19	0.27	10.69	0.029	12.217
ByuManch_NrAmite	0.22	0.31	6.85	0.04	6.5531
ByuManch_NrLiPra	0.23	0.32	6.46	0.04	3.6651
ByuManch_NrMSRiv	0.2	0.28	8.28	0.034	16.124
ByuManch_Perkins	0.23	0.32	6.43	0.036	30.1701488
ByuManch_Welsh	0.21	0.3	6.41	0.039	25.997
ByuPaul_HWY30	0.18	0.25	10.75	0.034	1.0466
ByuPaul_US_HWY30	0.16	0.23	10.67	0.028	2.9060
ByuPaul_US_LOC	0.16	0.23	11.38	0.023	2.4796
CampCreek_HWY42	0.24	0.34	6.69	0.042	0.83508
ChaneyBr_HWY16	0.23	0.32	6.49	0.041	2.9566
ChinqCan_C01	0.26	0.37	10.85	0.015	0.59205
ChinqCan_C02	0.25	0.35	9.94	0.018	2.8574
ClayCut_Airline	0.3	0.43	9.34	0.025	70.440
ClayCut_AntiochR	0.24	0.33	6.9	0.041	42.587
ClayCut_CalRd	0.26	0.37	7.56	0.036	47.481
ClayCut_Inns	0.24	0.34	6.64	0.041	52.619
ClayCut_JacksB	0.27	0.38	7.92	0.034	52.137
ClayCut_NrAmite	0.23	0.33	6.4	0.041	9.0344
ClayCut_Siegen	0.28	0.4	8.36	0.031	68.083
ClayCut_US_Tiger	0.24	0.34	6.85	0.041	20.025
ClaytonByuT1	0.23	0.32	6.54	0.043	6.9108
ClaytonByu_Bend	0.22	0.31	6.4	0.044	14.714
ClearCrkT1_01	0.25	0.35	6.56	0.042	0.22820
ClearCrkT1_02	0.25	0.34	6.55	0.042	0.25593
ClearCrk_01	0.25	0.36	6.32	0.046	0.26314
ClearCrk_02	0.25	0.35	6.39	0.044	0.68698
ClearCrk_03	0.23	0.32	6.54	0.04	1.1078
ClearCrk_04	0.24	0.34	6.55	0.042	0.79159
ClintonAllenLat	0.23	0.32	6.54	0.042	10.857
ClyellCrkNP	0.24	0.34	6.54	0.042	1.4517

ClyellT9_DS_FL	0.26	0.36	6.57	0.042	3.1219
ClyellT9_FL	0.26	0.36	6.56	0.042	0.74846
Clyell_CB	0.24	0.34	7.03	0.039	1.4374
Clyell_DS_I12	0.25	0.35	6.55	0.042	3.1873
Clyell_DS_LigoLn	0.22	0.31	6.51	0.043	1.2261676
Clyell_FLBlvd	0.25	0.35	6.56	0.042	1.7015
Clyell_I12	0.24	0.34	6.56	0.042	2.3278
Clyell_JoelWatts	0.24	0.34	6.56	0.042	1.1747
Clyell_LigoLn	0.24	0.34	6.54	0.042	1.5288
Clyell_LilClyell	0.24	0.34	6.57	0.042	1.0330
Clyell_LodStafrd	0.23	0.33	6.48	0.041	0.80894
Clyell_US_LOC	0.24	0.33	6.57	0.042	0.87043
Clyell_W_Hood	0.24	0.34	6.57	0.042	0.29336
ColtonCrk_HWY16	0.23	0.32	6.39	0.041	19.577
ColyellBay	0.24	0.33	7.41	0.037	1.7259
COMITE_atComite	0.22	0.31	7	0.088	1.3061
COMITE_Baker	0.23	0.33	6.76	0.071	3.1388
COMITE_DenhamSpr	0.25	0.34	6.47	0.055	13.447
COMITE_dsJOORRD	0.25	0.35	7.17	0.036	10.715
COMITE_dsLA37	0.23	0.32	6.43	0.044	14.171
COMITE_DS_OB	0.22	0.31	5.98	0.084	2.7268
COMITE_HooperRd	0.24	0.34	6.76	0.058	9.4396
COMITE_Hurricane	0.23	0.32	6.55	0.039	8.3836
COMITE_nrComite	0.26	0.37	7.74	0.053	3.6714
COMITE_RR	0.23	0.32	6.43	0.055	3.1842
COMITE_usLA37	0.25	0.36	7.23	0.032	15.661
COMITE_US_OB	0.22	0.3	6.17	0.039	3.5024
COMITE_Zachary	0.23	0.32	6.48	0.056	1.4482
CooperMillB_BC	0.26	0.36	6.5	0.041	2.5463
CooperMillB_Midw	0.24	0.34	6.55	0.042	5.6997
CooperMillB_UWB	0.22	0.31	6.07	0.038	0.88789
CorpCanalNP	0.3	0.42	10.32	0.018	57.073
CorpCanal_Myrtle	0.32	0.45	9.55	0.023	68.716
CorpCanal_Stanfrd	0.34	0.48	10.42	0.013	47.923
CorpCanal_State	0.33	0.46	10.23	0.017	55.738
DarlingCrk_AmiteR	0.2	0.29	7.95	0.041	0.80363
DarlingCrk_01	0.25	0.35	5.29	0.062	0.58469
DarlingCrk_02	0.25	0.34	4.84	0.066	0.49348
DarlingCrk_03	0.25	0.35	4.89	0.066	0.33802
DarlingCrk_04	0.24	0.34	5.42	0.059	0.33313
DarlingCrk_05	0.24	0.34	5.44	0.058	0.59307
DarlingCrk_06	0.24	0.34	6.25	0.059	0.32537
DarlingCrk_07	0.24	0.34	5.23	0.063	0.43465
DarlingCrk_08	0.23	0.33	5.45	0.059	0.73648
DarlingCrk_09	0.22	0.3	5.81	0.054	0.85908
DarlingCrk_10	0.23	0.33	5.5	0.057	0.97239
DarlingCrk_11	0.19	0.27	7.02	0.043	0.35708
DarlingCrk_12	0.19	0.26	8.12	0.036	0.68996
DarlingCrk_13	0.2	0.28	7.58	0.041	2.0228
DawsonCr_Bluebon	0.27	0.38	7.97	0.032	38.771
DawsonCr_College	0.3	0.42	9.13	0.026	44.4804083
DawsonCr_GovtSt	0.3	0.42	9.04	0.027	56.107
DawsonCr_Hund_DS	0.28	0.4	8.35	0.03	35.505
DawsonCr_QuailDr	0.27	0.38	8.23	0.032	41.939
DawsonCr_WardCr	0.28	0.4	8.49	0.03	53.245
DraughnsC_French	0.24	0.34	6.57	0.037	12.639
DraughnsC_GrnSpr	0.23	0.32	6.55	0.041	12.349
DraughnsC_MagBr	0.22	0.32	6.56	0.041	21.651

DuffByu_Jackson	0.23	0.33	6.64	0.042	1.7328
DuffByu_PtHud	0.26	0.36	6.58	0.042	0.29514
DuffB_DS_Jack	0.24	0.33	6.58	0.04	1.0838
DumplinC_DS_RR	0.24	0.34	6.57	0.042	30.589
DumplinC_I12	0.23	0.33	6.46	0.041	18.758
DumplinC_RR	0.22	0.31	6.53	0.042	13.630
DumplinC_US_LOC	0.22	0.31	6.55	0.042	14.160
DunnCrk_01	0.26	0.36	6.65	0.043	0.0148556
DunnCrk_02	0.23	0.32	6.9	0.041	0.38838
DunnCrk_03	0.26	0.36	5.59	0.055	0.79527
DunnCrk_04	0.25	0.36	5.57	0.055	0.56951
EastForkAmite_01	0.25	0.35	6.43	0.043	1.0971
EastForkAmite_02	0.27	0.38	6.16	0.048	0.54958
EastForkAmite_03	0.26	0.37	5.83	0.053	0.60027
EastForkAmite_04	0.26	0.37	5.87	0.051	0.46100
EFDumplin_Corbin	0.22	0.31	6.55	0.042	5.3992
EFDumplin_RR	0.23	0.32	6.52	0.042	19.431
ELatCypB_Lavey	0.26	0.37	6.57	0.042	26.556
ELatCypB_LCB	0.23	0.33	6.63	0.041	19.207
ElbowBayou	0.14	0.2	10.91	0.015	4.1475
ElbowByu_Burbank	0.18	0.25	10.33	0.022	6.4746
ENGINEERDEPOT_DS	0.25	0.35	6.73	0.041	32.4815429
ENGINEERDEPOT_US	0.28	0.39	7.8	0.034	48.736
FeldersB_BrownRd	0.25	0.35	6.57	0.042	5.0476
FeldersB_DSJMay	0.24	0.34	6.6	0.042	6.8146
FeldersB_WC	0.23	0.33	7.18	0.042	20.3136039
FlanaganByu_SC	0.24	0.33	6.62	0.042	1.1087
FlanaganByu_01	0.24	0.34	7.33	0.041	0.10746
FlatLake	0.15	0.22	9.86	0.014	1.6352
GatorByu_Gage	0.17	0.24	9.64	0.019	6.6041
GatorByu_USGage	0.14	0.2	11.21	0.015	6.0133
GraysCrkBr_BMcD	0.25	0.36	6.55	0.042	34.789
GraysCrkBr_Dunn	0.24	0.34	6.3	0.046	21.193
GraysCrkBr_I12	0.24	0.33	6.57	0.042	28.892
GraysCrkBr_RR	0.25	0.36	6.45	0.041	24.885
GraysCrkBr_USI12	0.24	0.34	6.57	0.042	15.633
GraysCrkLat_RR	0.23	0.33	6.45	0.043	32.240
GraysCrk_Hwy1033	0.24	0.34	6.49	0.043	5.0771
GraysCrk_HWY16	0.25	0.35	6.52	0.042	13.373
GraysCrk_I12	0.24	0.34	6.57	0.042	25.698
GraysCrk_Julban	0.22	0.31	5.83	0.037	15.817
GraysCrk_NrAmite	0.24	0.34	6.53	0.042	3.9243
GraysCrk_RR	0.24	0.34	6.56	0.042	29.655
GraysCrk_US	0.25	0.35	6.55	0.042	31.059
GraysCrk_WaxD	0.24	0.33	6.57	0.042	24.438
HannaC_PrideBar	0.21	0.3	7.19	0.037	0.39341
HareLat_Airline	0.26	0.37	7.5	0.036	44.206
HareLat_OldHmd	0.26	0.37	7.32	0.034	49.169
HendByu_DSPtVinc	0.24	0.34	6.82	0.032	8.8496
HendByu_HWY431	0.22	0.31	7.93	0.029	6.6224
HendByu_Joboy	0.24	0.33	6.57	0.042	25.642
HendByu_NrPtVinc	0.24	0.34	6.52	0.039	22.903462
HendByu_US_Timbr	0.24	0.34	6.57	0.036	18.8210413
HogBayou_BC	0.26	0.37	6.53	0.042	0.0410698
HoneyCut_East	0.26	0.37	7.02	0.039	46.597
HoneyCut_NrAmite	0.26	0.37	7.12	0.038	28.236
HoneyCut_West	0.27	0.38	6.95	0.04	45.153
HornsbyCrk_CnMkt	0.24	0.34	6.52	0.042	0.87147

HornsbyCrk_DSCan	0.25	0.35	6.56	0.042	1.2479
HornsbyCrk_FLBd	0.24	0.34	6.55	0.042	4.7545
HornsbyCrk_HCT1	0.23	0.32	6.48	0.043	1.9965
HornsbyCrk_HCT3	0.23	0.32	6.55	0.042	0.80977
HornsbyCT1_Corbn	0.23	0.32	6.53	0.042	1.2429
HornsbyCT3_Corbn	0.22	0.31	6.49	0.043	0.83705
HornsbyCT3_HC	0.22	0.31	6.53	0.042	1.1953
HornsbyC_I12	0.24	0.34	6.5	0.041	5.8602
HubByu_DS_GS_PH	0.22	0.31	6.53	0.041	1.5891
HubByu_GrnwelSpr	0.22	0.31	6.52	0.042	4.7680
HubByu_GS_PtHud	0.23	0.32	6.56	0.041	1.6434
HubByu_Peairs	0.22	0.31	6.47	0.043	0.17180
HunterByu_01	0.2	0.28	7.58	0.034	0.11622
HunterByu_02	0.2	0.28	7.46	0.034	0.20264
HunterByu_03	0.22	0.31	6.96	0.04	0.11391
HunterByu_04	0.21	0.29	7.41	0.034	0.72964
HunterByu_05	0.21	0.29	7.25	0.036	0.42069
HURRICANE_dsJOOR	0.25	0.36	7.2	0.038	37.3431941
HURRICANE_HOWELL	0.28	0.39	7.77	0.035	39.5094315
HURRICANE_Joor	0.27	0.38	8.02	0.034	33.617
HURRICANE_Presct	0.26	0.36	7.19	0.039	37.593
HURRICANE_Wildwd	0.27	0.37	7.66	0.036	47.5165675
IndianByu_PtHud	0.25	0.35	7.5	0.042	1.0859
IndianByu_UWB	0.24	0.34	7.54	0.042	0.89337
JacksB_Claycut	0.25	0.35	6.73	0.041	51.0796345
JacksB_ParkFor	0.3	0.42	8.4	0.031	55.294
JoinerCrk_01	0.19	0.26	6.46	0.048	0.45325
JoinerCrk_02	0.25	0.35	4.83	0.067	0.15623
JoinerCrk_03	0.24	0.34	4.84	0.067	0.75277
JoinerCrk_04	0.25	0.35	4.7	0.069	1.2911
JoinerCrk_05	0.23	0.32	5.47	0.059	0.45938
JoinerCrk_06	0.22	0.31	6.11	0.054	0.62268
JonesBayou	0.24	0.34	7.59	0.041	4.4986
JonesCr_Airline	0.34	0.48	10.81	0.017	70.532
JonesCr_FLBlvd	0.28	0.39	8.35	0.032	49.452
JonesCr_Mont	0.28	0.4	8.71	0.029	55.750
JonesCr_NrAmite	0.23	0.33	6.34	0.036	28.484
JonesCr_OldHamd	0.27	0.38	7.51	0.036	41.540
JonesCr_ONealLn	0.25	0.36	6.89	0.035	42.330
JonesCr_WeinerCr	0.27	0.39	7.73	0.034	46.875
KnoxBr_Firewood	0.26	0.37	7.07	0.036	53.614348
KnoxBr_ONealLn	0.24	0.34	6.47	0.041	39.615
LCypByu_Comite	0.25	0.35	7.11	0.039	13.959
LCypByu_DS_Lavey	0.21	0.3	6.9	0.039	8.9461
LCypByu_GBL	0.27	0.38	8.58	0.033	25.915
LCypByu_Hooper	0.23	0.33	7.48	0.041	11.256
LCypByu_Lavey	0.24	0.34	7.21	0.04	20.359
LCypByu_Thomas	0.24	0.33	7.3	0.041	8.1149
LCypByu_US_SL	0.25	0.35	7.02	0.041	16.664
LilClyell_DS_I12	0.24	0.34	7.68	0.039	4.8898
LilClyell_I12	0.24	0.33	6.51	0.042	7.5698
LilClyell_L01	0.25	0.36	6.53	0.043	8.6743
LilClyell_Prloux	0.22	0.31	8.22	0.042	7.8638
LilClyell_Range	0.23	0.33	6.53	0.043	23.691
LilClyell_RangLn	0.24	0.33	7.35	0.042	1.7862
LilClyell_Satsu	0.24	0.34	6.89	0.042	3.2243
LilSndyC2_DS_Jac	0.22	0.31	7.32	0.041	0.90336
LilSndyC2_DS_Mil	0.23	0.32	6.64	0.041	3.0768

LilSndyC2_DS_Per	0.23	0.32	6.46	0.041	0.75879
LilSndyC2_Jack	0.23	0.32	6.62	0.041	0.63725
LilSndyC2_Lib	0.23	0.32	6.33	0.044	0.54631
LilSndyC2_Milld	0.22	0.31	6.68	0.042	1.0885
LilSndyC2_Peairs	0.23	0.32	6.59	0.041	1.1749
LilSndyC2_US_Jac	0.23	0.33	6.89	0.041	0.79547
LilSndyC2_US_LOC	0.21	0.3	7.32	0.036	0.38812
LilSndyC2_Wind	0.23	0.32	6.48	0.043	0.58583
LittleSandyCrk_01	0.2	0.28	7.42	0.035	0.86589
LittleSandyCrk_02	0.2	0.29	7.33	0.035	0.81863
LittleSandyCrk_03	0.19	0.27	7.57	0.033	0.66558
LittleSandyCrk_04	0.2	0.28	7.53	0.034	0.39079
LittleSandyCrk_05	0.2	0.28	7.46	0.035	0.30085
LittleSandyCrk_06	0.21	0.29	7.14	0.037	0.29685
LivelyBT_FL	0.29	0.41	8.32	0.032	56.229
LivelyBT_LB	0.27	0.38	7.21	0.039	50.357
LivelyB_FLBlvd	0.28	0.39	7.72	0.035	39.952
LivelyB_HoneyCut	0.28	0.39	7.6	0.036	43.403
LivelyB_LBT	0.26	0.37	7.36	0.037	55.135
LivelyB_Pvt	0.25	0.36	6.57	0.042	10.351
LongSlashBranch	0.24	0.34	6.32	0.046	41.730
LSU_NP_MaySt	0.25	0.35	7.15	0.029	34.950
LSU_NP_Stanfrd	0.16	0.22	4.76	0.019	19.399
LWhiteByu_Comite	0.25	0.35	7.25	0.041	15.384
LWhiteByu_Pettit	0.23	0.33	7.57	0.041	5.8383
LWhiteByu_US_Pet	0.24	0.34	7.77	0.041	8.9864
MidClyellT3	0.23	0.32	6.57	0.042	4.7465
MidClyellT5_CnMk	0.23	0.32	6.52	0.042	7.3276483
MidClyellT5_MC	0.23	0.33	6.55	0.042	4.3389
MidClyellT5_Sprg	0.22	0.31	6.53	0.042	2.8569
MidClyellT6_GalG	0.24	0.33	6.55	0.042	18.635
MidClyellT6_MC	0.22	0.31	6.54	0.042	5.2490
MidClyell_CB	0.25	0.35	6.94	0.04	1.5404
MidClyell_CnMkt	0.24	0.33	6.5	0.043	1.7291
MidClyell_FLBlvd	0.23	0.32	6.57	0.042	5.8383
MidClyell_HoodRd	0.24	0.34	6.56	0.042	0.88321
MidClyell_I12	0.24	0.34	6.59	0.041	9.6887
MidClyell_MCT1	0.23	0.32	6.5	0.043	1.4727
MidClyell_MCT3	0.23	0.32	6.57	0.042	1.3646
MidClyell_MCT5	0.24	0.34	6.56	0.042	6.0060
MidClyell_MCT6	0.23	0.32	6.55	0.042	7.6729
MidClyell_TylrBy	0.24	0.34	6.55	0.042	3.0558
MidClyell_US_LOC	0.21	0.29	7.25	0.04	1.1465
MidClyell_WeissR	0.23	0.32	6.54	0.042	0.77599
MillCrk_CarsonRd	0.23	0.32	6.51	0.041	1.9742
MillCrk_MahoneyRd	0.2	0.28	7.47	0.034	0.55722
MillCrk_PrideBar	0.22	0.31	6.36	0.039	1.0121
MillC_SandyC	0.23	0.32	6.57	0.042	0.83369
MillersCT_I12	0.24	0.34	6.57	0.042	26.636
MillersCT_MC	0.24	0.33	6.45	0.041	36.358
MillersCT_UnT	0.24	0.34	6.55	0.043	44.669
MillersC_Julban	0.25	0.35	6.54	0.042	14.935
MolerB_CnMkt	0.22	0.31	6.56	0.042	2.0932
MolerB_Springfld	0.22	0.31	6.55	0.042	7.5495
MolerB_WC	0.21	0.3	6.5	0.041	8.2659
MuddyCrk_Henry	0.25	0.35	6.65	0.041	31.573
MuddyCrk_HWY42	0.24	0.34	6.6	0.04	19.8114269
MuddyCrk_LilPra	0.25	0.35	6.52	0.039	20.079

MuddyCrk_NrManch	0.25	0.35	6.71	0.038	14.587
MuddyCrk_NrOakGr	0.25	0.36	6.57	0.037	20.0852463
NBrWardsCr_atBR	0.28	0.39	8.14	0.032	47.344
NBrWardsCr_FL	0.33	0.46	10.08	0.021	64.625
NBrWardsCr_Hare	0.31	0.43	9.44	0.025	58.947
NBrWardsCr_I10	0.28	0.39	8.07	0.033	46.571
NewR_Maurepas	0.29	0.41	11.78	0.006	0.0227242
ROBERTCN_dsJOOR	0.23	0.32	6.88	0.041	10.771
ROBERTCN_Grnwell	0.25	0.35	7.49	0.037	36.330
ROBERTCN_Joor	0.23	0.32	6.87	0.042	11.061
ROBERTCN_T	0.24	0.33	6.74	0.041	36.252
ROBERTCN_US_LOC	0.26	0.36	7.06	0.039	30.201
RobertsByu_01	0.2	0.28	7.54	0.033	1.3567
RobertsByu_02	0.19	0.27	7.62	0.032	0.15016
RobertsByu_03	0.2	0.27	7.58	0.033	0.22279
RobertsByu_04	0.2	0.28	7.25	0.036	0.18000
SandyCrk_01	0.24	0.34	6.78	0.04	1.0143
SandyCrk_02	0.24	0.33	6.77	0.039	1.3716
SandyCrk_03	0.22	0.3	7.05	0.036	0.23185
SandyCrk_04	0.25	0.35	6.55	0.042	0.25371
SandyCrk_05	0.25	0.35	6.55	0.042	0.91705
SandyCrk_06	0.24	0.33	6.64	0.041	0.81362
SandyCrk_07	0.25	0.34	6.31	0.044	0.88330
SandyCrk_08	0.23	0.33	6.58	0.04	0.79449
SandyCrk_09	0.24	0.34	6.52	0.043	0.17275
SandyCrk_10	0.21	0.3	6.37	0.041	0.68851
SandyCrk_11	0.25	0.35	6.47	0.043	0.0819601
SandyCrk_12	0.22	0.31	6.62	0.041	1.1217
SandyCrk_13	0.22	0.31	6.89	0.041	0.60896
SandyCrk_14	0.21	0.29	7.41	0.036	0.41164
SandyCrk_15	0.21	0.3	7.84	0.039	0.0979339
SandyCrk_16	0.2	0.28	7.43	0.035	0.24939
SandyCrk_17	0.22	0.31	6.79	0.04	0.12967
SandyCrk_18	0.22	0.31	6.61	0.042	0.61230
SandyCrk_19	0.21	0.3	7.08	0.038	0.24765
SandyCrk_20	0.22	0.31	7	0.039	0.60173
SandyC_AlphonFor	0.22	0.3	5.87	0.05	0.45016
SandyC_BeaverPnd	0.23	0.33	6.5	0.04	1.2173
SandyC_FB	0.24	0.34	6.48	0.043	0.20566
SandyC_GrnwelSpr	0.23	0.32	6.37	0.043	1.8158
SandyC_MillC	0.23	0.33	6.51	0.042	0.63514
SandyC_PrideBay	0.23	0.33	6.44	0.041	2.1578
SandyC_StnyPtBur	0.23	0.32	6.47	0.041	0.95215
SandyC_UN3SC	0.25	0.35	6.51	0.043	0.28040
SandyRun_01	0.25	0.35	4.78	0.068	0.64430
SandyRun_02	0.24	0.34	5.07	0.064	0.56290
SandyRun_03	0.22	0.31	5.77	0.055	0.87739
SandyRun_04	0.19	0.27	6.41	0.048	0.86224
SandyRun_05	0.2	0.29	6.28	0.05	0.44846
SandyRun_06	0.2	0.28	6.47	0.048	0.62503
SandyRun_07	0.24	0.33	5.55	0.06	0.15926
SandyRun_08	0.22	0.31	6.74	0.045	0.18695
ScalousCr	0.21	0.29	7.46	0.036	0.36214
SCanal_Dyer	0.23	0.32	8.61	0.042	2.6231
SCanal_Plank	0.24	0.34	7.4	0.041	1.4444
ShoeCT1_SC	0.24	0.34	6.56	0.042	24.160
ShoeCT1_US_LOC	0.25	0.35	7.09	0.039	23.794
ShoeC_Comite	0.24	0.34	6.57	0.037	11.666

ShoeC_DS_Hooper	0.23	0.32	6.52	0.042	16.075
ShoeC_Gurney	0.25	0.35	6.49	0.041	7.5678
ShoeC_Hooper	0.26	0.36	7.24	0.038	14.541
ShoeC_Pecos	0.24	0.34	6.59	0.039	14.807
ShoeC_SCT1	0.23	0.32	6.73	0.041	10.928
SouthCanal_Div	0.23	0.33	8.5	0.04	7.3115
SouthCanal_HWY19	0.24	0.33	9.11	0.039	10.635
SOUTHLATERAL	0.25	0.35	6.72	0.042	27.981
SouthSandyRun_01	0.25	0.35	4.64	0.069	0.0017219
SouthSandyRun_02	0.25	0.35	5.14	0.062	0.19926
SouthSandyRun_03	0.25	0.35	5.02	0.064	0.71773
SouthSandyRun_04	0.25	0.35	5.04	0.064	1.6888
SpillersCT2_	0.25	0.35	7.33	0.037	1.9036
SpillersCT2_SC	0.23	0.32	6.52	0.038	3.1768
SpillersCT2_Wei	0.23	0.33	6.92	0.039	4.2960
SpillersCT2_3	0.22	0.31	6.3	0.048	3.3285
SpillersC_DS_Sim	0.22	0.31	6.55	0.042	3.4475
SpillersC_Hess	0.21	0.3	5.91	0.051	4.6047
SpillersC_HWY16	0.23	0.33	6.38	0.043	8.4231
SpillersC_Sims	0.21	0.3	6.13	0.048	0.70794
SpillersC_WeissRd	0.22	0.3	6.18	0.048	1.1227
StoneByu_01	0.23	0.32	6.12	0.039	0.95509
StoneByu_02	0.25	0.35	6.53	0.042	1.4037
StoneByu_03	0.23	0.32	6.84	0.039	1.0589
StoneByu_04	0.2	0.29	7.41	0.035	0.26012
StoneByu_05	0.19	0.26	6.99	0.032	0.59025
SUB_BLACKCRK_01	0.23	0.33	6.39	0.041	1.0418
SUB_BLACKCRK_02	0.24	0.34	6.4	0.041	1.6049
SUB_BLACKCRK_03	0.25	0.35	6.54	0.042	0.20261
SUB_BLACKCRK_04	0.25	0.35	6.5	0.041	0.33370
SUB_BLACKCRK_05	0.26	0.36	6.52	0.042	0.39154
SUB_COMITENP_01	0.26	0.37	6.57	0.042	1.5156
SUB_COMITENP_02	0.25	0.35	6.41	0.049	1.5850
SUB_COMITE_01	0.26	0.37	6.64	0.046	1.1991
SUB_COMITE_02	0.21	0.3	6.98	0.037	0.36478
SUB_COMITE_03	0.23	0.32	6.69	0.041	0.20981
SUB_COMITE_04	0.23	0.33	6.58	0.043	0.0857510
SUB_COMITE_05	0.24	0.34	6.56	0.042	0.26831
SUB_COMITE_06	0.22	0.31	6.98	0.039	0.14066
SUB_COMITE_07	0.21	0.29	7.21	0.036	0.21030
SUB_COMITE_09	0.21	0.29	7.05	0.036	0.5289632
SUB_COMITE_10	0.23	0.32	6.58	0.043	0.53244
SUB_COMITE_12	0.2	0.29	6.38	0.037	0.0078490
SUB_COMITE_13	0.22	0.31	6.95	0.038	1.4115
SUB_COMITE_14	0.22	0.31	6.87	0.039	1.2635
SUB_COMITE_15	0.21	0.3	6.94	0.037	0.52291
SUB_COMITE_18	0.22	0.3	6.4	0.039	0.39953
SUB_COMITE_19	0.23	0.33	6.63	0.041	0.43824
SUB_COMITE_21	0.22	0.31	6.58	0.055	0.51890
SUB_COMITE_22	0.22	0.31	6.84	0.05	0.53337
SUB_COMITE_23	0.24	0.34	6.22	0.085	0.59344
SUB_COMITE_25	0.23	0.32	6.19	0.148	0.78046
SUB_COMITE_26	0.23	0.33	6.44	0.111	0.50065
SUB_DOYLEBAYOU_01	0.25	0.35	6.57	0.042	0.81833
SUB_DOYLEBAYOU_02	0.24	0.34	6.55	0.042	0.22393
SUB_DOYLEBAYOU_03	0.26	0.36	6.56	0.042	0.47093
SUB_DOYLEBAYOU_05	0.25	0.35	6.57	0.042	0.44875
SUB_DOYLEBAYOU_06	0.24	0.34	7.17	0.041	0.59077

SUB_DOYLEBAYOU_07	0.25	0.35	6.5	0.04	1.3423
SUB_DOYLEBAYOU_08	0.25	0.35	6.81	0.041	1.3841
SUB_DOYLENP1_01	0.25	0.36	6.56	0.042	10.183
SUB_DOYLENP1_02	0.25	0.35	6.52	0.042	0.56884
SUB_FISHERBAYOU_01	0.2	0.29	7.44	0.034	0.15143
SUB_FISHERBAYOU_02	0.2	0.28	7.43	0.034	0.28530
SUB_FISHERBAYOU_03	0.2	0.29	7.38	0.034	0.24757
SUB_HOGBAYOU_01	0.25	0.35	6.53	0.042	0.33751
SUB_HOGBAYOU_02	0.25	0.35	6.55	0.042	0.21282
SUB_IRONBAYOU_01	0.24	0.34	6.56	0.042	0.99105
SUB_IRONBAYOU_02	0.24	0.34	6.55	0.042	0.75138
SUB_IRONBAYOU_03	0.26	0.36	6.53	0.042	0.82828
SUB_IRONBAYOU_04	0.26	0.36	6.54	0.042	0.43611
SUB_KNIGHTONBAYOU_01	0.2	0.28	7.38	0.035	0.45135
SUB_KNIGHTONBAYOU_02	0.2	0.28	7.35	0.036	0.10101
SUB_KNIGHTONBAYOU_03	0.2	0.28	7.45	0.034	0.23569
SUB_KNIGHTONBAYOU_04	0.22	0.3	6.78	0.04	0.0915768
SUB_LEWISCRK_01	0.21	0.3	7.09	0.037	6.4559
SUB_LEWISCRK_02	0.21	0.3	7.05	0.039	8.2446
SUB_LEWISCRK_03	0.21	0.3	6.82	0.039	1.1490
SUB_LITCOMITE_01	0.23	0.32	7.99	0.042	0.59420
SUB_LITCOMITE_02	0.23	0.32	6.78	0.041	0.0287793
SUB_LITCOMITE_03	0.24	0.34	6.63	0.041	0.56850
SUB_LITREDWOOD_01	0.22	0.31	6.12	0.039	0.68200
SUB_LITREDWOOD_02	0.24	0.33	6.49	0.041	0.17075
SUB_LITREDWOOD_03	0.24	0.33	6.66	0.041	0.23111
SUB_LITREDWOOD_04	0.22	0.3	6.83	0.039	0.30272
SUB_LITREDWOOD_05	0.2	0.28	7.45	0.034	0.5411356
SUB_MONAHANBAYOU_01	0.2	0.28	7.5	0.033	0.85356
SUB_MONAHANBAYOU_02	0.2	0.28	7.29	0.034	0.41186
SUB_PRETTYCRK_01	0.23	0.32	7	0.039	0.36189
SUB_PRETTYCRK_02	0.22	0.31	7.04	0.039	0.30823
SUB_PRETTYCRK_03	0.22	0.31	7.01	0.037	0.38800
SUB_PRETTYCRK_04	0.2	0.28	7.48	0.034	0.0727358
SUB_PRETTYCRK_05	0.24	0.34	6.37	0.046	0.76929
SUB_PRETTYCRK_06	0.21	0.29	7.1	0.036	0.42798
SUB_PRETTYCRK_07	0.22	0.31	6.99	0.039	0.70143
SUB_PRETTYCRK_08	0.23	0.32	6.46	0.041	8.5520
SUB_PRETTYCRK_09	0.21	0.29	5.86	0.038	0
SUB_REDWOODCRK_01	0.19	0.27	7.61	0.032	1.5693
SUB_REDWOODCRK_02	0.21	0.29	7.05	0.036	2.2165
SUB_REDWOODCRK_03	0.21	0.3	7.25	0.036	0.61863
SUB_REDWOODCRK_04	0.22	0.31	6.82	0.039	0.29699
SUB_REDWOODCRK_05	0.24	0.34	6.56	0.042	0.0899121
SUB_REDWOODCRK_06	0.22	0.32	6.93	0.038	1.7682
SUB_REDWOODCRK_08	0.23	0.32	6.63	0.04	0.25317
SUB_REDWOODCRK_09	0.2	0.28	7.39	0.034	0.84067
SUB_REDWOODCRK_10	0.23	0.32	6.85	0.039	0.25623
SUB_REDWOODCRK_11	0.25	0.35	6.59	0.041	0.70533
SUB_REDWOODCRK_12	0.23	0.32	6.94	0.038	0.48680
SUB_REDWOODCRK_13	0.24	0.33	6.55	0.042	0.44197
SUB_REDWOODCRK_14	0.24	0.34	6.55	0.042	0.34258
SUB_REDWOODCRK_15	0.25	0.35	6.77	0.041	0.20187
SUB_REDWOODCRK_16	0.24	0.34	6.49	0.042	0.0182202
SUB_REDWOODCRK_17	0.25	0.35	6.88	0.041	0.25766
SUB_REDWOODCRK_18	0.24	0.34	6.47	0.042	1.7623
SUB_REDWOODNP	0.25	0.35	6.55	0.042	0.0670558
SUB_SCHLEIBAYOU_01	0.2	0.29	7.47	0.034	1.1456

SUB_SCHLEIBAYOU_02	0.21	0.3	7.21	0.036	0.6438293
SUB_SCHLEIBAYOU_03	0.21	0.29	7.11	0.037	0.58500
SUB_SESSIONSBAYOU_NP	0.2	0.28	7.54	0.034	0.22409
SUB_SESSIONSBAYOU_01	0.2	0.28	7.42	0.034	0.0947252
SUB_SESSIONSBAYOU_02	0.21	0.29	7.25	0.037	0.51677
SUB_SESSIONSBAYOU_03	0.21	0.29	7.11	0.037	0.15278
SUB_SESSIONSBAYOU_04	0.22	0.31	6.49	0.043	0.54576
SUB_UNT_LEWISCRK	0.2	0.28	7.49	0.034	5.6627
SUB_UNT3_REDWOOD_1	0.26	0.37	6.57	0.042	2.6908
SUB_UNT3_REDWOOD_2	0.26	0.36	6.57	0.042	0.27021
SUB_UN_UN3_REDWOOD	0.26	0.37	6.57	0.042	2.8807
SUB_UN_UN4_REDWOOD_1	0.25	0.35	6.56	0.042	0.33138
SUB_UN_UN4_REDWOOD_2	0.25	0.36	6.56	0.042	0.40056
SUB_UN_UN4_REDWOOD_3	0.24	0.33	6.5	0.043	0.25333
SUB_UN3_REDWOOD_02	0.25	0.35	6.96	0.041	0.93988
SUB_UN4_REDWOOD_01	0.25	0.36	6.57	0.042	1.0741
SUB_UN4_REDWOOD_02	0.25	0.35	6.49	0.042	0.61594
SUB_WALNUTBR_01	0.25	0.35	6.56	0.042	0.21045
SUB_WALNUTBR_02	0.25	0.35	6.56	0.042	0.21054
SUB_WALNUTBR_03	0.24	0.34	6.38	0.043	0.29968
SUB_WFRKLITCOMITE_01	0.22	0.3	8.29	0.042	0.33878
SUB_WFRKLITCOMITE_02	0.22	0.31	6.99	0.04	0.34513
SUB_WHITEBAYOU_01	0.25	0.35	6.57	0.042	0.0955966
SUB_WHITEBAYOU_02	0.25	0.35	6.51	0.041	0.0632219
SUB_WHITEBAYOU_03	0.26	0.36	6.53	0.042	0.38256
SUB_WHITEBAYOU_04	0.26	0.36	6.56	0.042	0.46165
SUB_WHITEBAYOU_05	0.26	0.37	6.56	0.042	0.28198
SUB_WHITEBAYOU_06	0.25	0.35	6.51	0.041	0.33652
TaberC_CarsonRd	0.23	0.32	6.54	0.041	0.70421
TaberC_HannaC	0.23	0.32	6.84	0.04	0.80381
TaylorByu_DS_I12	0.24	0.34	6.58	0.041	11.301
TaylorByu_FL	0.23	0.32	6.57	0.042	34.622
TaylorByu_I12	0.23	0.32	6.51	0.041	26.543
TaylorByu_RR	0.23	0.32	6.55	0.042	17.894
UnDuffByu_DS	0.22	0.31	7.3	0.041	0.13907
UnDuffByu_US	0.24	0.34	6.67	0.042	11.790
UnT_GreenwellSp	0.23	0.32	6.55	0.041	1.0947
UNT1ADarlingCrk_01	0.25	0.35	4.71	0.069	0.40829
UNT1BlackCrk_01	0.25	0.35	5.06	0.064	0.28070
UNT1BluffCrk_01	0.22	0.3	7.15	0.036	0.65190
UNT1DarlingCrk_01	0.2	0.28	6.2	0.051	0.53803
UNT1DarlingCrk_02	0.24	0.33	4.76	0.064	0.47753
UNT1DarlingCrk_03	0.24	0.33	5.92	0.059	0.23218
UNT1DunnCrk_01	0.2	0.28	7.32	0.036	0.63681
UNT1SouthSandyRun_01	0.23	0.33	5.19	0.061	1.0359
UNT1WoodlandCrk_01	0.25	0.35	6.38	0.044	0.55089
UNT2ASSandyRun	0.24	0.34	4.49	0.068	0.14167
UNT2BlackCrk_01	0.24	0.34	5	0.065	1.7942
UNT2BluffCrk_01	0.2	0.28	7.54	0.034	0.59597
UNT2DarlingCrk_01	0.25	0.35	4.9	0.066	0.67620
UNT2DarlingCrk_02	0.25	0.35	4.71	0.068	0.92827
UNT2DarlingCrk_03	0.25	0.35	4.93	0.065	0.66776
UNT2SouthSandyRun_01	0.25	0.35	4.61	0.07	0
UNT2SouthSandyRun_02	0.24	0.34	4.92	0.064	0.12417
UNT3ADarlingCrk_01	0.24	0.34	5.19	0.062	0.0038889
UNT3BlackCrk_01	0.23	0.33	5.35	0.061	0.60149
UNT3DarlingCrk_01	0.24	0.34	5.09	0.065	0.45067
UNT3DarlingCrk_02	0.23	0.32	5.75	0.055	0.0077778

UNT3DarlingCrk_03	0.23	0.32	5.83	0.054	0.48229
UNT3DarlingCrk_04	0.21	0.3	6.15	0.05	0.27196
UnT3SandyC_Librt1	0.24	0.34	6.48	0.041	1.2096
UnT3SandyC_Librt2	0.23	0.33	6.49	0.043	1.7715
UNT3SouthSandyRun_01	0.25	0.35	4.63	0.07	0.11078
UNT3SouthSandyRun_02	0.25	0.35	4.69	0.069	0.89279
UNT3SouthSandyRun_03	0.25	0.35	4.78	0.067	0.76607
UNT4ADarlingCrk_01	0.25	0.35	5.19	0.062	0.10751
UNT4ADarlingCrk_02	0.25	0.35	5.57	0.056	0.31880
UNT4DarlingCrk_01	0.25	0.36	5.15	0.064	0.40187
UNT4DarlingCrk_02	0.25	0.34	5.37	0.06	0.0216583
UNT4DarlingCrk_03	0.23	0.33	6.24	0.048	0
Un_UpperWhiteByu	0.23	0.32	5.95	0.038	0.12629
Un1LilSndyC2_DS	0.23	0.33	7.1	0.042	1.4170
Un1LilSndyC2_US	0.25	0.35	6.57	0.042	0.71452
Un1MillC_PrideB	0.22	0.31	6.59	0.042	0.99213
Un1MillC_US_LOC	0.22	0.31	6.57	0.042	0.90915
Un1SandyC	0.23	0.32	6.89	0.041	0.0113031
Un2LilSndyC2_DS	0.23	0.32	6.62	0.041	0.32715
Un2LilSndyC2_US	0.23	0.33	6.99	0.041	0.84247
Un2_NBrWards_DS	0.24	0.34	6.73	0.041	43.778
Un2_NBrWards_US	0.28	0.39	8.09	0.033	45.003735
Un3LilSndyC2_DS	0.23	0.33	6.57	0.042	0.86592
Un3LilSndyC2_US	0.24	0.34	6.55	0.041	2.3949
Un4LilSndyC2	0.23	0.32	6.53	0.041	2.2116
Un4SandyC_DS	0.24	0.34	6.24	0.041	2.8390
Un4SandyC_US	0.23	0.32	6.55	0.04	2.8062
UpperWhiteByu_DS	0.25	0.35	7.62	0.042	2.2551
UpperWhiteByu_US	0.25	0.36	7.43	0.042	2.8131
UWhiteByu_Div	0.25	0.35	6.57	0.04	0.0050346
UWhiteByu_DW	0.25	0.36	6.55	0.042	1.1735
UWhiteByu_Hudson	0.25	0.35	6.62	0.042	3.1703
UWhiteByu_HWY64	0.25	0.35	6.75	0.042	8.2619
UWhiteByu_LowZac	0.25	0.35	7.08	0.041	12.254
UWhiteByu_US_Div	0.24	0.34	6.61	0.041	0.27039
UWhiteByu_UT	0.25	0.36	6.87	0.042	1.3593
WardsCr_Bluebon	0.32	0.45	9.69	0.023	55.8322501
WardsCr_Choctaw	0.28	0.4	8.21	0.032	49.443
WardsCr_College	0.26	0.37	7.71	0.035	29.460
WardsCr_EssenLn	0.27	0.38	7.96	0.035	34.257
WardsCr_GovtSt	0.29	0.42	8.92	0.028	51.109
WardsCr_GusYoung	0.25	0.36	7.07	0.038	51.183
WardsCr_Highland	0.24	0.33	7.03	0.039	30.984
WardsCr_I10_DS	0.23	0.32	7.84	0.039	42.099
WardsCr_I10_US	0.27	0.38	7.79	0.035	37.493733
WardsCr_Manchac	0.24	0.34	7.47	0.037	38.567
WardsCr_PecueLn	0.25	0.35	7.78	0.034	51.403
WardsCr_SiegenLn	0.26	0.36	7.34	0.036	50.555
WaxDitch	0.24	0.34	6.57	0.042	33.013
WClyellT1_DS_Spr	0.22	0.3	6.54	0.042	6.5104
WClyellT1_Pvt	0.23	0.32	6.37	0.045	1.4230
WClyellT1_SprfdR	0.22	0.31	6.54	0.042	1.4653
WClyell_ArnoldR	0.23	0.32	6.56	0.042	2.1512
WClyell_CnMkt	0.22	0.31	6.57	0.042	0.97486
WClyell_DS_Arnld	0.23	0.32	6.54	0.042	11.584
WClyell_DS_I12	0.24	0.34	6.51	0.041	11.052
WClyell_DS_Spr	0.22	0.32	6.56	0.042	2.9345
WClyell_HoodRd	0.24	0.34	6.61	0.042	4.3869

WClyell_I12	0.23	0.33	6.49	0.041	16.610
WClyell_JoeMayR	0.24	0.34	6.56	0.042	11.377
WClyell_NanWes	0.21	0.3	5.96	0.05	8.9421
WClyell_RR	0.23	0.33	6.51	0.042	15.850
WClyell_SprgfldR	0.22	0.31	6.55	0.042	2.1066
WeinerCr_DS	0.28	0.39	8.06	0.031	58.901
WeinerCr_I12	0.31	0.44	9.15	0.027	63.9663432
WeinerCr_US	0.31	0.43	9.02	0.027	59.846
WelshGullyT1	0.26	0.37	6.57	0.039	20.6953453
WelshGul_Manchac	0.21	0.3	6.96	0.041	7.7812
WelshGul_NrPrair	0.26	0.36	6.57	0.039	34.437
WestForkAmite_01	0.27	0.38	6.27	0.046	1.1152
WestForkAmite_02	0.27	0.37	5.88	0.052	0.44427
WestForkAmite_03	0.27	0.38	5.87	0.052	1.1260
WestForkAmite_04	0.26	0.37	5.91	0.05	0.56039
WFrkBeaverC2_Spr	0.23	0.32	6.44	0.043	23.4165698
WFrkBeaverC2_US	0.22	0.3	5.88	0.048	22.254
WindByu_Jackson	0.23	0.32	6.57	0.042	1.4493
WindByu_LSC2	0.23	0.33	6.48	0.043	0.95044
WindByu_Milldale	0.24	0.34	6.55	0.042	1.0838
WindByu_PeairsRd	0.23	0.32	6.52	0.041	2.5236
WLatCypB_ScotZac	0.25	0.36	7.91	0.038	24.655
WLatCypB_US_LOC	0.24	0.34	7.96	0.041	0.0493801
WoodlandCrk_01	0.25	0.35	6.5	0.041	1.3454
WoodlandCrk_02	0.25	0.35	6.32	0.044	0.37148
WoodlandCrk_03	0.23	0.32	6.92	0.04	0.11902
WoodlandCrk_04	0.23	0.32	6.99	0.039	0.83871
WoodlandCrk_05	0.25	0.35	6.57	0.042	0.43565
WoodlandCrk_06	0.24	0.34	6.6	0.042	0.0442563
WoodlandCrk_07	0.22	0.3	6.69	0.041	.000542479

Hydrologic Parameters for Future Conditions Year 2076

Subbasin	Initial Content	Saturated Content	Suction	Conductivity	Impervious %
AllenByu_HWY1032	0.24	0.34	6.55	0.042	19.876
AlligatorT_Bluff	0.25	0.35	6.99	0.034	33.33
AmiteDivCnl_C01	0.21	0.29	11.09	0.008	0.43575
AmiteDivCnl_C02	0.19	0.26	10.59	0.012	2.6346
AmiteDivC_HWY22	0.19	0.27	8.42	0.026	6.8531
AmiteRT34_HWY16	0.23	0.32	6.12	0.048	25.323
AmiteR_BarbByu	0.24	0.34	7.59	0.037	0.80789
AmiteR_BeaverCrk	0.24	0.33	6.45	0.043	0.42372
AmiteR_BluffCrk	0.22	0.31	7.29	0.082	1.3332
AmiteR_ChaneyBr	0.27	0.38	8.4	0.018	2.6272
AmiteR_ChinqCan	0.24	0.33	8.23	0.027	3.461
AmiteR_ClearCrk	0.24	0.34	5.51	0.056	0.98978
AmiteR_ColBay	0.2	0.29	6.96	0.025	4.8208
AmiteR_C01	0.23	0.32	6.31	0.041	0.9316
AmiteR_C02	0.21	0.3	5.91	0.038	3.2174
AmiteR_C03	0.23	0.32	6.22	0.046	0.97664
AmiteR_C04	0.22	0.32	6.18	0.039	9.6001
AmiteR_C05	0.23	0.32	6.25	0.047	7.3028
AmiteR_C06	0.23	0.33	6.76	0.032	11.695
AmiteR_C07	0.23	0.32	6.32	0.041	6.9509
AmiteR_C08	0.23	0.33	6.31	0.041	26.594
AmiteR_C09	0.23	0.32	6.31	0.054	4.0408
AmiteR_C10	0.23	0.32	6.3	0.041	17.573771
AmiteR_C11	0.25	0.35	7.42	0.03	16.448
AmiteR_C12	0.23	0.32	6.43	0.041	19.993
AmiteR_C13	0.22	0.31	6.21	0.04	5.697
AmiteR_C14	0.23	0.32	6.31	0.053	2.6007
AmiteR_C15	0.24	0.34	7.04	0.029	4.7168
AmiteR_DarlingCrk	0.24	0.33	6.45	0.049	1.0759
AmiteR_HendByu	0.16	0.22	8.77	0.02	10.652
AmiteR_HWY16	0.21	0.3	9.06	0.021	3.3982
AmiteR_HWY22	0.25	0.35	8.87	0.027	1.1262
AmiteR_KingGByu	0.24	0.34	8.88	0.027	2.0428
AmiteR_L03	0.24	0.34	6.37	0.041	37.1204606
AmiteR_Magnolia	0.24	0.34	7.03	0.06	16.296
AmiteR_Maurepas	0.26	0.36	10.43	0.016	1.1679
AmiteR_PigeonCrk	0.21	0.3	7.73	0.06	1.0115
AmiteR_PtVincent	0.21	0.29	6.27	0.033	6.1793
AmiteR_RockyCrk	0.21	0.3	7.45	0.055	0.89698
AmiteR_R03	0.26	0.36	6.85	0.039	46.048
AmiteR_StateHwy10	0.21	0.3	6.58	0.047	0.66589
AmiteR_StateHwy37	0.2	0.28	7.2	0.06	0.88284
AmiteR_StateHwy432	0.22	0.31	6.58	0.041	0.769
AmiteR_US_Div	0.04	0.05	3.77	0.004	3.3398
AmiteR_WhittenCrk	0.23	0.32	7.2	0.052	1.4494
AmiteR_17	0.24	0.34	6.86	0.06	1.5802
AmiteR_18	0.26	0.37	7.4	0.033	0.7627
AntiochC_LeeMrtn	0.25	0.35	6.56	0.042	1.535
BeaverBr_CnMkt	0.23	0.32	6.55	0.042	18.204
BeaverBr_DuffRd	0.23	0.32	6.55	0.042	11.2
BeaverBr_RR	0.23	0.32	6.55	0.042	9.0019
BeaverByuNP_Hoop	0.23	0.33	6.53	0.041	19.898
BeaverByuNP_US	0.22	0.31	6.56	0.042	13.992

BeaverByu_Denham	0.22	0.31	6.56	0.041	4.1070368
BeaverByu_French	0.25	0.35	6.94	0.036	23.407
BeaverByu_GrnSp	0.24	0.33	6.51	0.04	31.3692561
BeaverByu_Hooper	0.22	0.31	6.52	0.041	8.2017
BeaverByu_US_LOC	0.23	0.32	6.57	0.041	3.0644
BeaverByu_Wax	0.23	0.32	6.55	0.039	12.529
BeaverCrk_01	0.28	0.39	6.12	0.049	1.7672
BeaverCrk_02	0.27	0.38	6.18	0.048	0.66082
BeaverCrk_03	0.27	0.38	5.98	0.05	0.66816
BeaverCrk_04	0.26	0.37	6.21	0.046	0.37856
BeaverCrk_05	0.24	0.34	6.12	0.047	0.65128
BeaverCrk_06	0.22	0.3	6.21	0.041	0.35288
BeaverCrk_07	0.22	0.31	6.35	0.041	0.44113
BeaverC2_CnMkt	0.22	0.32	6.55	0.042	23.106
BeaverC2_ForeRd	0.22	0.32	6.57	0.042	13.956
BeaverC2_HWY16	0.23	0.32	6.44	0.043	28.137
BeaverC2_Magnol	0.23	0.33	6.47	0.043	35.792
BeaverC2_Sprgfld	0.23	0.32	6.56	0.042	33.808
BeaverC3_DS_Pear	0.22	0.31	7.22	0.041	0.51513
BeaverC3_Jackson	0.25	0.36	7.31	0.042	1.3859
BeaverC3_LSandy	0.23	0.32	7.02	0.042	0.31179
BeaverC3_Milldal	0.25	0.35	6.75	0.042	0.98826
BeaverC3_Peairs	0.23	0.32	6.85	0.042	1.0882
BeaverC3_US_LOC	0.25	0.35	7.03	0.042	1.0444
BeaverPondByu_DS	0.23	0.32	6.44	0.039	0.4075
BeaverPondByu_US	0.25	0.35	6.56	0.041	0.37552
BFountainNP	0.23	0.33	6.79	0.039	37.0823975
BFountNBr_Boyd	0.3	0.42	11.83	0.011	97.4509492
BFountNBr_Lee	0.24	0.33	11.34	0.015	43.271
BFountSBr_BF	0.2	0.29	12.02	0.009	23.351
BFountSBr_Gour	0.23	0.32	12.27	0.008	62.099
BFountSBr_US	0.31	0.44	10.21	0.02	72.0927236
BFountT1_DS	0.22	0.32	7.22	0.035	22.561
BFountT1_Highlnd	0.24	0.34	6.66	0.041	51.1179616
BFount_BFSBr	0.2	0.28	12.41	0.007	71.14
BFount_Bluebon	0.21	0.29	8.42	0.034	47.902
BFount_Burbank	0.27	0.39	12.14	0.009	45.947
BFount_BurbankDr	0.22	0.31	7.58	0.034	46.011
BFount_ByuManch	0.19	0.26	11.15	0.015	8.5045
BFount_ElbowByu	0.17	0.23	11.01	0.016	42.293
BFount_Nich_DS	0.15	0.22	12.2	0.01	39.717
BFount_Nich_US	0.34	0.48	11.96	0.01	98.418
BFount_US_Trib	0.17	0.23	10.49	0.02	10.103
BirchCrk_01	0.25	0.35	4.72	0.069	1.7106
BlackCrk_01	0.25	0.35	4.93	0.066	0.0026584
BlackCrk_02	0.2	0.29	6.39	0.048	0.50594
BlackCrk_03	0.25	0.35	5.18	0.062	1.3741
BlackCrk_04	0.25	0.35	4.94	0.065	1.4893
BlackCrk_05	0.23	0.32	5.6	0.057	0.25867
BlackCrk_06	0.21	0.3	6.62	0.043	1.5085
BlackCrk_07	0.21	0.29	6.42	0.046	0.47298
BlackCrk_08	0.24	0.33	6.04	0.05	2.0342
BlackCrk_09	0.24	0.33	5.71	0.058	1.7881
BLACKCR_CMB	0.26	0.37	6.45	0.041	0.46994
BLACKCR_HWY412	0.26	0.36	6.55	0.042	0.41178
BlackwtrBT1_BB	0.23	0.33	6.55	0.042	12.36
BlackwtrBT1_Core	0.23	0.32	6.57	0.042	3.2686
BlackwtrBT1_Mcul	0.22	0.31	6.55	0.041	4.3095

BlackwtrBT2_BB	0.23	0.32	6.53	0.042	2.3118
BlackwtrBT2_DW	0.23	0.32	6.56	0.042	1.8765
BlackwtrBT3_US	0.23	0.32	6.46	0.043	3.0351
BlackwtrB_BBT1	0.23	0.32	6.59	0.041	2.7163
BlackwtrB_BBT2	0.22	0.31	6.56	0.042	2.4249
BlackwtrB_Comite	0.23	0.33	6.57	0.041	17.242
BlackwtrB_McCull	0.22	0.31	6.56	0.042	8.4855
BlackwtrB_US	0.22	0.31	6.48	0.041	0.73895
BlackwtrT3_DS	0.22	0.31	6.53	0.043	1.9751
BluffCrk_AmiteR	0.23	0.32	6.54	0.044	0.99203
BluffCrk_01	0.24	0.33	6.85	0.039	0.88534
BluffCrk_02	0.22	0.31	7.15	0.037	0.7133
BluffCrk_03	0.19	0.27	7.63	0.033	1.0253
BluffCrk_04	0.2	0.28	7.43	0.035	0.2422
BluffCrk_05	0.2	0.28	7.41	0.035	0.54775
BluffCrk_06	0.2	0.28	7.36	0.035	0.87491
BluffCrk_07	0.21	0.3	7.22	0.036	0.80329
BluffSwamp_Gage	0.23	0.32	7.92	0.027	40.5299776
ByuBraud_HWY30	0.13	0.19	10.83	0.019	21.8392782
ByuBraud_HWY74	0.11	0.15	12.24	0.01	27.784
ByuBraud_US_LOC	0.18	0.25	10.15	0.029	13.48
ByuDuplant_LeeDr	0.28	0.39	8.81	0.025	32.019
ByuDuplant_NrDaw	0.26	0.37	8.13	0.03	28.66
ByuManch_Airline	0.21	0.3	6.76	0.038	40.923
ByuManch_BFount	0.19	0.27	9.48	0.022	12.962
ByuManch_Cotton	0.22	0.32	6.44	0.039	11.219
ByuManch_Gator	0.19	0.27	10.69	0.029	16.493
ByuManch_NrAmite	0.22	0.31	6.85	0.04	8.8466
ByuManch_NrLiPra	0.23	0.32	6.46	0.04	4.9479
ByuManch_NrMSRiv	0.2	0.28	8.28	0.034	21.767
ByuManch_Perkins	0.23	0.32	6.43	0.036	40.73
ByuManch_Welsh	0.21	0.3	6.41	0.039	35.096
ByuPaul_HWY30	0.18	0.25	10.75	0.034	1.413
ByuPaul_US_HWY30	0.16	0.23	10.67	0.028	3.9231
ByuPaul_US_LOC	0.16	0.23	11.38	0.023	3.3475
CampCreek_HWY42	0.24	0.34	6.69	0.042	1.1274
ChaneyBr_HWY16	0.23	0.32	6.49	0.041	3.9914
ChinqCan_C01	0.26	0.37	10.85	0.015	0.79927
ChinqCan_C02	0.25	0.35	9.94	0.018	3.8575
ClayCut_Airline	0.3	0.43	9.34	0.025	95.093
ClayCut_AntiochR	0.24	0.33	6.9	0.041	57.4921456
ClayCut_CalRd	0.26	0.37	7.56	0.036	64.099
ClayCut_Inns	0.24	0.34	6.64	0.041	71.035
ClayCut_JacksB	0.27	0.38	7.92	0.034	70.386
ClayCut_NrAmite	0.23	0.33	6.4	0.041	12.196
ClayCut_Siegen	0.28	0.4	8.36	0.031	91.912
ClayCut_US_Tiger	0.24	0.34	6.85	0.041	27.0335976
ClaytonByuT1	0.23	0.32	6.54	0.043	9.3295
ClaytonByu_Bend	0.22	0.31	6.4	0.044	19.864
ClearCrkT1_01	0.25	0.35	6.56	0.042	0.30807
ClearCrkT1_02	0.25	0.34	6.55	0.042	0.34551
ClearCrk_01	0.25	0.36	6.32	0.046	0.35524
ClearCrk_02	0.25	0.35	6.39	0.044	0.92743
ClearCrk_03	0.23	0.32	6.54	0.04	1.4955
ClearCrk_04	0.24	0.34	6.55	0.042	1.0686
ClintonAllenLat	0.23	0.32	6.54	0.042	14.657
ClyellCrkNP	0.24	0.34	6.54	0.042	1.9598
ClyellT9_DS_FL	0.26	0.36	6.57	0.042	4.2146

ClyellT9_FL	0.26	0.36	6.56	0.042	1.0104
Clyell_CB	0.24	0.34	7.03	0.039	1.9405239
Clyell_DS_I12	0.25	0.35	6.55	0.042	4.3029
Clyell_DS_LigoLn	0.22	0.31	6.51	0.043	1.6553
Clyell_FLBlvd	0.25	0.35	6.56	0.042	2.297
Clyell_I12	0.24	0.34	6.56	0.042	3.1425
Clyell_JoelWatts	0.24	0.34	6.56	0.042	1.5858
Clyell_LigoLn	0.24	0.34	6.54	0.042	2.0639
Clyell_LilClyell	0.24	0.34	6.57	0.042	1.3946
Clyell_LodStafrd	0.23	0.33	6.48	0.041	1.0921
Clyell_US_LOC	0.24	0.33	6.57	0.042	1.1751
Clyell_W_Hood	0.24	0.34	6.57	0.042	0.39604
ColtonCrk_HWY16	0.23	0.32	6.39	0.041	26.429
ColyellBay	0.24	0.33	7.41	0.037	2.3299
COMITE_atComite	0.22	0.31	7	0.088	1.7632
COMITE_Baker	0.23	0.33	6.76	0.071	4.2373
COMITE_DenhamSpr	0.25	0.34	6.47	0.055	18.153
COMITE_dsJOORRD	0.25	0.35	7.17	0.036	14.465
COMITE_dsLA37	0.23	0.32	6.43	0.044	19.131
COMITE_DS_OB	0.22	0.31	5.98	0.084	3.6812
COMITE_HooperRd	0.24	0.34	6.76	0.058	12.743
COMITE_Hurricane	0.23	0.32	6.55	0.039	11.318
COMITE_nrComite	0.26	0.37	7.74	0.053	4.9564
COMITE_RR	0.23	0.32	6.43	0.055	4.2987
COMITE_usLA37	0.25	0.36	7.23	0.032	21.142
COMITE_US_OB	0.22	0.3	6.17	0.039	4.7282
COMITE_Zachary	0.23	0.32	6.48	0.056	1.9551
CooperMillB_BC	0.26	0.36	6.5	0.041	3.4374
CooperMillB_Midw	0.24	0.34	6.55	0.042	7.6946
CooperMillB_UWB	0.22	0.31	6.07	0.038	1.1987
CorpCanalNP	0.3	0.42	10.32	0.018	77.048
CorpCanal_Myrtle	0.32	0.45	9.55	0.023	92.767
CorpCanal_Stanfrd	0.34	0.48	10.42	0.013	64.696
CorpCanal_State	0.33	0.46	10.23	0.017	75.246
DarlingCrk_AmiteR	0.2	0.29	7.95	0.041	1.0849
DarlingCrk_01	0.25	0.35	5.29	0.062	0.78933
DarlingCrk_02	0.25	0.34	4.84	0.066	0.66619
DarlingCrk_03	0.25	0.35	4.89	0.066	0.45633
DarlingCrk_04	0.24	0.34	5.42	0.059	0.44972
DarlingCrk_05	0.24	0.34	5.44	0.058	0.80065
DarlingCrk_06	0.24	0.34	6.25	0.059	0.43924
DarlingCrk_07	0.24	0.34	5.23	0.063	0.58677
DarlingCrk_08	0.23	0.33	5.45	0.059	0.99424
DarlingCrk_09	0.22	0.3	5.81	0.054	1.1598
DarlingCrk_10	0.23	0.33	5.5	0.057	1.3127
DarlingCrk_11	0.19	0.27	7.02	0.043	0.48206
DarlingCrk_12	0.19	0.26	8.12	0.036	0.93145
DarlingCrk_13	0.2	0.28	7.58	0.041	2.7308
DawsonCr_Bluebon	0.27	0.38	7.97	0.032	52.34
DawsonCr_College	0.3	0.42	9.13	0.026	60.0485512
DawsonCr_GovtSt	0.3	0.42	9.04	0.027	75.745
DawsonCr_Hund_DS	0.28	0.4	8.35	0.03	47.931
DawsonCr_QuailDr	0.27	0.38	8.23	0.032	56.617
DawsonCr_WardCr	0.28	0.4	8.49	0.03	71.881
DraughnsC_French	0.24	0.34	6.57	0.037	17.062
DraughnsC_GrnSpr	0.23	0.32	6.55	0.041	16.6708704
DraughnsC_MagBr	0.22	0.32	6.56	0.041	29.229
DuffByu_Jackson	0.23	0.33	6.64	0.042	2.3392

DuffByu_PtHud	0.26	0.36	6.58	0.042	0.39844
DuffB_DS_Jack	0.24	0.33	6.58	0.04	1.4631
DumplinC_DS_RR	0.24	0.34	6.57	0.042	41.295
DumplinC_I12	0.23	0.33	6.46	0.041	25.324
DumplinC_RR	0.22	0.31	6.53	0.042	18.4
DumplinC_US_LOC	0.22	0.31	6.55	0.042	19.116
DunnCrk_01	0.26	0.36	6.65	0.043	0.0200551
DunnCrk_02	0.23	0.32	6.9	0.041	0.52431
DunnCrk_03	0.26	0.36	5.59	0.055	1.0736
DunnCrk_04	0.25	0.36	5.57	0.055	0.76883
EastForkAmite_01	0.25	0.35	6.43	0.043	1.48113
EastForkAmite_02	0.27	0.38	6.16	0.048	0.74193
EastForkAmite_03	0.26	0.37	5.83	0.053	0.81036
EastForkAmite_04	0.26	0.37	5.87	0.051	0.62235
EFDumplin_Corbin	0.22	0.31	6.55	0.042	7.2889
EFDumplin_RR	0.23	0.32	6.52	0.042	26.232
ELatCypB_Lavey	0.26	0.37	6.57	0.042	35.85
ELatCypB_LCB	0.23	0.33	6.63	0.041	25.929
ElbowBayou	0.14	0.2	10.91	0.015	5.5992
ElbowByu_Burbank	0.18	0.25	10.33	0.022	8.7407
ENGINEERDEPOT_DS	0.25	0.35	6.73	0.041	43.85
ENGINEERDEPOT_US	0.28	0.39	7.8	0.034	65.794
FeldersB_BrownRd	0.25	0.35	6.57	0.042	6.8142
FeldersB_DSJMay	0.24	0.34	6.6	0.042	9.1997
FeldersB_WC	0.23	0.33	7.18	0.042	27.423
FlanaganByu_SC	0.24	0.33	6.62	0.042	1.4968
FlanaganByu_01	0.24	0.34	7.33	0.041	0.14507
FlatLake	0.15	0.22	9.86	0.014	2.2075
GatorByu_Gage	0.17	0.24	9.64	0.019	8.9155
GatorByu_USGage	0.14	0.2	11.21	0.015	8.1179
GraysCrkBr_BMcD	0.25	0.36	6.55	0.042	46.965
GraysCrkBr_Dunn	0.24	0.34	6.3	0.046	28.611
GraysCrkBr_I12	0.24	0.33	6.57	0.042	39.004
GraysCrkBr_RR	0.25	0.36	6.45	0.041	33.595
GraysCrkBr_USI12	0.24	0.34	6.57	0.042	21.105
GraysCrkLat_RR	0.23	0.33	6.45	0.043	43.5236504
GraysCrk_Hwy1033	0.24	0.34	6.49	0.043	6.8541
GraysCrk_HWY16	0.25	0.35	6.52	0.042	18.054
GraysCrk_I12	0.24	0.34	6.57	0.042	34.692
GraysCrk_Julban	0.22	0.31	5.83	0.037	21.352
GraysCrk_NrAmite	0.24	0.34	6.53	0.042	5.2978
GraysCrk_RR	0.24	0.34	6.56	0.042	40.034
GraysCrk_US	0.25	0.35	6.55	0.042	41.93
GraysCrk_WaxD	0.24	0.33	6.57	0.042	32.992
HannaC_PrideBar	0.21	0.3	7.19	0.037	0.5311
HareLat_Airline	0.26	0.37	7.5	0.036	59.6776898
HareLat_OldHmd	0.26	0.37	7.32	0.034	66.379
HendByu_DSPtVinc	0.24	0.34	6.82	0.032	11.947
HendByu_HWY431	0.22	0.31	7.93	0.029	8.9403
HendByu_Joboy	0.24	0.33	6.57	0.042	34.617
HendByu_NrPtVinc	0.24	0.34	6.52	0.039	30.9196737
HendByu_US_Timbr	0.24	0.34	6.57	0.036	25.408
HogBayou_BC	0.26	0.37	6.53	0.042	0.0554442
HoneyCut_East	0.26	0.37	7.02	0.039	62.906
HoneyCut_NrAmite	0.26	0.37	7.12	0.038	38.118
HoneyCut_West	0.27	0.38	6.95	0.04	60.956
HornsbyCrk_CnMkt	0.24	0.34	6.52	0.042	1.1765
HornsbyCrk_DSCan	0.25	0.35	6.56	0.042	1.6846

HornsbyCrk_FLBd	0.24	0.34	6.55	0.042	6.4186
HornsbyCrk_HCT1	0.23	0.32	6.48	0.043	2.6952
HornsbyCrk_HCT3	0.23	0.32	6.55	0.042	1.0932
HornsbyCT1_Corbn	0.23	0.32	6.53	0.042	1.6779
HornsbyCT3_Corbn	0.22	0.31	6.49	0.043	1.13
HornsbyCT3_HC	0.22	0.31	6.53	0.042	1.6137
HornsbyC_I12	0.24	0.34	6.5	0.041	7.9113
HubByu_DS_GS_PH	0.22	0.31	6.53	0.041	2.1452
HubByu_GrnwelSpr	0.22	0.31	6.52	0.042	6.4368
HubByu_GS_PtHud	0.23	0.32	6.56	0.041	2.2186
HubByu_Peairs	0.22	0.31	6.47	0.043	0.23193
HunterByu_01	0.2	0.28	7.58	0.034	0.1569
HunterByu_02	0.2	0.28	7.46	0.034	0.27356
HunterByu_03	0.22	0.31	6.96	0.04	0.15378
HunterByu_04	0.21	0.29	7.41	0.034	0.98502
HunterByu_05	0.21	0.29	7.25	0.036	0.56793
HURRICANE_dsJOOR	0.25	0.36	7.2	0.038	50.413
HURRICANE_HOWELL	0.28	0.39	7.77	0.035	53.338
HURRICANE_Joor	0.27	0.38	8.02	0.034	45.383
HURRICANE_Presct	0.26	0.36	7.19	0.039	50.75
HURRICANE_Wildwd	0.27	0.37	7.66	0.036	64.147
IndianByu_PtHud	0.25	0.35	7.5	0.042	1.4659
IndianByu_UWB	0.24	0.34	7.54	0.042	1.2061
JacksB_Claycut	0.25	0.35	6.73	0.041	68.958
JacksB_ParkFor	0.3	0.42	8.4	0.031	74.647
JoinerCrk_01	0.19	0.26	6.46	0.048	0.61189
JoinerCrk_02	0.25	0.35	4.83	0.067	0.21091
JoinerCrk_03	0.24	0.34	4.84	0.067	1.0162
JoinerCrk_04	0.25	0.35	4.7	0.069	1.743
JoinerCrk_05	0.23	0.32	5.47	0.059	0.62016
JoinerCrk_06	0.22	0.31	6.11	0.054	0.84062
JonesBayou	0.24	0.34	7.59	0.041	6.0732
JonesCr_Airline	0.34	0.48	10.81	0.017	95.218
JonesCr_FLBlvd	0.28	0.39	8.35	0.032	66.76
JonesCr_Mont	0.28	0.4	8.71	0.029	75.263
JonesCr_NrAmite	0.23	0.33	6.34	0.036	38.453
JonesCr_OldHamd	0.27	0.38	7.51	0.036	56.079
JonesCr_ONealLn	0.25	0.36	6.89	0.035	57.145
JonesCr_WeinerCr	0.27	0.39	7.73	0.034	63.281
KnoxBr_Firewood	0.26	0.37	7.07	0.036	72.3793698
KnoxBr_ONealLn	0.24	0.34	6.47	0.041	53.481
LCypByu_Comite	0.25	0.35	7.11	0.039	18.845
LCypByu_DS_Lavey	0.21	0.3	6.9	0.039	12.077
LCypByu_GBL	0.27	0.38	8.58	0.033	34.986
LCypByu_Hooper	0.23	0.33	7.48	0.041	15.195
LCypByu_Lavey	0.24	0.34	7.21	0.04	27.485
LCypByu_Thomas	0.24	0.33	7.3	0.041	10.955
LCypByu_US_SL	0.25	0.35	7.02	0.041	22.496
LilClyell_DS_I12	0.24	0.34	7.68	0.039	6.6012
LilClyell_I12	0.24	0.33	6.51	0.042	10.219
LilClyell_L01	0.25	0.36	6.53	0.043	11.71
LilClyell_Prloux	0.22	0.31	8.22	0.042	10.616
LilClyell_Range	0.23	0.33	6.53	0.043	31.982
LilClyell_RangLn	0.24	0.33	7.35	0.042	2.4114
LilClyell_Satsu	0.24	0.34	6.89	0.042	4.3528
LilSndyC2_DS_Jac	0.22	0.31	7.32	0.041	1.2195
LilSndyC2_DS_Mil	0.23	0.32	6.64	0.041	4.1537
LilSndyC2_DS_Per	0.23	0.32	6.46	0.041	1.0244

LilSndyC2_Jack	0.23	0.32	6.62	0.041	0.86029
LilSndyC2_Lib	0.23	0.32	6.33	0.044	0.73752
LilSndyC2_Milld	0.22	0.31	6.68	0.042	1.4694
LilSndyC2_Peairs	0.23	0.32	6.59	0.041	1.5861
LilSndyC2_US_Jac	0.23	0.33	6.89	0.041	1.0739
LilSndyC2_US_LOC	0.21	0.3	7.32	0.036	0.52396
LilSndyC2_Wind	0.23	0.32	6.48	0.043	0.79088
LittleSandyCrk_01	0.2	0.28	7.42	0.035	1.1689
LittleSandyCrk_02	0.2	0.29	7.33	0.035	1.1052
LittleSandyCrk_03	0.19	0.27	7.57	0.033	0.89853
LittleSandyCrk_04	0.2	0.28	7.53	0.034	0.52756
LittleSandyCrk_05	0.2	0.28	7.46	0.035	0.4061514
LittleSandyCrk_06	0.21	0.29	7.14	0.037	0.40075
LivelyBT_FL	0.29	0.41	8.32	0.032	75.9090292
LivelyBT_LB	0.27	0.38	7.21	0.039	67.983
LivelyB_FLBlvd	0.28	0.39	7.72	0.035	53.9348218
LivelyB_HoneyCut	0.28	0.39	7.6	0.036	58.594
LivelyB_LBT	0.26	0.37	7.36	0.037	74.432
LivelyB_Pvt	0.25	0.36	6.57	0.042	13.974
LongSlashBranch	0.24	0.34	6.32	0.046	56.3349429
LSU_NP_MaySt	0.25	0.35	7.15	0.029	47.183
LSU_NP_Stanfrd	0.16	0.22	4.76	0.019	26.189
LWhiteByu_Comite	0.25	0.35	7.25	0.041	20.768
LWhiteByu_Pettit	0.23	0.33	7.57	0.041	7.8817
LWhiteByu_US_Pet	0.24	0.34	7.77	0.041	12.131588
MidClyellT3	0.23	0.32	6.57	0.042	6.4077
MidClyellT5_CnMk	0.23	0.32	6.52	0.042	9.8923
MidClyellT5_MC	0.23	0.33	6.55	0.042	5.8575
MidClyellT5_Sprg	0.22	0.31	6.53	0.042	3.8568
MidClyellT6_GalG	0.24	0.33	6.55	0.042	25.157
MidClyellT6_MC	0.22	0.31	6.54	0.042	7.0861
MidClyell_CB	0.25	0.35	6.94	0.04	2.0796
MidClyell_CnMkt	0.24	0.33	6.5	0.043	2.3343
MidClyell_FLBlvd	0.23	0.32	6.57	0.042	7.8818
MidClyell_HoodRd	0.24	0.34	6.56	0.042	1.1923
MidClyell_I12	0.24	0.34	6.59	0.041	13.08
MidClyell_MCT1	0.23	0.32	6.5	0.043	1.9882
MidClyell_MCT3	0.23	0.32	6.57	0.042	1.8422
MidClyell_MCT5	0.24	0.34	6.56	0.042	8.1081
MidClyell_MCT6	0.23	0.32	6.55	0.042	10.358
MidClyell_TylrBy	0.24	0.34	6.55	0.042	4.1254
MidClyell_US_LOC	0.21	0.29	7.25	0.04	1.5478
MidClyell_WeissR	0.23	0.32	6.54	0.042	1.0476
MillCrk_CarsonRd	0.23	0.32	6.51	0.041	2.6651
MillCrk_MahoneyRd	0.2	0.28	7.47	0.034	0.75225
MillCrk_PrideBar	0.22	0.31	6.36	0.039	1.3664
MillC_SandyC	0.23	0.32	6.57	0.042	1.1255
MillersCT_I12	0.24	0.34	6.57	0.042	35.958
MillersCT_MC	0.24	0.33	6.45	0.041	49.083
MillersCT_UnT	0.24	0.34	6.55	0.043	60.303
MillersC_Julban	0.25	0.35	6.54	0.042	20.162
MolerB_CnMkt	0.22	0.31	6.56	0.042	2.8258
MolerB_Springfld	0.22	0.31	6.55	0.042	10.1918145
MolerB_WC	0.21	0.3	6.5	0.041	11.159
MuddyCrk_Henry	0.25	0.35	6.65	0.041	42.624
MuddyCrk_HWY42	0.24	0.34	6.6	0.04	26.745
MuddyCrk_LilPra	0.25	0.35	6.52	0.039	27.106
MuddyCrk_NrManch	0.25	0.35	6.71	0.038	19.693

MuddyCrk_NrOakGr	0.25	0.36	6.57	0.037	27.1150825
NBrWardsCr_atBR	0.28	0.39	8.14	0.032	63.914
NBrWardsCr_FL	0.33	0.46	10.08	0.021	87.244
NBrWardsCr_Hare	0.31	0.43	9.44	0.025	79.578
NBrWardsCr_I10	0.28	0.39	8.07	0.033	62.87
NewR_Maurepas	0.29	0.41	11.78	0.006	0.0306776
ROBERTCN_dsJOOR	0.23	0.32	6.88	0.041	14.541
ROBERTCN_Grnwell	0.25	0.35	7.49	0.037	49.046
ROBERTCN_Joor	0.23	0.32	6.87	0.042	14.9318039
ROBERTCN_T	0.24	0.33	6.74	0.041	48.94
ROBERTCN_US_LOC	0.26	0.36	7.06	0.039	40.771
RobertsByu_01	0.2	0.28	7.54	0.033	1.8315
RobertsByu_02	0.19	0.27	7.62	0.032	0.20272
RobertsByu_03	0.2	0.27	7.58	0.033	0.30076
RobertsByu_04	0.2	0.28	7.25	0.036	0.2429991
SandyCrk_01	0.24	0.34	6.78	0.04	1.3693
SandyCrk_02	0.24	0.33	6.77	0.039	1.8517
SandyCrk_03	0.22	0.3	7.05	0.036	0.313
SandyCrk_04	0.25	0.35	6.55	0.042	0.34251
SandyCrk_05	0.25	0.35	6.55	0.042	1.238
SandyCrk_06	0.24	0.33	6.64	0.041	1.0984
SandyCrk_07	0.25	0.34	6.31	0.044	1.1925
SandyCrk_08	0.23	0.33	6.58	0.04	1.0726
SandyCrk_09	0.24	0.34	6.52	0.043	0.23322
SandyCrk_10	0.21	0.3	6.37	0.041	0.92948
SandyCrk_11	0.25	0.35	6.47	0.043	0.11065
SandyCrk_12	0.22	0.31	6.62	0.041	1.5142
SandyCrk_13	0.22	0.31	6.89	0.041	0.8221
SandyCrk_14	0.21	0.29	7.41	0.036	0.55571
SandyCrk_15	0.21	0.3	7.84	0.039	0.13221
SandyCrk_16	0.2	0.28	7.43	0.035	0.33668
SandyCrk_17	0.22	0.31	6.79	0.04	0.17505
SandyCrk_18	0.22	0.31	6.61	0.042	0.82661
SandyCrk_19	0.21	0.3	7.08	0.038	0.33433
SandyCrk_20	0.22	0.31	7	0.039	0.81234
SandyC_AlphonFor	0.22	0.3	5.87	0.05	0.60771
SandyC_BeaverPnd	0.23	0.33	6.5	0.04	1.6434
SandyC_FB	0.24	0.34	6.48	0.043	0.27765
SandyC_GrnwelSpr	0.23	0.32	6.37	0.043	2.4514
SandyC_MillC	0.23	0.33	6.51	0.042	0.85744
SandyC_PrideBay	0.23	0.33	6.44	0.041	2.9131
SandyC_StnyPtBur	0.23	0.32	6.47	0.041	1.2854
SandyC_UN3SC	0.25	0.35	6.51	0.043	0.37854
SandyRun_01	0.25	0.35	4.78	0.068	0.86981
SandyRun_02	0.24	0.34	5.07	0.064	0.75992
SandyRun_03	0.22	0.31	5.77	0.055	1.1845
SandyRun_04	0.19	0.27	6.41	0.048	1.164
SandyRun_05	0.2	0.29	6.28	0.05	0.60542
SandyRun_06	0.2	0.28	6.47	0.048	0.84378
SandyRun_07	0.24	0.33	5.55	0.06	0.215
SandyRun_08	0.22	0.31	6.74	0.045	0.25238
ScalousCr	0.21	0.29	7.46	0.036	0.48889
SCanal_Dyer	0.23	0.32	8.61	0.042	3.5412
SCanal_Plank	0.24	0.34	7.4	0.041	1.9499
ShoeCT1_SC	0.24	0.34	6.56	0.042	32.6155493
ShoeCT1_US_LOC	0.25	0.35	7.09	0.039	32.122
ShoeC_Comite	0.24	0.34	6.57	0.037	15.75
ShoeC_DS_Hooper	0.23	0.32	6.52	0.042	21.701

ShoeC_Gurney	0.25	0.35	6.49	0.041	10.216
ShoeC_Hooper	0.26	0.36	7.24	0.038	19.63
ShoeC_Pecos	0.24	0.34	6.59	0.039	19.9900628
ShoeC_SCT1	0.23	0.32	6.73	0.041	14.753
SouthCanal_Div	0.23	0.33	8.5	0.04	9.8705
SouthCanal_HWY19	0.24	0.33	9.11	0.039	14.358
SOUTHLATERAL	0.25	0.35	6.72	0.042	37.774
SouthSandyRun_01	0.25	0.35	4.64	0.069	0.0023245
SouthSandyRun_02	0.25	0.35	5.14	0.062	0.269
SouthSandyRun_03	0.25	0.35	5.02	0.064	0.96894
SouthSandyRun_04	0.25	0.35	5.04	0.064	2.2798
SpillersCT2_	0.25	0.35	7.33	0.037	2.5698
SpillersCT2_SC	0.23	0.32	6.52	0.038	4.2887
SpillersCT2_Wei	0.23	0.33	6.92	0.039	5.7996
SpillersCT2_3	0.22	0.31	6.3	0.048	4.4935
SpillersC_DS_Sim	0.22	0.31	6.55	0.042	4.6541
SpillersC_Hess	0.21	0.3	5.91	0.051	6.2163
SpillersC_HWY16	0.23	0.33	6.38	0.043	11.371
SpillersC_Sims	0.21	0.3	6.13	0.048	0.95572
SpillersC_WeissRd	0.22	0.3	6.18	0.048	1.5157
StoneByu_01	0.23	0.32	6.12	0.039	1.2894
StoneByu_02	0.25	0.35	6.53	0.042	1.8951
StoneByu_03	0.23	0.32	6.84	0.039	1.4295
StoneByu_04	0.2	0.29	7.41	0.035	0.35117
StoneByu_05	0.19	0.26	6.99	0.032	0.79683
SUB_BLACKCRK_01	0.23	0.33	6.39	0.041	1.4065
SUB_BLACKCRK_02	0.24	0.34	6.4	0.041	2.1666
SUB_BLACKCRK_03	0.25	0.35	6.54	0.042	0.27352
SUB_BLACKCRK_04	0.25	0.35	6.5	0.041	0.4505
SUB_BLACKCRK_05	0.26	0.36	6.52	0.042	0.52858
SUB_COMITENP_01	0.26	0.37	6.57	0.042	2.0461
SUB_COMITENP_02	0.25	0.35	6.41	0.049	2.1397
SUB_COMITE_01	0.26	0.37	6.64	0.046	1.6188
SUB_COMITE_02	0.21	0.3	6.98	0.037	0.49245
SUB_COMITE_03	0.23	0.32	6.69	0.041	0.28324
SUB_COMITE_04	0.23	0.33	6.58	0.043	0.11576
SUB_COMITE_05	0.24	0.34	6.56	0.042	0.36222
SUB_COMITE_06	0.22	0.31	6.98	0.039	0.18989
SUB_COMITE_07	0.21	0.29	7.21	0.036	0.28391
SUB_COMITE_09	0.21	0.29	7.05	0.036	0.7141
SUB_COMITE_10	0.23	0.32	6.58	0.043	0.71879
SUB_COMITE_12	0.2	0.29	6.38	0.037	0.0105962
SUB_COMITE_13	0.22	0.31	6.95	0.038	1.9055
SUB_COMITE_14	0.22	0.31	6.87	0.039	1.7058
SUB_COMITE_15	0.21	0.3	6.94	0.037	0.70593
SUB_COMITE_18	0.22	0.3	6.4	0.039	0.53936
SUB_COMITE_19	0.23	0.33	6.63	0.041	0.59163
SUB_COMITE_21	0.22	0.31	6.58	0.055	0.70051
SUB_COMITE_22	0.22	0.31	6.84	0.05	0.72005
SUB_COMITE_23	0.24	0.34	6.22	0.085	0.80115
SUB_COMITE_25	0.23	0.32	6.19	0.148	1.0536
SUB_COMITE_26	0.23	0.33	6.44	0.111	0.67587
SUB_DOYLEBAYOU_01	0.25	0.35	6.57	0.042	1.1047
SUB_DOYLEBAYOU_02	0.24	0.34	6.55	0.042	0.30231
SUB_DOYLEBAYOU_03	0.26	0.36	6.56	0.042	0.63575
SUB_DOYLEBAYOU_05	0.25	0.35	6.57	0.042	0.60582
SUB_DOYLEBAYOU_06	0.24	0.34	7.17	0.041	0.79754
SUB_DOYLEBAYOU_07	0.25	0.35	6.5	0.04	1.8121

SUB_DOYLEBAYOU_08	0.25	0.35	6.81	0.041	1.8686
SUB_DOYLENP1_01	0.25	0.36	6.56	0.042	13.747
SUB_DOYLENP1_02	0.25	0.35	6.52	0.042	0.76793
SUB_FISHERBAYOU_01	0.2	0.29	7.44	0.034	0.20443
SUB_FISHERBAYOU_02	0.2	0.28	7.43	0.034	0.38516
SUB_FISHERBAYOU_03	0.2	0.29	7.38	0.034	0.33422
SUB_HOGBAYOU_01	0.25	0.35	6.53	0.042	0.45564
SUB_HOGBAYOU_02	0.25	0.35	6.55	0.042	0.28731
SUB_IRONBAYOU_01	0.24	0.34	6.56	0.042	1.3379
SUB_IRONBAYOU_02	0.24	0.34	6.55	0.042	1.0144
SUB_IRONBAYOU_03	0.26	0.36	6.53	0.042	1.1182
SUB_IRONBAYOU_04	0.26	0.36	6.54	0.042	0.58875
SUB_KNIGHTONBAYOU_01	0.2	0.28	7.38	0.035	0.60933
SUB_KNIGHTONBAYOU_02	0.2	0.28	7.35	0.036	0.13636
SUB_KNIGHTONBAYOU_03	0.2	0.28	7.45	0.034	0.31818
SUB_KNIGHTONBAYOU_04	0.22	0.3	6.78	0.04	0.12363
SUB_LEWISCRK_01	0.21	0.3	7.09	0.037	8.7155
SUB_LEWISCRK_02	0.21	0.3	7.05	0.039	11.1302238
SUB_LEWISCRK_03	0.21	0.3	6.82	0.039	1.5511
SUB_LITCOMITE_01	0.23	0.32	7.99	0.042	0.80217
SUB_LITCOMITE_02	0.23	0.32	6.78	0.041	0.038852
SUB_LITCOMITE_03	0.24	0.34	6.63	0.041	0.76748
SUB_LITREDWOOD_01	0.22	0.31	6.12	0.039	0.9207
SUB_LITREDWOOD_02	0.24	0.33	6.49	0.041	0.23051
SUB_LITREDWOOD_03	0.24	0.33	6.66	0.041	0.31199
SUB_LITREDWOOD_04	0.22	0.3	6.83	0.039	0.40867
SUB_LITREDWOOD_05	0.2	0.28	7.45	0.034	0.73053
SUB_MONAHANBAYOU_01	0.2	0.28	7.5	0.033	1.1523
SUB_MONAHANBAYOU_02	0.2	0.28	7.29	0.034	0.55601
SUB_PRETTYCRK_01	0.23	0.32	7	0.039	0.48855
SUB_PRETTYCRK_02	0.22	0.31	7.04	0.039	0.41612
SUB_PRETTYCRK_03	0.22	0.31	7.01	0.037	0.5238
SUB_PRETTYCRK_04	0.2	0.28	7.48	0.034	0.0981933
SUB_PRETTYCRK_05	0.24	0.34	6.37	0.046	1.0385
SUB_PRETTYCRK_06	0.21	0.29	7.1	0.036	0.57777
SUB_PRETTYCRK_07	0.22	0.31	6.99	0.039	0.94693
SUB_PRETTYCRK_08	0.23	0.32	6.46	0.041	11.545
SUB_PRETTYCRK_09	0.21	0.29	5.86	0.038	0
SUB_REDWOODCRK_01	0.19	0.27	7.61	0.032	2.1186
SUB_REDWOODCRK_02	0.21	0.29	7.05	0.036	2.9923
SUB_REDWOODCRK_03	0.21	0.3	7.25	0.036	0.83515
SUB_REDWOODCRK_04	0.22	0.31	6.82	0.039	0.40094
SUB_REDWOODCRK_05	0.24	0.34	6.56	0.042	0.12138
SUB_REDWOODCRK_06	0.22	0.32	6.93	0.038	2.3871
SUB_REDWOODCRK_08	0.23	0.32	6.63	0.04	0.34178
SUB_REDWOODCRK_09	0.2	0.28	7.39	0.034	1.1349
SUB_REDWOODCRK_10	0.23	0.32	6.85	0.039	0.34591
SUB_REDWOODCRK_11	0.25	0.35	6.59	0.041	0.9521915
SUB_REDWOODCRK_12	0.23	0.32	6.94	0.038	0.65718
SUB_REDWOODCRK_13	0.24	0.33	6.55	0.042	0.59666
SUB_REDWOODCRK_14	0.24	0.34	6.55	0.042	0.46249
SUB_REDWOODCRK_15	0.25	0.35	6.77	0.041	0.27253
SUB_REDWOODCRK_16	0.24	0.34	6.49	0.042	0.0245973
SUB_REDWOODCRK_17	0.25	0.35	6.88	0.041	0.34784
SUB_REDWOODCRK_18	0.24	0.34	6.47	0.042	2.3792
SUB_REDWOODNP	0.25	0.35	6.55	0.042	0.0905253
SUB_SCHLEIBAYOU_01	0.2	0.29	7.47	0.034	1.5465
SUB_SCHLEIBAYOU_02	0.21	0.3	7.21	0.036	0.86917

SUB_SCHLEIBAYOU_03	0.21	0.29	7.11	0.037	0.78975
SUB_SESSIONSBAYOU_NP	0.2	0.28	7.54	0.034	0.30252
SUB_SESSIONSBAYOU_01	0.2	0.28	7.42	0.034	0.12788
SUB_SESSIONSBAYOU_02	0.21	0.29	7.25	0.037	0.69764
SUB_SESSIONSBAYOU_03	0.21	0.29	7.11	0.037	0.20625
SUB_SESSIONSBAYOU_04	0.22	0.31	6.49	0.043	0.73677
SUB_UNT_LEWISCRK	0.2	0.28	7.49	0.034	7.6447
SUB_UNT3_REDWOOD_1	0.26	0.37	6.57	0.042	3.6326
SUB_UNT3_REDWOOD_2	0.26	0.36	6.57	0.042	0.36478
SUB_UN_UN3_REDWOOD	0.26	0.37	6.57	0.042	3.8889
SUB_UN_UN4_REDWOOD_1	0.25	0.35	6.56	0.042	0.44736
SUB_UN_UN4_REDWOOD_2	0.25	0.36	6.56	0.042	0.54076
SUB_UN_UN4_REDWOOD_3	0.24	0.33	6.5	0.043	0.342
SUB_UN3_REDWOOD_02	0.25	0.35	6.96	0.041	1.2688
SUB_UN4_REDWOOD_01	0.25	0.36	6.57	0.042	1.45
SUB_UN4_REDWOOD_02	0.25	0.35	6.49	0.042	0.83152
SUB_WALNUTBR_01	0.25	0.35	6.56	0.042	0.28411
SUB_WALNUTBR_02	0.25	0.35	6.56	0.042	0.28423
SUB_WALNUTBR_03	0.24	0.34	6.38	0.043	0.40457
SUB_WFRKLITCOMITE_01	0.22	0.3	8.29	0.042	0.45736
SUB_WFRKLITCOMITE_02	0.22	0.31	6.99	0.04	0.46593
SUB_WHITEBAYOU_01	0.25	0.35	6.57	0.042	0.12906
SUB_WHITEBAYOU_02	0.25	0.35	6.51	0.041	0.0853496
SUB_WHITEBAYOU_03	0.26	0.36	6.53	0.042	0.51646
SUB_WHITEBAYOU_04	0.26	0.36	6.56	0.042	0.62323
SUB_WHITEBAYOU_05	0.26	0.37	6.56	0.042	0.38068
SUB_WHITEBAYOU_06	0.25	0.35	6.51	0.041	0.45431
TaberC_CarsonRd	0.23	0.32	6.54	0.041	0.95069
TaberC_HannaC	0.23	0.32	6.84	0.04	1.0851
TaylorByu_DS_I12	0.24	0.34	6.58	0.041	15.256
TaylorByu_FL	0.23	0.32	6.57	0.042	46.74
TaylorByu_I12	0.23	0.32	6.51	0.041	35.833
TaylorByu_RR	0.23	0.32	6.55	0.042	24.1565793
UnDuffByu_DS	0.22	0.31	7.3	0.041	0.18774
UnDuffByu_US	0.24	0.34	6.67	0.042	15.916
UnT_GreenwellSp	0.23	0.32	6.55	0.041	1.4778
UNT1ADarlingCrk_01	0.25	0.35	4.71	0.069	0.55119
UNT1BlackCrk_01	0.25	0.35	5.06	0.064	0.37894
UNT1BluffCrk_01	0.22	0.3	7.15	0.036	0.88006
UNT1DarlingCrk_01	0.2	0.28	6.2	0.051	0.72634
UNT1DarlingCrk_02	0.24	0.33	4.76	0.064	0.64466
UNT1DarlingCrk_03	0.24	0.33	5.92	0.059	0.31344
UNT1DunnCrk_01	0.2	0.28	7.32	0.036	0.85969
UNT1SouthSandyRun_01	0.23	0.33	5.19	0.061	1.3985
UNT1WoodlandCrk_01	0.25	0.35	6.38	0.044	0.7437
UNT2ASSandyRun	0.24	0.34	4.49	0.068	0.19125
UNT2BlackCrk_01	0.24	0.34	5	0.065	2.4222
UNT2BluffCrk_01	0.2	0.28	7.54	0.034	0.80456
UNT2DarlingCrk_01	0.25	0.35	4.9	0.066	0.91286
UNT2DarlingCrk_02	0.25	0.35	4.71	0.068	1.2532
UNT2DarlingCrk_03	0.25	0.35	4.93	0.065	0.90147
UNT2SouthSandyRun_01	0.25	0.35	4.61	0.07	0
UNT2SouthSandyRun_02	0.24	0.34	4.92	0.064	0.167625
UNT3ADarlingCrk_01	0.24	0.34	5.19	0.062	0.00525
UNT3BlackCrk_01	0.23	0.33	5.35	0.061	0.81201
UNT3DarlingCrk_01	0.24	0.34	5.09	0.065	0.6084
UNT3DarlingCrk_02	0.23	0.32	5.75	0.055	0.0105
UNT3DarlingCrk_03	0.23	0.32	5.83	0.054	0.65109

UNT3DarlingCrk_04	0.21	0.3	6.15	0.05	0.36714
UnT3SandyC_Librt1	0.24	0.34	6.48	0.041	1.6329
UnT3SandyC_Librt2	0.23	0.33	6.49	0.043	2.3916
UNT3SouthSandyRun_01	0.25	0.35	4.63	0.07	0.14955
UNT3SouthSandyRun_02	0.25	0.35	4.69	0.069	1.2053
UNT3SouthSandyRun_03	0.25	0.35	4.78	0.067	1.0342
UNT4ADarlingCrk_01	0.25	0.35	5.19	0.062	0.14514
UNT4ADarlingCrk_02	0.25	0.35	5.57	0.056	0.43038
UNT4DarlingCrk_01	0.25	0.36	5.15	0.064	0.54252
UNT4DarlingCrk_02	0.25	0.34	5.37	0.06	0.0292387
UNT4DarlingCrk_03	0.23	0.33	6.24	0.048	0
Un_UpperWhiteByu	0.23	0.32	5.95	0.038	0.17049
Un1LilSndyC2_DS	0.23	0.33	7.1	0.042	1.913
Un1LilSndyC2_US	0.25	0.35	6.57	0.042	0.9646
Un1MillC_PrideB	0.22	0.31	6.59	0.042	1.3394
Un1MillC_US_LOC	0.22	0.31	6.57	0.042	1.2274
Un1SandyC	0.23	0.32	6.89	0.041	0.0152592
Un2LilSndyC2_DS	0.23	0.32	6.62	0.041	0.44166
Un2LilSndyC2_US	0.23	0.33	6.99	0.041	1.1373
Un2_NBrWards_DS	0.24	0.34	6.73	0.041	59.1
Un2_NBrWards_US	0.28	0.39	8.09	0.033	60.755
Un3LilSndyC2_DS	0.23	0.33	6.57	0.042	1.169
Un3LilSndyC2_US	0.24	0.34	6.55	0.041	3.2331
Un4LilSndyC2	0.23	0.32	6.53	0.041	2.9856
Un4SandyC_DS	0.24	0.34	6.24	0.041	3.8327
Un4SandyC_US	0.23	0.32	6.55	0.04	3.7883
UpperWhiteByu_DS	0.25	0.35	7.62	0.042	3.0444
UpperWhiteByu_US	0.25	0.36	7.43	0.042	3.7977
UWhiteByu_Div	0.25	0.35	6.57	0.04	0.0067967
UWhiteByu_DW	0.25	0.36	6.55	0.042	1.5842
UWhiteByu_Hudson	0.25	0.35	6.62	0.042	4.28
UWhiteByu_HWY64	0.25	0.35	6.75	0.042	11.154
UWhiteByu_LowZac	0.25	0.35	7.08	0.041	16.5425064
UWhiteByu_US_Div	0.24	0.34	6.61	0.041	0.3650287
UWhiteByu_UT	0.25	0.36	6.87	0.042	1.835
WardsCr_Bluebon	0.32	0.45	9.69	0.023	75.374
WardsCr_Choctaw	0.28	0.4	8.21	0.032	66.748
WardsCr_College	0.26	0.37	7.71	0.035	39.77051
WardsCr_EssenLn	0.27	0.38	7.96	0.035	46.246
WardsCr_GovtSt	0.29	0.42	8.92	0.028	68.997
WardsCr_GusYoung	0.25	0.36	7.07	0.038	69.096
WardsCr_Highland	0.24	0.33	7.03	0.039	41.828
WardsCr_I10_DS	0.23	0.32	7.84	0.039	56.834
WardsCr_I10_US	0.27	0.38	7.79	0.035	50.617
WardsCr_Manchac	0.24	0.34	7.47	0.037	52.066
WardsCr_PecueLn	0.25	0.35	7.78	0.034	69.3940296
WardsCr_SiegenLn	0.26	0.36	7.34	0.036	68.25
WaxDitch	0.24	0.34	6.57	0.042	44.567
WClyellT1_DS_Spr	0.22	0.3	6.54	0.042	8.7891
WClyellT1_Pvt	0.23	0.32	6.37	0.045	1.921
WClyellT1_SprfdR	0.22	0.31	6.54	0.042	1.9782
WClyell_ArnoldR	0.23	0.32	6.56	0.042	2.9041
WClyell_CnMkt	0.22	0.31	6.57	0.042	1.3161
WClyell_DS_Arnld	0.23	0.32	6.54	0.042	15.639
WClyell_DS_I12	0.24	0.34	6.51	0.041	14.921
WClyell_DS_Spr	0.22	0.32	6.56	0.042	3.9616
WClyell_HoodRd	0.24	0.34	6.61	0.042	5.9223
WClyell_I12	0.23	0.33	6.49	0.041	22.423

WClyell_JoeMayR	0.24	0.34	6.56	0.042	15.359
WClyell_NanWes	0.21	0.3	5.96	0.05	12.0717793
WClyell_RR	0.23	0.33	6.51	0.042	21.3979277
WClyell_SprgfldR	0.22	0.31	6.55	0.042	2.8439
WeinerCr_DS	0.28	0.39	8.06	0.031	79.517
WeinerCr_I12	0.31	0.44	9.15	0.027	86.355
WeinerCr_US	0.31	0.43	9.02	0.027	80.792
WelshGullyT1	0.26	0.37	6.57	0.039	27.939
WelshGul_Manchac	0.21	0.3	6.96	0.041	10.505
WelshGul_NrPrair	0.26	0.36	6.57	0.039	46.49
WestForkAmite_01	0.27	0.38	6.27	0.046	1.505565
WestForkAmite_02	0.27	0.37	5.88	0.052	0.59976
WestForkAmite_03	0.27	0.38	5.87	0.052	1.5201
WestForkAmite_04	0.26	0.37	5.91	0.05	0.75653
WFrkBeaverC2_Spr	0.23	0.32	6.44	0.043	31.612
WFrkBeaverC2_US	0.22	0.3	5.88	0.048	30.043
WindByu_Jackson	0.23	0.32	6.57	0.042	1.9565
WindByu_LSC2	0.23	0.33	6.48	0.043	1.2831
WindByu_Milldale	0.24	0.34	6.55	0.042	1.4631
WindByu_PeairsRd	0.23	0.32	6.52	0.041	3.4069
WLatCypB_ScotZac	0.25	0.36	7.91	0.038	33.285
WLatCypB_US_LOC	0.24	0.34	7.96	0.041	0.0666631
WoodlandCrk_01	0.25	0.35	6.5	0.041	1.8163
WoodlandCrk_02	0.25	0.35	6.32	0.044	0.5015
WoodlandCrk_03	0.23	0.32	6.92	0.04	0.16068
WoodlandCrk_04	0.23	0.32	6.99	0.039	1.1323
WoodlandCrk_05	0.25	0.35	6.57	0.042	0.58812
WoodlandCrk_06	0.24	0.34	6.6	0.042	0.059746
WoodlandCrk_07	0.22	0.3	6.69	0.041	0.000732347

8.6 Annex H-6: Appendix G: Hydrologic and Hydraulic Models – Description of Past Alternatives

Darlington Dam

Darlington Dam is a proposed dam on the Amite River near Darlington, Louisiana. The dam would provide FRM benefits by attenuating floodwater in its impoundment, and releasing water for an extended time at a lower rate, thus saving downstream areas from the peak flows of the upper Amite River.

This alternative was considered potentially effective for providing significant FRM benefits, so it was selected as an alternative to model. The Darlington Dam was modeled as a Dry Dam, meaning that it began with no water in the impoundment. This allowed for maximum storage capacity for purposes of evaluating potential effectiveness.

The dam is intended to retain the 25-year flood event and smaller events within the flood control pool. For those events, water will not reach the elevation of the emergency spillway, and only the low level outlet works will be utilized for outflow. For events larger than the 25-year event, the emergency spillway will be activated and the surcharge pool will be utilized.

The Darlington Dam model obtained from LaDOTD utilized a 100-year dam design. For this modeling effort, HH&C was tasked with modeling the 25-year dry dam. HH&C edited the 2D area connection of the Darlington Dam to represent the 25-year dry dam. Those edits included lowering the dam crest and the emergency spillway elevation. When the water surface elevation in the impoundment is below the elevation of the emergency spillway, water flows through the dam via the low level outlet, which is three 10-ft by 10-ft culverts at the base of the dam. When the water surface is higher than the emergency spillway, the low level outlet is closed.

In order to properly represent the operation of the dam outlets in the model, stage-flow rating curves were extracted from model results of both the low level outlet and the emergency spillway. The low level outlet was represented as three 10-ft by 10-ft box culverts, and the spillway was represented as a 1000-ft wide weir at elevation 172.8 ft NAVD 88. The stage-flow rating curves that resulted from both of those structures were combined into one rating that that is controlled by the culvert rating curve below elevation 172.8 ft NAVD 88, and controlled by the weir at elevations above 172.8 ft NAVD 88. Those curves were combined into a single stage-flow rating curve that was applied to the 2D area connection of the Darlington Dam.

Lily Bayou, Bluff Creek, and Darlington Creek Dry Detention Ponds (Alternative 8A)

The Lily Bayou, Bluff Creek, and Darlington Creek dry detention ponds are dams on three tributaries of the upper Amite River. The dams would provide FRM benefits by attenuating floodwater in their impoundments, and releasing water for an extended time at lower rates, thus saving the Amite River Basin from the peak flows of the three streams.

This alternative was considered potentially effective for providing significant FRM benefits, so it was selected as an alternative to model. This alternative was modeled by assuming that all of the flow upstream of each detention pond would be stored in the ponds for every flood event. The assumption of storing all floodwater in the detention ponds allowed for the maximum potential benefits to be gained from this alternative. Because of this assumption of complete storage, detailed analysis was not performed for sizing of outlet works.

Sandy Creek Dry Detention Pond (Alternative 8C)

Sandy Creek Dry Detention Pond is a dam on Sandy Creek, a right bank tributary of the Amite River. The dam would provide FRM benefits by attenuating floodwater in its impoundment, and releasing water for an extended time at a lower rate, thus saving the lower Sandy Creek Basin and the lower Amite River Basin from the peak flows of upper Sandy Creek.
This alternative was considered potentially effective for providing significant FRM benefits, so it was selected as an alternative to model. This alternative was modeled by assuming that all of the flow upstream of the detention pond would be stored in the pond for every flood event. The assumption of storing all floodwater in the detention pond allowed for the maximum potential benefits to be gained from this alternative. Because of this assumption of complete storage, detailed analysis was not performed for sizing of outlet works.

Spanish Lake Pump Station and Gate Operation

The Spanish Lake area and surrounding bayous (Bayou Fountain and Bayou Manchac) historically flood due to backwater from the Amite River. A pump station that collects water from the northwest portion of Spanish Lake and pumps to the Mississippi River was originally considered to divert incoming floodwaters flowing upstream up Bayou Manchac. That alternative was modeled with the 100 year event, and it was determined that the influence area of a pump station in that location could not have significant FRM benefits to the Spanish Lake area. A pump station located nearer to the confluence of Bayou Fountain and Bayou Manchac (near the entrance to Spanish Lake) was considered, as that could have a more significant influence area. But that pump station location was several miles from where it would pump water to in the Mississippi River, and thus was screened out due to cost.

This alternative was considered not economically feasible for FRM, and thus was not modeled for all ACE events.

Highway 22

Highway 22 crosses the Amite River Diversion approximately 3 miles downstream from the Amite River. For large events where there is significant flow out of the banks of the Amite River Diversion, Highway 22 acts as a barrier to flow. This causes backup of water upstream of Highway 22. Adding additional drainage underneath Highway 22, or turning Highway 22 into a short causeway, was considered as a way to mitigate the flow blockage. Both of these options were modeled with the 100 year event. Water levels were able to be lowered upstream of Highway 22, but it was determined that there were not enough structures in the region that could see benefit from this project.

This alternative was considered not beneficial enough to be modeled for all ACE events.

Port Vincent Bridge

Highway 42 crosses the Amite River at Port Vincent, Louisiana. The Port Vincent Bridge has several piers and a bridge deck that were assumed to act as a restriction to flow, causing an increase in water levels upstream of the bridge. Replacing the existing bridge with a clear span bridge and raising the bridge deck were considered as an alternative to mitigate the flow blockage. Evaluation of the impacts of the existing bridge for the 500 year event shows that water levels do not reach the elevation of the bridge deck. Several bridge piers are in the flow path, so conceivably a clear span bridge could show FRM benefits. But water levels upstream of the bridge could only be expected to be lowered by approximately one foot at the 500 year event, and by less than that for higher frequency events.

Based on the small expected hydraulic impact of the bridge, this alternative was not modeled for the suite of ACE events.

Amite River Re-meandering

Adding meanders to the Amite River above the Comite River was an alternative suggested recently by other federal agencies. The potential benefit is that there would be additional length in the river, and thus additional storage capacity, and floodwaters would be slowed down on their journey to inundate populated areas downstream. There are potential benefits from this alternative, especially at higher frequency events where the Amite River is still in its banks.

There are design and feasibility challenges with this alternative and the true potential for FRM benefits is quite unclear. At lower frequency events, the Amite River is out of its banks, and mostly flowing as sheet flow across the entire flood plain. In those cases, the shape and length of the river channel is less significant. There would be difficulty in “adding” meanders to the river in a stable way. Man-made shaping of rivers in a “natural” manner requires a thorough understanding of river morphodynamics, and significant erosion control measures would need to be taken.

This alternative was not modeled, because it was not presented to USACE or considered until hydraulic modeling was mostly complete. It cannot be definitively be said that river meander restoration will not yield FRM benefits downstream, especially for high frequency events. It may be worth modeling this alternative.

Highway 16

Highway 16 crosses Colyell Creek south of Port Vincent, Louisiana, approximately one mile upstream from the confluence with the Amite River. The Highway 16 Bridge has several piers and a bridge deck that are assumed to act as a restriction to flow, causing an increase in water levels upstream of the bridge. Due to the relative small size of Colyell Creek, the Highway 16 Bridge was not included in the hydraulic model that was used for this modeling effort. Analysis of the potential impacts of this bridge for the 200 year event show that the likely elevation of the bridge deck is above the peak water surface. The bridge deck is likely not a restriction to flow to any of the model events except for the 500 year. In order to model this alternative, a survey of the existing Highway 16 Bridge would be required, as well as further refinement of the hydraulic model.

There is a low density of structures in the region where water backs up behind the Highway 16 Bridge. Based on the low density of structures in the region, the lack of survey data for the bridge, and the small expected hydraulic impact of the bridge deck, this alternative was not modeled for the suite of ACE events.

Results

Hydraulic model runs were made for the full suite of eight 24-hour average recurrence interval events (2-year, 5-year, 10-year, 25-year, 50-year, 100-year, 200-year, and 500-year) for baseline without project (2026) and FWOP (2076). Model runs were also made for the full suite of eight 24-hour ACE events for three alternatives: Darlington Dam, Alternative 8A, and Alternative 8C. All alternative model runs were made using the baseline (2026) hydrology.

Results of hydraulic modeling were used to generate water surface elevation and depth grids for every alternative for the full suite of eight 24-hour ACE events. Those results grids were provided to the GIS and Economics branches for use in developing economics analyses.

Water surface elevations at three key locations on the Amite River (Baywood, Denham Springs, and Port Vincent) are shown in Tables 2 through 4 for each alternative and each frequency event.

Table 2
Stages in the Amite River at Baywood, Louisiana (ft NAVD88)

	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	200 Year	500 Year
FWOP	85.2	87.8	89.5	91.3	92.4	93.5	94.5	96.5
Baseline	85.2	87.8	89.5	91.3	92.4	93.5	94.5	96.5
Alternative 8A	85.0	87.6	89.3	91.2	92.4	93.4	94.4	96.3
Alternative 8C	85.2	87.8	89.5	91.3	92.4	93.5	94.5	96.5
Darlington Dam	79.4	80.5	81.4	82.4	83.1	83.7	83.9	84.5

Table 3
Stages in the Amite River at Denham Springs, Louisiana (ft NAVD 88)

	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	200 Year	500 Year
FWOP	30.0	32.4	34.1	36.6	38.5	40.1	41.7	43.3
Baseline	30.0	32.4	34.1	36.6	38.5	40.1	41.7	43.3
Alternative 8A	29.8	32.2	33.8	36.4	38.2	39.9	41.6	43.1
Alternative 8C	29.6	32.0	33.6	36.1	38.0	39.6	41.4	43.0
Darlington Dam	26.1	27.7	29.1	31.1	32.6	33.9	35.2	37.5

Table 4
Stages in the Amite River at Port Vincent, Louisiana (ft NAVD 88)

	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	200 Year	500 Year
FWOP	7.8	9.0	10.1	11.5	12.6	13.5	14.5	16.1

Baseline	7.6	8.9	9.9	11.4	12.5	13.5	14.5	16.0
Alternative 8A	7.5	8.7	9.8	11.2	12.4	13.3	14.3	15.9
Alternative 8C	7.4	8.7	9.7	11.1	12.3	13.2	14.2	15.8
Darlington Dam	5.8	6.9	7.7	8.7	9.7	10.6	11.6	13.1

Mississippi Valley Division,
Regional Planning and Environment Division South

Amite River and Tributaries East of the Mississippi River, Louisiana

Appendix I – Nonstructural Implementation Plan

December 2023

CONTENTS

LIST OF TABLES

LIST OF FIGURES

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Section 1
Definitions Related to the Nonstructural Plan

Term	Definition
AEP	Annual Exceedance Probability (AEP) means the probability that a given rainfall total accumulated over a given duration will be exceeded in any one year.
Base Flood	The term "base flood" is defined by the National Flood Insurance Project (NFIP) as the "flood having a 1 percent chance of being exceeded in any given year and is also called the .01 annual exceedance probability flood".
Base Flood Elevation (BFE)	The computed elevation to which floodwater is anticipated to rise during the base flood. The base flood elevation or BFE is shown on community's Flood Insurance Rate Map (FIRM).
Dry Floodproofing	Dry floodproofing consists of sealing all areas of a structure up to a maximum of approximately 3 feet above ground level to reduce damage caused by .01 AEP BFE based on year 2076 hydrology by making walls, doors, windows and other openings resistant to penetration by water. Walls are coated with sealants, waterproofing compounds, or plastic sheeting. Back-flow from water and sewer lines is prevented by installing mechanisms such as drain plugs, standpipes, grinder pumps, and back-up valves. Openings, such as doors, windows, sewer lines, and vents, may also be closed temporarily with sandbags or removable closures, or closed permanently.
Economically Justified	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 2026-2076) unless they have been identified eligible based on social vulnerability (SV) criteria and included in the next highest aggregation regardless of economic justification.
Elevation (of structure)	The entire foundation of the residential structure will be lifted and placed on a new foundation (i.e., columns, piers, posted or raised foundation walls) so that the lowest habitable finished flood is above the design water surface elevation. All utilities and mechanical equipment, such as air conditioners and hot water heaters, will also be raised to this elevation. This measure is applicable to permanent residential structures only.
Eligible structures	Structures that are determined by the United States Army Corps of Engineers (USACE) to be eligible for floodproofing or elevation after the completion of the investigations and analyses as described herein in the secondary eligibility description.

First Floor Elevation (FFE)	First floor elevation or FFE refers to the height of the first lowest floor of the structure above the adjacent grade. The higher the FFE of e a structure, the less likely that flood damage to the structures will occur.
Floodproofing	As defined by the Federal Emergency Management Agency (FEMA) in 44 CFR, Chapter 1, Part 59, "floodproofing" means any combination of structural and nonstructural additions, changes, or adjustments to structures that reduce or eliminate flood damages to real estate or improved real property, water and sanitary facilities, structures, and their contents.
Hazardous, Toxic, and Radioactive Waste (HTRW)	HTRW means hazardous, toxic, and radioactive waste as more specifically defined in Engineer Regulation (ER) 1165-2-132, "Hazardous, Toxic, and Radioactive Waste (HTRW) Guidance for Civil Works Projects".
Historic Structure	As defined in 44 CFR Part 59, a historic structure is a structure that is: (1) listed individually in the National Register of Historic Places (maintained by the Department of the Interior) or preliminarily determined by the Secretary of the Interior as meeting the requirements for individual listing on the National Register; (2) certified or preliminarily determined by the Secretary of the Interior as contributing to the historical significance of a registered historic district or a district preliminarily determined by the Secretary to qualify as a registered historic district; (3) individually listed on a state inventory of historic places with historic preservation projects which have been approved by the Secretary of the Interior; and (4) individually listed on a local inventory of historic places in communities with historic preservation projects that have been certified either by (a) an approved state project as determined by the Secretary of the Interior or; (b) directly by the Secretary of the Interior in states without approved projects.
Manufactured Home	"Manufactured home" and "manufactured housing" mean a factory-built, residential dwelling unit constructed to standards and codes, as promulgated by the United States Department of Housing and Urban Development, under the National Manufactured Housing Construction and Safety Standards Act of 1974, 42 U.S.C. 5401 et seq., as amended. Further, the terms "manufactured home" and "manufactured housing" may be used interchangeably and apply to structures bearing the permanently affixed seal of the United States Department of Housing and Urban Development. To be eligible for elevation, a manufactured home must have a permanent foundation, be permanently affixed to the ground, meet the anchoring, construction, installation and other requirements of La. R.S. 51:912, ART XIV-B., and be legally classified as immoveable real property under state law. Notwithstanding the provisions of La. R.S. 9:1149.6, the manufactured homeowner and any subsequent owner of an immobilized manufactured home, may not de-immobilize the manufactured home in the future by detachment, removal, authentic act of de-immobilization, or any other method.
Mobile Home	"Mobile home" means a factory-built, residential dwelling unit built to voluntary standards prior to the passage of the National Manufactured Housing Construction and Safety Standards Act of 1974. This term includes and is interchangeable with the term "house trailer" but does not include the term "manufactured home." To be eligible for elevation, a mobile home must have a permanent foundation, be permanently immobilized in accordance with the requirements of La. R.S. 9:1149.4, as amended from time to time, and be legally classified as immoveable real property under state law. Notwithstanding the provisions of La. R.S. 9:1149.6, the mobile homeowner and any subsequent owner of an immobilized mobile home, may not de-immobilize the mobile

	home in the future by detachment, removal, authentic act of de-immobilization, or any other method.
Modular Home	"Modular home" and "modular housing" mean a factory-built, residential dwelling unit built to the International Residential Code as adopted by the Louisiana State Uniform Construction Code Council pursuant to La. R.S. 51:911.22, as amended from time to time. To be eligible for elevation, a modular home must have a permanent foundation, be permanently affixed to the ground, be legally classified as immoveable real property under state law, and meet the anchoring, construction, installation, and other requirements of La. R.S. 51:912, ART XIV-B. Notwithstanding the provisions of La. R.S. 9:1149.6, the modular homeowner and any subsequent owner of a modular home, may not de-immobilize the modular home in the future by detachment, removal, authentic act of de-immobilization or any other method.
National Flood Insurance Program (NFIP)	The NFIP is a program that makes federally-backed flood insurance available in those states and communities that agree to adopt and enforce flood-plain management ordinances to reduce future flood damage. The program of flood insurance coverage and floodplain management administered under the Act and applicable federal regulations promulgated in Title 44 of the Code of Federal Regulations, Subchapter B.
Non-Federal Interest (NFI)	The NFI plans to act as the sponsor, including any non-Federal interest that has contributed to, or is expected to contribute to, the non-Federal cost share of the proposed feasibility study or project modification.
Non-Federal Sponsor (NFS)	The NFS is the cost-sharing partner for the design, construction of the project, as well as for the Operation, Maintenance, Repair, Rehabilitation and Replacement (OMRR&R) of the project.
Nonstructural Measures	Nonstructural floodproofing measures are permanent or contingent measures applied to a structure and/or its contents that prevent or provide resistance to damage from flooding. Nonstructural food proofing measures differ from structural floodproofing measures (i.e., levees, floodwalls, etc.) in that they focus on reducing the consequences of damages from flood events instead of focusing on reducing the probability of damages from flood events.
Nonstructural Plan	Nonstructural measures are permanent or contingent measures applied to a structure and/or its contents that prevent or provide resistance to damages from flooding. Nonstructural Plan measures differ from structural measures in that they focus on reducing consequences of flooding instead of focusing on reducing the probability of flooding. Nonstructural measures reduce flood damages without significantly altering the nature or extent of flooding. The Nonstructural measures for this report include the elevation of eligible residential structures and floodproofing of eligible nonresidential structures.
Nonresidential Structure	A nonresidential structure are those not herein defined as Residential.

Preliminary Structure Eligibility Criteria	To be considered preliminarily eligible for participation in the Nonstructural Plan, a structure must meet these criteria: 1. The structure must have a first-floor elevation at or below the applicable floodplain (which may be 0.1, 0.04 or 0.02 AEP floodplain depending on the location of the structure), based on hydrologic conditions predicted to occur in 2026 (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 2026-2076) unless they have been identified eligible based on SV criteria and included in the next highest aggregation regardless of economic justification. The structure must have a permanent foundation and be deemed 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.
Residential Structure	One- or two-family dwellings which are 3-stories or less in height intended for human habitation, for living, sleeping, cooking or eating purposes, or any combination thereof as defined by International Residential Code Chapter 11 Section N1101.6.
Structural Plan	Structural measures are physical modifications designed to reduce the frequency of damaging levels of flood inundation. For purposes of this report, these measures include levees and floodwalls.
Special Flood Hazard Area (SFHA)	An area having special flood, mudflow or flood-related erosion hazards and shown on a Flood Hazard Boundary Map or a Flood Insurance Rate Map (FIRM) Zone A, AO, A1-A30, AE, A99, AH, AR, AR/A, AR/AE, AR/AH, AR/AO, AR/A1-A30, V1-V30, VE or V. The Special Flood Hazard Area (SFHA) is the area where the NFIP's floodplain management regulations must be enforced.
Wet Floodproofing	Wet floodproofing prevents or provides resistance to damage from flooding while allowing floodwaters to enter the structure or area and equalize pressures on foundation walls or lower-level walls. A key feature associated with wet floodproofing are openings to allow floodwaters in, consisting of engineered flood vents in the structure walls.

Section 2
Introduction

This Nonstructural (NS) Implementation Plan (Plan) describes the general process for the implementation of NS elevations and floodproofing measures to reduce the risk of flood damages to residential and nonresidential structures caused by riverine flooding from excessive rainfall events, in addition to residual flood damages associated with coastal storm events in the Amite River Basin (ARB) study area. USACE recognizes that there are unique challenges in the implementation of a relatively large Plan. Because of this, USACE has proactively leveraged national experts in the planning, design, and construction of the NS measures included in the Plan for this study. These national experts include the USACE National Nonstructural Committee, Flood Risk Management Center of Expertise, as well as project delivery teams that are currently working to implement similar projects (e.g., Southwest Coastal Louisiana; South Central Coastal Louisiana, Neuse River Basin; Florida Keys Monroe County; and the Fire Island Inlet to Montauk Point General Reevaluation Study). See generally: https://www.crt.state.la.us/Assets/OCD/hp/uniquely-louisiana-education/Disaster-Recovery/The%20History%20of%20Building%20Elevation%20in%20New%20Orleans%2012-21-12.pdf. The Non-Federal Sponsor (NFS), State of Louisiana, acting by and through, the Louisiana Department of Transportation and Development (LADOTD), and local stakeholders have also provided valuable information pertinent to the study. The USACE places a priority on continuing this coordination during preconstruction engineering and design (PED) and construction, and sharing lessons learned with other USACE teams. This will likely include updating the Hydrology & Hydraulics existing conditions modeling to incorporate newly built projects by the NFS or USACE that would change the flood risk for the project area. The PED phase occurs after Congress authorizes the final recommended plan.

This Plan describes the general process for the implementation of elevations and floodproofing measures to reduce the risk of flood damages to residential and nonresidential structures within the study area. The Plan is based on previous and on-going USACE projects and studies that contain a NS component in the tentatively selected and recommended plans. However, the implementation of the Plan for this study may be modified when new USACE guidance is issued for the implementation of NS plans and as the study progresses. The information in this plan presents a strategy that may be used to implement NS measures in support of the authorized plan and will be refined and updated as more information becomes available.

The primary goal of the Plan proposed is to reduce flood risk for structures in the study area. To preliminarily qualify for inclusion in the Plan, a structure must have a First Floor Elevation (FFE) at or below the applicable floodplain based on hydrologic conditions predicted to occur in 2026 (the beginning of the 50-year period of analysis). The FFE threshold varies by location throughout the parishes but averages 6 feet. A total of approximately 3,298 structures in the study area meet this requirement. Of the approximate total of 3,298 structures, there are approximately 2,918 residential structures and 380 nonresidential structures. Property owner participation in the Plan is voluntary. Based upon current information, the anticipated duties and obligations of property owners are generally outlined in other Sections of this Appendix (including Sections 4, 5, 6 and 8). However, some of this information may be modified as the Plan is finalized. While groups of structures have been evaluated for the most cost-effective NS measure, the USACE reserves the right to determine which measure shall ultimately be implemented at each structure location, including consideration of project costs and benefits as well.

The project area shall be subdivided into distinct geographic areas or reaches for implementation and maps of these areas will be prepared and regularly updated to depict the current stage of structure elevation eligibility names of the property owners, property line boundaries, locations of hazardous, toxic, and radioactive waste (HTRW), zoning districts, boundaries of regulatory floodways, flood zones, and other important information.

It is anticipated that implementation of the Plan will occur over an approximate 10-year period with approximately 500 structures to be elevated and/or floodproofed a year after an 18-month PED phase. Section 7 of this appendix provides additional information.

2.1 SUMMARY OF PLAN DEVELOPMENT

All nonstructural plans employed the USACE "logical aggregation method" which according to USACE Planning Bulletin 2019-03, nonstructural analyses are to be conducted using the method. Rather than the individual structure, selected groups of structures known as "aggregates" are the unit of analysis and each such aggregate is a separable element that must be incrementally justified. Aggregates were arranged based on several factors. Since the study area is subject to riverine, rainfall and residual flood damages associated with hurricanes, and coastal storm flood events, aggregates were primarily grouped according to the source (type of flood event) of the flooding. Using this method, 57 floodplain aggregates (groups of structures) were identified. An assessment of all structures located in the 10-, 20- and 50-year (10 percent, 4 percent and 2 percent annual exceedance probability or AEP) floodplains was performed. The net benefits of each aggregate were analyzed based on the damages they would incur at the 10 percent, 5 percent and 2 percent AEP.

The initial Nonstructural National Economic Development (NED) alternative was identified to be the plan strictly for the study purpose of rainfall flood risk. When adding an increment of residual risk for storm surge, the HEC-FDA economic model uses aggregations based on the rainfall waster surface elevations (WSE) only and calculates the flood damages based on the predominate condition since the relative WSE at a given probability changes, the expected annual damage changes. The predominant condition WSE takes the higher of the WSEs generated by two hydrologic boundary condition scenarios: one condition accounts for basin-wide extreme rainfall events with normal highwater downstream boundary condition, and a secondary condition that has negligible basin rainfall with storm surge downstream boundary conditions. Eight flooding events were used (2, 5, 10, 25, 50, 100 and 500) for the HEC-FDA analysis the assignment of stages relative to the probabilities change.

The Plan includes additional structures above the NED plan, to include comprehensive net benefits accounted for under Other Social Effects (OSE) account. per *1983 Economic and Environmental Principles and Guidelines for Water and Related Land Resource Implementation Studies* (P&G), and more specifically flood risk management benefits to communities experiencing social vulnerability (SV). The primary database used to represent SV data was the CDC's Social Vulnerability Index (CDC-SVI). CDC-SVI data included representation for socioeconomic status, age, disabilities, language, minority status, housing, and transportation. Areas in the 90th percentile or higher were flagged as having high SV. The aggregates used to identify the NED Plan were further subdivided into 19 SV sub aggregates allowing the team to evaluate impacts and formulate alternatives specific to areas experiencing high SV. Eligibility for incremental comprehensive benefits plans relied on a comparison of the benefits at the 10 percent, 5 percent, and 2 percent AEP floodplain aggregations and parametric construction costs at the sub aggregate level. The Plan includes all structures eligible within NED Plan and expanded eligibility to include all structures within SV sub aggregates at the next highest floodplain aggregation even if the sub aggregation did not have positive net benefits.

In order to be preliminarily eligible for inclusion in the Plan, 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 0.1, 0.04, .02 AEP year floodplain depending on the location of the structure), based on hydrologic conditions predicted to occur in 2026 (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 2026-2076) unless they have been identified eligible based on SV criteria and included in the next highest aggregation regardless of economic justification.
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.

Additional information regarding the development and refinement of the Plan is contained in Appendix G: Economic and Social Consideration.

Based upon current information, the anticipated duties and obligations of property owners are generally outlined in other sections of this Appendix (including Sections 4, 5, 6, and 8). However, some of this information may be modified as the study progresses and/or as the Plan is finalized. While groups of structures (aggregates and sub-aggregates) have been evaluated for the most cost-effective NS measure, the USACE reserves the right to determine which measure shall ultimately be implemented at each structure location.

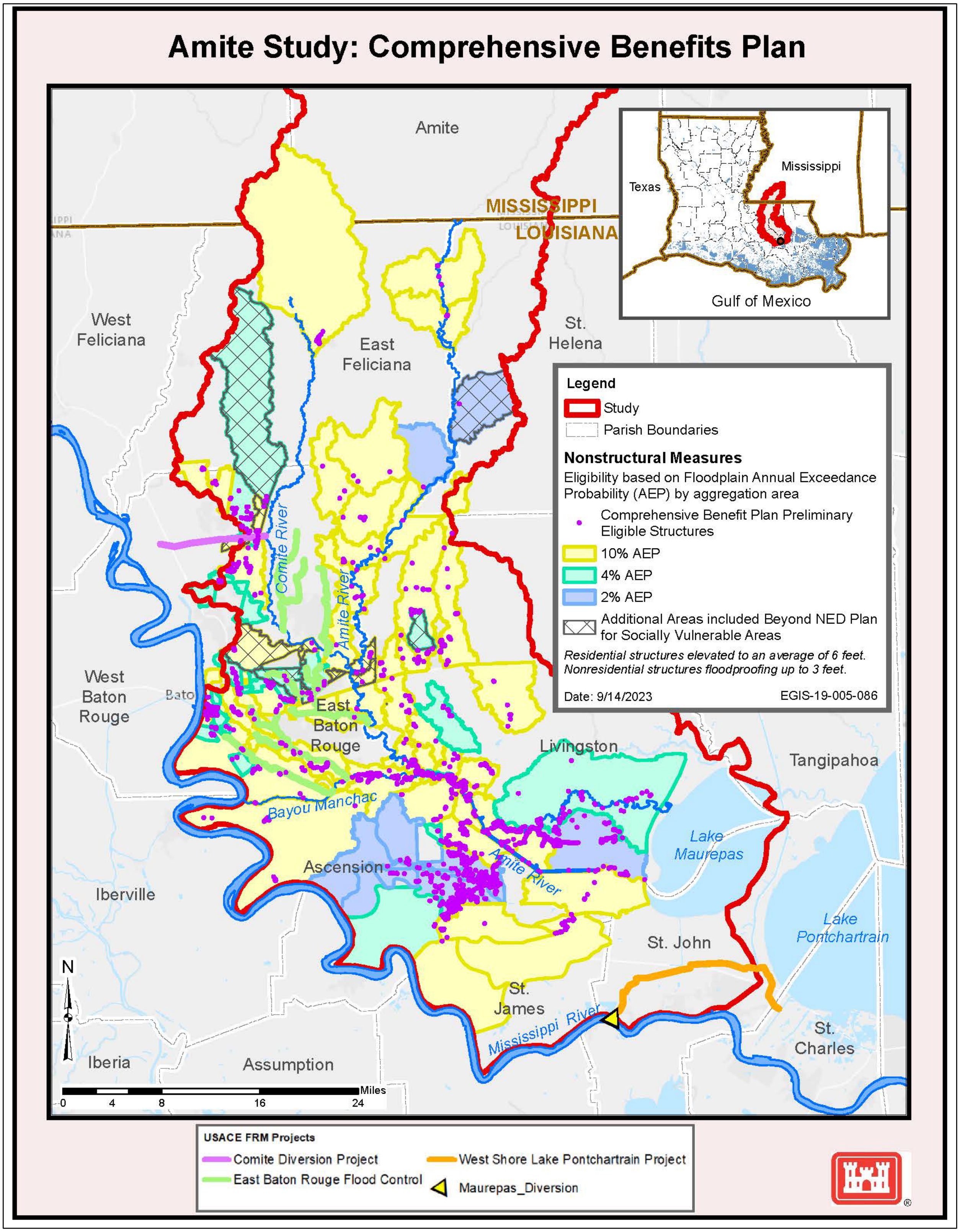

Figure I:2-1. Map of the Nonstructural Plan

2.2 PROPOSED NONSTRUCTURAL MEASURES

The Plan is currently based on the following measures, which will be refined as additional data becomes available. Additional information regarding other NS measures will be added, as appropriate, and as the Plan is refined.

2.2.1 Elevation of Eligible Residential Structures

Elevation of eligible residential structures to the 100-year base flood elevation (BFE) will be based on WSE of the USACE Hydraulics and Hydrology modeled 2076 year event. Foundations must be designed to properly address all loads and their effects on the supported structure, be appropriately connected to the floor structure above, and utility connections must be properly elevated. Elevations will not exceed 13 feet above ground level. If the required elevation is greater than 13 feet above ground level, the structure would still be eligible for elevation up to that height with the residual risk present. It is estimated that the BFE, based on 2076 hydrology, for 99 percent of the prospective structures is below 13 feet above ground level. Actions may include the following:

- Elevation on piers, columns, or piles;
- Elevation on continuous foundation walls;
- Elevating on open foundations (e.g., piles, piers, posts, or columns);
- Elevation of slab;
- Slab separation;
- Elevation on fill;
- Second story conversion/attic build-out.

Some of the advantages and disadvantages associated with elevating a residential structure are displayed in Table I:2-1.

2.2.2 Dry Floodproofing of Eligible Nonresidential Structures

Dry floodproofing involves techniques applied to keep nonresidential structures dry by sealing the structure to keep floodwaters out. In dry floodproofing, the portion of a structure that is below the FFE (walls and other exterior components) is sealed to make it watertight and substantially impermeable to floodwaters. Such watertight impervious membrane sealant systems can include wall coatings, waterproofing compounds, impermeable sheeting, and supplemental impermeable wall systems, such as cast-in-place concrete. Doors, windows, sewer and water lines, and vents are closed with permanent or removable shields or valves. The expected duration of flooding is critical when deciding which sealant systems to use because seepage can increase over time, rendering the floodproofing ineffective. Waterproofing compounds, sheeting, or sheathing may fail or deteriorate if exposed to floodwaters for extended periods. Sealant systems are also subject to damage (puncture) in areas that experience water flow of significant velocity, or ice or debris flow. The USACE National Flood Proofing Committee has investigated the effect of various depths of water on masonry walls. The results of their work show that, as a general rule, no more than 3 feet (0.9 m) of water should be allowed on a nonreinforced concrete block wall that has not previously been designed and constructed to withstand flood loads. Therefore, application of sealants and shields should involve a determination of the structural soundness of a building and its corresponding ability to resist flood and flood-related loads. A Licensed Professional Engineer registered in Louisiana should be involved in any design of dry floodproofing mitigation systems so that they can evaluate the building to determine the appropriate height of dry floodproofing. Research in this subject area is available in: *Flood Proofing Tests – Tests of Materials and Systems for Flood Proofing Structures* (USACE, 1988).

Some of the advantages and disadvantages associated with dry floodproofing are displayed in Table I:2-2.

Table I:2-2. Advantages and Disadvantages of Dry Floodproofing

Advantages	Disadvantages
Reduces the flood risk to the structure and contents if the design flood level is not exceeded	Requires ongoing maintenance
May be less costly than other retrofitting measures	Usually requires human intervention and adequate warning time for installation of protective measures
Does not require the extra land that may be needed for floodwalls or reduced levees	May not provide protection if measures fail or the flood event exceeds the design parameters of the measure
Retains the structure in its present environment and may avoid significant changes in appearance	May result in more damage than flooding if design loads are exceeded, walls collapse, floors buckle, or the building floats
	May adversely affect the appearance of the building if shields are not aesthetically pleasing
	May not reduce damage to the exterior of the building and other property

2.2.3 Wet Floodproofing of Eligible Nonresidential Structures

Wet floodproofing involves techniques designed to permit floodwaters to enter a structure to prevent or provide resistance to damage from flooding. Wet floodproofing of a structure interior is intended to prevent unbalanced hydrostatic pressure on the walls and support systems of the structure by equalizing interior and exterior water levels during a flood.

Some of the advantages and disadvantages associated with wet floodproofing are displayed in Table I:2-3.

Table I:2-3. Advantages and Disadvantages of Wet Floodproofing

Advantages	Disadvantages
Reduces the risk of flood damage to a building and its contents, even with minor mitigation	Usually requires a flood warning to prepare the building and contents for flooding
Prevents unbalanced hydrostatic pressure on walls	Requires human intervention to evacuate contents from the flood-prone area
May be eligible for flood insurance coverage of cost of relocating or storing contents, except basement contents, after a flood warning is issued	Usually requires human intervention and adequate warning time for installation of protective measures
Costs less than other measures	Results in a structure that is wet on the inside and possibly contaminated by sewage, chemicals, and other materials borne by floodwaters and may require extensive cleanup
Does not require the extra land that may be needed for floodwalls or reduced levees	May reduce the structures functionality
Retains the structure in its present environment and may avoid significant changes in appearance	Limits the use of the floodable area
	May require ongoing maintenance

2.3 PUBLIC EDUCATION AND ENGAGEMENT

USACE and/or the NFS will engage in a public education campaign to inform property owners and any impacted renters of those properties of the NS component the ASA-CW selected alternative including, but not limited to eligibility criteria, the application process, responsibilities of property owners to clear title and remediate contaminated properties, and other key information about the project. USACE and/or the NFS shall prepare and distribute written materials such as project information pamphlets, letters of invitation to participate, and public meeting notices. In addition, USACE and/or the NFS will issue press releases, hold public meetings and workshops, make presentations to homeowner’s associations and other civic groups and organizations, and utilize a variety of social media and other public relations methods to inform property owners and tenants of the project.

In order to maximize community understanding, acceptance, and participation in the Plan, it is imperative that NFS government and local agencies are instrumental in the effort to communicate the benefits of the Plan and project. Local community involvement is a requisite for success. Familiarity with local political and community leaders will likely improve residents level of comfort, trust, and understanding of the project goals, objectives, and benefits.

Section 3

Process for the Elevation of a Residential Structure

3.1 PRELIMINARY ELIGIBILITY

Multifamily structures such as condominium and apartment buildings are grouped with residential structures. To be considered preliminarily eligible for participation in the Plan the residential structure must meet these criteria:

1. The structure must be in the 0.1, 0.04 or 0.02 AEP year floodplain depending on the location of the structure, based on hydrologic conditions predicted to occur in 2026 (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 2026-2076) unless they have been identified eligible based on SV criteria and included in the next highest aggregation regardless of economic justification.
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.

A residential structure that has a FFE at the specified floodplain for that location, would be elevated to the .01 AEP BFE based on year 2076 hydrology. Costs attributable to elevating to the BFE is part of the project costs. Costs attributable to elevating in excess of the BFE will not be paid for as a project cost and all such costs must be borne solely by the property owner. If the BFE is greater than 13 feet above ground level, the structure would still be eligible for elevation up to the 13 feet height with the residual risk present. Foundations must be designed to properly address all loads and their effects on the supported structure, be appropriately connected to the floor structure above, and utility connections must be properly elevated.

3.2 SECOND STAGE OF ELIGIBILITY DETERMINATIONS

The following is a general description of the process that will apply to willing owners of preliminarily eligible residential structures. Participating owners of eligible structures must complete and submit an application to USACE, but the processing, investigation and verifying tasks for final eligibility may be shared between USACE and the NFS depending on the NFS's capability. Incomplete applications or applications that contain false or misleading information or substantial errors will not be processed.

Owners of preliminarily eligible structures that do not want their structure elevated, may elect to not participate. USACE and the NFS will defer any further action on that structure until such time as the property owner elects to participate or until the period of construction ends. If there is a title transfer (i.e., the home is sold or there is a donation, succession, foreclosure, etc.) and the project remains authorized and funded, the new owner(s) may elect to participate. A property owner may elect not to participate at any time prior to the issuance of right-of-entry for construction for the elevation of the structure. For properties with multiple owners, all of the owners must consent in writing to the elevation of the structure during the application process. Because the Plan requires voluntary participation there will be no exercise of eminent domain by the NFS or USACE.

Residential property owners will be required to grant a temporary right-of-entry to agents of USACE and the NFS to enter in and upon the property to conduct such investigations deemed necessary for USACE to determine final eligibility of the structure for participation in the Project. These investigations may include, building condition assessments, surveys, limited environmental testing and site assessments, inspections to verify current elevation and determine elevation requirements, and to conduct other activities deemed necessary by USACE. Refusal to grant temporary right-of-entry to USACE will constitute an election by the property owner not to participate.

Title research and appraisals will be completed by the NFS to confirm fee ownership and the existence of leases, third party interests, and any liens, judgments, or mortgages on the property. The title research will identify the names and addresses of all of the owners of an interest in the property, inclusive of owners of the fee interest, leasehold or third-party interest and holders of any liens, mortgages, or judgments against the property. The property owner must provide satisfactory proof of ownership of the real property and the permanent structure to be elevated. Proof of ownership shall include an authentic Certificate of Title and a Certificate of Mortgage that identifies the names of all of the owners of the real property and the structure to be elevated, as well as any holders of a lease interest, third party interest holders and any holders of a lien or encumbrance against the property. All property owners, leaseholders, mortgagees, lienholders, and any other person or entity with an interest in the real property on which the structure to be elevated is located, as well as all persons and entities who have an interest in the structure to be elevated, must consent in writing to the elevation of a structure on a USACE form designated for such purpose. Additionally, the property owner shall provide written verification from the tax assessor that no taxes are due and payable on the property, as well as documentation from any holder of a mortgage, lien, or encumbrance, that the mortgage, lien, or encumbrance is in good standing or has been satisfied and released.

The property must have clear title that is not subject to any outstanding right or interest that will present an impediment to the implementation of the project including but not limited to property/boundary disputed, succession matters, etc. To that end, as one of the conditions of being determined to be eligible to participate in the Plan, the property owner shall be responsible to clear the title of all ownership issues, (in accordance with the conditions and requirements deemed necessary by the USACE), from holders of leases, liens, judgments, encumbrances, or third-party interests at the property owner's sole expense. The failure of the property owner to provide clear title documentation and obtain the required consents of other interest holders, to the satisfaction of USACE, shall result in a USACE determination of ineligibility of the structure to participate in the Plan.

USACE policy is to avoid the use of project funds for Hazardous, Toxic, and Radioactive Waste (HTRW) removal and remediation activities. Refer to ER 1165-2-132 and the American Society for Testing and Materials (ASTM) E 1527-13, Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process (ASTM, 1997). Pursuant to Engineer Regulation 1165-2-132, Hazardous, Toxic, and Radioactive Waste (HTRW) Guidance for Civil Works Projects (26 June 1992), an American Society for Testing and Materials (ASTM) Phase I Environmental Site Assessment (ESA) and Asbestos investigation site reconnaissance will need to be conducted. It will be conducted during PED.

Prior to construction and after a right-of-entry for on-site HTRW investigations is provided by the property owner, an ASTM E 1527-13 Phase II ESA will be completed. If the Phase II ESA identifies contamination, the property owner will be notified in writing of the remediation that is required and that the work must be performed by a licensed HTRW remediation professional. If the presence of HTRW, asbestos, or asbestos-containing materials in a damaged or friable form is confirmed on the property, the property owner shall be obligated, at his sole cost and expense, to conduct all necessary response and remedial activities in full compliance with applicable local, state, and federal laws and regulations and provide proof thereof before USACE makes a final determination as to whether the structure meets the eligibility requirements. In addition, documentation from a third party licensed HTRW remediation professional must be provided by the property owner to the USACE with sufficient evidence to support that the contamination has been successfully and properly remediated.

A determination that a structure is qualified for elevation will be made by USACE after all inspections, investigations, assessments, title research, and other required activities related to eligibility for elevation is complete and prior to the development of the scope of work.

Additional requirements for residential structure elevation are:

- The structure is not located on federal property or leased land;
- The structure can be elevated to meet the required BFE so that the habitable floors are raised to levels that will protect the structure from flooding and reduce risk from future losses to the extent practicable;

- A condition assessment will identify any issues that are immediately inhibitive which, if possible, the owner will need to address before being declared eligible. The lifting contractor will make the final assessment on the viability of lifting;
- The structure is deemed permanently anchored or affixed to the ground to render it immobile;
- The structure is legally classified as immoveable real property under state law and if applicable, the structure owner provides USACE with an authentic and current act of immobilization and agrees in writing not to take any future actions such as the removal or detachment of the structure, the execution of an act of de-immobilization, or other actions such that the structure is legally classified as moveable personal property;
- The owner of a manufactured, modular, or mobile home must also be the owner of the real property to which the structure is deemed permanently anchored or affixed;
- The property owner does not owe taxes or other debts to any state or local governmental entity or to the United States of America or to the USACE;
- The property owner has not previously received any disaster assistance for the elevation or floodproofing of the structure;
- The structure must have an approved sanitary disposal system and be in compliance with existing local and state health, building and zoning codes as of the time of the structure elevation. Code compliance is the responsibility of the property owner (both for implementation and cost) as a matter of eligibility of the structure;
- The implementation of NS measures will not impact threatened or endangered species or their habitats;
- Implementing NS measures on the property does not require fill in the waters of the United States and would not result in any impact to wetlands;
- See specific requirements for the elevation of manufactured, modular, and mobile homes located in Section 3.6 of this Appendix.

If USACE determines that the structure is eligible for elevation, the entire foundation of the structure will be lifted and placed on a new foundation (i.e., columns, piers, posted or raised foundation walls) so that the lowest habitable finished floor is at or above the .01 AEP BFE predicted to occur in 2076 to a maximum of 13 feet above ground level. All utility connections and mechanical equipment, such as air conditioners and hot water heaters, will also be raised up 13 feet above ground level.

3.3 ELEVATION COSTS

Elevations will require the issuance of state and local government permits prior to the commencement of any onsite construction. No Federal funds will be used to restore, replace, or repair a structure or bring a structure into compliance with applicable building and other codes. No additions to the habitable spaces of a structure (including but not limited to, outbuildings, detached garages, sheds, etc.) will be permitted in the performance of the elevation work. Elements of structure elevation work that are potentially eligible project costs include, but are not limited to: design costs; costs of title searches (in review of title information submitted by the property owner), surveys; costs of obtaining all required permits (i.e., zoning or land use approvals, environmental permits or required certifications, historic preservation approvals, and building permits); and the costs for the following tasks:

- Raising the roof and extending the walls of a side structure attached to the main structure (i.e., garage);
- Raising mechanical equipment (e.g., air conditioner, furnace, water heater, electrical panel, fuel storage, valves, or meters);
- Connecting, disconnecting, and extending utility connections for electrical power, fuel, incoming potable water, wastewater discharge;
- Meeting access requirements of applicable building and other codes (e.g., stairs with landings, guardrails) and/or the Americans with Disabilities Act;
- Creating large vent openings in the foundation and walls to meet requirements for floodwater entry and exit;
- Special access improvements (e.g., elevators, lifts, ramps, etc.) when a satisfactory written medical opinion is provided by a medical doctor who is active, in good standing and licensed by the State of Louisiana, stating that special handicapped access is required for a handicapped or mobility challenged property owner and/or the property owner’s family member and/or other person currently residing in the structure, and/or by a tenant currently occupying the structure. Multiple access points may also be eligible where necessary to meet state and/or local building and other code requirements;
- Removal of any trees and other vegetation which restrict the elevation work;
- Debris removal (all demolition debris (hazardous and non-hazardous) shall be removed and taken to an approved landfill;
- Site grading and site restoration including grading landscaping to it preconstruction condition but it cannot adversely affect drainage of adjacent properties;
- Temporary site protection measures during the elevation work such as temporary construction fencing;
- Allowable relocation assistance funds for displaced tenants who are unable to occupy the structure during the elevation process in accordance with the Uniform Relocation Assistance (URA) and Real Property Acquisition Policies for Federal and Federally Assisted Programs of 1970, Public Law 91-646, 84 Stat. 1984 (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. Relocation assistance for tenants who cannot live in the structure during the elevation process, may include, among other thing, advisory services, eligible reasonable out-of-pocket expenses incurred during temporary displacement (e.g., moving and storage of household goods required to be removed during construction, temporary quarters, meals, etc.);
- If additional work is required as a condition of building permit issuance, and if such work is not listed as eligible herein, the property owner will be required to

fund and conduct such additional work. In no event shall the structure be elevated if USACE determines that the structure is not physically sound and/or capable of being raised safely.

The costs that exceed that which is necessary to safely elevate a structure are deemed ineligible costs and any such costs are the sole financial responsibility of the property owner. The following items are ineligible:

- Any work that is not strictly necessary for the safe completion of the structure elevation;
- Any structural and system repair due to existing deficiencies;
- Modifications or improvements to a septic system except for extension of lines from the raised structure to the existing system and back flow valves;
- Cost for elevation above the (2076) 0.01 AEP BFE elevation;
- Modifications to structures that are not attached to the eligible structure;
- Modifications to pools, spas, hot tubs, and related structures or accessories;
- Modifications to decks and patios not connected to or immediately adjacent to the structure except for modifications that are expressly required by building codes (e.g., stairways and landing modifications);
- Removal of movable objects which restrict the elevation work;
- The proper remediation, removal and disposal of environmental contaminants including but not limited to HTRW, lead, asbestos, and asbestos-containing materials in damaged or friable form. All HTRW remediation costs shall be borne solely by the property owner;
- Costs associated with bringing a non-conforming structure into compliance with current building codes, housing codes, and/or other applicable codes;
- Special access improvements are not eligible costs, unless a satisfactory written medical opinion is provided by a medical doctor who is active, in good standing and licensed by the State of Louisiana stating that special handicapped access is required for a handicapped or mobility challenged property owner and/or the property owner’s family member and/or other person currently residing in the structure, and/or by a tenant currently occupying the structure.
- Structures not considered the primary residence (i.e., detached garage, shed and/or barns).

However, the participation in the Plan does not guarantee reduced rates under the NFIP.

Pursuant to 44 CFR 60.3(d), developments are restricted from obstructing the flow of water and increasing flood heights. State and local building and zoning codes must be taken into consideration in the implementation process. Some codes contain restrictions on “substantial improvements” to existing non-confirming structures that require that the entire structure be brought up to current code requirements, which may increase the costs beyond that of the elevation costs alone. In addition, zoning codes may have height restrictions for buildings in residential areas that might affect the ability of certain structures to be raised without obtaining a variance or other form of relief from the zoning code. The property owner will be responsible for obtaining any required variances. All elevations shall be considered "development in the floodplain" and will require local permits prior to any onsite construction. Failure to obtain the required local permits may result in a violation of the local floodplain ordinance and/or the NFIP. The elevated structure must comply with the locally adopted floodplain ordinances. The NFS and the local government with jurisdiction will be responsible for ensuring that the elevated structure is compliant with the NFIP.

3.4 ACCESSIBILITY ACCOMMODATIONS

If a property owner and/or the property owner's family member or other person or tenant, who is a current occupant of the structure at the time of scheduling elevation of the structure, is physically disabled or has mobility impairments, such as in the case of elderly structure owners, special access improvements (e.g., elevators, lifts, ramps, etc.) may be an eligible cost. A satisfactory written medical opinion must be provided by a medical doctor who is active, in good standing, and licensed by the State of Louisiana, and state that special handicapped access is required for a handicapped or mobility challenged property owner and/or the property owner's family member and/or other person currently residing in the structure, and/or by a tenant currently occupying the structure. Multiple access points may also be eligible where necessary to meet state and/or local building and other code requirements. Where ramps are used to provide access, the ramps shall be designed to meet Federal standards for slope and width. Where ramps are not technically feasible, a mechanical chairlift may be installed. Special access features shall be subject to state and local building and other applicable codes.

3.5 RELOCATION ASSISTANCE

Tenants who are deemed to be "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). Displacement longer than 90 days will be consistent with the URA. Appropriate advisory services, including reasonable advance written notice of:

- Date and approximate duration of the temporary relocation;
- Address of the suitable decent, safe, and sanitary dwelling to be made available for the temporary period;
- Terms and conditions under which the tenant may lease and occupy a suitable decent, safe, and sanitary dwelling in the building/complex upon completion of the project;

- Provisions of reimbursement, in accordance with the requirements of the URA including 49CFR part 24, paragraph 24.402, for all reasonable out of pocket expenses incurred in connection with the temporary relocation;
- In addition to relocation advisory services, residential displaced tenants may be eligible for other relocation assistance including relocation payments for moving expenses and replacement housing payments for the increased costs of renting a comparable replacement dwelling;
- All temporary housing costs must be approved in advance in writing by USACE.

3.6 ELEVATION OF MANUFACTURED, MODULAR, AND MOBILE HOMES

There are unresolved areas of legal and policy concern associated with including manufactured, modular, and mobile homes in the structures that may be eligible for elevation. The Project Delivery Team (PDT) has not researched how many of the preliminary eligible structures are manufactured homes, or modular homes, or mobile homes at this time. The PDT is continuing to work with the vertical team, the Offices of Counsel, the USACE National Nonstructural Committee and others, to reach consensus on the propriety of including these types of structures for elevation in the Plan. This collaboration will continue to evaluate how to best protect the federal investment and enforce requirements to ensure that these kinds of homes remain immoveable real property and permanently affixed to the ground in perpetuity.

The State of Louisiana classifies property as either immoveable or moveable. Immoveable property refers to things like land and everything permanently attached to it like a house or buildings. Moveable property are things that physically exist and can be moved from one place to another. Generally, a house and the land upon which it sits would be considered immoveable property. However, if the home is a manufactured, modular or mobile home, it is classified as moveable personal property under state law unless it has been permanently immobilized in accordance with the requirements of state law. See La. R.S. 9:1149.4 (2022) Manufactured, modular and mobile homes that are not permanently affixed to the ground are considered personal property like a vehicle and are subject to the Vehicles License Tax. Further, if the manufactured, modular or mobile home is located on land that is owned by someone other than the owner of the home, the manufactured, modular or mobile home is considered moveable and is treated like cars and boats.

Immobilizing means the manufactured, modular or mobile home is made a part of the land, both physically and legally. If made immoveable, the home is legally treated like land and other buildings on the land. In order for a manufactured, modular, or mobile home to be legally classified as immoveable real property, the structure owner must comply with the requirements of La. R.S. 9:1149.4 (2022), which include the execution of an act or declaration of demobilization stating that the structure shall remain permanently attached to the lot or tract of land described in the act or declaration, and the act or declaration of immobilization must contain the written consent of all owners of the structure and all holders of a mortgage or security interest. Upon recordation of the act of immobilization in the public records, the structure is subject to all laws concerning immoveable property.

Although an act of immobilization must state that the manufactured, modular, or mobile home shall remain permanently attached to the land, the act of immobilization can be "undone." Even if a manufactured, modular, or mobile home has been immobilized in accordance with state law, La. R.S. 9:1149.6 (2022) authorizes the owner (and subsequent owners) to thereafter de-immobilize the manufactured, modular and mobile home. This process effectively transforms the immobilized corporeal immoveable manufactured, modular or mobile home back to the legal status of a corporeal moveable thing and personal as opposed to real property. La. R.S. 9:1149.6 (2022), provides that an owner may de-immobilize a manufactured, modular or mobile home by detachment or removal. To be effective against third persons, the owner must comply with statutory provisions requiring the execution of an act of demobilization, recording of the act in the public records, and the submission of application to the department of public safety, office of motor vehicles, for a new certificate of title. Upon issuance of a new certificate of title, the de-immobilization process is complete, and the manufactured, modular or mobile home shall be deemed moveable and subject to all laws concerning moveable personal property.

3.7 REAL ESTATE REQUIREMENTS FOR THE IMPLEMENTATION OF RESIDENTIAL STRUCTURE ELEVATIONS

The elevation of eligible residential structures will require the NFS to acquire a standard right of entry for survey and exploratory work and a standard right of entry for construction. A standard temporary work area easement will be acquired for the duration of construction on any improvements. Also, the NFS will be required to obtain subordinations and releases for all rights required for project implementation, including the temporary ROW easements.

In addition, a non-standard estate in the form of a permanent easement for restrictions and access (permanent easement), will likely be proposed by CEMVN and submitted in accordance with USACE regulations with a request for approval later in the study process. It is anticipated that such an easement will be imposed in, on, over, and across the land on which the residential structure(s) has been or will be elevated in connection with this project. The contemplated easement will perpetually prohibit the grantors, heirs, successors, assigns, and all others from: (1) using any portion of the ground level of the elevated structure for human habitation; (2) constructing or placing any enclosure or permanent obstruction that would impair the flow of water on the ground level of the elevated structure; and (3) engaging in other uses of the elevated structure or the land that would impair, contravene, or interfere with the integrity of the elevated structure. There would be a reservation of rights and privileges in favor of the grantors, heirs, successors, and assigns to use the land in such a manner so as not to interfere with, or abridge, the rights, easement, prohibitions, and restrictions contained in the easement. The easement would also include a right of ingress and egress over and across the land by NFS, its representatives, agents, contractors, and assigns, for the purpose of inspecting and monitoring the elevated residential structures and land in order to enforce the rights and prohibitions contained in the easement. A similar non-standard estate (permanent easement) to that described above, may also be required for manufactured, modular and mobile homes that are to be elevated as part of the Plan. A Real Estate Plan regarding the estates to be acquired will be developed during PED phase of the project.

Section 4

Process for Dry Floodproofing of Eligible Non-Residential Structures

Dry floodproofing consists of sealing all areas below the flood damage risk reduction level of a nonresidential and nonresidential portions of mixed-use structures to make walls, doors, windows, and other openings impermeable to water penetration and watertight to ensure that floodwaters cannot get inside. Based on NFIP testing conducted at the Engineering Research and Development Center, dry floodproofing can generally only be performed on the walls and portions of a conventionally built structure from the ground level to up to 3 feet above ground level. Walls are coated with sealants, waterproofing compounds, or plastic sheeting is placed around the walls and covered. Back-flow valves from water and sewer lines prevention mechanisms such as drain plugs, standpipes, grinder pumps, and back-up valves are installed. Openings, such as doors, windows, sewer lines, and vents, may also be closed temporarily, with sandbags or removable closures, or permanently sealed.

Dry floodproofing measures to be implemented under the Plan include:

- Backflow valves;
- Closures on doors, windows, stairwells and vents--they may be temporary or permanent;
- Rearranging or protecting damageable property--e.g., relocate or raise utility connections, adhesives; sealants and floor drains.

Dry floodproofing of nonresidential structures must be performed in accordance with engineering and design standards and building codes. Applicable design standards and building codes are summarized and compiled within the NFIP Technical Bulletin (TB) 3-93, Nonresidential Floodproofing—Requirements and Certification, and the requirements pertaining to dry flood-proofing of nonresidential structures found in 44 C.F.R. §§ 60.3(b)(5) and (c)(4).

4.1 NONRESIDENTIAL PRELIMINARY ELIGIBILITY

To be considered preliminarily eligible for participation in the NS Project, a structure must meet these criteria:

1. The structure must be in the 0.1, 0.04 or 0.02 AEP year floodplain depending on the location of the structure, based on hydrologic conditions predicted to occur in 2026 (the beginning of the 50-year period of analysis) at a specific location.
2. The structure must have a permanent foundation and be deemed 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.

3. The elevation or floodproofing measures proposed for the structure must be economically justified based on an aggregation or sub aggregation level, as defined herein.
4. Structure is located in an area where there is low velocity flooding (less than 3 ft/sec) and the flooding is not flashy (more than 1 hour of warning).
5. Does not have crawl foundation or basement.

Dry floodproofing achieves flood damage risk reduction, but it is not recognized by the NFIP for any flood insurance premium rate reduction when applied to nonresidential and residential structures and may not be used under the NFIP for new or substantially damaged buildings located in a Special Flood Hazard Area.

4.2 SECOND STAGE OF ELIGIBILITY DETERMINATIONS

The secondary stage of eligibility determinations is the same as presented in Section 3.2 of this NS implementation plan except it is for dry floodproofing and nonresidential structures.

4.3 DRY FLOODPROOFING COSTS

Eligible costs. All dry floodproofing will require the issuance of local permits prior to any onsite construction. No Federal funds will be used to restore, replace, or repair the structure or bring the structures up to current building codes. Elements of structure work that are deemed to be potentially eligible dry floodproofing costs include, but are not limited to: design costs; costs of obtaining all required permits (i.e., zoning or land use approvals, environmental permits or required certifications, historic preservation approvals, building permits, etc.): costs for title searches and the review of title documents; survey and inspection costs; and costs for the following tasks:

- Installation of backflow valves;
- Closures on doors, windows, stairwells and vents-- temporary or permanent;
- Rearranging or protecting damageable real property components--e.g., relocate or raise utility connections;
- Sump pumps and sub-drains;
- Water resistant material; water resistant window coverings, doors and jambs; waterproof adhesives; sealants and compounds, and floor drains;
- Plastic sheeting around the walls;
- Connecting, disconnecting, and extending utility connections for electrical power, fuel, incoming potable water, wastewater discharge;
- Removal of any trees that restrict the dry floodproofing of a structure;
- Temporary site protection measures during site work.

Unless otherwise limited by state, Federal, or local laws or ordinances or structural limitations, the dry floodproofing option that provides the greatest level of risk reduction based on the flooding at the 0.01 AEP BFE predicted to occur in 2076, shall be the option available to the owner of the structures. If additional work is required as a condition of building permit issuance, and if such work is not listed previously as eligible, the property owner will be required to complete the required work at the owner's sole expense.

Ineligible costs. The costs that exceed that which is necessary to safely dry floodproof a structure is deemed ineligible costs and any such costs remain the sole responsibility of the property owner. The following costs are ineligible:

- Any structural and system repair due to existing deficiencies;
- Modifications or improvements to a septic system except for extension of lines from the flood proofed structure to the existing system and back flow valves;
- Cost for dry floodproofing more than 3 feet above ground level;
- Modifications to structures that are not attached to the eligible structure;
- Modifications to tubs, pools, spas, hot tubs, and related structures or accessories;
- Relocation of movable objects that restrict the dry floodproofing of a structure;
- The proper remediation, removal and disposal of environmental contaminants including but not limited to HTRW, lead, asbestos, and asbestos-containing materials in damaged or friable form;
- Costs associated with bringing a non-conforming structure into compliance with current building code, housing code, and/or other applicable codes.

4.4 REAL ESTATE REQUIRED FOR DRY FLOODPROOFING

A standard temporary work area easement will be required for the duration of construction of any improvements. A separate perpetual non-standard easement in the form of a "Land Use Restrictions Easement and Perpetual Access for Inspection and Project Monitoring Easement" (perpetual easement) which provides the necessary rights and restrictions to protect the federal investment will also be required. Such a non-standard estate will likely be proposed by CEMVN and submitted for approval by HQUSACE in accordance with the USACE regulations later in the study process. The contemplated perpetual easement will prohibit the grantors, heirs, successors, assigns, and all others from engaging in other uses of the structure or the land that would impair, contravene, or interfere with the integrity of the structure. Further, the perpetual easement would contain a reservation of rights and privileges in favor of the grantor(s),heirs, successors and assigns, of all such rights and privileges that can be made of the property without interfering with or abridging the rights, and restrictions imposed, but subject to existing easements for public roads and highways, public utilities, railroads, and pipelines. The easement would also include a right of ingress and egress over and across the land by the NFS for inspection and monitoring of the structure and land for the enforcement of the rights and prohibitions contained in the easement. A Real Estate Plan regarding the estates to be acquired will be developed during PED phase of the project.

Section 5
Process for Wet Floodproofing of Eligible Non-Residential Structures

Wet floodproofing prevents or provides resistance to damage from flooding while allowing floodwaters to enter the structure or area and equalize pressures on foundation walls or lower-level walls. A key feature associated with wet floodproofing are openings to allow floodwaters in, consisting of engineered flood vents in the structure walls. Per FEMA TB, 7-93:

Flooding of a structure's interior is intended to prevent unbalanced hydrostatic pressure on the walls, surfaces, and supports of the structure by equalizing interior and exterior water levels during a flood. Inundation also reduces the danger of buoyancy from hydrostatic uplift forces. Such measures may require alteration of a structure's design and construction, use of flood-resistant materials, adjustment of building operation and maintenance procedure, relocation and treatment of equipment and contents, and emergency preparedness for actions that require human intervention.

Wet floodproofing of structures must be performed in accordance engineering design standards and building codes. Applicable design standards and building codes are summarized and compiled within FEMA TB 1-93, Openings in Foundation Walls for Buildings Located in Special Flood Hazard Areas, and FEMA 259, Engineering Principles and Practices for Retrofitting Flood Prone Residential Buildings, FEMA 348. Protecting Building Utilities from Flood Damage, and the requirements pertaining to floodproofing of structures found in 44 C.F.R. §§ 60.3(b)(5) and (c)(4).

5.1 PRELIMINARY ELIGIBILITY

To be considered preliminarily eligible, a structure must meet these criteria:

1. The structure must be in the 0.1, 0.04 or 0.02 AEP year floodplain depending on the location of the structure, based on hydrologic conditions predicted to occur in 2026 (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, as defined herein.
3. The structure must have a permanent foundation and be deemed 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.
4. Structure is located in an area where there is low velocity flooding (less than 3 ft/sec) and the flooding is not flashy (more than 1 hour of warning).

Wet floodproofing achieves flood damage risk reduction, but it is not recognized by the NFIP for any flood insurance premium rate reduction when applied to nonresidential and residential structures and may not be used under the NFIP for new or substantially damaged buildings located in a Special Flood Hazard Area.

5.2 SECOND STAGE OF ELIGIBILITY DETERMINATIONS

The secondary stage of eligibility determinations is the same as presented in Section 3.2 of this plan except it is for wet floodproofing and nonresidential structures.

5.3 WET FLOODPROOFING COSTS

Eligible costs. All wet floodproofing will require the issuance of local permits prior to any onsite construction. No Federal funds will be used to restore, replace, or repair the structure or bring the structures up to current building codes. Elements of structure work that are deemed to be potentially eligible wet floodproofing costs include, but are not limited to: design costs; costs of obtaining all required permits (i.e., zoning or land use approvals, environmental permits or required certifications, historic preservation approvals, building permits, etc.): costs for title searches and the review of title documents; survey and inspection costs; and costs for the following tasks:

- Wet floodproofing of the structure;
- Engineered flood vents;
- Flood-resistant construction materials such as rigid foam board wall insulation or cement board and molding within the interior of the building,
- Elevation and wet floodproofing of electric outlets,
- Concrete floor treatment and interior wall and floor sealer/stains;
- Exterior paint coatings;
- Sand/water blasting or other manual removal of rusted coatings and application of epoxy coatings;
- Elevation and wet floodproofing of mechanical and electrical equipment;
- Connecting, disconnecting, and extending utility connections for electrical power, fuel, incoming potable water, wastewater discharge;
- Removal of any trees which restrict access to floodproofing the structure;
- Temporary site protection measures during site work.

Unless otherwise limited by state, Federal, or local laws or ordinances or structural limitations, the wet floodproofing option that provides the greatest level of risk reduction based on the flooding at the 0.01 AEP floodplain based on 2076 hydrology, shall be the option available to the owner of the structures. If additional work is required as a condition of building permit issuance, and if such work is not listed previously as eligible, the property owner will be required to complete the required work at the owner's sole expense.

Ineligible costs. The costs that exceed that which is necessary to safely wet floodproof a structure is deemed ineligible costs and any such costs remain the sole responsibility of the property owner. The following costs are ineligible:

- Any structural and system repair due to existing deficiencies;
- Modifications or improvements to a septic system except for extension of lines from the flood proofed structure to the existing system and back flow valves;
- Cost for wet floodproofing more than 3 feet above ground level;
- Modifications to structures that are not attached to the eligible structure;
- Modifications to tubs, pools, spas, hot tubs, and related structures or accessories;
- Relocation of movable objects that restrict the wet floodproofing of a structure;
- The proper remediation, removal and disposal of environmental contaminants including but not limited to HTRW, lead, asbestos, and asbestos-containing materials in damaged or friable form;
- Costs associated with bringing a non-conforming structure into compliance with current building code, housing code, and/or other applicable codes.

5.4 REAL ESTATE REQUIRED FOR WET FLOODPROOFING

A standard temporary work area easement will be required for the duration of construction of any improvements. A separate perpetual non-standard easement in the form of a “Land Use Restrictions Easement and Perpetual Access for Inspection and Project Monitoring Easement” (perpetual easement) which provides the necessary rights and restrictions to protect the federal investment will also be required. Such a non-standard estate will likely be proposed by CEMVN and submitted for approval by HQUSACE in accordance with the USACE regulations later in the study process. The contemplated perpetual easement will prohibit the grantors, heirs, successors, assigns, and all others from engaging in other uses of the structure or the land that would impair, contravene, or interfere with the integrity of the structure. Further, the perpetual easement would contain a reservation of rights and privileges in favor of the grantor(s),heirs, successors and assigns, of all such rights and privileges that can be made of the property without interfering with or abridging the rights, and restrictions imposed, but subject to existing easements for public roads and highways, public utilities, railroads and pipelines. The easement would also include a right of ingress and egress over and across the land by the Non-Federal Sponsor for inspection and monitoring of the structure and land for the enforcement of the rights and prohibitions contained in the easement. A Real Estate Plan regarding the estates to be acquired will be developed during PED phase of the project.

Section 6

Flood Risk Reduction Actions to be taken by the Non-Federal Sponsor

The Non-Federal Sponsor will be required to undertake certain flood event risk reduction actions to comply with Section 402 of the Water Resources Development Act of 1986, as amended (33 U.S.C. 701b-12) (Section 402). These actions, include but are not limited to, actions to ensure the NFS government, and municipal and local governments within the parishes develop, comply, monitor, and enforce floodplain management plans, regulations, building codes, land use and zoning regulations, and any other developmental controls that are consistent and compliant with the requirements of Section 402 and the regulations promulgated thereunder. In addition, the NFS shall:

- Inform affected interests of the extent of protection afforded by the authorized plan not less than once each year;
- Participation in and compliance with applicable Federal floodplain management and flood insurance projects.
- Compliance with Section 402 of the Water Resources Development Act of 1986, as amended (33 U.S.C. 701b-12), including the preparation of a floodplain management plan within one year after the date of execution of the Project Partnership Agreement (PPA); implementation of such plan not later than one year after completion of construction of the project, or functional elements of the project. The final authorized plan shall be designed to reduce the impacts of future flood events in the project area, including but not limited to, addressing those measures to be undertaken by non-Federal interests to preserve the level of flood risk reduction provided by the completed project. The NFS will provide an informational copy of the plan to USACE once the plan is finalized.
- Publication of floodplain information and provision of the information to zoning and other regulatory agencies for use in adopting regulations, or taking other actions, to prevent unwise future development and to ensure compatibility with the completed project.

Additionally, the NFS will be obligated to prevent obstructions or encroachments on the properties that have been flood proofed (including prescribing and enforcing regulations to prevent such obstructions or encroachments). Presently, many communities within East Feliciana, St. Helena, East Baton Rouge, Livingston, Iberville, and Ascension Louisiana Parishes participate in the NFIP (See FEMA Community Status Book, Louisiana, August, 2023 fema.gov/cis/LA.html).

Section 7

Performance of Work

The Plan may be implemented using one or more of the methods described in this Section. The “traditional method” of implementation is generally described in publications of the USACE National Nonstructural Committee and Flood Risk Management Planning Center of Expertise. Under the traditional method, USACE will procure contracts that will allow a contractor to perform floodproofing work on multiple structures through a series of one or more task orders. In such event, the selected contractor will generally be responsible for all work associated with the elevation and/or floodproofing from beginning to end (i.e., from plan approval, to construction, to final inspection and acceptance of the work by USACE). A design build contract will be used as a best practice.

It is anticipated that implementation of the Plan will occur over an approximate 10-year period after an 18-month PED phase. However, this timeframe is highly dependent upon the number of structures receiving NS measures, the amount of funding allocated in any given year, and the participation rate. The 10-year implementation schedule is based on the assumption that five separate USACE managed contractors would each floodproof and/or elevate 100 structures concurrently, thereby totaling approximately 500 structures to be elevated and/or floodproofed within a given year. The first 6 months of the implementation schedule will include a pilot program of approximately 10 structures to streamline processes needed with various stakeholders and contractors. The implementation of other USACE projects in Louisiana containing a NS plan were also considered in making the 500 structures a year assumption. The PDT also assumed that it would take a four-month period of time to complete the elevation or floodproofing on structures with a slab foundation, and a three-month period of time to complete the elevation or floodproofing of structures with a crawl foundation. If there is a cost associated with the residential structure elevation that is coverable by the program, then that cost would be paid by NFS and/or USACE and not by the structure owner. The structure owner would not be expected to pay the coverable cost and wait for reimbursement. The program would allow for direct payment to the contractor by the USACE for certain coverable elevation costs.

Maps of the eligible aggregate and sub-aggregation areas will be prepared by the PDT and regularly updated to depict the current stage of structure elevation eligibility. After the USACE confirms final eligibility, the right of entry granted by the property owner will authorize USACE, the NFS, and their respective contractors to enter upon the properties to implement the floodproofing measures and for inspection and enforcement purposes. The easements and any required releases and/or subordination agreements, shall be recorded by the NFS in the appropriate public records of the parish in which the property is located and shall be binding upon all of the owners, their heirs, assigns and successors in interest, as well as upon all tenants, third party interest holders and holders of any liens, mortgages, judgments, and encumbrances in the property. After the required documents are recorded, the required elevation or floodproofing work will be commenced, completed and inspected.

A certificate of occupancy must be issued by the appropriate qualified building official with jurisdiction to certify that the floodproofing or elevation work was completed properly and in accordance with the final USACE approved plans and specifications. Additionally for elevations, a professional land surveyor must verify that the structure has been elevated to the required elevation. When the elevation or floodproofing work is completed, all structures must be covered by flood insurance in an amount at least equal to the costs of the elevation or floodproofing work, or to the maximum limit of coverage made available with respect to the property, whichever is less. The NFS is responsible for ensuring and maintaining compliance with any enforceable restrictions for the structure and property. The property owner is required to operate and maintain the integrity of their specific NS measures. After final inspection, approval, and acceptance of the work by the District Engineer, a notice of construction completion (NCC) will be issued to the NFS, and the floodproofing or elevation work for the structure will be financially closed out by USACE.

Section 8

Implementation Tasks and Cost Estimates

The below tables present the PDT's projection of implementation tasks. Project costs by implementation task and durations with assumptions will be developed during the feasibility level design phase. Table I:8-1 displays, in sequential order, implementation tasks which are color-coded by the following categories of work: PED; Real Estate; Construction Management; Construction, and Contingency. The analysis assumes 100 percent participation. Table I:8-2 presents a more detailed schedule, color-coded to match the first table for ease of reference. Additional details on specific tasks, work break down structure and activity-specific costs will be developed by the PDT early in the PED phase as part of the scoping and Project Management Plan (PMP) development (this will occur in conjunction with execution of the Design Agreement or Project Partnership Agreement.) Tasks and cost estimates are subject to significant change during the period of time between the signing of the Chief's Report and Congressional authorization and appropriation required to begin the project.

Table I:8-1. Projected Implementation Task and Cost Summary with 10-18%PED

Implementation Task	First Cost
Preconstruction Engineering & Design (PED)	$ 91.5 M through $164.7 M
Real Estate	$ 89.4 M
Construction Management	$ 91.5 M
Construction	$ 915.1 M
Contingency	$ 374 M through $ 397 M

Table I:8-2. Projected Implementation Task Summary

IMPLEMENTATION TASK LIST (in sequential order)	Estimated Duration	Assumptions
PMP & Project Partnership Agreement (PPA) Development	TBD	TBD
Public Outreach / Structure owner Meetings	TBD	TBD
Notification Owner Eligibility/Applications Received w/ Deed & Right of Entry for Survey	TBD	TBD
Application Processing & Acceptance	TBD	TBD
Ownership Verification, HTRW, Sanitary Evaluation & Section 106 Review	TBD	TBD
Consulting A/E Firm Contract	TBD	TBD
Survey / Design Site Visit of Structure	TBD	TBD
Certificate of Title / Title Review	TBD	TBD
Plans & Specs Development	TBD	TBD
Appraisal / Informal Value Estimate / Appraisal Review	TBD	TBD
SOW Feedback/initiate permit applications & variance process (as needed)	TBD	TBD
Easement / Deed Restrictions	TBD	TBD
Record Easement Parish Clerk of Court	TBD	TBD
NFS Issue Authorization for Entry	TBD	TBD
Contractor Market Research & Outreach	TBD	TBD
Establish MATOC/SATOC Contract	TBD	TBD
Finalize permits and town variances (as needed)	TBD	TBD
IGE Development	TBD	TBD
Request & Receipt of Contractor Proposals (incl. Task Orders)	TBD	TBD
Final Homeowner Coord. / Award Contract	TBD	TBD
Cultural Resources Mitigation	TBD	TBD
Floodproofing Agreement Request & Execution	TBD	TBD
Pre-Construction Meeting with Homeowner & Contractor	TBD	TBD
Construction Contract & Contract Administration	TBD	TBD
Construction Management	TBD	TBD
Final Inspections	TBD	TBD
Review NFS Credit/Reimbursement Package	TBD	TBD
Financial Closeout	TBD	TBD

Section 9

Methods for Scheduling and/or Prioritizing

The scheduling and/or prioritization of residential structure elevations will be subject to the availability of Federal funds. The locations for scheduling and/or prioritizing the work will be determined during PED and conducted in an efficient and cost-effective manner. Some of the methods for scheduling and/or prioritizing NS work that will be considered as part of the prioritization process are as follows:

9.1 CRITICAL SERVICE AREAS OR COMMUNITY LIFELINES

Priority should be given to structures identified through collaboration of stakeholders, NFS and public input, that are in critical service areas and are community lifelines as identified by the recently developed 2019 *Office of Community Development State of Louisiana Master Action Plan for the utilization of Community Development Block Grant mitigation Funds*. Critical service areas or community lifelines refer to indispensable services that enable continuous operation of critical business and government functions in the wake of a disaster event, and are essential to human health and safety, economic security, and foster community resilience. These include:

- Safety and security
- Communications
- Food, water, shelter
- Transportation
- Health/medical
- Hazardous material
- Energy

9.2 CLUSTERING

If numerous property owners in a contiguous neighborhood or subdivision agree to participate, that particular area could be targeted for priority in structure elevation and floodproofing implementation. A focus on clustered properties can create a ranking hierarchy of which properties to address first. The size of a cluster will need to be defined, but could consist of zip codes or neighborhoods. This approach will rank efficiency as the main factor in determining which eligible properties should be prioritized.

9.3 CLUSTERING BASED ON SOCIALLY VULNERABLE COMMUNITIES

This methodology would identify populations in areas of social vulnerability using Center for Disease Control and Prevention (CDC) Socially Vulnerable Index (SVI) most recent data. For this effort US percentile ranking may be chosen over Louisiana percentile ranking to ensure that all census tracts with potential SVI are captured. Detailed documentation of the SVI percentile ranking, and data dictionary can be found on the CDC's website.

9.3.1 Clustering Process:

According to CDC's SVI documentation, census tracts at the 90th percentile or higher indicate high vulnerability. SVI includes four themes: Socioeconomic Status; Household Characteristics; Racial & Ethnic Minority Status; and Housing Type/Transportation (Figure I:9-1). To capture all SV, census tracts with 90th percentile or higher in any of the four themes may be classified as highly vulnerable, which are areas where the population is exposed to high levels of environmental stressors and are low-income who reside in disadvantage communities as identified by CEQ's Climate and Economic Justice Screening Tool area using the most recent race demographic statistics from the U.S. Census Bureau. This approach would rank environmental and demographic data as the main factor in determining which eligible properties should be prioritized. Homeowners in disadvantaged communities or those living at or below the poverty level would be given priority.

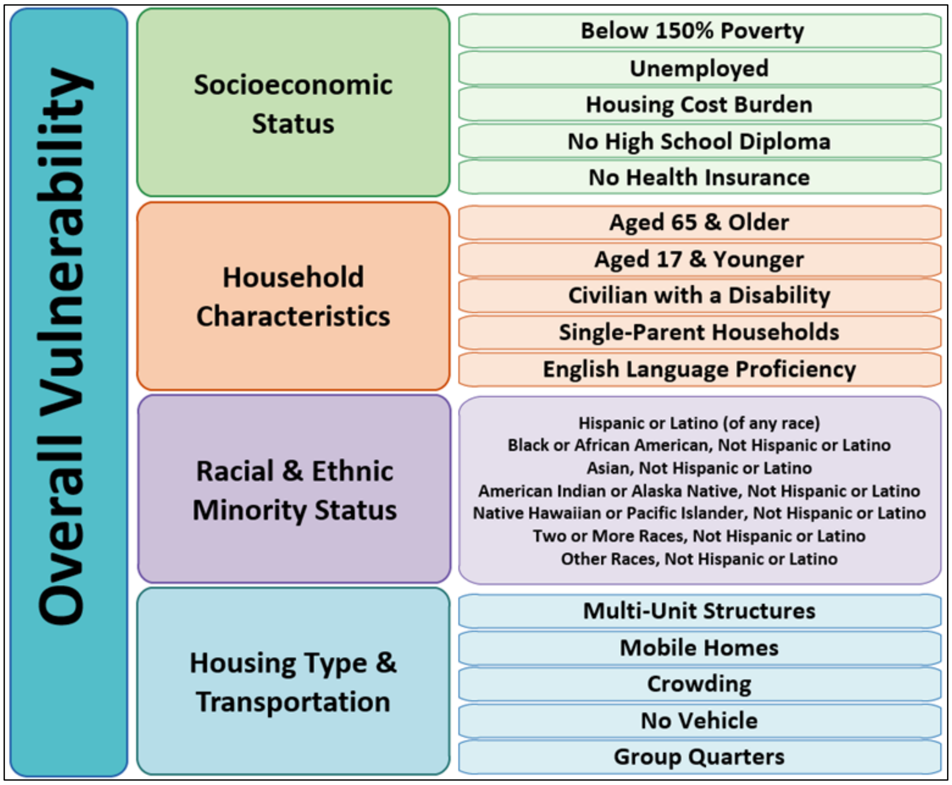

Figure I:9-1. Social Vulnerability Themes

9.4 FLOOD RISK-LEVEL

Willing property owners may not exist in clusters. In such cases, an alternative option is to focus on the willing property owners who have structures that exhibit the highest risk for flood damages. For example, if 1,000 property owners who reside in the 0.1 AEP floodplain will be prioritized for construction. Once these properties are elevated, the next highest-risk properties will be targeted. This approach will rank risk exposure as one of the main factors in determining which eligible properties should be prioritized.

9.5 FIRST-COME, FIRST-SERVED

This approach would involve creating a list of eligible structures that will be ranked based on how quickly elevation contractors can be procured and the processing of applications and the finalization of eligibility determinations. This approach would help ensure that resources will be used effectively by focusing on properties that have owner support for the residential structure elevations.

Section 10

Operation, Maintenance, Repair, Replacement, and Rehabilitation

There are no NFS OMRR&R obligations for the completed NS work other than the performance of monitoring and periodic inspections. The required inspection and monitoring of the completed NS 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 documenting whether or not any violations have been found. NS 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 2076 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 based on individual structure but is to be documented and with reference to associated 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. For all structure types (residential and nonresidential) OMRR&R costs are expected to be ‘de minimus.’ Costs for these efforts have not yet been calculated but will be included in the final Integrated Feasibility Report and Environmental Assessment.

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.