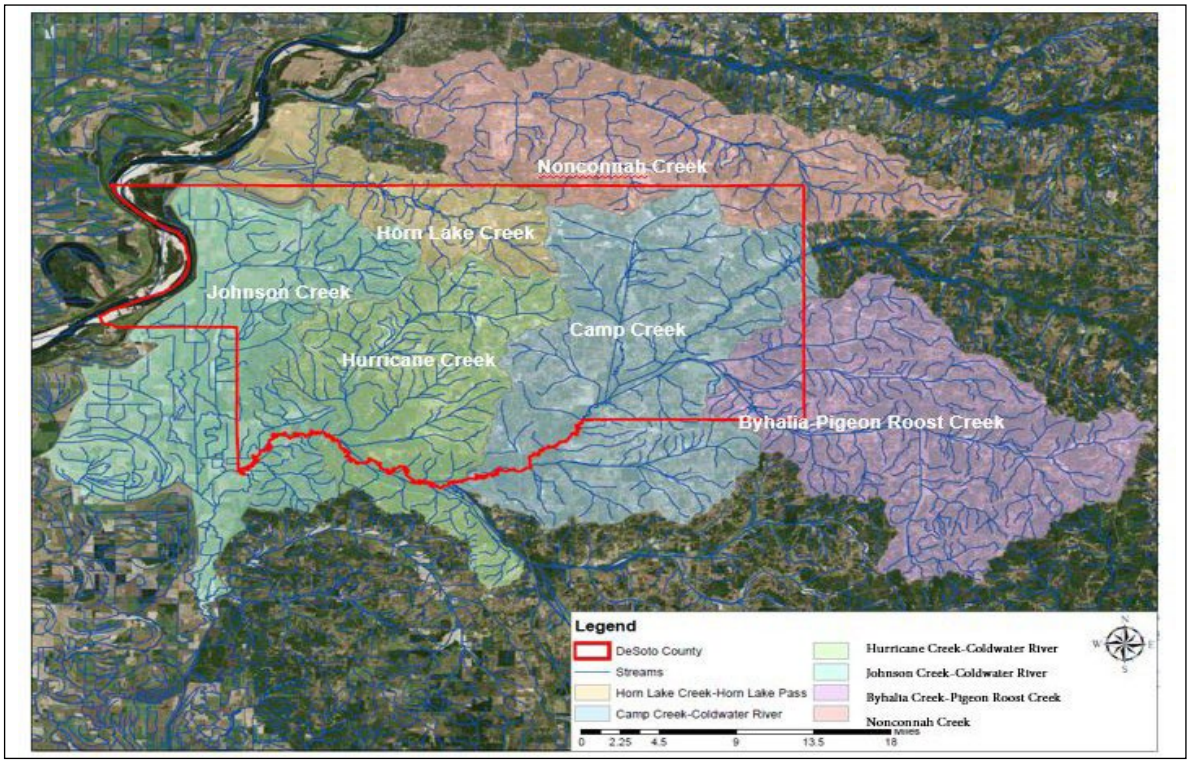
Mississippi Valley Division,
Regional Planning and Environment Division South

Memphis Metropolitan Stormwater – North DeSoto County Feasibility Study, DeSoto County, Mississippi



Final Feasibility Report with Integrated Environmental Impact Statement

October 2023

Cover Page

County: DeSoto County, Mississippi

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

Non-Federal Sponsor: DeSoto County Board of Supervisors

Abstract: This Final Integrated Feasibility Report and Environmental Impact Statement documents the analysis of proposed actions related to the feasibility of flood risk management and ecosystem restoration alternatives within DeSoto County, Mississippi. Alternatives identified within, including the Recommended Plan and the No Action Alternative.

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Estimated Cost of Preparing Draft Report: $3,500,000

Executive Summary

The U.S. Army Corps of Engineers (USACE), Mississippi Valley Division, Memphis District (CEMVM), prepared this final Integrated Feasibility Report and Environmental Impact Statement (final IFR-EIS) for the Memphis Metropolitan Stormwater-North DeSoto, DeSoto County, Mississippi Feasibility Study. The non-Federal sponsor (NFS) is the DeSoto County Board of Supervisors. This study is authorized pursuant to the United States House of Representatives Committee on Transportation and Infrastructure resolution on March 7, 1996, regarding the Memphis Metro Area, which requested a review of the Chief of Engineers Report on the Wolf River and Tributaries, Tennessee and Mississippi, published as House Document Numbered 76, 85th Congress, and other pertinent reports, to determine whether any modifications of the recommendations contained therein are advisable at this time, with particular reference to the need for improvements for flood control, environmental restoration, water quality, and related purposes associated with storm water runoff and management in the metropolitan Memphis, Tennessee area and tributary basins including Shelby, Tipton, and Fayette Counties, Tennessee, and DeSoto and Marshall Counties, Mississippi. This area includes the Hatchie River, Loosahatchie River, Wolf River, Nonconnah Creek, Horn Lake Creek, and Coldwater River Basins. The review evaluated the effectiveness of existing Federal and non-Federal improvements and determined the need for additional improvements to prevent flooding from storm water, to restore environmental resources, and to improve the quality of water entering the Mississippi River and its tributaries. This study was initially funded through the Consolidated Appropriations Act, 2018, Public Law 115-141, Division D up to $3,000,000 with a 50/50 cost share. A Feasibility Cost Sharing Agreement with DeSoto County Board of Supervisors (sponsor) was executed on September 21, 2018. The study was approved for an additional $500,000 with a 50/50 cost share executed through a revised Feasibility Cost Sharing Agreement with the sponsor on August 9, 2022. The draft IFR-EIS and the Recommended Plan (RP) reflect sponsor, agency, stakeholders, and public input. It presents opportunities to reduce damages from flood risk and channel instability as well as to improve aquatic habitat in DeSoto County, Mississippi (Figure ES-1.)

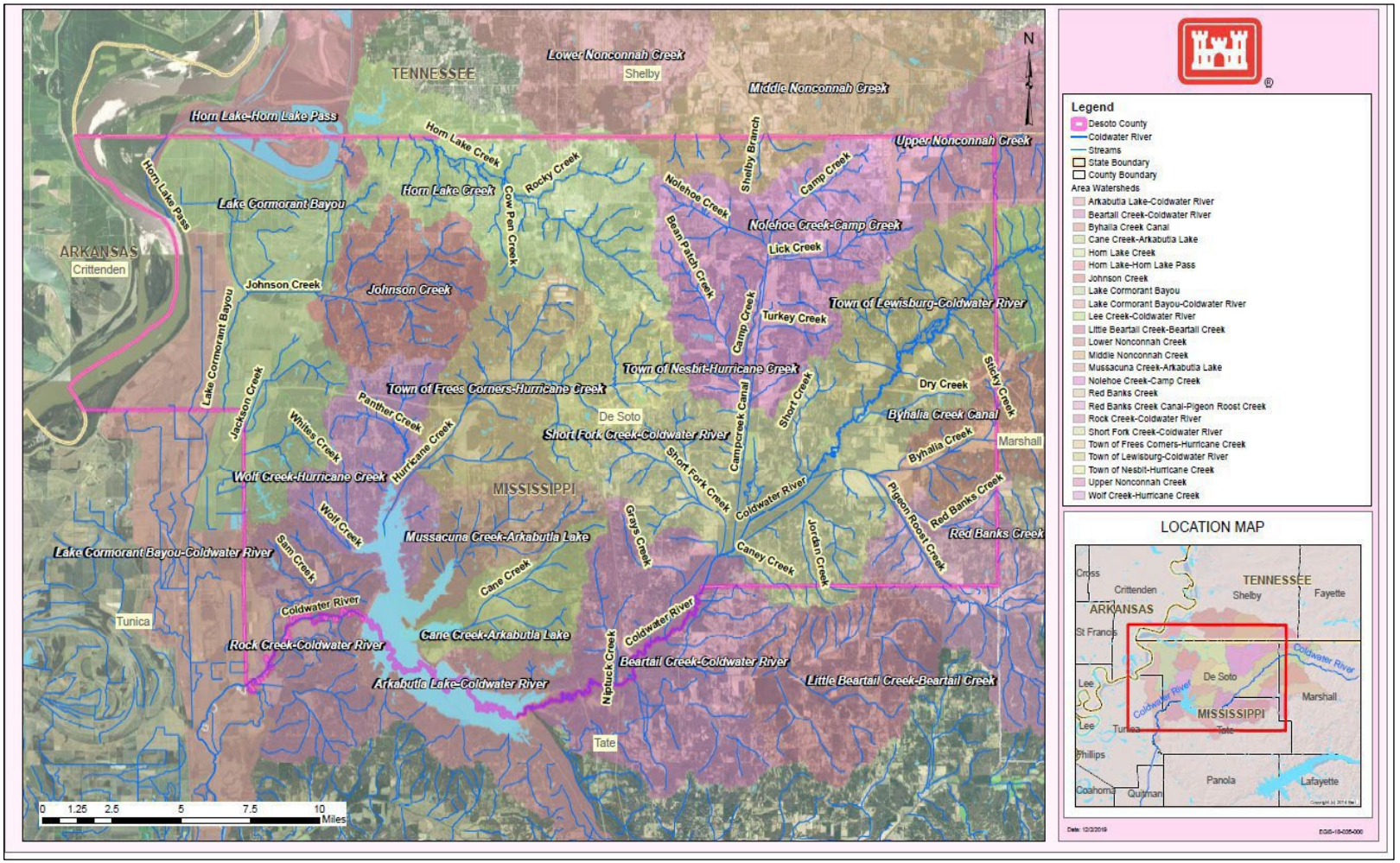

Figure ES-1. Study Area

Note: The Horn Lake Creek Watershed (circled in blue) is where flooding is concentrated. The yellow circled watersheds are areas where channel instability and aquatic habitat degradation is concentrated.

Purpose and Need: Repeated flooding occurs within the cities of Horn Lake, Southaven, Olive Branch, and Hernando. This study evaluates opportunities to provide flood risk management (FRM) alternatives to reduce the risks of flooding to the public and commercial, residential infrastructure. The study also evaluates road closures; accessibility to critical infrastructure; and addresses life safety concerns caused by flooding. In addition, the purpose of the ecosystem restoration component is to evaluate opportunities to reduce or arrest the uncontrolled down-cutting of the channel beds and subsequent channel widening, erosion, sedimentation; improve in-stream habitat along with reforestation of stream corridors to restore Bottomland Hardwood (BLH) habitat structure and function.

Plan Formulation: The planning process was separated into two separate project purposes, one to address FRM issues with recurrent flooding threats to lives, property, and infrastructure; and a second to address habitat degradation result in from chronic channel incision, loss of bottomland hardwood forests, and loss of fish passage connectivity.

Flood Risk Management Recommended Plan: The Plan Formulation for FRM went through several iterations and evaluated numerous alternatives including structural measures nonstructural measures, and a combination of those measures. The range of study alternatives was refined based on preliminary analyses of effectiveness and cost. Twenty-six (26) FRM measures were evaluated based on the planning objectives, constraints, and opportunities presented in section 4.1. The final array of alternatives included:

- a levee and floodwall on the east side of Highway 51 immediately South of the intersection of Goodman Road;
- a channel enlargement feature along Horn Lake Creek between River Mile 18.56-19.41, just west (downstream) of the intersection of Highway 51;
- four detention basins along the tributaries of Horn Lake Creek, two located along Cow Pen Creek, one along Rocky Creek and one along Lateral D;
- and nonstructural alternatives to include dry floodproofing for 14 residential and 21 commercial structures.

The area of Bullfrog corner, at the intersection of US Highway 51 and Goodman Road, experiences the majority of the flood damages in the study area. In the initial formulation one-dimensional modeling supported a channel improvement alternative in this area.

Refined two-dimensional modeling revealed that channel improvement was ineffective and lead to development of a levee-floodwall alternative. The levee-floodwall combination alternative provides flood risk management to the west side of Horn Lake Creek in the Bullfrog Corner area**.**

Throughout the Desoto County study area, the team did initially assess fully nonstructural alternatives with aggregations formulated at the 0.04, 0.02, and 0.01 Annual Exceedance Probability (AEP-year floodplains. Although effective, these nonstructural alternatives were not highly efficient, and costs exceeded the benefits. Additionally, the refined two-dimensional model analysis tended to lower expected stages in many areas, further

reducing relative efficiency. However, because the levee-floodwall alternative provided relief only on the western side of the area of primary damage, a nonstructural aggregation was created from those structures experiencing residual damage on the eastern side of this area. This nonstructural alternative is based on community cohesion standpoint by providing a reduction in residual flood damages to the east side of Horn Lake Creek at Bullfrog corner, which does not receive flood risk management from the levee/floodwall.

The NED plan, Plan 8a, levee and floodwall is not the Recommended Plan (RP). The RP is Plan 8b which includes the Plan 8a levee and floodwall on the east side of Bullfrog Corner to reduce flood risk to the west side of Bullfrog Corner as well as voluntary dry floodproofing for 14 residential and 21 commercial structures. This plan is estimated to produce $2.43 million in equivalent annual benefits at an average annual cost of $1.06 million for a benefit-to-cost ratio (BCR) of 2.57 and net annual benefits of $1.49 million (FY23 costs and 2.5% discount rate). The proposed structural plan would reduce flood risk damage to 180 structures during the 0.002 AEP (500-year) event.

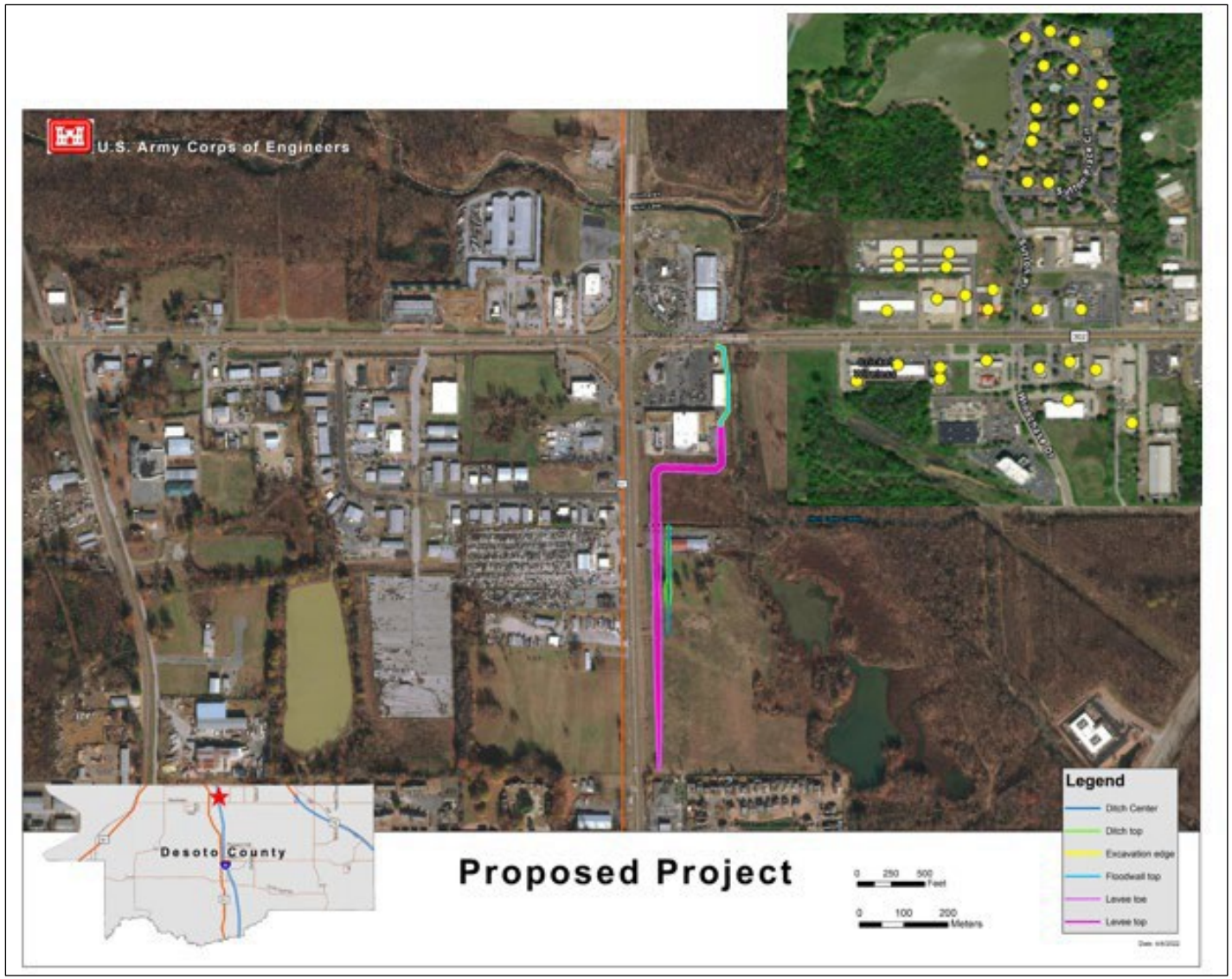

Figure ES-2. Plan 8b Levee and Floodwall, and Structures Identified for Voluntary Dry Floodproofing (yellow dots)

Ecosystem Restoration Recommended Plan: Agricultural production and residential development have contributed significantly to the loss of BLH forest along the Mississippi River Flyway and in DeSoto County. In addition, drainage efforts and improved infrastructure have fragmented the remaining BLH forests to the extent that many BLH forests no longer provide flood water storage, nutrient trapping, groundwater recharge and wildlife habitat. Remnant patches of BLH forest have been conserved because of their increasing value for outdoor recreation such as fishing, hunting, wildlife viewing and hiking, as well as regulatory efforts to conserve these areas. The formulation of plans for aquatic ecosystem restoration (AER) utilized an innovative stream condition index watershed modeling approach developed in partnership with USACE Engineering Research and Development Center (ERDC) team. Three aquatic ecosystem restoration measures were evaluated based on the planning objectives and constraints presented in section 5.1. The final array of alternatives included a system of grade control structures alone, as well as grade control structures and various quantities of reforested BLH riparian zones.

Per USACE Civil Works guidance ecosystem restoration projects are formulated to contribute to national ecosystem restoration (NER). Contributions to NER (Aquatic Ecosystem Restoration, or AER outputs) are increases in the net quantity and/or quality of desired ecosystem resources; and are measured based on changes in ecological resource quality as a function of improvement in habitat quality and/or quantity and expressed quantitatively in physical units or indexes (but not monetary units). The NER plan reasonably maximizes ecosystem restoration benefits compared to costs.

The NER RP includes a comprehensive system of 74 bank stabilizing grade control structures (GCS) paired with lateral stone toe protection, and riser pipes. This system of grade control is coupled with 328 acres of riparian restoration covering 10 of the 17 streams evaluated (Camp, Cane, Hurricane, Johnson, Lick, Mussacuna, Nolehoe, Nonconnah, Red Banks, and Short Fork Creeks), as depicted in Figure ES-3. During optimization, Horn Lake Creek was removed from the AER plan because the tree clearing necessary to construct lateral stone toe protection along with grade control structures would out pace reforestation.

The estimated implementation cost for the AER RP is approximately $40.2 million which would be cost shared $26.1 million (65%) Federal and $14.1 million (35%) non-Federal. The AER plan is estimated to provide 31 AAHUs at an average annual cost of $4.8K per AAHU. The total annual cost of the NER plan is $1.65 million.

Figure ES-3. Ecosystem Restoration Plan

Significant Resources and Environmental Considerations: Section 6 describes the impacts of significant resources associated with the Final Array of alternatives. Plan 8b, the RP, would have no adverse impacts on the environment; therefore, a mitigation plan is not needed. A Programmatic Agreement to defer identification, evaluation, and mitigation of historic properties has been executed on October 6, 2022, The Interagency Team has expressed no significant resource or environmental concerns. The FRM plan provides benefits to areas of Environmental Justice (EJ) concern in three ways as follows: 1) reduced flood stages for commercial structures/businesses that low income and minority communities may frequent, 2) reduced damages for commercial dry floodproofed structures from the nonstructural plan; and 3) reduced flooding on some portions of roadways around low income or minority communities. See below unresolved Issues/Areas of Controversy as to the current modeling, structures, and need for additional survey data during the Pre-Construction Engineering and Design (PED). The AER plan would stabilize and restore approximately 20 miles of stream, support connectivity of an estimated 83 stream miles, and provide 327 acres of BLH riparian habitat restoration.

Views of the Public, Agencies, Stakeholders and Tribes: A Notice of Intent (NOI) to prepare the Integrated Feasibility Report-EIS (IFR-EIS) was published in the Federal Register on August 9, 2019 (Vol. 84, No. 154). Public scoping meetings were held on December 5, 2018, and August 29, 2019. An initial IFR-EIS was released on May 29, 2021, a public meeting was held on June 29, 2021, to review the initial tentatively selected FRM and NER plans. Interagency team meetings were held on December 19, 2019, June 24, 2021, and March 3, 2022, to discuss study updates, potential environmental impacts and benefits, and modeling efforts. Coordination with the interagency team is complete, and no significant concerns were identified for threatened or endangered species, water quality, or other significant resources. The RP requires no compensatory mitigation per the Clean Water Act, WRDAs of 1986, 2007, and 2016.

The following agencies agreed to be cooperating agencies and participate in the National Environmental Policy Act (NEPA) process: the U.S. Fish and Wildlife Service (USFWS) and the U.S. Environmental Protection Agency (USEPA). Members of the Interagency Team that have coordinated throughout the study process include the Cooperating Agencies, as well as, the Natural Resources Conservation Service, Mississippi Department of Environmental Quality (MDEQ), Mississippi Department of Wildlife Fisheries and Parks (MDWFP), and the Mississippi Emergency Management Agency (MEMA).

Tribal and State Historic Preservation Office (SHPO) consultations began in September 2019. Four consultation meetings have been held to date. The Chickasaw Nation has agreed to be an invited signatory to the programmatic agreement while the Cherokee Nation has agreed to be a consulting party. The programmatic agreement has been signed by the MS SHPO as of 2 September 2022, and is included in Appendix F.

A detailed discussion of the public scoping is included in section 2.4, and agency coordination is detailed in Appendix F.

Integrated Feasibility Report and Environmental Impact Statement (IFR/EIS) Review Timeline: The USACE conducted concurrent review of the draft IFR-EIS, including public, technical, legal, and policy reviews. The revised draft IFR-EIS was available for a 45-day public review May 06, 2022- June 21, 2022. A public meeting was held on June 2, 2022. No written comments were received.

Final IFR/EIS Review: The USACE will conduct a 30-day State and agency review on the final IFR/EIS.

After the final feasibility report is submitted to USACE headquarters, a Chief's Report will be developed for review and approval by the Chief of Engineers, with such modifications as the Chief Engineer deems necessary. Once the Chief of Engineers signs the report, the Chief of Staff signs 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 is also provided

to the Office of the Assistant Secretary of the Army for Civil Works for review by the Administration.

The USACE submitted the RP for authorization as a Federal project, at the discretion of the Commander, Headquarters, and USACE. The NFS, DeSoto County Board of Supervisors, supports the RP..

The USACE recognizes the project authority and formulation methodology is limited in what it can provide. It is recommended that the sponsor and other entities consider additional actions in a holistic approach to further mitigate flood risk damages and increase overall resiliency.

Unresolved Issues/Areas of Controversy: The FRM goal is to develop alternatives to reduce the severity of flood risk and damages to residential structures, businesses, and critical infrastructure as well as reduce the risk to human life. Roadway flooding remains an area of concern in the Horn Lake Creek watershed and no alternatives were identified that would completely eliminate flooding on Goodman Road or Highway 51, north of Goodman Road, during less frequent events. It is anticipated that road closures would be required at the 0.01 AEP event.

The revised draft integrated feasibility report and environmental impact statement identified potential inducements, and many of the concurrent review comments focused on potential inducements and the real estate instruments required to adequately address potential inducements. However, topographic ground surveys and interviews of business owners indicate that any potential flood inducements that were previously identified are not realistic and were removed from the RP. This presents a low risk to the RP decision.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDICES

SECTION 1
Introduction

The U.S. Army Corps of Engineers (USACE), Mississippi Valley Division, Regional Planning and Environment Division South (RPEDS), prepared this final Integrated Feasibility Report and Environmental Impact Statement (IFR-EIS) for the Memphis Metropolitan Stormwater, DeSoto County, Mississippi Feasibility Study. This final IFR-EIS satisfies the requirements of

U.S. Army Corps of Engineers policies that guide water resource development studies, including the Planning Guidance Notebook (Engineering Regulation 1105-2-100), Procedures for Implementing NEPA (Engineering Regulation 200-2-2), and other related guidance. The National Environmental Policy Act (NEPA) of 1969 (Public Law 91-190), as amended, requires all Federal agencies to address environmental consequences of major Federal actions on the natural and human environment. Compliance guidance for NEPA is contained in Title 40 of the Code of Federal Regulations (CFR), Parts 1500 through 1508, and in the USACE regulations, including 33 CFR 230 and 325. The primary intent of NEPA is to ensure that environmental information is made available to officials and citizens regarding major Federal actions. This final IFR-EIS and the Recommended Plan (RP) reflect sponsor, agency, stakeholders, and public input. This final IFR-EIS analyzes the environmental impacts associated with implementing alternatives, reviews the process for identifying the RP and concludes with recommendations for project implementation. This final IFR-EIS presents opportunities to reduce damages from flood risk and aquatic habitat degradation in DeSoto County, Mississippi. USACE is the lead agency under NEPA. The non-Federal Sponsor is DeSoto County Board of Supervisors.

1.1 USACE PLANNING PROCESS

The USACE planning process follows a six-step process. This process is a structured approach to problem solving which provides a consistent framework for decision making while also integrating an Environmental Impact Statement (EIS). This document follows those six steps which are:

Step 1 - Identifying problems and opportunities
Step 2 - Inventorying and forecasting conditions
Step 3 - Formulating alternative plans
Step 4 - Evaluating alternative plans
Step 5 - Comparing alternative plans
Step 6 - Selecting a plan

The Memphis Metropolitan Stormwater study authority covers a large area including six river basins, across five counties in two states and as such affords the ability to work with multiple sponsors (Figure 1-1.). The initial focal area was identified as the Horn Lake and Coldwater River Basins within the boundaries of DeSoto County. The most significant flooding issues occur in the northern part of the Desoto County, while channel instability and aquatic habitat

degradation occurs along most of the streams throughout the County. The study scope based on the study authority specifically referenced the need for flood risk management, environmental restoration, water quality, and related purposes associated with stormwater runoff and management.

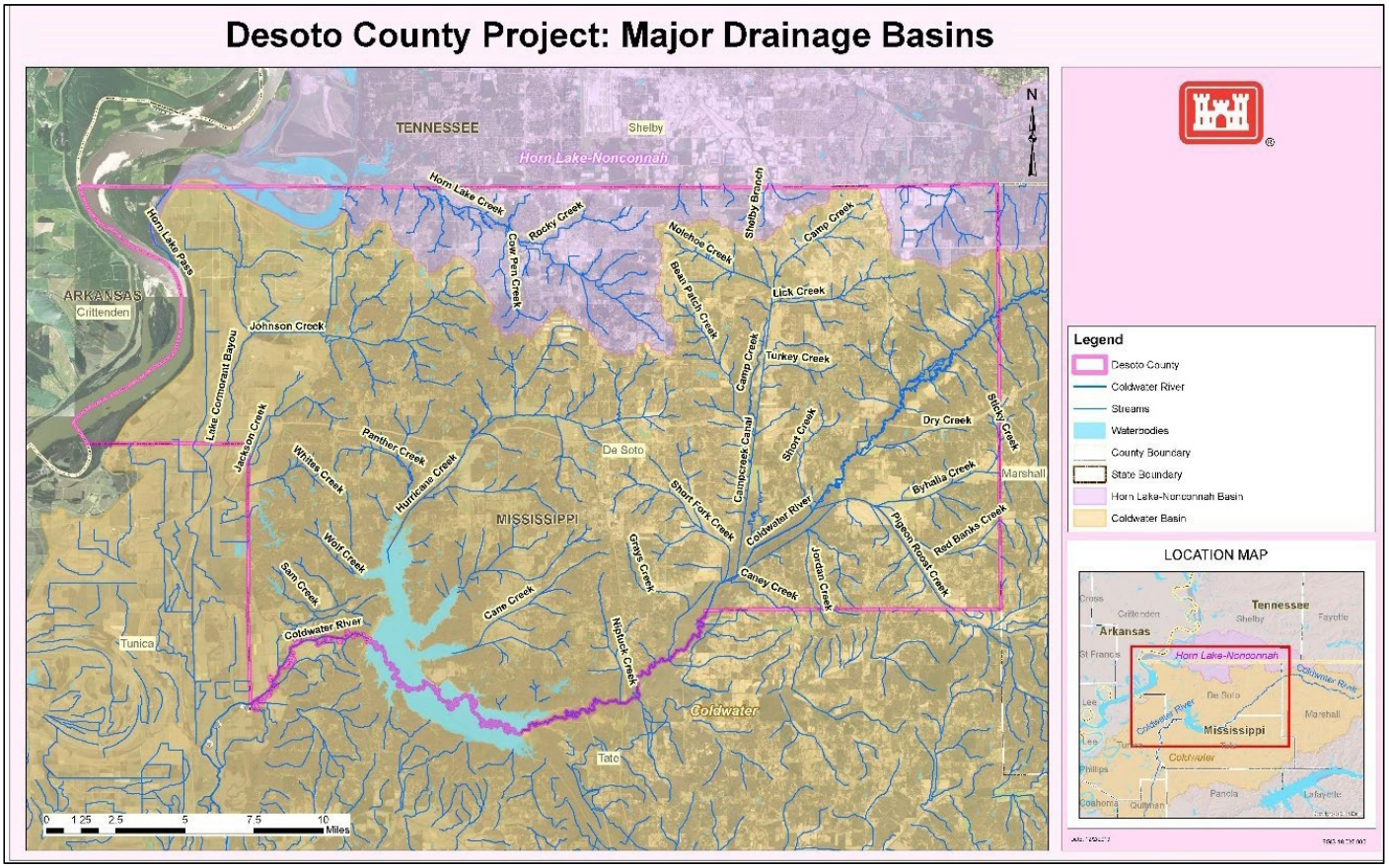

Figure 1-1. DeSoto County Study Area

1.2 AUTHORITY

This study is authorized pursuant to the United States House of Representatives Committee on Transportation and Infrastructure resolution on March 7, 1996, regarding the Memphis Metro Area, as follows:

> *The Secretary of the Army reviewed the report of the Chief of Engineers on the Wolf River and Tributaries, Tennessee and Mississippi, published as House Document Numbered 76, Eighty-fifth Congress, and other pertinent reports, to determine whether any modifications of the recommendations contained therein are advisable at this time, with particular reference to the need for improvements for flood control, environmental restoration, water quality, and related purposes associated with storm*

water runoff and management in the metropolitan Memphis, Tennessee area and tributary basins including Shelby, Tipton, and Fayette Counties, Tennessee, and DeSoto and Marshall Counties, Mississippi. This area includes the Hatchie River, Loosahatchie River, Wolf River, Nonconnah Creek, Horn Lake Creek, and Coldwater River Basins. The review shall evaluate the effectiveness of existing Federal and non-Federal improvements and determine the need for additional improvements to prevent flooding from storm water, to restore environmental resources, and to improve the quality of water entering the Mississippi River and its tributaries.

1.3 NON-FEDERAL SPONSOR

The non-Federal sponsor (NFS) is the DeSoto County, Board of Supervisors hereafter referred to as DeSoto County. A Feasibility Cost Sharing Agreement was executed on September 21, 2018. This study is funded through the Consolidated Appropriations Act, 2018, Public Law 115-141, Division D up to $3,000,000 with a 50/50 cost share.

If authorized and funded, the DeSoto County Board of Supervisors has also been identified as the construction NFS and would enter into a Project Partnership Agreement (PPA) with USACE. After the signing of a PPA, the NFS is prepared to 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 Operations, Maintenance, Repair, Rehabilitation, and Replacement (OMRR&R) of the project or of the completed functional portion of the project.

1.4 STUDY AREA

The study area lies in the Horn Lake Creek-Nonconnah and Coldwater River Basins. This includes Horn Lake Creek and tributaries, Nonconnah River, Camp Creek and Tributaries, Hurricane Creek, Johnson Creek, and numerous tributaries of the Coldwater River watershed in northern DeSoto County, Mississippi (Figure 1-1.). The study area includes the cities of Horn Lake, Southaven, Olive Branch, Walls, and Hernando. Description of FRM Component Project area:

The most significant flooding to structures occurs in the Horn Lake Creek-Nonconnah Basin. The Horn Lake Creek watersheds make up the specific project area where the flood risk management measures were investigated (Figure 1-1., waterbodies in pink). Horn Lake Creek is approximately 26 miles in length, crossing the Tennessee-Mississippi state line at stream mile 12.5. Horn Lake Creek has a total drainage area of 54 square miles with 42 square miles in Mississippi. Major tributaries include Rocky Creek, Cow Pen Creek, Lateral D, and Southaven Creek. Horn Lake Creek and its tributaries serve as the primary drainage outlets for the cities of Southaven and Horn Lake, Mississippi.

There are several significant infrastructure features in the study and project area including:

- Interstates 55 and 69

- U.S. Highways 51 and 61
- Three major rail lines
- Several large underground pipelines
- An overhead Tennessee Valley Authority high power transmission line

Description of AER Component Project Area:

The entire study area (DeSoto County, Mississippi, Figure 1-1.) was investigated for ecosystem restoration opportunities. The streams included in the NER Plan are Horn Lake Creek, Nonconnah Creek, Nolehoe Creek, Camp Creek, Lick Creek, Hurricane Creek, Johnson Creek, Cane Creek, Short Fork Creek, Red Banks Creek, and Mussacuna Creek. These specific streams were all identified by the NFS and/or the public as heavily impacted.

1.5 PRIOR REPORTS

Several prior reports and studies were reviewed and utilized in this report. Information from the documents identified in Table 1-1 was deemed the most significant to problem identification and plan formulation.

Table 1-1. Prior Reports and Studies

Project Year	Study/Report/Environmental Document Title	Document Type
1981	Memphis Metropolitan Area Urban Study, (led to next GDM report)	Urban Study
1986	Horn Lake Creek and Tributaries, Phase I General Design Memorandum (GDM)	General Design Memorandum (GDM)
1988	The Horn Lake Creek and Tributaries Including Cow Pen Creek, General Design Memorandum Re-evaluation	General Design Memorandum Re-evaluation
1999	The Memphis Metro Area, Tennessee, and Mississippi Reconnaissance Report	Reconnaissance Report
2005	Horn Lake Creek and Tributaries Tennessee and Mississippi, General Reevaluation Report	General Reevaluation Report
2015	Johns Creek Continuing Authorization Project (CAP 205, flood control project)	Continuing Authorities Project Report (CAP) 205
2018	Big Sunflower River Watershed (Quiver River), Mississippi Final Feasibility Report with Integrated Environmental Assessment	Integrated Feasibility Report with EA
2019	Mid-South Regional Resilience Plan	HUD, Disaster Resilience Draft Report

1.5.1 Existing USACE Projects

1.5.1.1 The Horn Lake Creek and Tributaries, Tennessee, and Mississippi Project

This project was authorized in 1986, revised in 1988 under a General Design Memorandum, and was completed in 1998 per a Project Cooperation Agreement between the Horn Lake Creek Drainage District Commission and USACE. The completed project included:

- selective channel clearing on Horn Lake Creek;
- vegetative clearing on upper Horn Lake Creek;
- vegetative clearing on the lower Cow Pen Creek;
- channel enlargement on Cow Pen Creek and;
- vegetative clearing on the lower end of Rocky Creek.

The constructed project provided a 25-year level of risk reduction to existing development along Cow Pen Creek; a 1.1-year level of protection along Horn Lake Creek; and a 1.1 to 2-year level of protection along Rocky Creek. Although hiking/biking trails were proposed along Rocky Creek and Cow Pen Creek, these trails were never constructed.

1.5.1.2 Mississippi Delta Headwaters Project (MDHP)

The Mississippi Delta Headwaters Project was previously referred to as the Demonstration Erosion Control Project (DEC). The purpose of this project is to demonstrate the effectiveness of comprehensive planning by developing and implementing a plan to reduce flooding, erosion, and sedimentation in the Yazoo Basin Foothills area. It is a continuation of joint efforts undertaken by the Vicksburg District of USACE and the Natural Resource Conservation Service (NRCS), U.S. Department of Agriculture, in the Yazoo Basin. Because this project is a part of the Mississippi River and Tributaries, Yazoo Basin Headwater area, there are no local cooperation requirements under Public Law 99-662. This project is ongoing. The MDHP received $1.2M in FY 2022 workplan funds, which will be used to complete surveys, watershed analysis, field investigation, site type and location, and hydraulic modeling on 13 streams in the Coldwater Basin, both in DeSoto County and beyond. Streams that may be investigated as part of both the MMS-North DeSoto County study as well as MDHP include Red Banks Creek, Camp Creek, and Lick Creek.

1.5.2 Local Ordinances

1.5.2.1 NFIP Participation and the DeSoto County Flood Damage Prevention Ordinance

DeSoto County participates in the FEMA National Flood Insurance Program (NFIP). The cities of Southaven and Olive Branch joined NFIP in 1987, and Horn Lake Creek joined NFIP in 1990. To participate in the NFIP, communities must, at a minimum, regulate all development in the designated Special Flood Hazard Area (SFHA) in accordance with the NFIP criteria and any applicable State and community floodplain management laws. The local floodplain management administrator is responsible for the enforcement of the local floodplain management ordinance.

The purpose of the DeSoto County Flood Damage Prevention Ordinance is to promote public health, safety, and general welfare and to minimize public and private losses due to flood conditions in specific areas by provisions designed to:

- Restrict or prohibit uses that are dangerous to health, safety, and property due to water or erosion hazards, which result in damaging increases in erosion or in flood heights or velocities.
- Require that uses vulnerable to floods, including facilities that serve such uses, be protected against flood damage at the time of initial construction.
- Control the alteration of natural floodplains, stream channels, and natural protective barriers that are involved in the accommodation of floodwaters.
- Control filling, grading, dredging, and other development that may increase erosion or flood damage; and
- Prevent or regulate the construction of flood barriers that would unnaturally divert floodwaters, or which may increase flood hazards to other lands.

A complete copy of the Ordinance, which was signed into law 2 December 2019, can be found at: https://www.desotocountyms.gov/DocumentCenter/View/254/DeSoto-County-Flood- Ordinance-

SECTION 2
Problems and Opportunities (Purpose and Need)

2.1 SPECIFIC PROBLEMS AND OPPORTUNITIES

Flood risk management problems result from altered headwater hydrology which have caused major damaging floods in May 2010, May 2011, September 2014, and March 2016 in the Horn Lake Creek and Coldwater River Basins. DeSoto County received a Presidential Disaster Declaration in 2011. Flooding in September 2014 prompted a State of Emergency declaration, the Coast Guard responded to evacuate trapped residents, and the U.S. Small Business Administration provided Federal assistance afterwards. Since 1994, three lives have been lost in DeSoto County due to flooding. Flooding inundates major transportation corridors and neighborhoods, isolates communities, damages public infrastructure and development (residential, commercial, and industrial), and threatens life safety. Repeated flooding occurs within the Cities of Horn Lake, Southaven, Olive Branch, and Hernando.

Drainage of headwaters from rainfall events cause flooding of residential and nonresidential structures downstream in the vicinity of Horn Lake Creek Basin and the Coldwater River Basin. The landscape has been heavily developed. Critical infrastructure, roads, schools, and medical facilities are at risk of flooding and the inundation of roads during flood events causes safety issues countywide.

The purpose of the FRM component is to evaluate opportunities to reduce the risks of flooding to the public; and commercial and residential property; and critical infrastructure. The FRM component also addresses road closures impacting access to critical infrastructure, and life safety risks resulting from flooding.

Aquatic ecosystem degradation in DeSoto County include reduced and degraded bottomland hardwood (BLH) forested and in-stream habitat largely due to development encroachments, channel alterations and channel bed degradation. Development in DeSoto County has occurred over the decades as population has increased resulting in residential expansion and an increase in commercial activity. The channel bed degradation exists as a result of head-cutting, increased flows and erosion. Increased runoff from development is causing channel instability, scouring, and degrading aquatic habitat. Channel alterations in the DeSoto County watersheds have caused a decline in the ability of streams and adjacent lands to support the requisite functions for fish and wildlife. Most bottomland hardwoods have been cleared and wetlands are isolated or drained.

The purpose of the aquatic ecosystem restoration (AER) component is to evaluate opportunities to reduce or arrest the uncontrolled down-cutting of the channel beds and subsequent channel widening, erosion, sedimentation; replace and improve in-stream

habitat along with reforestation of stream corridors to restore BLH habitat structure and function.

2.2 PLANNING GOALS AND OBJECTIVES

There are both FRM and AER goals and objectives identified in this study. Planning objectives represent desired positive changes to future conditions. All the objectives focus on alternatives within a 50-year period of analysis from 2028 to 2078.

2.2.1 Flood Risk Management Planning Goals and Objectives

The FRM goal is to reduce the severity of flood risk and damages to residential and commercial properties, and critical infrastructure, and reduce the risk to human life. The Federal objective of water and related land resources project planning is to contribute to National Economic Development (NED) consistent with protecting the Nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements.

The FRM planning objectives include:

- Objective 1. Reduce flood damages to residential and commercial property in DeSoto County.
    - *Metric 1*: Maximize net benefits across the four accounts (national economic development, regional economic development, other social effects, and environmental quality).

- Objective 2. Reduce impacts to critical infrastructure.
    - *Metric 2*: Evaluate changes in water surface elevation as well as timing duration, and velocity of peak stage.

- Objective 3. Reduce risk to human life from flooding and rainfall events throughout DeSoto County.
    - *Metric 3*: Evaluate post-project changes to the water surface elevation as well as timing of the peak stage.

2.2.2 Aquatic Ecosystem Restoration Planning Goals and Objectives

The ecosystem restoration goal is to stabilize channels and re-connect/restore riparian habitat, which would minimize channel degradation and erosion and support aquatic ecosystem form and function along main stem channels and tributaries in the DeSoto County watersheds.

The ecosystem restoration planning objectives include:

- Objective 4 Restore aquatic habitat by reducing channel degradation such as incision and erosion.

  - *Metric 4*: Evaluate the channel evolution model, bank stability, riparian zones, rooting depth, root density, surface protection, and bank angle.
- Objective 5. Restore suitable habitat for native and special status species.
  - *Metric 5*: Evaluate habitat diversity, fish cover, canopy cover, and riparian zones and surface protection.

2.3 PLANNING CONSTRAINTS

The study constraints include:

- Ensure study is compliant with Federal Aviation Administration (FAA) regulations associated with the Memphis International Airport. For all airports, the FAA recommends a distance of 5 miles between the farthest edge of the airport's airspace and the hazardous wildlife attractant if the attractant could cause hazardous wildlife movement into or across the approach or departure airspace.
- Maintain consistency with DeSoto County Flood Damage Prevention Ordinance.

2.4 PUBLIC SCOPING SUMMARY

General scoping was initiated prior to the National Environmental Policy Act (NEPA) Notice of Intent (NOI) in conformity with 40 CFR 1500-1508. A public website page (https://www.mvm.usace.army.mil/Missions/Projects/North-DeSoto-County-Feasibility-Study) with the study information was established in August 2019. In accordance with NEPA, an NOI to prepare an IFR-EIS was published in the Federal Register on August 9, 2019 (Vol. 84, No. 154). Public scoping meetings were held on December 5, 2018, and August 29, 2019. DeSoto County also released an online survey, which received approximately 41 responses. These results indicate public concern about flooding in DeSoto County. During the meetings, members of the communities were able to mark areas of concern on maps and provide written comments. Comments received at the meetings represented concerns about road closures, safety risks, and erosion.

The draft Integrated Feasibility and Environmental Impact Statement, entitled "Memphis Metropolitan Stormwater – North DeSoto County Feasibility Study, DeSoto County, Mississippi" was released to the on May 28, 2021. On June 29, 2021, a public meeting was held to update the public on the tentatively selected plan (TSP) (of May 2021, no longer considered the TSP), and allow for public comments. In addition to this in-person meeting, a virtual presentation was prepared and posted on the project website. Comments received during the meeting and public comment period were related to erosion and stream instability, roadway flooding, increase in stormwater flooding, culvert sizing, residential flooding, and wastewater treatment facility locations. Less than 10 members of the public attended the meetings. No responses by regular Postal Service mail were received.

A second public meeting was held June 2, 2022, to update the public on the revised tentatively selected plan and allow for public comments. Feedback from these meetings and report reviews showed that the public and officials in the local area recognized the need for flood risk management and channel stabilization in the area. Issues and concerns raised

during the scoping meeting included maintenance of existing drainage and channel stabilizing infrastructure, and the RP levee alignment may be impacted by recent real estate transactions occurring in Horn Lake. The revised draft IFR-EIS was available for a 45-day public review May 06,2022-June 21, 2022.

Comments received to date are included in Appendix F.

Coordination with the interagency team, which includes the United States Fish and Wildlife Service (USFWS), U.S. Environmental Protection Agency (USEPA), Mississippi Department of Environmental Quality (MDEQ), Mississippi Department of Wildlife Fisheries and Parks (MDWFP), and the Mississippi Emergency Management Agency (MEMA) began in December 2018; and invitations to become cooperating agencies were accepted by the USFWS and the USEPA. Interagency team meetings were held on December 19, 2019, June 24, 2021, and March 3, 2022, to discuss study updates, potential environmental impacts and benefits, and modeling efforts. The MDEQ is concerned with on-going development in DeSoto County without comprehensive planning for future flooding or water quality issues. There are also concerns that the lands that are currently being considered may not be available when the project is ready for construction. The MDWFP requested that the USACE ensure the appropriate consideration for compensatory mitigation and fish passage in the streams. The USFWS has provided informal coordination regarding the threatened species that could be found within the project areas, as well as potential measures to provide in-stream habitat, such as creating riffles using riprap, strategically sunken coarse woody debris, and creating bank habitat. A meeting was held with the USFWS to discuss potential impacts to fish passage due to the placement of grade control structures. It was determined that surveys would be conducted prior to construction of any in-stream features to determine species composition and locations. Coordination with the interagency team is complete, and no significant concerns on threatened or endangered species, water quality certification, or other items were raised.

Copies of all feedback received is included in Appendix F and on the project website (https://www.mvm.usace.army.mil/Missions/Projects/North-DeSoto-County-Feasibility- Study). The USACE has continued coordination and outreach with Federal and state resource agencies. The coordination and outreach with Tribes, agencies, stakeholders, and members of the public will continue throughout the feasibility phase.

SECTION 3
Existing and Future Conditions (Affected Environment)

This section describes the existing conditions of the affected environment and a forecast of the "future without-project" conditions if there is no action taken.

3.1 ENVIRONMENTAL SETTING OF THE STUDY AREA

3.1.1 Geographic Location

The study area extends throughout DeSoto County, Mississippi and includes the Horn Lake Creek, Hurricane Creek-Coldwater River, Johnson Creek-Coldwater River, Camp Creek-Coldwater River, Byhalia Creek Canal-Pigeon Roost Creek and Upper Coldwater River watersheds. The study area includes but is not limited to the cities of Horn Lake, Southaven, Olive Branch, Walls, and Hernando. The most significant flood risks are in the northern part of the county, but the entire county was considered for flood risk and ecosystem restoration. An inventory of residential and non-residential structures was developed using the National Structure Inventory (NSI) version 2.0 for the portions of the county impacted by riverine flooding associated with the future without project condition. For this study, the structure inventory was modified to include two major basins: Horn Lake and Coldwater. The study area has a total of 4,013 structures in Horn Lake Basin and 973 structures in Coldwater Basin located across the combined 28 study area reaches. Other streams such as Hurricane, Short Fork, Pigeon Roost, Red Banks, Short Fork, Short, and Bean Patch were analyzed, but no flood-prone structures existed at the time of the analysis. Figure 3-1. shows the structure inventory and the boundaries of the county.

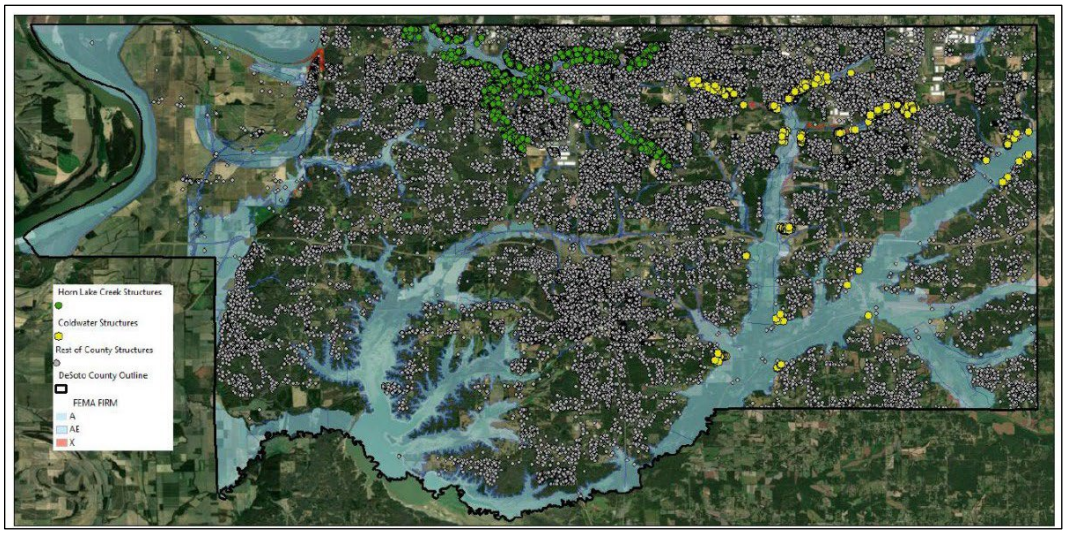

Figure 3-1. North DeSoto County Boundary and Structure Inventory

3.1.2 Climate

The climate of Desoto County, Mississippi is generally mild and humid. Summers are long and hot and provide a long growing season. Winters are usually short and moderate. The average temperature is about 60 degrees F. Average monthly temperatures range from about 40 degrees F in January to about 81 degrees F in July. The basin lies in a moderate to heavy rainfall belt with an average annual rainfall total of about 55 inches.

3.1.3 Geomorphic and Physiographic Setting

The study area lies within the Mississippi Valley Loess Plains (MVLP) Ecoregion, which stretches from near the Ohio River in western Kentucky to Louisiana. The loess plains of the ecoregion consist primarily of irregular plains; some gently rolling hills; wide, flat floodplains; and bluffs near the Mississippi River. Thick loess is one of the most distinguishing characteristics of the MVLP. The bluff hills are located in the western portion of the MVLP in DeSoto County, and contains soils that are deep, steep, silty, and erosive. To the east, upland forests are dominated by oak, hickory, and pine, and to the west on bluffs some mixed and southern mesophytic forests, are the dominant natural vegetation. Agriculture is now the typical land cover in the Kentucky and Tennessee portion of the region, while in Mississippi there is a mosaic of forest and cropland (Chapman et. al., 2004).

Table 3-1 identifies the stream status including the land cover as identified by the National Land Classification Data (NLCD) within 100 meters of each stream and water quality status per MDEQ for streams in the study area. The MDEQ data presented in the table was prepared for the 2020 303(d) list, 305(b) list, and/or the Completed total maximum daily load (TMDL) Reports.

Table 3-1. Stream Water Quality Status

Stream	BLH-Wet Acreage*	BLH Acreage*	Water Quality Status (MDEQ Data)
Horn Lake Creek	349	142	303(d) Listed due to Pollutants: Nutrient Pollution Organic Enrichment Low Dissolved Oxygen (DO) Sedimentation Total Phosphorus TMDL Report Completed in 2005 for Sediment TMDL Report Completed in 2006 for Organic Enrichment/Low DO, and Nutrients
Nonconnah Headwaters	213	171	N/A
Camp Creek	308	75	TMDL Report Completed 2008 Biological Impairment(s) due to: Ammonia Toxicity Total Nitrogen/Phosphorus Organic Enrichment/Low DO and Nutrients Sedimentation
Nolehoe Creek	19	29	N/A
Licks Creek	111	77	N/A
Johnson Creek	189	129	TMDL Reports Completed in 2008 Biological Impairment(s) due to: Organic Enrichment/Low DO Nutrients Sedimentation
Hurricane Creek	233	77	TMDL Report Completed in 2003 Biological Impairment(s) due to: Organic Enrichment/Low DO Nutrients
Cane Creek	32	35	Biological Impairment: Organic Enrichment/Low DO and Nutrients Sedimentation Pesticides
Mussacuna Creek	91	50	TMDL Reports Completed in 2008 and 2020 Biological Impairment(s) due to: Organic Enrichment/Low DO Nutrients Sedimentation
Red Banks Creek	165	7	Biologically Impaired, no pollutants identified; No TMDL

3.1.4 Land Use

Land use ranges from a high concentration of commercial, industrial, and residential development to land that is cultivated for crops or pasture which are sometimes bordered by deciduous forests. The landscape is defined by its waterways, primarily the Mississippi and Coldwater Rivers, which have informed development and transportation routes. Major transportation corridors including Interstates 55 and 69/269 dissect the study area into four nearly equal quadrants with the county seat of Hernando being centrally located within the study area. More developed land is situated along the central north-south axis of Interstate 55 and U.S. Highway 51. The majority of developed land use exists in northern DeSoto

County and includes the municipalities of Horn Lake, Southaven, and Olive Branch. These three communities are threaded along Mississippi State Highway 302.

As shown in Table 3-2., 18 percent of DeSoto County is currently developed land. The rest of the land use is split between agricultural land, which includes pasture and hay, and undeveloped land. Undeveloped land is primarily classified as forest, wetlands, and shrubs.

According to local planners, the Horn Lake Creek basin was considered 35 percent developed in the year 2000. Since 2000, the municipalities in North DeSoto County have provided an attractive alternative for commercial and residential development in the Memphis, Tennessee metropolitan area, outside of Memphis proper. The commercial acreage for DeSoto County is currently estimated to be approximately 22,762 acres (35.5 square miles) in size. The residential acreage is roughly 90,391 acres (141.2 square miles). The undeveloped acreage is estimated to be 204,846 acres (320.1 square miles). The approximate total land use acres for DeSoto County are 317,999 acres (496.9 square miles). The development in DeSoto County has increased exponentially, with the Horn Lake Drainage Basin expected to be approximately 95 percent developed outside of the 100 year floodplain by the year 2027. While DeSoto county limits development within the .01 AEP floodplain, it is critical that the county continues to monitor the impact of development on stormwater run-off.

Table 3-2. Land Use in DeSoto County, MS

Land Class Name	Percentage 2018
Developed Land	18%
Agricultural Land	36%
Undeveloped Land	46%
Total	100%

Source: USGS National Land Cover Database

3.1.5 Flood History

DeSoto County experienced significant flooding and flash flooding during the 10-year period from 1994 to 2004. Appendix N, Table N:1-2 summarizes the history and magnitude of the floods that occurred between 1994 and present. Four of the more recent and largest-magnitude floods that occurred in the Horn Lake Creek basin were in November 2001, October 2002, and September 2014. Headwater hydrology has been altered and major flood damage occurred in May 2010, May 2011, September 2014, and March 2016. Three documented deaths occurred in DeSoto County related to flooding. Table 3-3 documents the flood history and reported related deaths.

Table 3-3. History of Flooding in DeSoto County

Location	Date	Time	Magnitude of Flood	Total Rainfall (in[1])	Deaths Reported
Southaven	4/26/94	5:15 pm	Flash Flooding	Not Available	1
DeSoto County	4/27/04	9:00 pm	Flash Flooding	Not Available	0
Southaven	3/5/1997	9:30 am to 10:30 am	Flash Flooding	Not Available	0
DeSoto County	11/28/01 to 11/30/01	6:05 pm to 11:59 pm	Heavy Flooding	8.13	1
DeSoto County	12/12/01	2:35 pm	Moderate Flooding	2.32	0
DeSoto County	12/15/01 to 12/18/01	8:00 pm to 12:00 pm	Moderate Flooding	2.10	0
Southaven	7/12/02	11:00 am to 12:00 pm	Flash Flooding	1.13	0
Horn Lake	9/19/02 to 9/20/02	6:00 pm to 11:30 am	Flash Flooding	3.00	0
DeSoto County	10/10/02	1:45 am to 6:00 pm	Heavy Flooding	5.62	1
Horn Lake	12/19/02	8:30 am to 10:30 am	Flash Flooding	2.77	0
Horn Lake	7/18/03	3:40 pm to 5:30 pm	Flash Flooding	Not Available	0
DeSoto County	2/15/04	5:15 am to 7:00 am	Flash Flooding	0.45	0
MIA, TN	9/11/14	N/A	Heavy Flooding	4.45	0

[1]Rainfall data reflects total rainfall for the time provided. This data was taken from the closest reporting station in Olive Branch, MS; therefore, the actual rainfall in the Horn Lake Creek Basin, resulting in flooding, could have been higher or lower than the amounts listed. (Data Source: The National Climatic Data Center)

3.2 EXISTING CONDITIONS

3.2.1 Significant Resources

This section describes the historic and existing conditions for significant environmental resources for the natural and human environment including wetlands and BLH forest, upland forest, water quality and aquatic resources, wildlife, threatened and endangered species, air quality, geology and soils, flood risk, cultural resources, aesthetics, recreation, environmental justice, and socioeconomics. A resource is considered significant if it is recognized by statutory authorities including laws, regulations, Executive Orders (EO), policies, rules, or guidance; if it is recognized as important by some segment of the general public; or if it is determined to be important based on technical or scientific criteria. Table 3-

4. provides summary information of the institutional, technical, and public significance of these resources.

Table 3-4. Significant Resources in the Study Area

Resource	Institutionally Important	Technically Important	Publicly Important
Wetland and Bottomland Hardwood Resources	Clean Water Act of 1977, as amended; Executive Order 11990 of 1977, Protection of Wetlands; EO 11988, and Fish and Wildlife Coordination Act of 1958.	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.
Upland Forest Resources	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.
Water Quality and Aquatic Resources	Fish and Wildlife Coordination Act of 1958, as amended; Clean Water Act of 1977, as amended.	USACE, FWS, 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, aquatic resources, and the desire for clean drinking water.
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 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.
Threatened and Endangered Species and species of concern	The Endangered Species Act of 1973, as amended; and the Bald Eagle Protection Act of 1940.	USACE, USFWS, NRCS, USEPA, MDFWP, and MDEQ 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.
Air Quality	Clean Air Act of 1963, as amended.	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.
Cultural 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.
Aesthetics	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 Mississippi; and the large per-capita number of recreational	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.

Resource	Institutionally Important	Technically Important	Publicly Important
	boat registrations in Mississippi.		
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 Mississippi; and the large per-capita number of recreational boat registrations in Mississippi.
Socioeconomics	USACE ER 1105-2-100, and National Environmental Policy Act of 1969. Executive Order 12898 of 1994	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 these effects on the human environment.	Government programs, policies and projects can cause potentially significant changes in many features of the socioeconomic environment.
Environmental Justice	Executive Order 12898 of 1994	E.O. 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,	federal actions can cause disproportionately high adverse human health or environmental effects to minority and/or low- income populations.
Prime and Unique Farmland	Farmland Protection Policy Act of 1981.	State and Federal agencies recognize the value of farmland to produce food, feed, and forage.	Public places a high value on food and feed production.

3.2.1.1 Natural Environment

3.2.1.1.1 Wetlands and Bottomland Hardwood Forest

The wetlands within DeSoto County provide useful functions, such as detaining precipitation and floodwater, cycling nutrients, exporting organic carbon, maintaining plant communities, and providing habitat for fish and wildlife. However, most wetlands are isolated and/or perched and exist without hydrologic connection to streams and tributaries due to incision, drainage, public infrastructure, and commercial and residential development. Preliminary assessments were conducted in select areas of DeSoto County to determine the relative wetland resource conditions and functions in the area. Preliminary results indicated that wetlands in the area provide wetland functions at a moderate level. Wetland sampling was limited to two locations within the Horn Lake Creek watershed and are representative of wetland conditions in the study area. Disturbances are evident at both local and regional scales within the DeSoto County. Commonly observed features included habitat fragmentation, vegetation removal, alteration of flow paths (e.g., ditching), stream bank erosion, stream channel down cutting, bank failure and mass wasting, introduced invasive species, and other impacts associated with wetlands in a rapidly developing urban/suburban setting. These landscape alterations have decreased the level of wetland function within DeSoto County.

As stated in the Mississippi State Wildlife Action Plan (MSWAP) 2015-2025:

> BLH forests occur in river floodplains that receive periodic inundation from rivers during heavy rainfall events. Bottomland terraces are irregularly flooded for durations of several days to a month or more. On these lowland sites, the water table remains

elevated during the winter and spring seasons and soils remain moist through much of the growing season. Their soils are enriched by the influx of nutrients and sediments during floods.

Agricultural production and residential development have contributed significantly to the loss of BLH forest within the Lower Mississippi Alluvial Valley (LMAV), along the Mississippi River Flyway and in DeSoto County. In addition, drainage efforts and improved infrastructure have fragmented the remaining BLH forests to the extent that many no longer provide flood water storage, nutrient trapping, groundwater recharge and wildlife habitat. Remnant patches of BLH forest have been conserved because of their increasing value for outdoor recreation such as fishing, hunting, wildlife viewing and hiking, as well as regulatory efforts to conserve these areas.

The BLH forests exist mainly within the riparian corridor of streams and largely within the top bank of streams. Approximately 1,781 acres of BLH or other forested wetlands exist within 100 meters of the streams included in the study, see Table 3-1. for acreages specific to each stream according to National Land Cover Database (2021). There is a well-documented loss of riparian BLH within the MVLP, which directly contributes to the degradation of streams in the region and in DeSoto County. Bare banks and kudzu dominate much of the stream banks and adjacent habitat, impacting structure and organic materials and limiting colonization by macroinvertebrates, which provide a base for the food chain. In addition, the study area lies within the Mississippi Flyway and loss of BLH has impacted the usefulness of the area for migratory bird species. Incision of streams in DeSoto County has caused a lowering of the water table, causing BLH wetlands to become drier over time. Streams continue to degrade and widen uncontrollably, impacting BLH habitats as well as residential and commercial properties, agriculture, roadways, and bridges.

3.2.1.1.2 Mesic Upland Forests

According to the MSWAP 2015-2025:

Plant communities of mesic habitats are likely to include lower slope/high terrace hardwoods. Hardwood forests in this type are often found on moist portions of upland habitats protected from fire (by slope) and high terraces or ridges of floodplains.

Included in these mesic forests are small seepage slopes or springs. The diversity of the hardwood and pine forest communities have decreased due to land clearing, overcutting, introduction of invasive species (especially Chinese privet), erosion and the suppression of fire over long periods. Being situated on gently sloping landscapes with relatively deep and fertile soil, the mesic forest types were more likely to be converted to agriculture.

The moderately moist and occasionally wet (palustrine) hardwood forest habitats of this type are found on lower slopes and high terraces of streams and rivers of Mississippi. Small drainageways, floodplains, stream terraces, levees, low moist plains, and some lower slopes are landforms that support this vegetation type. The lowlands have soils ranging in textures

from clay and silt to, occasionally, sandy loam. The coarser textured soils are usually found on ancient secondary terraces. Although these landforms sometimes flood, they often have deeper soils and receive lateral subsurface seepage and surface runoff from adjacent uplands. Their low position on the landscape ensures that the habitat remains moist during the growing season. This habitat type often has an elevated water table during the late winter and early spring. However, the water table may drop precipitously during early spring growth. Common tree species found in this habitat type may include various species of oak, beech, maple, sweetgum, and hickory.

The upland forested habitats within DeSoto County have been heavily impacted with approximately 868 acres of upland forested lands remaining within 100 meters of the streams included in the study, see Table 3-1. for acreages specific to each stream. Upland forests have been more heavily impacted due to the ease of clearing and use for agricultural, residential, and commercial uses. These forest types are critical in the functioning of the Mississippi River Flyway, as well as providing the required foraging, rest, and reproduction for species within the area.

3.2.1.1.3 Water Quality and Aquatic Resources

DeSoto County is essentially separated into two 8-digit Hydrologic Units; the Coldwater – 08030204, and the Horn Lake-Nonconnah – 08010211. Channel degradation and aggradation caused by residential and commercial development, channelization, erosive soils, agricultural practices, and other channel alterations in the DeSoto County watersheds have caused a decline in the ability of streams and adjacent lands to support the requisite functions for fish and wildlife.

The streams in DeSoto County that have total maximum daily loads (TMDL) assigned are noted in Table 3-1. The most prevalent water quality concerns as noted from the MDEQ TMDL reports are excessive nutrients, organic enrichment/low dissolved oxygen, and sedimentation. In addition, Red Banks Creek is listed as biologically impaired due to toxicity.

The Coldwater River Basin is located within the larger Yazoo Drainage Basin and is impounded by a flood control dam that changed the hydrologic regime and created Arkabutla Lake. As such, the Coldwater River system is highly modified and fish passage has been blocked. Substrates consist of silty, clay and sand sediments. Streams that flow into the Coldwater River as well as the Horn Lake – Nonconnah Basin are generally sluggish. Sedimentation appears to have increased over time in the study area's streams due to high stream flows causing erosion and bank failures during flood events along with incision, head-cutting, heavy agricultural practices, and commercial and residential development. In addition, low normal flows, and aggradation in some areas along with bare, unshaded banks, and excess nutrients cause low dissolved oxygen impairing streams for biological use.

3.2.1.1.4 Wildlife

The streams and forests provide remnant or isolated habitat for a variety of migratory game and non-game birds, mammals, amphibians, and reptiles. However, several factors prevent

a connected, functioning ecosystem including (but not limited to) limited primary productivity in many stream reaches, a lack of structure and organic materials, limited colonization by macroinvertebrates, and limited BLH/riparian habitat. Wildlife species and utilization varies from the highly urbanized, to rural, to forested, to less developed areas.

Aquatic species endemic to the area, including the Yazoo darter and Yazoo shiner, red-bellied dace, and piebald madtom (currently petitioned for listing under the ESA) are threatened by systemic degradation of streams in northern Mississippi. Fish passage in the study streams is limited by barriers including perched culverts or bridge stabilization, stream blockages, and sedimentation. Suitable habitat for Federally threatened species, reclassified to endangered effective March 31, 2023, northern long-eared bat (NLEB) (discussed in more detail below), is scarce. In addition, BLH loss and aquatic instability within the MVLP has impacted the Mississippi Flyway. Neo-tropical migratory species and other priority species listed by the Audubon Society, rely on the Mississippi Flyway as a migration corridor, winter resting area and for forage and reproductive purposes. Small mammals are also likely to utilize the forested tracts, which provide a haven from the urban sprawl associated with that area of the county.

State listed species within the study area include (but are not limited to) migratory songbirds such as the Chuck-will's-widow, Prothonotary warbler and Kentucky warbler and mammals including the American black bear, eastern red bat and long-tailed weasel. For a full list of state listed species of concern within 2 miles of each stream basin, see Appendix F (Public Interagency and Tribal Coordination).

Threats to wildlife are on-going and include development and associated pollution, agriculture, and human disturbance and modification of natural systems such as channelization, construction of levees and reservoirs, and other flood risk management projects. Conservation and restoration of remaining habitat along with invasive species control is recognized as a priority conservation action by the Mississippi Department of Fisheries, Wildlife and Parks (MDFWP, 2016).

3.2.1.1.5 Threatened and Endangered Species

Threatened and endangered species principally stem from the alteration, degradation, and loss of habitats from human disturbance. The continued high rate of commercial development throughout continues to reduce available 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 faunae.

According to results previously obtained from USFWS Information, Planning, and Conservation (IPaC) conservation planning tool, one threatened species, the Northern Long-eared Bat (NLEB; *Myotis septentrionalis*), may occur within the proposed study area. However, on November 30, 2022, the USFWS published a final rule, 87 FR 73488, 50 CFR

17, to reclassify the NLEB as endangered under the Endangered Species Act with an effective date of March 31, 2023 per 88 FR 4908.

The NLEB has been heavily impacted by white-nose syndrome (WNS) and as a result, was listed as threatened by USFWS in January 2016 and reclassified as endangered effective March 31, 2023. The WNS is caused by a fungus called *Pseudogymnoascus destructans* and is named after the appearance of a white fuzz that appears on the face, ears, and wings of affected bats. The WNS spreads prolifically among hibernating bats causing them to burn energy stores, leave hibernacula in winter, and is often fatal. Estimates of mortality in affected hibernacula are as high as 90-100 percent. NLEB spend winter hibernating in caves and mines, called hibernacula, using caves or mines with constant temperatures, high humidity, and no air currents. In the summer, the NLEB uses trees (live or dead) with exfoliating bark, cracks, or crevices to roost. Maternity colonies generally have 30 to 60 female/juvenile bats at the beginning of the summer. Most female NLEB within a maternity colony give birth around the same time, usually from late May through July, depending on the location of the colony. No known NLEB hibernacula, maternity colonies, or roost trees are known to exist within the study area.

3.2.1.1.6 Air Quality

The USEPA, 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.

DeSoto County is currently designated by the EPA as a maintenance area for ozone under the 2015 8-hour standard. DeSoto County has been classified as marginal, which is the least severe classification. This classification is the result of area-wide air quality modeling studies, and the information is readily available from the Mississippi Department of Environmental Quality, Air Quality Division. Federal activities proposed in DeSoto County 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 (NOX) emissions caused by the construction of the project. Prescribed de minimis levels of 100 tons per year per pollutant are applicable in DeSoto County. Projects that would result in discharges below the de minimis level are exempt from further consultation and development of mitigation plans for reducing emissions.

3.2.1.1.7 Geology and Soils

The majority of the study area lies within the loess plains of the MVLP. Physiography of the loess plains ecoregion is evidenced by dissected irregular level to gently rolling plains; wide, flat floodplains; and low gradient silt and sand bottomed streams. Geology within the area consists of Quaternary loess with alluvial silt and sand in floodplains, some Quaternary and Tertiary sandy clay decomposition residuum and Tertiary (Eocene) sand and clay. Common soil series include Grenada, Loring, Calloway, Memphis, Providence, and on floodplains Oaklimeter, Ariel, Falaya, Collins, and Waverly. Elevations typically range from 70-630 feet above mean sea level. (Chapman et. al., 2004). A portion of the study area extends into the bluff hills of the MVLP. This ecoregion is dissected by hills, ridges and irregular plains. Steep hillsides and narrow valleys to the west transition to smoother terrain to the east. Streams are moderate to low gradient with sand, silt and occasional gravel substrate. Quaternary loess is often 30-50 feet thick or more, with Tertiary (Eocene to Miocene) sand, silt, and clay. Common soil series expected within the region include Memphis, Loring, and Natchez. Common soils on floodplains may include Adler and Collins soils. Elevations range from approximately 60-360 feet above mean sea level (Chapman et. al., 2004).

3.2.1.2 Human Environment

3.2.1.2.1 Cultural Resources

DeSoto County is rich in archaeological and architectural resources. In the Horn Lake Creek drainage area, which encompasses Cow Pen Creek, Rocky Creek, and Lateral D, there have been 27 surveys completed since 1986. There are 17 sites within this watershed including 2 mound centers (22 DS500 and 22 DS509), 14 ineligible lithic and ceramic scatters, and 1 unknown aboriginal site. None of these sites would be impacted by the proposed project.

In the Coldwater River drainage area, there have been 17 surveys since 1979. There are 32 sites within this drainage area, included two eligible sites, 22 DS518, an unknown aboriginal

mound site and 22 DS746, a historic cemetery. Ten of the sites are ineligible and 20 are unknown or unevaluated. These sites range from lithic and ceramic scatters to historic scatters. None of these sites would be impacted by the proposed project.

There are eight built-environment properties and four districts listed in the National Register of Historic Places (NRHP) in DeSoto County. In addition, there are seven Mississippi Landmark Properties within DeSoto County. Most of these properties and districts are located in Hernando, Mississippi, with one NRHP property and one Mississippi Landmark located in Olive Branch. None of these sites would be impacted by the project. Areas that have not been surveyed within the project study area would be surveyed prior to any future construction. Appendix N. Tables N:1-3. and N:1-4. identifies previously recorded archeological sites.

On the National Register of Historic Places, the National Park Service (NPS) has designated five historic districts, all of them located in the city of Hernando. The Hernando Commerce Street Historic District, the Hernando Courthouse Square District, the Hernando Northside Historic District, the Hernando South Side (Magnolia) Historic District, and the North Elm Historic District are along the Delta Bluffs Scenic Byway. Seven other significant historic places dot the landscape and help narrate the county's unique culture and history. DeSoto County Tourism and their "South of the Ordinary" campaign promotes the county's natural, cultural, and recreational resources. Regional tourism programs include, but are not limited to, www.visitthedelta.com, www.mississippihills.org, www.visitmississippi.org, and www.msdeltaheritage.com.

3.2.1.2.2 Aesthetics

On the immediate eastern banks of the Mississippi River, the western extent of the study area is within the Mississippi Alluvial Plain ecoregion. This ecoregion characterized by the extensive agricultural bottomland flatlands made possible by channelization and flood management systems, making it one of the more heavily altered ecoregions in the United States. This heavily cultivated landscape consists of a patchwork of thin strips of dense BLH forests that are juxtaposed with the straight borders and perimeters of neighboring agricultural land and historic development along the river corridor. As the ecoregion transitions eastward from the Mississippi Alluvial Plain, most of the study area is within the Mississippi Valley Loess Plains ecoregion. This ecoregion is characterized by the irregular plains and gently rolling hills which are distinguished with thick loess and oak-hickory-pine forests. (Chapman, S.S, Griffith, G.E., Omernik, J.M., Comstock, J.A., Beiser, M.C., and Johnson, D., 2004, Ecoregions of Mississippi, Reston, Virginia, U.S. Geological Survey).

The Great River Road National Scenic Byway provides the primary source of visual access on the West side of the project area and adjoining lands. The designation by the US Department of Transportation Federal Highway Administration recognizes archeological, cultural, natural, recreational and scenic qualities of River Road from Minnesota to Louisiana. Additionally, the Delta Bluffs Scenic Byway is within the study area and provides visual access into the historic communities of Walls and Hernando. This byway is a part of the Mississippi Scenic Byways Program (MSBP) under the Mississippi Department of

Transportation (MDOT), which help preserve, enhance, and protect the state's intrinsic resources for visitors and residents of the state.

3.2.1.2.3 Recreation

The study area is within the Mississippi North Delta Planning and Development District and is included in the Mississippi Statewide Comprehensive Outdoor Recreation Plan (SCORP). DeSoto County has 44 active recreation facilities and 30 passive recreation facilities according to Mississippi SCORP "Ensuring Mississippi's Outdoor Legacy" 2019-2024 prepared for the Mississippi Department of Wildlife, Fisheries, & Parks (MDWFP). These 74 facilities are managed by MDWFP resources and/or DeSoto County resources. See Appendix N, Table N:1-5. for a listing of DeSoto County parks and recreation facilities.

According to the United States Department of the Interior National Park Service Land & Water Conservation Fund (LWCF), nine recreation projects have been supported between 1965 and 2015. 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 NPS approves substitution property of reasonably equivalent usefulness and location and of at least equal fair market value. See Appendix N, Table N:7. for a listing of funding from the LWCF.

"The Outdoor Industry Association reports that active outdoor recreation contributes $8 billion annually in consumer spending to Mississippi's economy and supports 79,000 jobs. These jobs generate $2.1 billion in wages and salaries and produces $620 million annually in state and local tax revenue. The U.S. Census Bureau reports that each year over 1.3 million people participate in hunting, fishing, and wildlife watching in Mississippi contributing $1.1 billion to the state economy" (www.lwcfcoalition.org: State Fact Sheets May 2019).

3.2.1.2.4 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 proposed FRM system alternatives. The EJ assessment identifies environmental and demographic indicators for the project alternatives, using the EPA tool, EJSCREEN and other tools. The EJSCREEN tool's environmental indicators are discussed in the EJ Appendix M of this report.

If an alternative 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 taking offsetting benefits into account, then there may be a disproportionate finding. Avoidance or mitigation are then required. Regardless, if an alternative is disproportionate or not, mitigation measures to reduce impacts to areas of EJ concern are presented in the Environmental Consequences section and the EJ Appendix M.

Additional EJ Outreach and Meetings:

EJ Outreach was conducted during the public comment period when the draft report was released to the public to gain insight from residents in areas of EJ concern about the proposed project and potential positive and adverse impacts. More information about EJ outreach can be found in the EJ Appendix M.

Areas of EJ concern within the study area of Desoto County, MS are identified using the NHGIS tool which provides the most recent U.S. Census Bureau 5-year survey data, 2016-2020. 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. Within these populations, there are residents, community leaders and organizations, among others. U.S. Census data is the source for the number of minority and low-income populations in the study area. For a particular Census Block Group (CBG), if a majority of residents identify as a person of color (minority), then the CBG is considered an area of EJ concern. Additionally, if the % of minority residents in a CBG is meaningfully greater than the % in state of Mississippi, that CBG is also considered an area of EJ concern. In this case, the meaningfully greater than percentage is 50%. Finally, CBGs having 19.6% or more of residents living below poverty are considered areas of EJ concern. As recommended in EPA’s EJ Promising Practices document, a reference area’s percentage of residents living below poverty can be used as the threshold for identifying areas of EJ concern based upon poverty status. The state of Mississippi percentage of residents living below poverty is used to identify CBGs in the Desoto study that are considered areas of EJ concern. Poverty level, for 2020, was $26,200 for a family of four. Study area CBGs having 19.7 percent or more of residents living below poverty level are considered areas of EJ concern.

The Affected Environment EJ section describes the low-income and minority composition of the County as a whole and of the County’s U.S. Census Bureau Block Groups. Census Block Groups (shown on Figure 3-2. as numbers) are smaller geographic areas for which the U.S. Census Bureau provides demographic data. For example, the area of EJ concern labeled 702103 represents U.S. Census Tract 70210, Block Group 3. Overall, the county is majority white with 37 percent of residents identify as minority. The largest minority in the county identifies as Black/African American. The largest city in DeSoto County is Southaven, which is home to about 30 percent of the county population. While the County as a whole is majority White, there are many areas in the County where a majority of the population identifies as a minority. Table M-1. in Appendix M provides census information for the study area Census Block Groups. Figure 3-2. shows the 26 Census Block Groups in the study area (Desoto County) that are majority minority (areas of EJ concern). Note that a Census Tract is made up of several Block Groups (the first 5 digits of the number is for the Census Tract and the last digit is the Block Group number in that census tract).

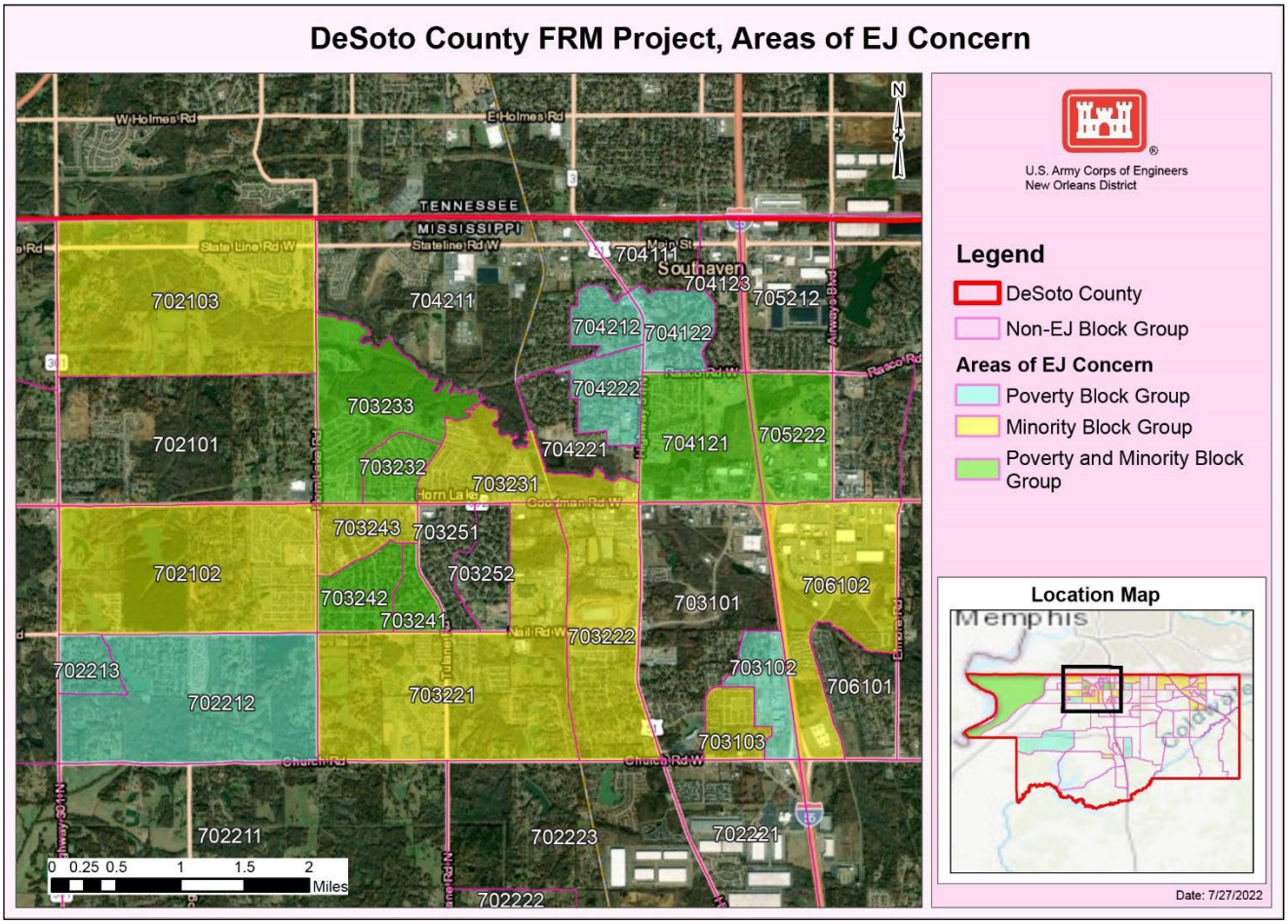

Figure 3-2. Census Block Groups, Areas of EJ Concern (Minority and Low Income)

Source: Source: Map Census block group polygons and census data 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

The county is majority white, a vast majority of the population live above the poverty threshold. Just under 10 percent of DeSoto County residents had income below the poverty threshold which in 2020 was $26,200 for a family of four. However, some areas within the County are low-income, as identified by the 19.6% or more threshold and are shown in Table M-2. in Appendix M and on Figure 3-2. above. All the block group areas shown in Table M-2. in Appendix M have approximately 20 percent or more of the population living below the poverty threshold are considered areas of EJ concern.

3.2.1.2.5 Socioeconomics

3.2.1.2.5.1 Population and Housing

Table 3-5. shows the population trend in DeSoto County and in the State of Mississippi from 1970 to 2010 and projections through 2040. Population is steadily increasing in both DeSoto County and the State of Mississippi. Total number of households (Table 3-6.) also shows a steady increasing trend from 1970 to 2010 and projections through 2040.

Table 3-5. Total Population (Thousands)

	Dec- 1970	Dec- 1980	Dec- 1990	Dec- 2000	Dec- 2010	Dec- 2020	Dec- 2030	Dec- 2040
DeSoto County (MS)	36.0	54.1	68.6	108.7	161.8	188.0	217.9	246.3
Mississippi	2,221.1	2,526.7	2,578.9	2,848.4	2,970.3	3,009.5	3,079.6	3,155.1

U.S. Census Bureau (BOC); Moody's Analytics (ECCA) Forecast

Table 3-6. Number of Households. Total (Thousands)

	Dec- 1970	Dec- 1980	Dec- 1990	Dec- 2000	Dec- 2010	Dec- 2020	Dec- 2030	Dec- 2040
DeSoto County (MS)	9.3	16.3	23.5	39.4	58.0	69.2	83.6	97.9
State	638.1	829.1	913.3	1050.0	1118.0	1176.6	1248.1	1310.7

U.S. Census Bureau (BOC); Moody's Analytics (ECCA) Forecast

3.2.1.2.5.2 Employment, Business, and Industrial Activity

Table 3-6 shows the growth of non-farm payroll over the last four decades and projections through 2040. Total nonfarm payroll employment is the number of paid US workers in all businesses, excluding those who work for farms, serve in the military, volunteer for nonprofit organizations, and perform unpaid work in their own household. Self-employed, unincorporated individuals are excluded as well. The leading employment sectors for DeSoto County are Trade, Transportation and Utilities; Leisure and Hospitality; Government; and Education & Health Services. Tables 3-7., 3-8. and 3-9. show the Labor Force, Employment, Unemployment, and Unemployment Rate for DeSoto County and the State of Mississippi, respectively. DeSoto County has consistently had a lower unemployment rate than the State of Mississippi. The labor force shows a steady increase over the period and projected through 2040.

Table 3-7. Employment: Nonfarm Payroll, (Thousands) for Desoto County

	Dec-1970	Dec-1980	Dec-1990	Dec-2000	Dec-2010	Dec-2020	Dec-2030	Dec-2040
Natural Resources and Mining	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.02
Construction	0.22	0.68	0.98	1.90	1.86	2.32	2.83	3.54
Manufacturing	2.65	3.76	6.24	7.07	3.68	4.64	5.04	5.48
Trade, Transportation, Utilities	1.14	2.59	5.10	9.13	14.29	20.74	24.56	28.89
Information	0.05	0.07	0.13	0.21	0.19	0.25	0.30	0.35
Financial Activities	0.35	0.46	0.69	1.06	1.64	1.61	1.95	2.34
Prof. and Business Services	0.53	0.77	1.90	3.11	4.03	6.87	8.77	11.17
Education & Health Services	0.09	0.31	1.24	2.57	5.57	7.25	9.14	11.19
Leisure and Hospitality	0.46	0.79	1.47	4.00	6.99	10.27	12.89	16.03
Other Services (no Public Administration)	0.15	0.22	0.41	1.19	1.40	1.77	2.06	2.34
Government	1.60	2.09	2.37	3.84	6.75	7.57	8.94	10.17
Total Nonfarm payroll	7.28	11.76	20.54	34.08	46.42	63.30	76.49	91.52

U.S. Bureau of Labor Statistics: Census of Employment & Wages (QCEW - ES202); Moody's Analytics (ECCA) Forecast

Table 3-8. Labor Force, Employment, Unemployment, & Unemployment Rate for Desoto County

	Dec-1990	Dec-2000	Dec-2010	Dec-2020	Dec-2030	Dec-2040
Labor Force*	37.38	59.23	79.62	89.12	103.05	119.81
Employment*	35.39	57.81	73.68	84.88	98.02	114.02
Unemployment*	2.00	1.42	5.94	4.24	5.03	5.79
Unemployment Rate, (%)	5.34	2.39	7.46	4.75	4.88	4.83

BLS; Moody's Analytics (ECCA) Forecast. * Numbers reported in thousands (1000)

Table 3-9. Labor Force, Employment, Unemployment, & Unemployment Rate for State of MS

	Dec-1990	Dec-2000	Dec-2010	Dec-2020	Dec-2030	Dec-2040
Labor Force*	1,183.98	1,319.27	1,306.61	1,269.67	1,312.42	1,389.67
Employment*	1,094.04	1,248.24	1,170.88	1,187.34	1,224.16	1,296.76
Unemployment*	89.94	71.03	135.73	82.33	88.26	92.90
Unemployment Rate*	7.60	5.38	10.39	6.48	6.73	6.69

BLS; Moody's Analytics (ECCA) Forecast. Numbers reported in thousands (1000)

3.2.1.2.5.3 Community and Regional Growth (Income)

Per Capita Income is a proxy for community and regional growth. Community and regional growth also track with population and employment trends described in the preceding sections. Table 3-10 shows the growth in per capita since 1970 and projections through 2040.

Table 3-10. Income: Per Capita, ($) for DeSoto County, MS

Dec-1970	Dec-1980	Dec-1990	Dec-2000	Dec-2010	Dec-2020	Dec-2030	Dec-2040
3,003	8,405	16,666	26,480	31,722	41,159	52,607	69,432

U.S. Census Bureau (BOC); Moody's Analytics (ECCA) Forecast

As shown in Appendix M Figure M 2-3., there are several areas of EJ concern around the proposed project area.

3.2.1.2.6 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 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).

According to NLCD, there are 114,480 acres of farmland within Desoto County. Conditions needed to designate the acreage as prime farmland in the project area are presented in Figure 3-3.; however, no specific acreage of prime farmland is provided. Outside of mitigation, farmland should not be removed from production and prime and unique farmland will only be utilized for mitigation if no other farmland is made available.

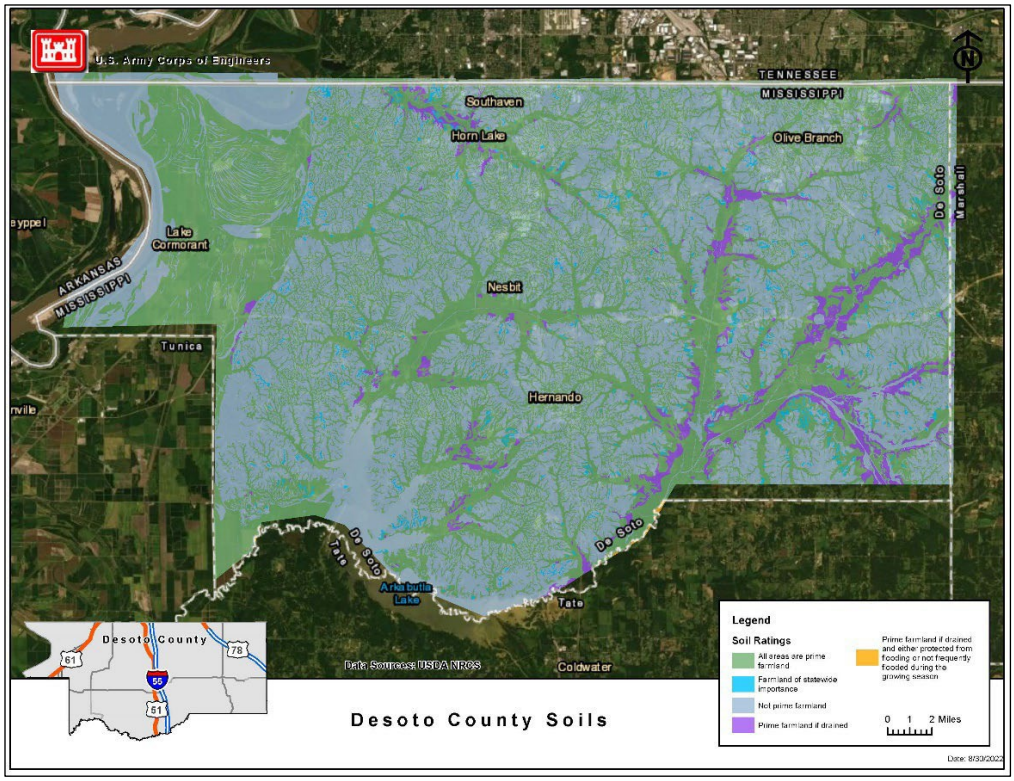

Figure 3-3. DeSoto County, MS. Soils

3.3 FUTURE WITHOUT PROJECT (FWOP) CONDITIONS (NO ACTION) ALTERNATIVE

The CEQ regulations for implementing NEPA require the evaluation of the No Action Alternative (40 CFR § 1502.14(c). The future without project (FWOP) describes conditions if the proposed action is not implemented. Appendix G, Figures 72. through 75. depict the without project inundation maps.

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 this report discusses ongoing programs and potential projects in the study area for floodplain related activities. None of the programs and potential projects listed in Section 1.5 are currently in construction, and if they were implemented, would have only localized flood risk management within the study area. The projects/programs would have the potential to reduce the number of eligible structures for the nonstructural portion of the RP. The following assumptions are part of the projected without-project condition:

- Desoto County planners considered the Horn Lake Creek Basin to be 35 percent developed in the year 2000.
- DeSoto County experienced significant flooding and flash flooding during the 10-year period from 1994 to 2004. Four of the most recent and largest-magnitude

floods that occurred in the Horn Lake Creek basin were in November 2001, December 2001, October 2002, and December 2002. Appendix N Table N-3. summarizes the history and magnitude of the floods that occurred from 1994-2014.

- Commercial, residential, and industrial developments occur to the top banks of Horn Lake Creek and tributaries. More residences and businesses are located within the 1% AEP than when the 1993 Flood Insurance Rate Maps were completed.
- Attempts to remove debris and vegetation from the Horn Lake Creek and tributaries channels has not been effective as a means to alleviate flooding in the area.
- Development is occurring countywide, and while DeSoto County is proactively ensuring that development is not occurring in the .01 AEP floodplain, it is important that the County continues to predict and prevent changes in run-off in the future.
- In proportion to this increase in development, the area is expected to see an increase in flow discharges. Table 3-11. shows a comparison of the 100-year discharges at various locations for 2002 versus 2027 conditions.

Table 3-11. Comparison of 1% Annual Exceedance Probability (AEP)

Location	Stream Mile	Drainage Area (Square Mile)	1% Annual Exceedance Probability (AEP)	
			Year 2002	Year 2027
Mississippi River F/P	8.4	54.5	19,800	20,600
Stateline Road	12.5	41.6	18,500	20,300
ICRR	18.2	18.2	14,700	16,200
Highway 51	19.4	22.4	15,600	17,000
Interstate 55	21.2	13.1	9,700	12,400
Elmore Road	22.2	7.4	6,000	7,700

3.3.1 Climate Change

The 2014 USACE Climate and Resiliency Policy Statement states that “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.” Executive Order 13990, of January 20, 2021, on Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis (86 Fed. Reg. 7037), directs agencies to review and take action to address, among other things, greenhouse gas emissions and resilience to the impacts of climate change. Executive Order 14008 (Tackling the Climate Crisis at Home and Abroad (86 Fed. Reg. 7619), of January 27, 2021, places the climate crisis at the forefront of foreign policy and national security planning and states

that the US will move quickly to build resistance to the impacts of climate change that are already manifest and will continue to intensify according to current trajectories.

The 2015 review conducted by the USACE Institute for Water Resources (IWR) summarizes the available literature on climate change for the Lower Mississippi River Region, which includes the Horn Lake Creek Basin. Climate trends are included in detail in Climate Appendix H.

In anticipating the changes across the 50-year planning horizon the area will continue to see increases in intense rainfall, but the trend in annual average rainfall is inconclusive. Rising temperatures may play a role in reducing the resiliency of the basin; magnifying the severity of droughts by increasing evapotranspiration rates and reducing water storage in lakes and wetlands which can lead to further cutting off bottom land hardwoods from flowing water sources. Rising temperature may also raise water temperatures which will adversely affect plant and animal life. Climate literature is not conclusive on the projections for increases in annual precipitation. However, more frequent and intense rainfall events in the region are anticipated. Increased frequency of fall hurricanes that track through the area has been noted over the past century and a statistically significant trend has been found in our sub-region. A higher frequency of intense runoff events will produce higher stream flows and raise the risk of erodibility of banks and stream beds.

The USACE climate change analysis, as documented in Appendix H, indicates:

- There is an increasing trend in frequency of intense rainfall within the region.
- There is some consensus regarding trends in extreme precipitation events.
- Average annual temperatures are expected to increase.
- There is no consensus in the projected stream flow trends.

Based on the lack of clear evidence showing an increase in streamflow, the effects of climate change can be considered within the standard uncertainty bounds associated with the hydrologic/hydraulic analysis being conducted as part of this study. See Appendix H for additional details.

3.3.2 Relevant Resources

This section contains a description of relevant resources in a future within which the proposed action would not be implemented and the predicted environmental restoration benefits, flood risk management benefits, etc. would not be achieved (No Action Alternative).

3.3.2.1 Natural Environment

3.3.2.1.1 Wetlands and Bottomland Hardwood Forest

Under the FWOP conditions, direct impacts to wetlands and BLH within DeSoto County may continue; however, much of the land that can be used for commercial and residential purposes has been developed. In addition, regulatory requirements have been put in place

to protect remaining wetlands and BLH forests that are now understood to provide useful functions, such as detaining precipitation and floodwater, cycling nutrients, exporting organic carbon, maintaining plant communities, and providing habitat for fish and wildlife.

In addition to the potential for direct impacts from development, the on-going degradation in and along stream within Desoto County would continue. The uncontrolled stream bed degradation of DeSoto County streams would continue to worsen and would directly impact the remnant wetlands, BLH forests and riparian buffers along streams. It is estimated that the continued stream deepening and widening would cause the loss of approximately 191 acres of stream bank, riparian habitat, low to moderate quality BLH forest habitat, shrub-scrub and agricultural lands along with some residential and/or commercial development.

This continued degradation causes a trend of stream stability loss impacting habitat, scour and aggradation, water quality, and property along streams.

3.3.2.1.2 Upland Forest

Under the FWOP conditions, upland mesic forests would continue to be cleared for commercial and residential purposes. This expected trend would cause the continued degradation of foraging, cover, and reproductive habitat for wildlife. The Mississippi Flyway would also continue to degrade placing further stress and competition on species.

3.3.2.1.3 Water Quality and Aquatic Resources

Under the FWOP condition, water quality and aquatic resources are expected to remain impaired and continue to worsen due to land-use practices which lead to uncontrolled sedimentation, low dissolved oxygen, and excess nutrients which are all listed as biological impairments by the MDEQ (MDEQ, 2020 303d list). High velocity and flashy stream flows during flood events are expected to increase with continued development, especially in or near floodplains. These increasing flows cause erosion and bank failures along with incision, head-cutting and stream widening. In addition, low normal flows and aggradation in some areas along with bare, unshaded banks would continue to impair streams for biological use.

3.3.2.1.4 Wildlife

Under the FWOP conditions, wildlife diversity, habitat and usage would continue to be limited and likely decline as forested areas, aquatic resources, and water quality continue to decline in quality and quantity, as described in previous sections.

The streams which currently provide remnant or isolated habitat for a variety of migratory game and non-game birds, mammals, amphibians, and reptiles would continue to degrade preventing a connected, functioning ecosystem. The already limited primary productivity, structure and organic materials, colonization by macroinvertebrates, and BLH/riparian forests and buffers would continue to degrade. Wildlife diversity and utilization would continue to be impacted continued stream degradation.

Aquatic species endemic to the area, including the Yazoo darter and Yazoo shiner, red-bellied dace, and piebald madtom, already threatened by systemic degradation of streams in

north Mississippi, would continue to suffer habitat loss. Fish passage would continue to be impacted by bridge stabilization, stream blockages, and sedimentation. Suitable habitat for Federally threatened species, northern long-eared bat (discussed in more detail below), are scarce and continuing to degrade. The Mississippi Flyway which supports species such as warblers, herons, waterfowl, raptors, and many other priority species listed by the Audubon Society, would continue to be impacted, as noted previously, due to direct and indirect impacts due to development, erosion and water quality impairments.

3.3.2.1.5 Threatened and Endangered Species

The Federally listed species within the range of the study, northern long-eared bat, would not be directly impacted or benefitted under the FWOP; however as with any population in the vicinity, continued habitat decline would prevent a stable ecosystem that could support these species.

3.3.2.1.6 Air Quality

Under the FWOP, Desoto County would remain classified as marginal for ozone, the least severe classification. This classification is the result of area-wide air quality modeling studies, and the information is readily available from the Mississippi Department of Environmental Quality, Air Quality Division.

3.3.2.1.7 Geology and Soils

Under the FWOP conditions, significant erosion would continue to impact land adjacent to streams. It is expected that approximately 191 acres of land could be lost across Desoto County without appropriate erosion prevention.

3.3.2.2 Human Environment

The population of DeSoto County is projected to continue to steadily grow (as illustrated in Appendix L-Economics, section 1.3) under the FWOP. The Horn Lake Drainage Basin in particular is expected to be approximately 95 percent developed by the year 2027 and is expected to remain at this percentage until the year 2050 and beyond. This projection is based on proposed changes in land use and population increases. In the absence of a project, flooding would continue and with development expected to continue at this rapid pace, future flooding problems would likely increase.

3.3.2.2.1 Flood Risk

Under FWOP conditions flooding is expected to continue and without action DeSoto County communities at risk would remain at risk. Development is expected to continue at a rapid pace (as described in section 3.1.5). While climate trends are uncertain, there is evidence of increased precipitation, increases in air temperature and an increase in in the occurrence of extreme flood events in Desoto County (as described in Section 3.1.3). Future flood risk is expected to increase in a future with no action.

3.3.2.2.2 Cultural Resources

Under the FWOP, impacts to cultural resources, where applicable, would continue to occur from erosion and urban development.

3.3.2.2.3 Aesthetics

Communities within the study area would continue to be at risk from high water events induced by rainfall events under the FWOP. 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. Communities near 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.

3.3.2.2.4 Recreation

Under the FWOP conditions, 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.

3.3.2.2.5 Environmental Justice and Other Social Effects

Under the FWOP conditions, there would be no Federal action (construction of flood risk management measures) and therefore there would be no additional impacts to minority or low-income communities. The study area would continue to experience damages from rainfall and roads would continue to experience flooding during high water events as they do today.

3.3.2.2.6 Socioeconomics

3.3.2.2.6.1 Population and Housing

Population is anticipated to steadily increase in both DeSoto County and the State of Mississippi. Total number of households (Table 3-4.) also shows a steady increasing trend through 2040.

3.3.2.2.6.2 Community and Regional Growth

Community and regional growth are trending upward along with population, as shown in Table 3-8. The growth in per capita income within DeSoto County rising from $41,159 in December 2020 to $69,432 by December 2040.

3.3.2.2.7 Prime and Unique Farmland

Under FWOP conditions, prime and unique farmland would continue to experience trends noted by agricultural land in general, with development, both industrial and residential, driven by projected population increases, expected to continue.

SECTION 4
Flood Risk Management Plan Formulation

The Principles and Guidelines describe the process for Federal water resource studies and 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 channel improvement) followed by formulation based on economics damage centers (e.g., where the greatest consequences are) minimizing structure damage, life loss, and/or more local flood risk management. These measures were developed based on previous reports and studies, NFS information, stakeholder/public input, new hydrology and hydraulics, geotechnical assessments, a screening process that includes evaluation of completeness, effectiveness, acceptability and efficiency, as well as professional judgment. This section also describes the plan formulation process, to identify the RP, which includes development of cost estimates and economic analysis.

The PDT identified measures and alternatives that would reduce flood damages to businesses, residents, and infrastructure in DeSoto County, which would be measurable by evaluating structural damages. This risk reduction is measurable by evaluating structural and content damage to residential and non-residential structures as well as damages to residential vehicles. In addition, measures and alternatives were evaluated based on their ability to reduce risks to human life from flooding and rainfall events, and risks to critical infrastructure within the study area such as hospitals, schools, electric substations, and emergency services (fire, police, EMS). The PDT identified areas where structural damages were expected to occur in the Horn Lake Creek Basin and the Upper Coldwater Basin. The PDT began formulation with a review of the 2005 Horn Lake Creek Study. The 2005 plan focused entirely on the area known as Bullfrog Corner within the Horn Lake Creek Basin.

The 2005 plan included detention for downstream inducements, channel enlargement and stabilization along Horn Lake Creek (HLC), stabilization of Rocky Creek at its confluence with HLC, and clean out of a diversion ditch and placement of a weir and berm on the drainage ditch just upstream of Bullfrog Corner. While the 2005 plan in its entirety was screened, many of the individual measures of that alternative were retained. The study evaluated five types of structural measures: detention basins, channel modifications, re-routing flows, levees and removing constrictions. Both physical and non-physical nonstructural measures including elevating structures, floodproofing, road closures, and flood warning features.

Multiple panning iterations were required to meet the planning objectives and the four Planning and Guidance criteria: completeness, efficiency, effectiveness, and acceptability, and to buy down decision risks. Reformulation was required after the selection of the original TSP and after more data, modeling and analysis was completed.

The plan formulation process utilized the best available information early in the study to identify the first TSP in May 2021. Additional analyses was completed after TSP to refine the design and cost estimates. The revised design and costs were incorporated into two-dimensional hydraulic modeling and the economic analysis was updated in order to develop an accurate assessment of the performance and cost-effectiveness of the plan. The remaining portion of this Section (4.1) and Section 4.2 outline the first iteration of plan formulation to arrive at that first TSP. Section 4.3 outlines the iteration for the RP.

4.1 FLOOD RISK MANAGEMENT MEASURES

A combination of nonstructural and structural measures were developed to best address the flooding concerns. The measures were evaluated by a screening process based on the planning objectives, constraints, as well as the opportunities and problems of the area. 26 nonstructural and structural measures (Table 4-1.) were evaluated. Based on the results of the preliminary analysis 8 of the measures were found to be potentially justifiable and were carried forward for use in creating alternative plans (highlighted rows in Table 4-1.). A general description of the measures that were considered are described below.

Nonstructural Measures: reduce the human exposure or vulnerability to a flood hazard without altering the nature or extent of the flood hazard. Nonstructural measures could be used in conjunction with any of the structural flood mitigation measures to reduce residual risk.

- Flood warning system/evacuation plans: This measure relies upon stream gages and rain gages for collecting hydrologic information, and computer modeling to determine the impacts of flooding for areas of potential flood risk. A flood warning system, when properly installed and calibrated, can identify the time available for people occupying the floodplain to safely implement temporary measures or to evacuate the area.
- Floodplain Management Regulations: Land use regulations are effective tools in reducing flood risk and flood damage. The principles of these tools are based in the National Flood Insurance Program (NFIP) which requires minimum standards of floodplain regulation. For communities where future growth and expansion has been identified, restrictive land use regulations may be a deterrent to life loss and property damage.
- Property acquisition (buyouts): This nonstructural measure consists of acquiring the at-risk structure and land that the structure sits upon. The structure is either demolished or if in good condition is sold to others and relocated to a site external to the floodplain.
- Relocation: Physically moving the existing at-risk structure away from the flood hazard area to a location which is completely outside of the floodplain.

- Elevation: lifting an existing structure to an elevation which is at least equal to or greater than the design water surface elevation, which could be the 0.01 AEP flood elevation.
- Dry Floodproofing of structures: Waterproofing the structure with an impermeable membrane to prevent flood waters from entering. This can be done to residential homes as well as commercial and industrial structures to provide protection up to 3 feet.

Structural Measures: Physical modifications designed to reduce the frequency of damaging levels of flood inundation

- Detention Basins: regional, below grade structures, designed to attenuate flood peaks and release downstream at non-damaging flow rates. Can involve either one large upstream detention basin and/or smaller detention basins located upstream of existing infrastructure.
- Channel modifications: There are numerous possible variations of this measure, including improving or enlarging the channel with and without concrete and/or rock stabilization.
- Re-routing flows: Includes modifying channel to re-route flow of stream to reduce water surface elevation during flood events, as well as diverting flow to a stormwater ditch during flood events.
- Levees: An earthen embankment, floodwall, or similar structure along a waterway whose purpose is flood risk management or water conveyance could be constructed to reduce the risk of flooding for communities and other significant structures and/or lands. This could also be combined with channelization.
- Removing Constrictions: this includes bridge modification and removal, as well as dredging, clearing, and snagging within the stream.

4.1.1 Natural and Nature Based Features

Natural and Nature Based Features (NNBF) is a USACE initiative that supports more sustainable practices, projects, and outcomes by working to intentionally align natural and engineering processes to deliver economic, environmental, and social benefits efficiently and sustainably through collaborative processes (Bridges et al. 2021, 2018; King et al. 2020). NNBFs have been analyzed during the plan formulation process per guidance (ER 200-1-5, EP 1100-1-3, EP 1100-1-5, EP 1100-2-2. Section 1184 of WIIN 2016 and Section 1149 of WRDA 2018, as amended by Section 116 WRDA 2020). Multiple NNBF measures were evaluated utilizing four criteria which include producing efficiencies, using natural processes, broadening benefits, and promoting collaboration. NNBFs that were carried forward during the initial formulation included protection of large diameter trees and snags, reintroduction of stream sinuosity and microtopography within detention basins, and floodplain connection within the detention basins.

4.2 FLOOD RISK MANAGEMENT INITIAL SCREENING

Measures were screened based on their ability to deliver on the objectives and their preliminary cost effectiveness (if costs far outweighed benefits and the benefit-cost ratio was less than 1). Nonstructural (acquisition, elevation and dry floodproofing) was initially identified as optimal at the 0.04 Annual Exceedance Probability (AEP) frequency (“25 yr.”) and as a result all other frequencies were screened.

26 individual flood risk management measures were considered and of those, 18 were screened and removed from consideration. In general, ring levees proved difficult to fit into highly developed areas effectively. The PDT considered numerous detention basins, and channel enlargement configurations including each of the features identified in the 2005 General Reevaluation Report during the measure evaluation. Measures that were removed from consideration early in the plan formulation process were screened in large part because they were found to be ineffective (in some cases inducing flooding with limited benefits) and inefficient (had high costs and produced very limited benefits). Detention basins evaluated for Elmore Road and on the southeast corner of Hwy 51 and Goodman Road were conceptually promising; however, these detention basins were dropped from further evaluation due to inefficiency (volume constraints) or because their location within the watershed limited the impact on areas of high flood risk.

Table 4-1. Initial Flood Risk Management Measures

Measure Description	Location	Reduces Damage or Risks to			Reason for Screening
		Commercial & Residential Infrastructure	Critical Infrastructure	Life Safety	
Large Scale Reservoir (Conceptual): H&H modeled a fictitious reservoir test the concept	Horn Lake Creek				While conceptually feasible, one single large capacity reservoir site was unavailable
Detention at Sewerage Lagoon site	NW of Bullfrog Corner				This site should be avoided due to potential HTRW.
Rocky Creek Detention	Elmore Rd		X		
Horn Lake Creek Detention	Elmore Rd.	X			
Lateral D Detention	Church and Airways	X			
Cow Pen Detention	S. of Nail and Hurt Rd	X	X		
Horn Lake Creek Detention	Goodman at Hwy 51				Site is an existing wetland with limited capacity to hold more water
Airways and I-55 Detention	Airways and I-55	X			Volume limited and high costs of excavation made this alternative no longer economically justified
Detention with berms	Same measure 9-12				Berms could create life safety risk
Bridge Removal and Replacement	Railroad, Hwy 51, Elmore Rd.				Minimal reduction in WSE, high cost
Clearing and Snagging	HLC and tributaries		,		Very minimal reduction in WSE
Zoning Ordinances	HLC and Coldwater				Responsibility of NFS, shared ordinances
Buy Outs	HLC and Coldwater	X			
Floodproofing Commercial Structures	HLC and Coldwater	X			
Elevate Residential Structures (flood plain aggregations 25, 50, 100 yr.)	HLC and Coldwater	X			
Elevate Roads and Bridges	HLC and Coldwater				Not within USACE authority
Rocky Creek Ring Levee at Shelby Apartments	RC just north of confluence with HLC	X			Does not address access to critical facilities/road flooding
Rocky Creek Levee 2 b/w I-55 and Airways	RC b/w I-55 and Airways	X			Does not address access to critical facilities/road flooding
Horn Lake Creek Levee 1 b/w Airways and Elmore	HLC b/w Airways and Elmore	X			Does not address access to critical facilities/road flooding

Measure Description	Location	Reduces Damages or Losses to			Reason for Screening
		Commercial & Residential Infrastructure	Critical Infrastructure	Life Safety	
Horn Lake Creek Levee 2 around bullfrog corner	HLC @ Hwy 51 and Goodman	X			Would not address flooding on roadways
Horn Lake Creek Drainage Ditch Levee; around bullfrog corner	from I55 S. of Goodman Rd to RR		X		Blocks flows down Bullfrog Corner/MDOT Drainage Ditch
HLC Channel enlargement with rip rap	RM 18.86-19.41	X	X	X	
HLC Channel enlargement large; No concrete lining, move sewer interceptor	RM 19.41-19.82	X	X	X	Does B/C<1, moving infrastructure cost prohibitive
HLC Concrete Lined	RM 19.41-19.82	X	X	X	Environmental concerns, B/C<1, moving infrastructure cost prohibitive
Re-route HLC at RR bridge	Horn Lake Creek at RR bridge				Likely to induce flooding on Horn Lake Creek between Hwy 51 and the Railroad
Berm with a diversion weir, side slope 1:4, crown width of 10. Ditch bottom width of 20' side slope of 1:2.5; Remove channel obstructions along ditch south of Goodman Road at Hwy 51	RM 18.80 – 19.91				Would induce flooding downstream

4.2.1 Flood Risk Management Alternative Plans

Alternatives were assembled through the plan formulation process. Alternative plans were identified using one or more of the retained management measures that were carried forward after the initial measure screening evaluation. The team assembled 3 nonstructural and 19 structural alternatives. These 22 alternatives in the initial array were screened using criteria and economic evaluations outlined in Table 4-2. and were further evaluated using the Principles and Guidelines (P&G) screening criteria identified in Table 4-3. The shaded cells in Table 4-2. are the alternatives that were carried forward.

Table 4-2. Initial Array of Alternatives

Alt ID	Alternative	Measures Included	Primary Screening Criteria	Initial B/C Ratio
NS-25yr	0.04 AEP Nonstructural alternative	Elevating Residential and Flood proofing Commercial Structures, buy outs if found necessary	Most efficient and effective nonstructural plan (highest net benefits)	1.34
NS-50yr	0.02 AEP Nonstructural alternative	Elevating Residential and Flood proofing Commercial Structures	0.04 AEP Nonstructural had the highest net benefits	1.02
NS-100yr	0.01 AEP Nonstructural alternative	Elevating Residential and Flood proofing Commercial Structures	0.04 AEP Nonstructural had the highest net benefits	0.85
6	Basin Wide Bermless Detention	All Detention Combined (alt ID 9-12)	Inefficient, doesn't address road flooding or access to critical infrastructure	N/A
7	2005 Plan	Combination of channel enlargement, diversion, berm and weir, and detention	The channel enlargement was effective and retained, while all other individual measures were screened (ineffective). The berm/weir cause inducements. The plan only works if detention basin is large enough and the basin identified in the 2005 plan is an HTRW site that should be avoided. Only other potential site is an existing wetland	2.57
9	Rocky Creek Detention	Detention Basin on Rocky Creek	Maximizes Net Benefits-effective	1.06
10	Horn Lake Creek Detention at Elmore	Upstream detention basin at Elmore Road	Elmore detention cost prohibitive-inefficient	0.77
11	Lateral D Detention	Detention on Lateral D. near Airways	Maximizes Net Benefits-efficient and effective	2.08
12	Cow Pen Creek Detention	Detention on Cow Pen Creek near Nail and Hurt Rd.	Retained-NFS would like to explore optimizing the design to address roadway flooding	.75
14	Horn Lake Creek Berm Drainage Ditch Levee	Drainage ditch, small levee blocking water from entering stormwater drainage ditch south of Bullfrog Corner	Induces flooding	N/A

Alt ID	Alternative	Measures Included	Primary Screening Criteria	Initial B/C Ratio
16	Horn Lake Creek Drainage Ditch Levee and Detention Combo 1	Drainage Ditch Levee, Horn Lake Detention and Rocky Creek Detention	Negative Net Benefits - Elmore detention cost prohibitive; levee causes inducements	0.75
17	Multi Detention with Drainage Ditch Levee Combo 2	Levee+ 4Detention: Bullfrog Levee, HLC detention at Elmore, Rocky Creek Detention, Cow Pen detention, Lat D detention	Negative Net Benefits - Elmore detention cost prohibitive; levee causes inducements	0.80
18	Horn Lake Creek Channel Enlargement	River mile 18.86-19.41	This is the most viable feature included in the 2005 Plan (#7)- efficient, effective	2.33
19	Multi Detention without Levee Combo 3	4 Detention only: Horn Lake Detention, Rocky Creek Detention, Cow Pen Creek Detention and Lateral D Detention	updated costs show that Elmore is cost prohibitive (inefficient)	0.62
20	Three Detention sites (Plans 9+11+12)	Rocky Creek Detention, Cow Pen Creek Detention and Lateral D Detention	NFS requests retaining each detention to address roadway flooding	.85
21	Horn Lake Creek Channel Enlargement plus Three Detention sites	Rocky Creek Detention, Cow Pen Creek Detention and Lateral D Detention+ HLC Channel Enlargement with Rip Rap	This combined Plan 18+20, and though it is cost effective, plan 22 is more efficient than plan 18.	1.10
22	Extended Horn Lake Creek Channel Enlargement	Extended Channel Enlargement with Rip Rap (18.60-19.41)	Maximizes Net Benefits--efficient and effective	2.35
23	Horn Lake Creek Channel Enlargement +Lateral D detention	Extended HLC Channel Enlargement +Lateral D Detention (Plan 11+22)	Maximizes Net Benefits-efficient and effective, acceptable	1.64
24	Extended Horn Lake Channel Enlargement with Cow Pen Detention	Extended HLC Channel Enlargement +Cow Pen Detention (Plan 12+22)	Maximizes Net Benefits -efficient and effective, acceptable	1.65
5	Extended Horn Lake Channel Enlargement with Rocky Detention	Extended HLC Channel Enlargement +Rocky Creek Detention (Plan 9+22)	Maximizes Net Benefits-efficient and effective, acceptable	1.34
26	Extended Horn Lake Channel Enlargement with 2 detention basins	Extended HLC Channel Enlargement +Cow Pen Detention + Lateral D Detention (Plan 11+12+22)	Maximizes Net Benefits-efficient effective, acceptable	1.37
27	Extended Horn Lake Channel Enlargement with 3 Detention basins+ NS	Extended HLC Channel Enlargement +Cow Pen Detention +Rocky Creek Detention+ Lateral D Detention (Plan 9+11+12+22)	Maximizes Net Benefits-efficient and effective, acceptable	1.11

Note: Shaded cells are alternatives that were carried forward during the screening process. The BC ratios in this table were based on Rough Order of Magnitude (ROM) costs.

4.2.2 Flood Risk Management Alternative Plan Screening Against Principles and Guidelines Criteria

USACE planning guidance requires that plans be evaluated against four criteria listed in the Principles and Guidelines: completeness, effectiveness, efficiency, and acceptability. Other criteria deemed significant by participating stakeholders are also used to evaluate alternatives. The screening criteria represent the most critical factors to be considered in selecting plans for further evaluation. The following criteria were used to assess the overall characteristics of each alternative measure to identify those most likely to meet the project purpose and objectives. Screening of alternatives was done using the formulation criteria including effectiveness, efficiency, acceptability, and completeness. Measures are screened based on the set of criteria described in Table 4-3.

Table 4-3. FRM Screening Criteria

Screening Criteria	Plan Specific Metrics
Effectiveness: the extent to which an alternative plan alleviates the specified problems and achieves the specified opportunities	Reducing damage to structures Reducing water surface elevation
Efficiency: 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	Cost effective Create or enhance stream and wetland habitats; Cultivate recreational opportunities.
Acceptability: 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	Avoid or minimizes negative impacts to •T&E and protected species; •Critical habitat •Water quality (Sediment TMDL) • Cultural, historic, and Tribal resources
Completeness: whether plan includes all elements necessary to achieve the objectives.	1) Reduce risk to human life from flooding and rainfall events; 2) Reduce flood damages to businesses, residents; and 3) Reduce risks to critical infrastructure

12 alternatives were retained during initial array screening (Table 4-2., highlighted cells). Those were combined to develop an intermediate array of flood risk management alternatives. The intermediate array of flood risk alternatives is identified in Table 4-4.

Table 4-4. Intermediate Array of Flood Risk Management Alternatives

Alt ID	Description	Effective	Efficient	Acceptable	Complete
No Action	USACE would take no action to address flood risks	Flooding would continue			
1A	3 detention sites: Cow Pen, Lateral D and Rocky. Initial array plan 20	Yes, each detention basin reduces flood related damages on the tributary, but none reduce damage on Horn Lake Creek	Detention are costly but not prohibitively so.	Acceptable, but requires mitigation for loss of BLH	Complete, but does not reduce flood risks on Horn Lake Creek
1B	3 detention sites: Cow Pen, Lateral D and Rocky, plus 25 YR Nonstructural, identified in initial array table as plans: NS-25+ 20	Reduces flood damages but flooding remains at Bullfrog Corner (Hwy 51 and Goodman Rd)	Costly, but not prohibitively so	Acceptable, but requires mitigation for loss of BLH	Complete, but does not reduce flood risks at Bullfrog Corner (Hwy 51 and Goodman Rd)
2A	3 detention sites (Cow Pen, Lateral D, and Rocky) plus HLC Channel Enlargement 18.86-19.41. Initial Array plans: 20+18	Reduces damages, but induces flooding downstream of railroad	Costly, but not prohibitively so	Acceptable, but requires mitigation for loss of BLH	Incomplete without mitigation for induced flooding
3A	Channel Enlargement RM 18.86-19.41. Initial Array plan 18	Reduces damages on Horn Lake Creek on the NW side of Bullfrog Corner	Efficient, but leaves significant residual risk	Acceptable, will require mitigation for loss of BLH	Complete, but leaves significant residual risk on roads and tributaries
3B	Channel Enlargement RM 18.86-19.41 plus 25 YR Nonstructural. Initial Array plans: NS- 25+18.	Effective at reducing damages, will induce flooding downstream of railroad	Efficient but does not address road flooding	Acceptable	Complete but leaves residual risk on roads and tributaries
4A	4% AEP Nonstructural alternative. Initial Array plan: NS: 25 yr.	Effective at reducing structural damages but does not address water on roads	Most efficient NS plan	Acceptable, fewest environmental impacts	Complete but leaves residual risk on roads
5A	Extended Horn Lake Creek Channel Enlargement 18.6- 19.4. Initial Array plan 22.	Effective at reducing damages in the immediate vicinity (downstream of Bullfrog Corner)	More efficient than smaller channel enlargement (3A)	Acceptable	Complete but leaves residual risk on roads and tributaries
5B	Extended Horn Lake Creek Channel Enlargement+ 25 YR Nonstructural. Initial Array Plans: NS-25 yr+22	Effective at reducing damages, does not address water on roads	efficient	Acceptable when paired with BLH mitigation	Complete but leaves residual risk on roads

Alt ID	Description	Effective	Efficient	Acceptable	Complete
6A	Extended Horn Lake Creek Channel Enlargement+ Lateral D Detention. Initial Array Plan 23.	Effective at reducing damages, does not address water on roads	efficient	Acceptable when paired with BLH Mitigation	Complete, leaves residual risk on Cow Pen and Rocky Creek
6B	Extended Horn Lake Creek Channel Enlargement+ Lateral D Detention+ 25 YR Nonstructural. Initial Array plan: NS-25 yr+23	Reduces damages, does not address water on the roads	More efficient than 5B or 6A	Acceptable when coupled with BLH mitigation	Complete
7	Extended Horn Lake Creek Channel Enlargement + Cow Pen, Lat D, Rocky Detention+ 25 YR Nonstructural. Initial Array plan: 27	Reduces damages and	More expensive, but larger expected annual damages reduced than 6B	Acceptable when coupled with BLH mitigation	Complete

4.3 INITIAL FINAL ARRAY, REFORMULATION, AND REVISED FINAL ARRAY

INITIAL FINAL ARRAY

In May 2021, the initial final array of FRM alternatives were identified and are presented in Table 4-5. and in Figures 4-1. through 4-3. The PDT initially identified the extended channel enlargement as the most efficient and effective measure to reduce flooding on Horn Lake Creek. However, channel enlargement alone would not reduce flood damages on the tributaries of Horn Lake Creek. Nonstructural flood proofing and elevations, detention basins, along with the extended channel enlargement were all carried forward as the initial final array of alternatives that would address flooding on Horn Lake Creek and its three tributaries. These benefit to cost ratios were based on the one-dimensional hydraulic modeling.

Table 4-5. Initial Final Array of Flood Risk Management Plans (2021)

Alt ID	Description	B/C
No Action	USACE would take no action to address flood risks	N/A
4A	0.04 AEP Nonstructural (NS)	1.34
5A	Extended (Ext) Horn Lake Creek (HLC) Channel Enlargement 18.6-19.4	2.35
5B	Ext. HLC Channel Enlargement+ 4% AEP NS	1.29
6A	Ext. HLC Channel Enlargement+ Lateral D Detention	1.64
6B	Ext. HLC Channel Enlargement+ Lateral D Detention+ 0.04 AEP NS	1.66
7A	Ext. HLC Channel Enlargement + Cow Pen, Lat D, Rocky Detention+ 0.04 AEP NS	1.12

REFORMULATION

In order to address high risks and uncertainties in data accuracy the hydraulic analysis was updated from one-dimensional to two-dimensional Hydraulic analysis (HEC-RAS) and used the updated results to revise the economic analysis (HEC-FDA) in November 2021. This updated analysis indicated that only plan 5A, the extended channel enlargement on Horn Lake Creek was effective or economically justified, as shown in table 4-6. The PDT then conducted another iteration of plan reformulation (Table 4-6.) which identified a newly formulated levee and floodwall system with nonstructural (plan 8a and plan 8b), that was efficient, effective, and acceptable. No plan was identified that might reduce the risk of flood damages to residential and commercial property and also remove the risk of flooding of the roadway.

Goodman Road between Hwy 51 and Interstate Blvd. remains at risk of overtopping at the 0.01 AEP event. During reformulation the PDT evaluated adding eight 4 feet by 12 feet box culverts under Goodman Rd. east of Hwy 51 for a total span of 96 feet and found that with the levee and floodwall in place these culverts did not effectively reduce roadway flooding at the 0.1 AEP (10 yr.) event.

The two-dimensional HEC-RAS model allowed the team to visualize where water begins coming out of banks on Horn Lake Creek. While the earlier one-dimensional analysis assumed the water would stay in banks until it reached a stormwater drainage ditch, the two-dimensional model showed this was not the case. Two-dimensional modeling included more accurate terrain data, which showed that structures that were previously lumped between two cross sections (and assumed to be flooding equally) now had limited flood risk because it was identified that they were constructed on higher ground surface elevation (fill) relative to the adjacent ground. Additionally, the overall stages associated with all eight frequencies decreased significantly, with some areas having more than a reduction of two feet of depth in the two-dimensional model relative to the previous one-dimensional HEC-RAS model.

Levees identified earlier in formulation (under the one-dimensional model scenario) were too far downstream from the initial flooding to reduce many of the damages. The levee and floodwall identified in the final iteration (fall 2021) was the only levee located upstream of the stormwater ditch. Plan 4A, the 0.04 AEP nonstructural plan, was evaluated and identified as unjustified as such the initial final array plans which had included this feature were all re-evaluated without this component, thus plan 7A (Table 4-5) became plan 7 (Table 4-6). The team then ceased all further evaluation of Plan 4A, and the 0.04 AEP Nonstructural Plan.

REVISED FINAL ARRAY

Table 4-6. Revised Final Array of Flood Risk Management Alternatives (2022)

Alt ID	Description	B/C
No Action	USACE would take no action to address flood risks	N/A
5A	Ext. HLC Channel Enlargement 18.56-19.41	1.32
6A	Ext. HLC Channel Enlargement+ Lateral D Detention	.44
7	Ext. HLC Channel Enlargement + Cow Pen, Lat D, Rocky Detention	.42
8a	Levee and Floodwall	6.86
8b	Levee and Floodwall + dry floodproofing 14 residential apartment buildings and 21 commercial structures	2.57

Figures 4-4 thought 4-6 illustrate the revised final array of FRM alternatives.

Figure 4-2. Final Array Plan 5A. Extended Channel Enlargement

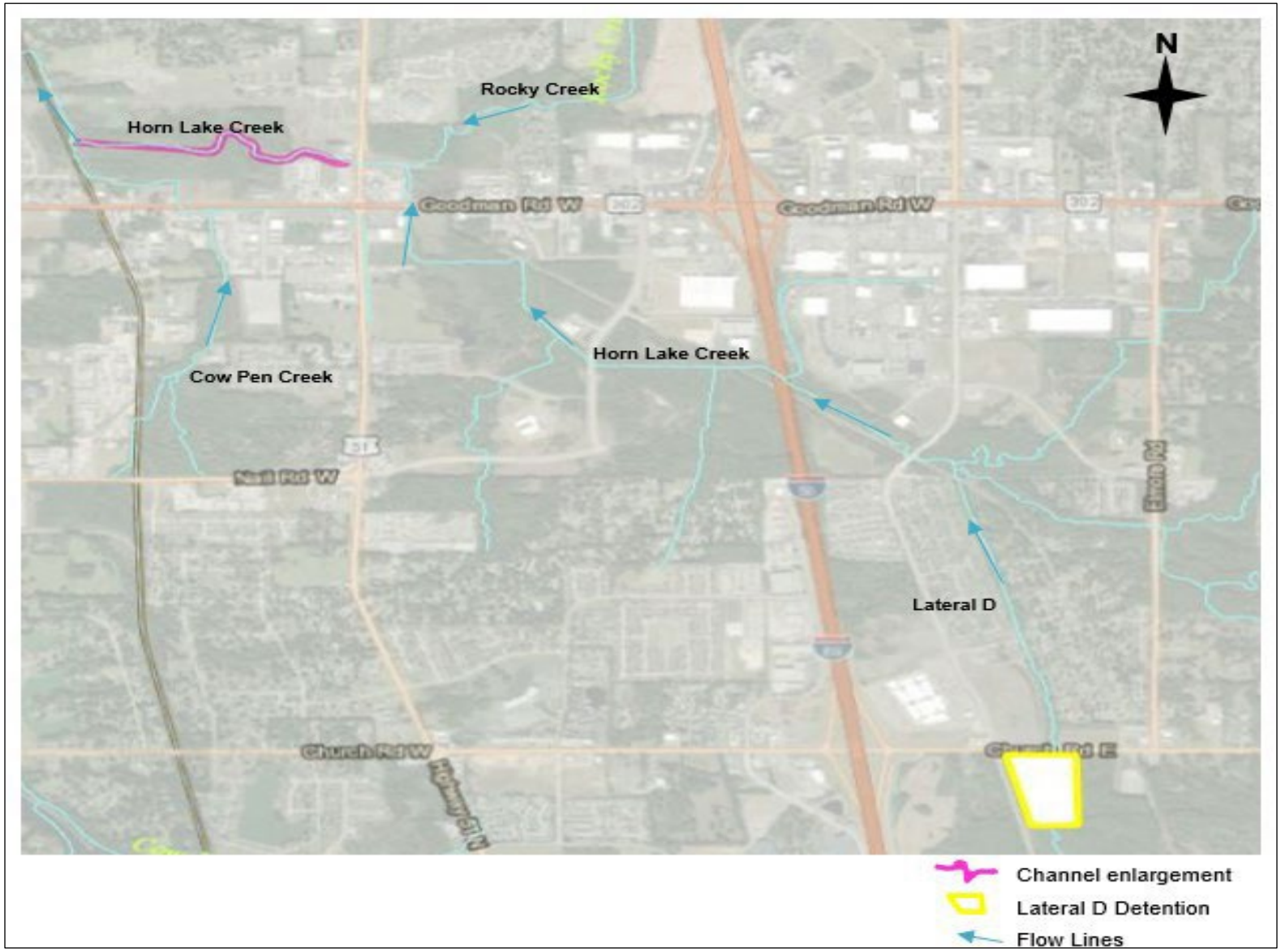

Figure 4-3. Plan 6A. Channel Enlargement + Lateral D Detention Basin

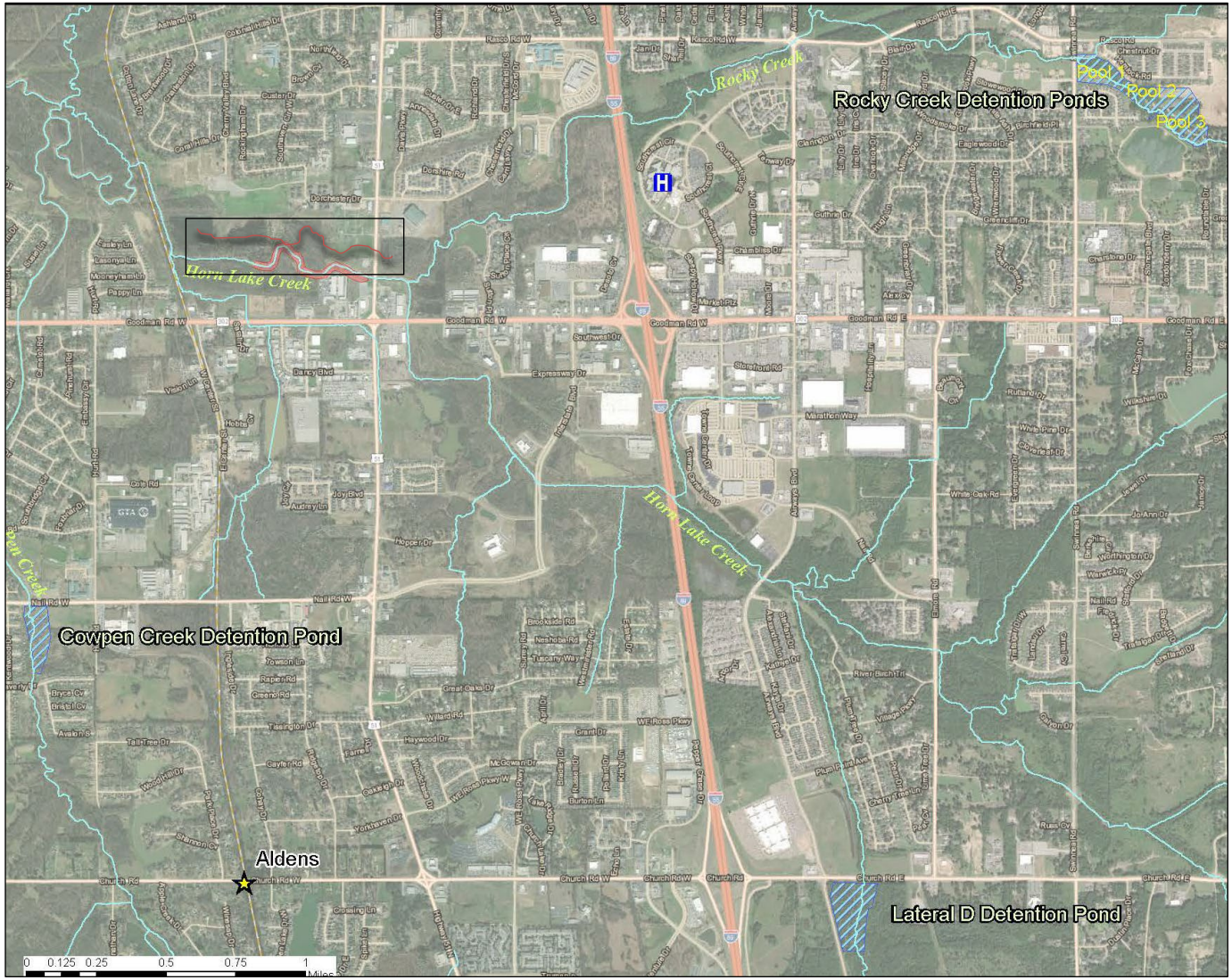

Figure 4-4. Plan 7. Channel Enlargement + 3 Detention Basins

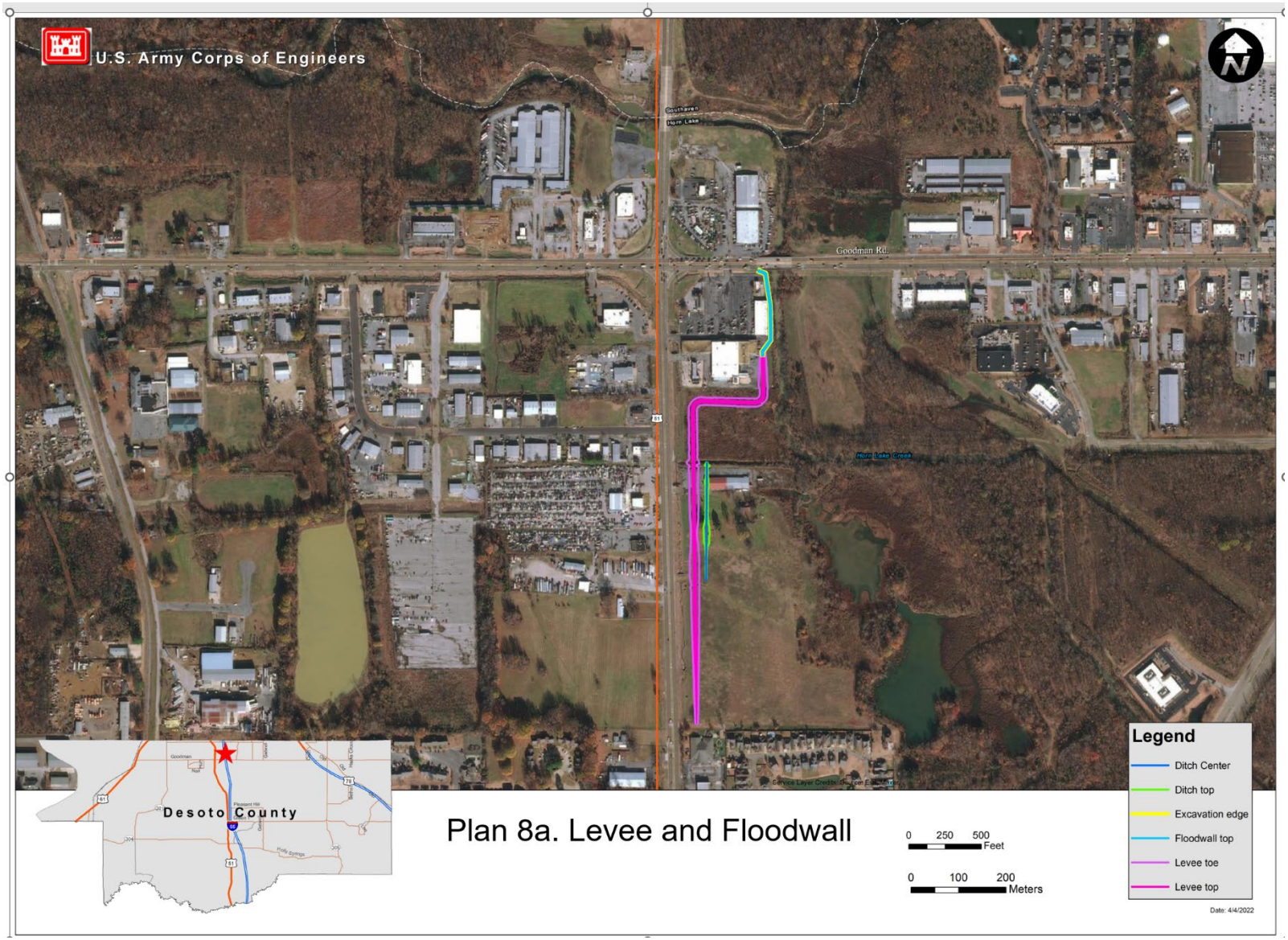

Figure 4-5. Final Array Plan 8a. Levee and Floodwall

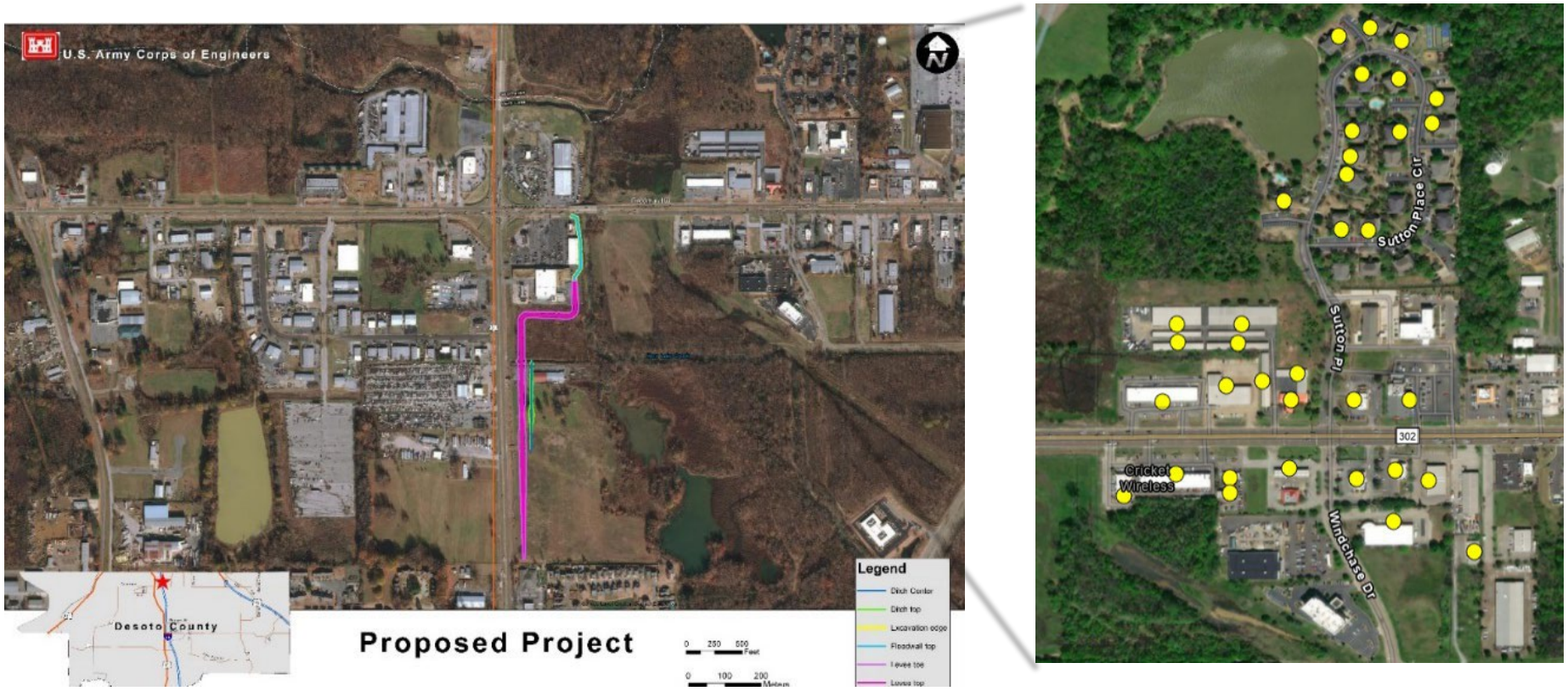

Figure 4-6. Plan 8b. (Levee and Floodwall + Dry Floodproofing of 35 structures (21 commercial and 14 residential structures)

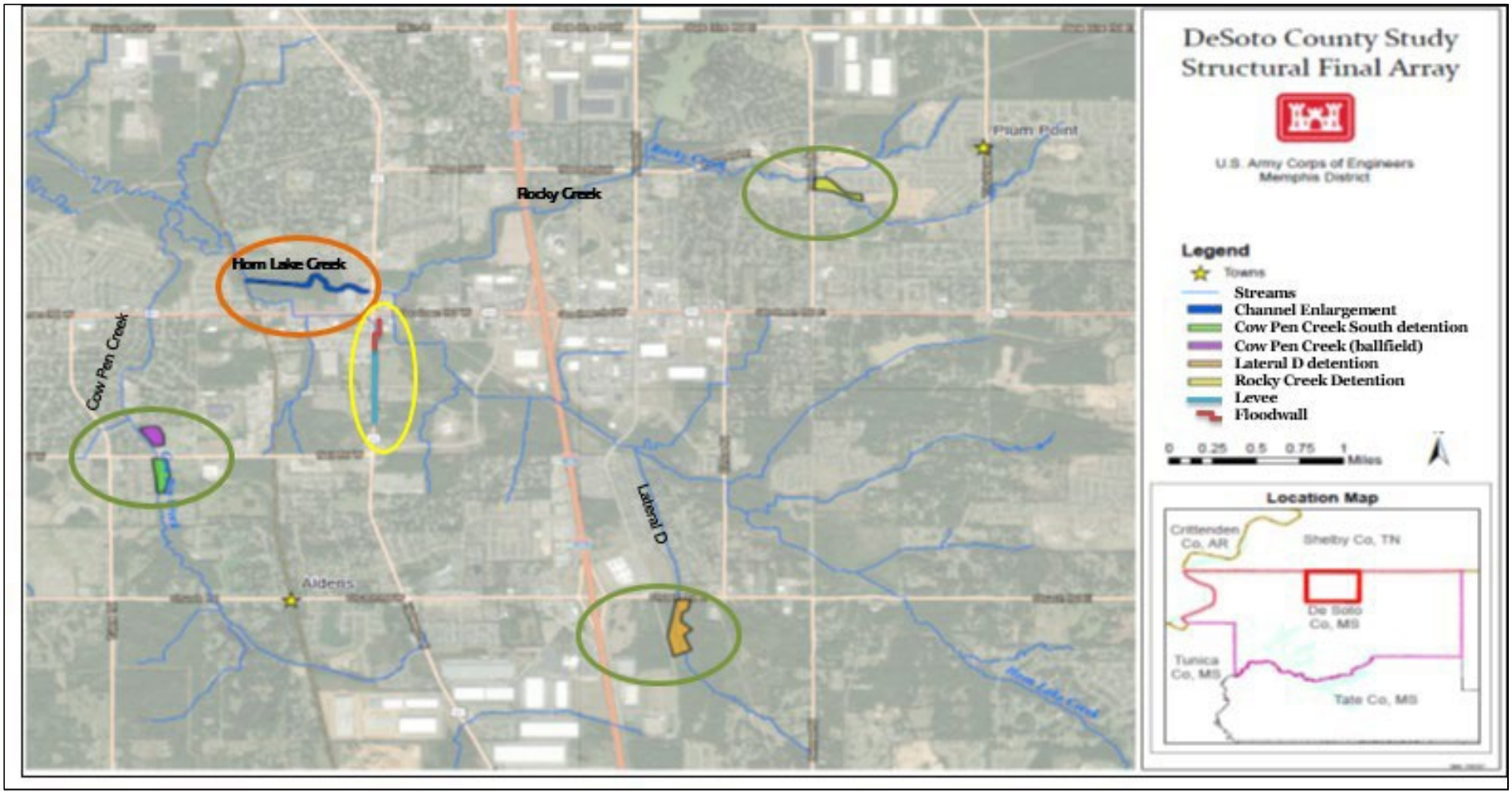

Figure 4-7. DeSoto County Flood Risk Management Structural Final Array

4.3.1 No Action Alternative

Under the No Action Alternative, no flood risk management would occur. DeSoto County would continue experiencing damages from rainfall. This would be exacerbated as development continues throughout the region. A No Action Alternative does not allow for any possibility of increasing resilience to flooding for DeSoto County or communities within it.

Base year expected annual damages are $3.1 million. Equivalent annual damages for the 50-year period of analysis without action are anticipated to be $3.4 million (2022 Price Level; 2.5% Discount Rate).

4.3.2 Plan 5A - Extended Channel Enlargement

A channel enlargement along HLC would be constructed downstream of Goodman Road in Horn Lake, Mississippi. This measure was adopted from the 2005 General Re-evaluation Report. The measure was reevaluated and found to perform well enough to carry forward for further analysis. The channel enlargement improved hydraulic efficiency downstream of Goodman Rd. and better conveyed floodwater away from development, reducing damages. Extending the channel enlargement to the railroad overpass further improved suitability compared to the 2005 plan. The Horn Lake Creek channel enlargement will increase the bottom width to 40 feet for approximately 4,500 linear feet from Mile 18.56 to Mile 19.41, downstream of Goodman Rd. in Horn Lake, MS. The banks of the improved channel will be flattened to a 3H to 1V slope for stability. Though the 2005 proposal had continuous stone under the entire channel, hydraulic analysis determined that revetment was necessary on the banks and toe, not across the entire bottom, and that a smaller stone gradation was acceptable. The revised enlargement and slope flattening will require 68,200 cubic yards of excavation, all of which will be disposed off-site. Approximately 21,200 tons of riprap will be placed at sides at the toe to prevent scour damage. The riprap will be placed 2-foot deep at the toe and 5 feet up both banks. Only at the downstream transition will stone protection extend across the entire bottom width. The riprap will be placed over approximately 4,300 tons of filter material. The upper banks will be protected with 22,800 square yards of turf reinforcing mat.

NNBFs that were considered along with the Horn Lake Creek channel enlargement during formulation included incorporating a bench-cut into the channel enlargement feature, using softer technologies to provide stabilization (rather than full riprap slopes), and one-sided channel clearing. Using a bench cut to allow for a ‘terraced’ slope was screened, as space in the area is highly limited and the work is located along a forested stretch of Horn Lake Creek. Constructing a bench cut would cause additional impacts to existing BLH forest and restrict access to conduct future maintenance activities. While riprap is required along the channel bottom and 5 feet up the slope, using softer technologies would be incorporated into the upper slopes of the channel design. A turf-reinforcing mat would be used that allows vegetation, rather than stone, to provide stabilization. One-sided channel clearing was screened as both banks must be stabilized to ensure that the downstream infrastructure is protected. The banks are currently at a 1-foot horizontal to 1-foot vertical (1H:1V) slope and altering flow may cause instability if both banks are not sloped to a more stable angle.

Updated hydraulics illustrated that HLC overflows its banks during the 0.5 AEP event upstream of Goodman Road and Hwy 51 and the enlarged channel. As anticipated, the one-dimensional analysis did not define how water flows between the modeled cross-sections.

The two-dimensional hydraulic analysis provided insight into where and how flooding would occur between the modeled cross-sections and illustrated that the channel enlargement alone would not produce the reductions in water surface elevations illustrated in the one-dimensional hydraulic. Based on this updated H&H and subsequent economic analysis, the channel enlargement was deemed ineffective. Plan 5A is expected to provide $594,000 benefits annually (2022 Price Level). This plan would reduce some risks of flooding however, the risk reduction is limited.

4.3.3 Plan 6A – Plan 5A with Lateral D Detention Basin

The Plan 6A extended channel enlargement measure is the same as described in Section 4.3.2 above and is combined with the top performing detention basin, located on the Lateral D tributary to HLC in Southaven, Mississippi. The inline detention basin would encompass approximately 22 acres of BLH that would require clearing. The bottom area of the detention basin would be approximately 16 acres. The area would be excavated to a depth of approximately 10 feet with 3H:1V side slopes. Approximately 350,000 cubic yards would be excavated to create the maximum storage of 177-acre-feet detention basin. A 500-linear foot outlet embankment would be constructed to include a 48-inch reinforced concrete pipe (RCP) outlet with a 100-linear foot overflow spillway armored with approximately 2,000 tons of riprap over approximately 500 tons of filter material on the downstream side. The spillway would operate at elevation 300.0 (the 0.50 AEP event, or 2-year flood). The current design assumes replanting approximately 10 percent, or 2.2 acres with native vegetation of the area that would be cleared.

NNBF that were considered in the formulation of the detention basins included reforestation or revegetation of herbaceous native species, as appropriate, reintroduction of stream sinuosity and floodplain connection. Reforestation/revegetation can be incorporated into the detention basins designs, however accommodations had to be made to ensure the basin's ability to maintain flood storage capacity and to address the potential for sediment trapping which could reduce the capacity. It was estimated that 10 percent of each detention basin area would be reforested with native bald cypress and flood tolerant oak species with other species as determined appropriate by the interagency team. In addition, the low flow channel would be constructed as a meandering channel within the basin. Microtopography would be incorporated into the detailed design of the basins to allow for flow diversity, depth diversity, and wetland functions. The floodplain is currently disconnected from the channel due to severe bed degradation, so the incorporation of NNBFs within the basin would also help to reconnect the isolated and degraded floodplain wetlands to better hydrology Once hydraulic modeling and economic analysis was updated to include 2 dimensions in the overbank and updated terrain data this plan was identified as ineffective; neither the channel enlargement nor the Lateral D detention basin were incrementally justified.

Plan 6A is expected to provide $484,000 in benefits annually (2022 Price Level).

4.3.4 Plan 7 - Plan 6A with Rocky Creek, and Cow Pen Creek Detention Basins

Plan 7 was initially (May 2021) identified as the LPP and the TSP. This plan added two detention basins to the previously described plan 6A combination that included channel enlargement, and Lateral D detention basin. The added detention basins along Cow Pen Creek would have totaled approximately 20 acres (2 pools), and one along Rocky Creek totals approximately 9 acres. While this plan was initially identified as the LPP (May 2021), updated H&H modeling and subsequent economic analysis indicated reduced expected annual damages in the Lateral D, Cow Pen, and Rocky Creek tributaries. Each of the individual plan features were identified as ineffective and unjustified.

Plan 7 is expected to provide $1,151,000 in benefits annually (2022 Price Level).

4.3.5 Plan 8a-Levee and Floodwall System

Plan 8a includes a levee and floodwall system. The new 3,000 linear foot levee and floodwall system would protect structures on the left-bank of Horn Lake Creek upstream of Goodman Rd. The levee would run approximately 2,500 linear feet adjacent to US Hwy. 51 and would provide flood risk management for a 0.002 AEP event. A 600-linear-foot ditch would drain a depression on the riverside of the levee. Where development makes a levee infeasible, flood risk management would transition to a 525 linear feet floodwall. Plan 8a would reduce flood damages to 180 structures during the 500 yr. event.

The proposed borrow area for the levee and floodwall would provide opportunities for ecosystem restoration. As detailed designs are developed, wetland features and other NNBF to include microtopography and reforestation would be incorporated into the proposed borrow area, improving the overall wetland and BLH acreage in Desoto County. If the proposed on-site borrow source is determined to be infeasible during detailed design, ecosystem restoration by way of riparian reforestation would still be feasible on the riverside of the levee.

Plan 8A is expected to provide $1,506,000 in equivalent annual benefits (2022 Price Level; 2.5% Discount Rate).

4.3.6 Plan 8b-Levee and Floodwall System + Dry Floodproofing of 21 Commercial and 14 Residential Structures

Plan 8b includes a levee and floodwall system identified in plan 8b combined with dry-floodproofing of 35 structures, 21 commercial and 14 residential to reduce the risk of flood damages. Because the levee-floodwall alternative provided relief only on the western side of the area of primary damage, a nonstructural plan was created from those structures experiencing residual damage on the eastern side of this area. This plan initially only included 29 commercial structures. Eight of the 29 commercial structures were dropped from the consideration when further analysis showed that they had no flood risk. It was discovered that the residential apartments adjacent to the 29 commercial structures initially selected are located within an area of Environmental Justice concern. Within this apartment complex, 14 apartments are impacted by residual flooding with the levee-floodwall in place,

but at less frequent flood events than the initial plan. Due to this, the nonstructural plan was modified to include a total of 35 dry floodproofed structures, including 21 of the originally identified commercial structures and the 14 residential apartments in the disadvantaged community.

The proposed structural component would reduce flood damages to 180 structures during the 0.002 AEP event. The nonstructural dry floodproofing measures would benefit 21 commercial structures and 14 residential (apartments) structures located on the east side of Hwy 51 and Goodman Road.

Plan 8b is expected to provide $1,940,000 equivalent annual benefits (2022 Price Level; 2.5% Discount Rate).

4.4 BENEFIT/COST ANALYSIS-FRM FINAL ARRAY

The benefit analysis of the FRM plans was completed utilizing the HEC-FDA model. Class 3 cost estimates were provided for the final array of FRM alternatives. The benefit-cost analysis is summarized in Table 4-7. below.

Table 4-7. Benefits and Costs of the Final Array of FRM Alternatives

	Plan 5a*	Plan 6a*	Plan 7*	Plan 8a	Plan 8b
	Ext. Channel Enlargement	Ext. Channel Enlargement + Lateral D Detention	Ext. Channel Enlargement + 4 Detention Basins	Levee and Floodwall	Levee and Floodwall + Dry Floodproofing 35 Structures
First Cost	$5,828	$20,278	$60,251	$6,904	$25,788
Interest During Construction	$108	$536	$1,663	$155	$244
Total Investment Cost	$5,936	$20,814	$61,914	$7,059	$26,031
Annualized Project Costs	$199	$698	$2,075	$249	$918
Annual OMRR&R	$367	$691	$1,352	$26	$26
Total Annual Costs	$566	$1,388	$3,428	$275	$944

Total Annual Benefits	$746	$607	$1,445	$1,887	$2,429
Net Annual Benefits	$180	($781)	($1,982)	$1,474	$1,374
Benefit to Cost Ratio	1.32	0.44	0.42	6.86	2.57
Residual Risk	$2,519	$2,629	$1,962	$1,939	$1,505

*Note: Damages and benefits displayed for plans 5a, 6a, and 7 are expected annual numbers. (FY22 Price Level for 5a, 6a, and 7; FY 23 Price Level for 8a and 8b 2.5% Discount Rate, Thousands)

4.5 SYSTEM OF ACCOUNTS-FLOOD RISK MANAGEMENT EVALUATION

To facilitate evaluation and display effects of the alternatives, the P&G lays out four Federal accounts: National Economic Development (NED), Environmental Quality (EQ), Regional Economic Development (RED), and Other Social Effects (OSE). Table 4-8. compares the four Federal accounts against the revised final array. This is a summary of the highest-ranking alternatives by account:

NED Account - The intent of comparing alternative flood risk management plans in terms of NED account is to identify the beneficial and adverse effects that the plans may have on the national economy. Beneficial effects increase the economic value of the national output of goods and services attributable to a plan. Increases in NED are expressed as a plans' economic benefits, and the adverse NED effects are the investment opportunities lost by committing funds to the implementation of a plan. Alternative 8a ranks highest (ranked #1) in this account based on the higher net benefits captured. Plan 8a is the National Economic Development (NED) Plan.

EQ Account - The EQ account identifies the long-term effects that the alternative plans may have on relevant environmental resources. The Water Resources Council defines relevant environmental resources as those components of the ecological, cultural and aesthetic environments that, if affected by the alternative plans, could have a material bearing on the decision-making process. Plans 5A, 6A, and 7 consist of channel widening to various levels as well as implementing detention basins for the latter two. In contrast, plans 8a and 8b consist of levee and floodwall recommendations. Plan 8b also includes dry flood proofing of 21 commercial and 14 residential structures. Bottomland hardwood forest and wetland losses associated with channel enlargement alternatives vary from approximately 20 to 48-acres with these alternatives compared to no net loss with either alternative 8a or 8b, the levee and floodwall alternatives. While all alternatives would likely be visible from adjacent highways and roads, only alternatives 5A, 6A, and 7 would have the potential to impact land used by the City of Southaven's *Cherry Valley Park and Greenspace*, an important recreational feature of the area. Additionally, the proposed borrow areas associated with alternatives 8a and 8b could potentially provide additional recreational opportunities as well as ecosystem restoration possibilities. A detailed analysis of relevant significant resources as well as quantified effects amongst alternatives can be found in Section 6.

RED Account - The RED account measures the economic impact proposed plans have on regional activity, specifically, regional income and regional employment. Alternative 7 ranked highest (rank 1) due to the increased amount of economic development in DeSoto County from this, the largest, most costly plan.

OSE Account - The OSE account includes long-term community impacts in the areas of public facilities and services, recreational opportunities, transportation and traffic and man-made and natural resources. The plan 8b nonstructural aggregation includes apartments included in an area of EJ concern that are at risk of flooding in the future without project.

Therefore, Plan 8b ranks highest (rank 1) by reducing residual risk for a potentially disadvantaged community.

Table 4-8. compares the completeness and effectiveness by measurement of the four accounts.

Table 4-8. System of Four Accounts

	National Economic Development (NED)		Environmental Quality(EQ)	Regional Economic Development (RED)	Other Social Effects (OSE)
Plan 5a - Extended Channel Enlargement	Avg Annual Benefits	$746K	Second smallest construction footprint; 20-acre BLH loss; potential recreational impacts	Local Economic Impact: $8.2M	Reduces stages on Horn Lake Creek. Roadways remain at risk of inundation.
	Avg Annual Costs	$566K			
	Net Benefits	$180K		Local Jobs Created: 63	
	BCR	1.32			
	Rank	3	2	4	5
Plan 6a - Extended Channel Enlargement + Lateral D Detention	Avg Annual Benefits	$607K	Removal of mature trees; 20-acre BLH loss; potential recreational impacts	Local Economic Impact: $28.5 M	Reduces flood stages in the Bullfrog Corner area. Roadways remain at risk of inundation.
	Avg Annual Costs	$1,388K			
	Net Benefits	$-781K		Local Jobs Created: 219	
	BCR	0.44			
	Rank	4	3	3	4
Plan 7- Extended Channel Enlargement + Lateral D + Rocky Creek +Cow Pen Detention	Avg Annual Benefits	$1.45M	Largest Construction Footprint; removal of mature trees; 48-acre BLH loss; potential recreational impacts	Local Economic Impact: $84.8 M	May reduce stages over roadways in the Cow Pen Creek watershed but leaves roadway flooding in the Horn Lake Creek watershed.
	Avg Annual Costs	$3.43M			
	Net Benefits	$-1.98M		Local Jobs Created: 651	
	BCR	0.42			
	Rank	5	4	1	3
Plan 8a - Levee and Floodwall	Avg Annual Benefits	$1.88M	No BLH/wetland loss; no recreational impacts; potential borrow site benefits	Local Economic Impact: $15 M	Reduces roadway flooding on Goodman Rd. West of Hwy 51. Portions of Goodman Rd and Hwy 51 remain at risk of inundation.
	Avg Annual Costs	$275K			
	Net Benefits	$1.61M		Local Jobs Created: 115	
	BCR	6.86			
	Rank	1	1	5	2
Plan 8b - Levee and Floodwall + Dry Floodproofing of 35 structures	Avg Annual Benefits	$2.43M	No BLH/wetland loss; no recreational impacts; potential borrow site benefits;	Local Economic Impact: $40.5 M	Reduces structure damages in Bullfrog Corner, including risk reduction for 14 residential structures in an EJ community. Portions of Goodman Rd and Hwy 51 remain at risk of inundation.
	Avg Annual Costs	$944K			
	Net Benefits	$1.49M		Local Jobs Created: 311	
	BCR	2.57			
	Rank	2	1	2	1

Trade Offs

Plan 8b maximizes net benefits across all four accounts. However, there are trade-offs, and no plan ranks 1 in each of the four accounts. The plan 8a levee and floodwall has the greatest net benefits and as such is the NED plan. Plan 7 has the highest impact on the regional economy and the largest number of local jobs created, and as such ranks highest in RED metrics. The plans that include the levee and floodwall (plans 8a, and 8b) are the only plans that require no environmental mitigation, and the area east of the levee is identified as a potential wetland benefit which results in plans 8a, and 8b ranking slightly higher than plan 5A in the EQ account.

Comprehensive Benefits Evaluation

The nonstructural dry floodproofing measures included in plan 8b would benefit 21 commercial structures and 14 residential structures. This logical aggregation provides community cohesion by reducing residual flood damages to the east side of Horn Lake Creek at Bullfrog corner, which does not receive flood risk management from the levee/floodwall and includes apartments included in an EJ community that are at risk of flooding in the future without project. Plan 8b, ranks the highest in benefits to the OSE account due to the fact that the added measure of voluntary dry floodproofing provides an added increment of resilience to a vulnerable community and the businesses within and adjacent to that community that provide goods and services.

While Plan 8a maximizes economic net benefits and is the NED plan, Plan 8b is the RP because it provides a positive benefit to cost ratio while taking a more proactive approach towards achieving environmental justice and providing resilience to the EJ community on the east side of the levee floodwall that would experience residual flood risk. Plan 8b includes a nonstructural component that, adds the benefit of reducing residual flood risk and contributes to the resilience of vulnerable and potentially disadvantaged communities.

None of the plans are successful at eliminating roadway flooding. It is anticipated that road closures will be required at the 0.01 AEP (100 yr.) event. We recommend that DeSoto County work with Mississippi Department of Transportation to raise roadways in the area.

During less frequent events the parking lot surrounding the DeSoto apartments located at Goodman Road and Sutton Place may continue to flood and cars could be impacted. To protect the resident's vehicles, we recommend that a non-federal entity consider construction of a walking path between the apartments and a commercial parking lot to the east that sits on high ground. A walking path could enable residents to move their vehicles to this adjacent lot prior to a storm event and walk back to their residence, while avoiding the busy highway.

4.6 PROPOSED ACTION-RECOMMENDED FRM PLAN

The NED plan is not the RP. A waiver request was submitted to the Assistant Secretary of the Army (Civil Works) (ASA (CW)) in accordance with USACE Policy: ER 1105-2-100 2-

3(f)(1) which allows the Assistant ASA CW to 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 structural features of the RP, the levee floodwall combination, provides risk reduction to the west side of Horn Lake Creek in the Bullfrog Corner. While the nonstructural dry floodproofing measures of the RP would benefit 21 commercial structures and 14 residential structures located on the east side of Hwy 51 and Goodman Road. This plan reduces flood risk to the area of Bullfrog Corner at the intersection of US Highway 51 and Goodman Road which experiences the majority of the flood damages in the study area.

This nonstructural alternative is based on community cohesion standpoint by providing a reduction in residual flood damages to the east side of Horn Lake Creek at Bullfrog Corner, which does not receive flood risk management from the levee/floodwall. The alternative is rational from a standpoint of including aggregated commercial buildings and buildings in an area of environmental justice concern. This aggregation has been progressively modified through planning iterations occurring as new information was received during plan development.

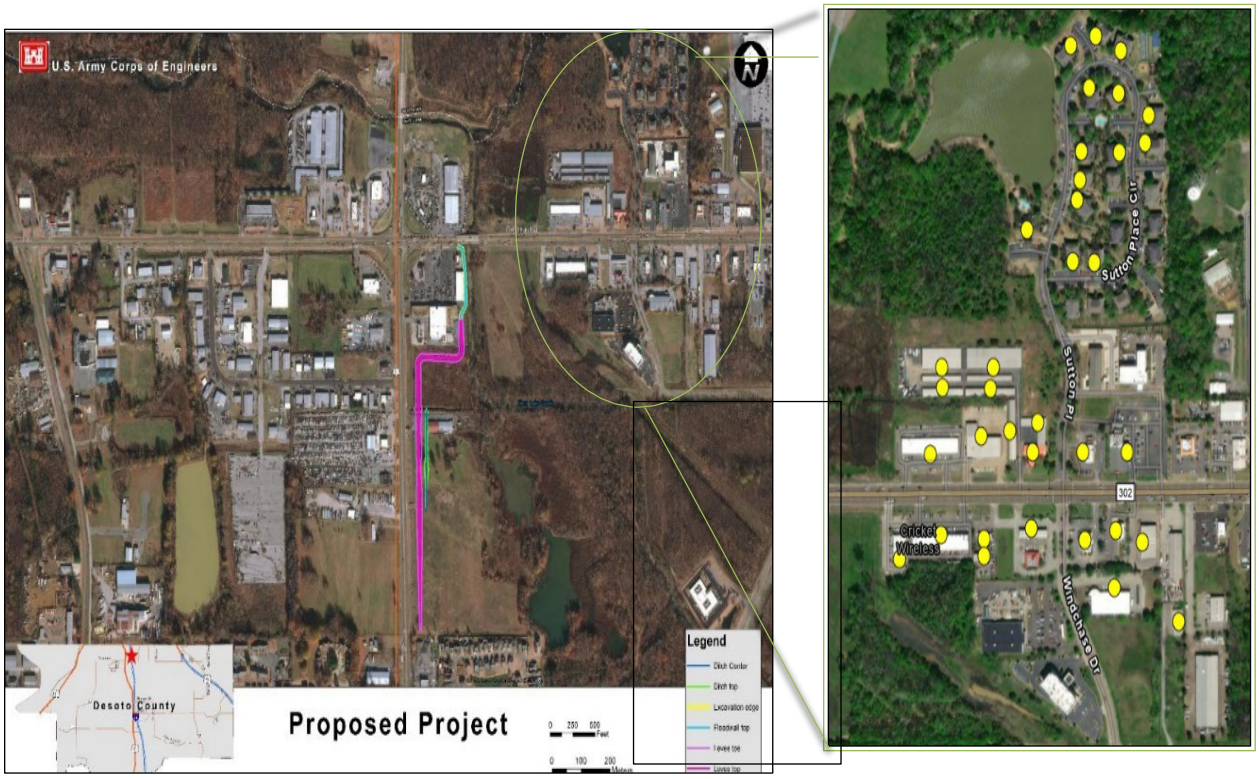

Figure 4-8. FRM Recommended Plan. Plan 8b Levee and Floodwall plus dry floodproofing of 14 residential and 21 commercial structures.

SECTION 5
Aquatic Ecosystem Restoration Plan Formulation

Aquatic Ecosystem Restoration (AER) initiatives attempt to return the function of natural areas or ecosystems to a close approximation of their conditions prior to disturbance, or to less degraded, more natural conditions. In Desoto County, a return to pre-disturbance conditions is not feasible. However, the PDT, in formulation of ER measures and alternatives, determined that partial restoration is possible, with significant and valuable improvements made to degraded aquatic resources to include streams and associated BLH and riparian habitats. Improvements to the structural components and the functions of the Desoto County streams were considered in the formulation of opportunities and objectives. The goal of the Desoto County ER component of the Feasibility Study is to re-establish the attributes of a naturalistic, functioning, and self-regulating system.

Significance of resources and effects are derived from institutional, public or technical recognition. Institutional recognition of a resource or effect means its importance is recognized and acknowledged in the laws, plans and policies of government and private groups. Technical recognition of a resource or an effect is based upon scientific or other technical criteria that establishes its significance. Public recognition means some segment of the general public considers the resource or effect to be important. Public recognition may be manifest in controversy, support or opposition expressed in any number of formal or informal ways.

Institutional, public, and technical significance is summarized in Section 3.2.1 above and is established in Appendix N, Table N-1. Technical significance of the NER Plan is described below and in Section 5.8.

The goal of the ecosystem approach is to restore and sustain the health, productivity, and biological diversity of ecosystems, address the problems of habitat fragmentation and consider the social and economic goals of the surrounding communities. The PDT's approach to ecosystem restoration considers the effects of proposed actions over the long-term life of the project, ecosystem needs, and land use in the area. In developing alternatives to the stream and associated riparian habitat degradation that is occurring in Desoto County, the PDT considered the interconnectedness and dynamics of stream systems, along with human activities in the landscape to propose courses of action that would address multiple water resources issues. The investigations and recommendations address multiple purposes and objectives. For example, the restoration of in-stream and riparian habitat improves land use trends, primary productivity, biodiversity, connectivity with riparian reforestation, and flow diversity. Providing structures serves to preserve and restore vegetation along the stream banks and stream stability, reducing erosion that may cause damage to property, and further channel imbalance (degradation and aggradation) which may cause localized flooding and scour.

Section 1184 of WIIN 2016 and Section 1149 of WRDA 2018, as amended by Section 116 WRDA 2020 requires USACE to consider natural and nature-based features during plan formulation of feasibility studies. Nature-based features that would be incorporated into future phases of detailed design include protection of large diameter trees and snags and avoidance of clearing or otherwise impacting mature and/or highly functional forested riparian zones for construction of channel stabilization measures, reintroduction of stream sinuosity within highly degraded stream reaches where widening has already occurred, and reintroduction of microtopography within the riparian reforestation zones.

17 streams were evaluated for ecosystem restoration. Streams included in the initial formulation included 4 streams that drain west into Mississippi River including: Horn Lake Creek, Cow Pen Creek, Rocky Creek and Nonconnah Creek and 13 streams that drain south into the Coldwater Basin and ultimately to Arkabutla Lake including: Coldwater River, Lick Creek, Nolehoe Creek, Camp Creek, Hurricane Creek, Cane Creek, Mussacuna Creek, Johnson Creek, Cuffawa Creek, Short Fork Creek, Red Banks Creek, Pigeon Roost Creek, and Byhalia Creek. These streams are identified on Figure 5-1.

There is a well-documented loss of riparian BLH within the MVLP, which directly contributes to the degradation of streams in the region and in DeSoto County.

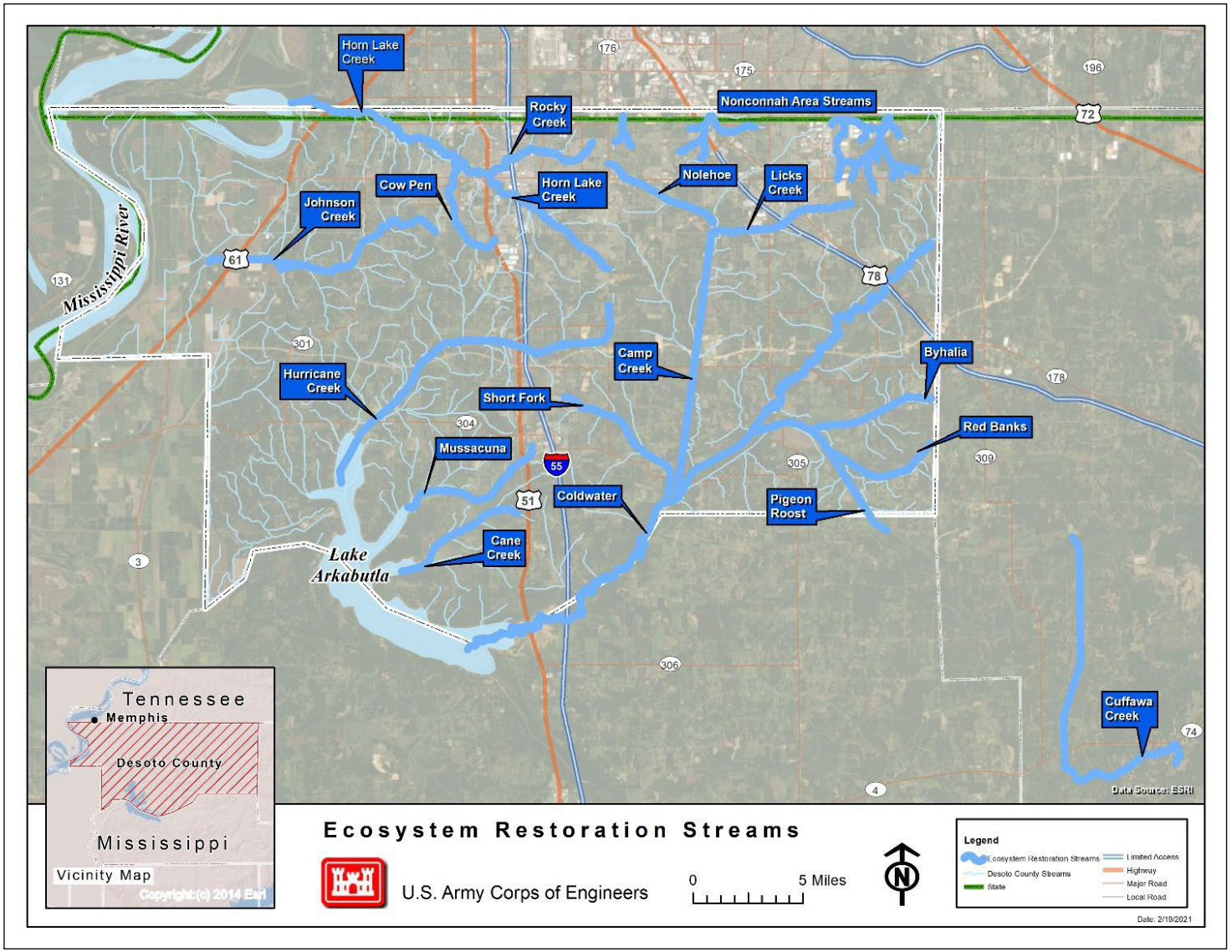

Figure 5-1. DeSoto County Streams Evaluated for Ecosystem Restoration

5.1 ECOSYSTEM RESTORATION MEASURES

The PDT developed measures to address the uncontrolled degradation of the channel beds and subsequent channel widening, erosion, and sedimentation; replace and improve in-stream habitat; and reforestation of stream corridors to restore BLH habitat structure and function. The ecosystem restoration goal is to stabilize channels and connect/improve riparian habitat, which would minimize channel degradation and erosion and support aquatic ecosystem form and function along main stem channels and tributaries in the DeSoto County watersheds over a 50-year period of analysis. Through PDT and NFS discussion, experts from the Engineering, Research and Development Center (ERDC), and input from the public, it was determined that the severe erosion of these streams must be arrested before any other ER measures could be reasonably sustainable. 7 ER measures were considered (Table 5-1.) and are described below.

The efforts performed as part of this study were preliminary in nature. There is considerable uncertainty in the findings of this study. Some limitation of the current analysis includes limited field investigations which forced the PDT and experts to rely heavily on interpretation of LiDAR. A more rigorous evaluation of the impacts to overall stability of the system and water surface profiles is highly encouraged for future phases of this project.

Grade control: The high degree of channel modifications that have occurred and the erosive nature of the soils in Desoto County led the team to decide that grade control and channel stabilization measures should be considered as a basis for any ER plan in the County. The GCS include a variety of rock structures constructed across the channel and anchored in the streambanks to provide a hard point in the streambed that resists the erosion forces of the degradational zone and maintains a streambed elevation. GCS considered include both high and low drop structures.

Bank stabilization: Bank protection methods to prevent erosion and bank failures include rip rap placement, lateral stone toe protection, synthetic erosion control products, and placement of riser pipes.

Terrestrial habitat restoration: As BLH loss within the MAV and MVLP is well documented, restoration and reforestation of riparian lands (lands adjacent to stream banks) is a recommended ER measure. Reforestation has multiple benefits to include stabilization of soils and stream banks, shading of streams, nutrient uptake, as well as improvement of forage, cover, and reproductive habitats for native wildlife

In-stream maintenance: Clearing, snagging, or channel excavation to reduce impediments to flow.

Table 5-1. Ecosystem Restoration Measures Evaluated

Type	ID	Description	Screened (S); Retained (R)	Reason for Screening
Grade Control	ER-1	Low drop structures	R	
	ER-2	High drop structures	S	Negative impacts to fish passage
Bank Stabilization	ER-3	Riser pipes	R	
	ER-4	Lateral stabilization with stone toe protection	R	
	ER-5	Rip rap	R	
Terrestrial Habitat Construction	ER-6	Riparian buffer strips	R	
In-stream maintenance	ER-7	Clearing and snagging	S	Snags could provide aquatic habitat

5.2 ECOSYSTEM RESTORATION SCREENING CRITERIA

The primary ecosystem restoration objective is to restore and protect aquatic and riparian ecosystems by decreasing channel slopes and stabilizing bank lines which would improve transport of stream flows and sediment. The initial screening criteria was to retain for further evaluation those streams that were considered as degradational. Streams were evaluated using light detection and ranging (LIDAR) and Geographic Information Systems (GIS) data. Initial discussions with the sponsor and field visits allowed the PDT to identify 9 streams that were degradational. Further conversations with stakeholders representing the six drainage districts in the region added 5 additional streams into consideration. Of the added 5 only 4 flow within the boundary of DeSoto County, the streams that are not within the study area were screened. Of the four remaining streams, only 2 were identified as degradational. If a stream was identified as stable, with a stable plan form geometry, then this stream was screened out for ecosystem restoration. Figure 5-2. identifies the screened streams in red and those identified for ecosystem restoration in blue.

Streams identified as degradational-Horn Lake Creek, Nolehoe Creek, Licks Creek, Nonconnah Creek, Johnson Creek, Camp Creek, Hurricane Creek, Short Fork, Red Banks, Mussacuna Creek, Cane Creek

Streams identified as aggradational or stable-Cow Pen Creek, Rocky Creek, Lateral D, Pigeon Roost

Streams outside of planning area-Cuffawa Creek

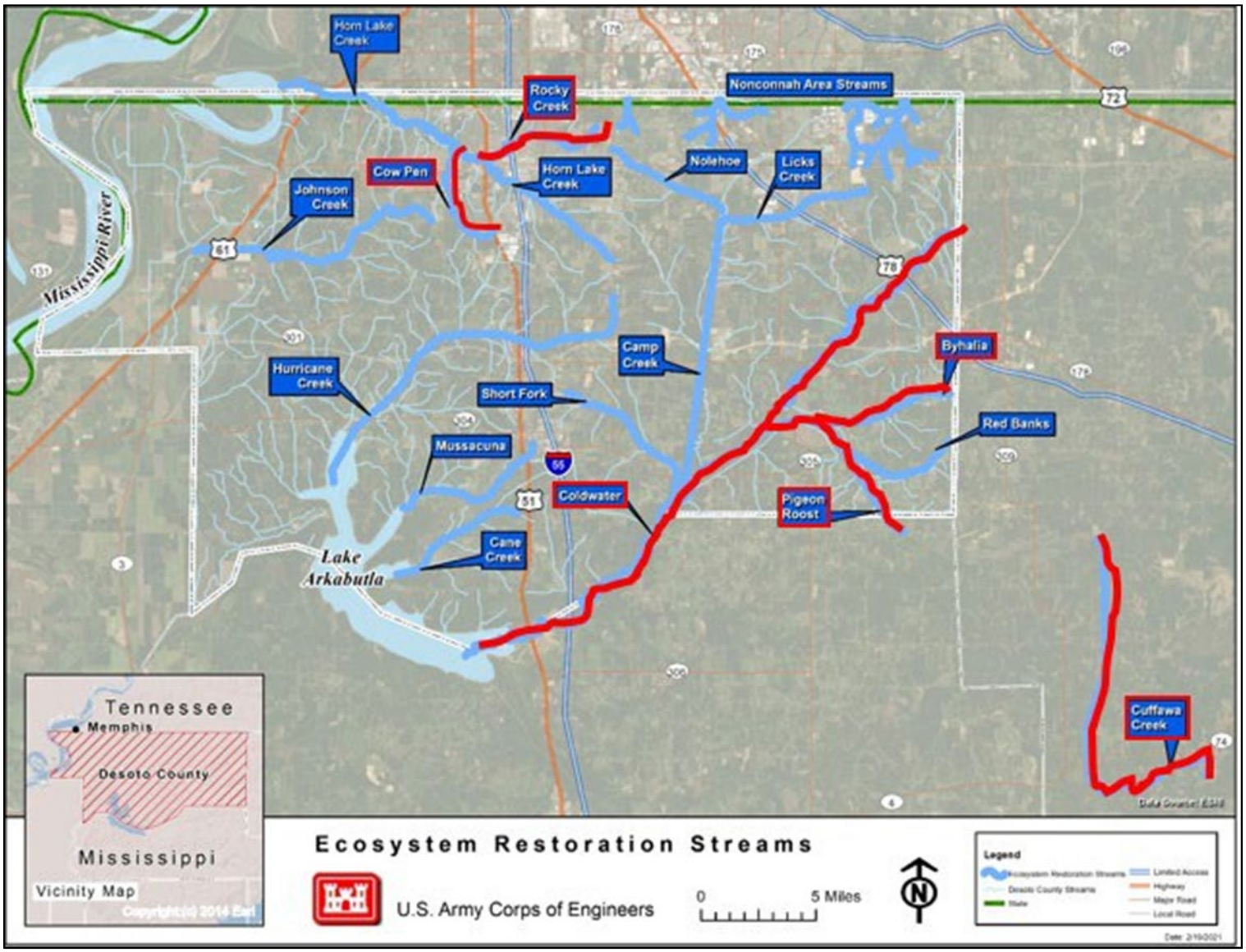

Figure 5-2. DeSoto County Streams Screened (in red) for Ecosystem Restoration

5.3 SCREENING OF ECOSYSTEM RESTORATION MEASURES

Measures that did not meet the ecosystem restoration objectives identified for the study were screened. The ecosystem restoration planning objectives for this study include:

- Support aquatic habitat by reducing channel degradation such as instability and erosion.
- Restore suitable habitat for native and special status species.

Measures, identified in Table 5-1., that were screened from further consideration:

Measure ER 2 - High Drop Structures. This measure could potentially block fish passage small fish and other aquatic species.

Measure ER 7 - Clearing and Snagging. This measure would not meet the objectives for ecosystem restoration. Clearing and snagging a channel is often considered a channel improvement measure; however, not in the context of ecosystem restoration. Clearing removes valuable shade and organic input, removes nutrient uptake and releases sediment into the stream until the bank is re-stabilized. Snagging a channel can also remove organic materials from the channel and remove flow diversity and 'rest' or cover areas for small fish and other aquatic species.

5.4 ECOSYSTEM RESTORATION ALTERNATIVE PLANS

Three restoration alternatives were considered on each of the 11 streams identified as needing bank stabilization. Those alternatives included:

1. System of grade control structures for channel stabilization. This system includes channel bottom rock-riffle structures, channel bank lateral stone toe protection, and riser pipes.
2. Reforestation of the maximum available acreage, as identified using NLCD mapping, with no stabilization.
3. System of grade control structures and channel stabilization along with riparian reforestation.

Alternative 3 (above) was further optimized into alternatives 3, 4, 5a and 5b, as shown below, with varying riparian reforestation quantities:

3. (modified): System of grade control structures with maximum riparian reforestation identified using NLCD data.
4. Alternative 4: System of grade control structures with riparian reforestation adjacent to and within 100 feet of the GCS system along one bank line.

5a. System of grade control structures control plus 25% of the available riparian reforestation within 328 feet of the stream edge on one bank line.

5b. System of grade control structures plus 10% of the available riparian reforestation within 328 feet of the stream edge on one bank line.

5.5 ECOSYSTEM RESTORATION ALTERNATIVE PLAN SCREENING

Screening of ecosystem restoration alternatives was done using the formulation criteria including effectiveness, efficiency, acceptability, and completeness. Measures are screened based on the set of criteria described in Table 5-2.

Table 5-2. AER Screening Criteria

Ecosystem Restoration Screening Criteria	AEP Objective Specific Metrics
Effectiveness: the extent to which an alternative plan alleviates the specified problems and achieves the specified opportunities	Support aquatic habitat by reducing channel degradation such as instability and erosion. Metrics to measure the success of the project include evaluation of the channel using the evolution model, bank stability, riparian zones, rooting depth, root density, surface protection, and bank angle. Restore suitable habitat for native and special status species. Metrics to measure the success of the project include habitat diversity, fish cover, canopy cover, and riparian zones and surface protection
Efficiency: 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	Best buy plans are selected using the Cost Effectiveness Incremental Cost Analysis CE/ICA program which combines the alternatives into the most efficient combinations.
Acceptability: 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	Avoid adversely affecting fish passage; Avoid or minimizes negative impacts to cultural, historic, and Tribal resources; Avoid adversely affecting human life or inducing additional flood risk. Most likely scenario to acquire land for ecosystem restoration. No more than 25% of the total ecosystem restoration plan cost should be attributable to land acquisition (USACE policy)
Completeness: whether plan includes all elements necessary to achieve the objectives.	Support aquatic habitat by reducing channel degradation such as instability and erosion. Metrics to measure the success of the project include evaluation of the channel using the evolution model, bank stability, riparian zones, rooting depth, root density, surface protection, and bank angle. Restore suitable habitat for native and special status species. Metrics to measure the success of the project include habitat diversity, fish cover, canopy cover, and riparian zones and surface protection

The screened alternatives include:

Alternative 1 - System of grade control structures for channel stabilization

Alternative 1 would stabilize channels and prevent further stream bed degradation. This would be accomplished through a system of loose rock riffle, with additional slope armor and riser pipes to account for the erodibility of local soils. However, without reforestation, a significant amount of habitat potential would not be realized. This alternative was considered incomplete as the planning objectives noted in Section 2.2.2 (Objective 5. Restore suitable

habitat for native and special status species.) would not be met. Therefore, alternative 1 was screened from detailed analysis.

Alternative 2 -Riparian Reforestation alone (without in-stream stabilization)

Alternative 2 would provide a significant amount of habitat, 3,554 acres; however, without stabilization of the channel these channels would continue to incise and degrade. Therefore, the reforestation acreage would not be sustainable over the 50-year period of analysis, as approximately 191 acres of land is expected to be lost due to incision and widening of the channels in the FWOP condition. This alternative was considered incomplete as the planning objectives noted in Section 2.2.2 (Objective 4. Support aquatic habitat by reducing channel degradation such as instability and erosion and Objective 5. Restore suitable habitat for native and special status species.) would not be met. Therefore, alternative 2 was screened from detailed analysis.

Alternative 3 - System of grade control structures with maximum riparian reforestation identified using NLCD data

Alternative 3, would provide a significant amount of habitat, 3,554 acres while also stabilizing channels. However, this alternative would not be cost effective or acceptable by USACE policy stating “Land acquisition in ecosystem restoration plans must be kept to a minimum.

Project proposals that consist primarily of land acquisition are not appropriate. As a target, land value should not exceed 25 percent of total project costs.”

Alternative 5a - System of grade control structures with 25% of the available riparian reforestation within 100m of the stream edge on one bank line.

Alternative 5a on each of the eleven streams includes the system of GCS identified in Alternative 1 in addition to the reforestation of 25 percent of cultivated crops, barren land, hay/pasture, herbaceous, and shrub/scrub within 328 feet of each stream. The expected AAHUs, proposed number of GCS, and riparian reforestation acreage for each stream in Alternative 5 are shown in Table 5-4. The PDT initially identified an NER plan that included 88 grade control structures along with reforestation of 25 percent of the reforestable area as identified by the NLCD. After more detailed cost work was completed, it was determined that acquisition of 25 percent of reforestable land would cost more than is acceptable by USACE policy stating “Land acquisition in ecosystem restoration plans must be kept to a minimum. Project proposals that consist primarily of land acquisition are not appropriate. As a target, land value should not exceed 25 percent of total project costs.”

5.6 FINAL ARRAY OF ECOSYSTEM RESTORATION PLANS

Stakeholder engagement helped to identify streams of concern throughout DeSoto County. Stream and ecosystem degradation were the subject of numerous meetings with the NFS, city planners, engineers, and local leaders. Throughout the study the PDT continued to use several forms of data (detailed in Appendix A. Watershed Assessment Model Documentation, B. DeSoto County Stabilization Report, and C. Fluvial Geomorphology) to determine whether each stream was degradational and in need of ecosystem restoration.

Alternatives 1, 2, 3, and 5a were eliminated from further evaluation and are not presented as part of the final array of ecosystem restoration plans.

5.6.1 No Action Alternative

Under the No Action Alternative, no ecosystem restoration would occur. DeSoto County would continue experiencing damages from rainfall. This would be exacerbated as development continues throughout the region.

All future without project conditions are discussed in Section 3. With the no action alternative, streams would continue to destabilize, widen, and banks would continue to erode causing continued impacts from sedimentation, excess nutrients and low dissolved oxygen. In addition, the widening would cause continued impacts to infrastructure and property. Without construction of the NER Plan, it is estimated that approximately 190 acres of land adjacent to the final array of streams could be lost due to erosion and bank failures.

5.6.2 Alternative 4 – Grade Control with Associated Riparian Plantings

Alternative 4 on each of the 11 streams includes the system of GCS identified in Alternative 1 in addition to the reforestation of cultivated crops, barren land, hay/pasture, herbaceous, and shrub/scrub along one bank at a width of approximately 100 feet within the proposed GGS system reach. While Alternative was screened as a stand-alone alternative in Section 5.5, it was retained in combination with reforestation. The expected AAHUs, number of GCS, and riparian reforestation acreage for each stream in Alternative 4 are shown in Table 5-3.

Table 5-3. Ecosystem Restoration Alternative 4

Stream	Alt. ID	# GCS	Riparian Reforestation (acres)	Annual Average Habitat Units (AAHUs)
Camp	CP-4	7	47	53
Cane	CN-4	9	6	7
Horn Lake	HL-4	14	17	53
Hurricane	HN-4	9	62	52
Johnson	JC-4	11	43	48
Lick	LC-4	3	11	8
Mussacuna	MC-4	3	9	9
Nonconnah	NO-4	7	5	5
Nolehoe	NL-4	11	18	38
Red Banks	RB-4	5	24	25
Short Fork	SF-4	9	12	14
11 streams		88	254 acres	315 AAHUs

5.6.3 Alternative 5b – Grade Control with Restoration of 10% Percent of Reforestable Riparian Acreage

The PDT initially identified an NER plan that included 88 grade control structures along with reforestation of 25 percent of the reforestable area as identified by the NLCD. While Alternative 1 was screened as a stand-alone alternative (see Section 5.5), it was retained in combination with reforestation. This alternative was identified as Alternative 5. However, after more detailed costs were developed it was determined that acquisition of 25% of reforestable land would cost more than is allowable by USACE policy. Land acquisition in ecosystem restoration plans must be kept to a minimum and project proposals that consist primarily of land acquisition are not appropriate. As a target, land value should not exceed 25 percent of total project costs.

Plan 5 was optimized to include the reforestation of 10% of the reforestable land along each stream. A combination of 10 %of the reforestable area and grade control were run through the IWR Cost Effectiveness/Incremental Cost Analysis Plan (CE/ICA) to determine the best buy plan which included a combination of those alternatives for each stream.

Table 5-4. Ecosystem Restoration Alternative 5 Including 5a and 5b Acres and Benefits

Stream	Alt. ID	# GCS	Riparian Reforestation (acres)		# AAHU 25% screened	# AAHU 10%
			Plan 5a-25% screened	Plan 5b-10%*		
Camp	CP-5	7	98	39	98	48
Cane	CN-5	9	66	26	45	21
Horn Lake	HL-5	14	64	20	55	55
Hurricane	HN-5	9	160	64	133	53
Johnson	JC-5	11	122	49	113	52
Lick	LC-5	3	36	14	20	10
Mussacuna	MC-5	3	57	23	33	16
Nolehoe	NL-5	11	32	13	47	35
Nonconnah	NO-5	7	107	20	75	12
Red Banks	RB-5	5	48	19	40	21
Short Fork	SF-5	9	106	42	70	34
11 streams		**88**	**896**	**329**	**729**	**357**

*Optimized acreage=329, with an AAHU return of 368.

5.7 SYSTEM OF ACCOUNTS-AQUATIC ECOSYSTEM RESTORATION

As described in section 4.5 the four categories, known as the System of Accounts as suggested by the U.S. Water Resources Council, address long-term impacts and are

defined in such a manner that each proposed plan can be easily compared to the No Action plan and other alternatives. Collectively, the four accounts are required to include all significant effects of a plan on the human environment.

The AER RP is justified by the National Economic Development (NED) account, as quantified by the Cost Effectiveness-Incremental Cost Analysis (CE/ICA). The CE/ICA results allowed the team to choose the plan that maximizes habitat lift, as well as cost-efficiency.

A screening table matrix was created that scored each stream based on logistical factors such as construction accessibility and real estate, social impact such as recreational value, economic impacts (potential for bringing in business) and technical value (connectivity). This matrix, illustrated in table 5-5. below.

5.8 ECOSYSTEM RESTORATION PLAN INCREMENTAL COST ANALYSIS

National Ecosystem Restoration Plan

The CE/ICA was used to identify the NER Plan. A detailed accounting of the CE/ICA is available in Appendix L-Economics Section 7.3 Figures L:7-2. and L: 7-3. The NER plan includes a “best buy” alternative for 10 of the 11 degraded streams. The next increment would have included Horn Lake Creek, and during feasibility level design it was determined that Horn Lake Creek should be removed from the AER plan because the tree clearing necessary to construct the lateral stone toe protection along with grade control would out pace reforestation.

The NER (Table 5-6.) plan has a total cost of $40.2 million with a benefit of 31 AAHUs.

The Ecosystem Restoration Plans identified as best buys have average annual costs per average annual habitat units that are highly competitive verses other restoration studies across the country, with a $5,700 cost/unit. As a result, the PDT recommends proceeding with the best buy plan which includes a mixture of Alternative 4 and Alternative 5 for a total of 74 grade control structures on the 10 creeks and 327 acres of riparian reforestation to form the NER RP. The technical, public and institutional significance of this 11-stream restoration plan is described below (the definitions of the technical criteria are included in italics). See Figure 5-3. and Figure 5-4.

Table 5-5. Evaluation Criteria

Alternative #	Acceptable	Complete	Efficient	Effective		P&G Accounts					
				Objective 1:	Objective 2:	NED	RED	EQ		OSE	
				Restore suitable habitat for native and special status species.	Support aquatic habitat by reducing channel degradation such as instability and erosion.	Avg Annual Cost (1000's)	Gross Regional Product (1000's)	Acres Restored	AAHU	Water Quality	Habitat Connectivity
No Action	No	No	No	No	No	—	—	190 acres lost		Continued bank erosion would lead to sedimentation, excess nutrients, and low dissolved oxygen.	land adjacent to streams would be lost and habitat fragmented due to erosion and bank failures
Alternative 4	Highly	Fully	Highly	Fully Meets	Fully Meets	$1,724	$37,445	254	312	Predicted water quality improvement	restores suitable habitat and expands area within corridor or home range
Alternative 5b	Highly	Fully	Highly	Fully Meets	Fully Meets	$1,774	$38,643	329	357		
NER Plan[1]	Highly	Fully	Highly	Fully Meets	Fully Meets	$1,519	$33,811	327	314		

Figure 5-3. CE/ICA Incremental Cost Analysis, The plan including 10 restored streams, providing 31 AAHUs is (identified in the bright green bar) was identified as the NED Plan.

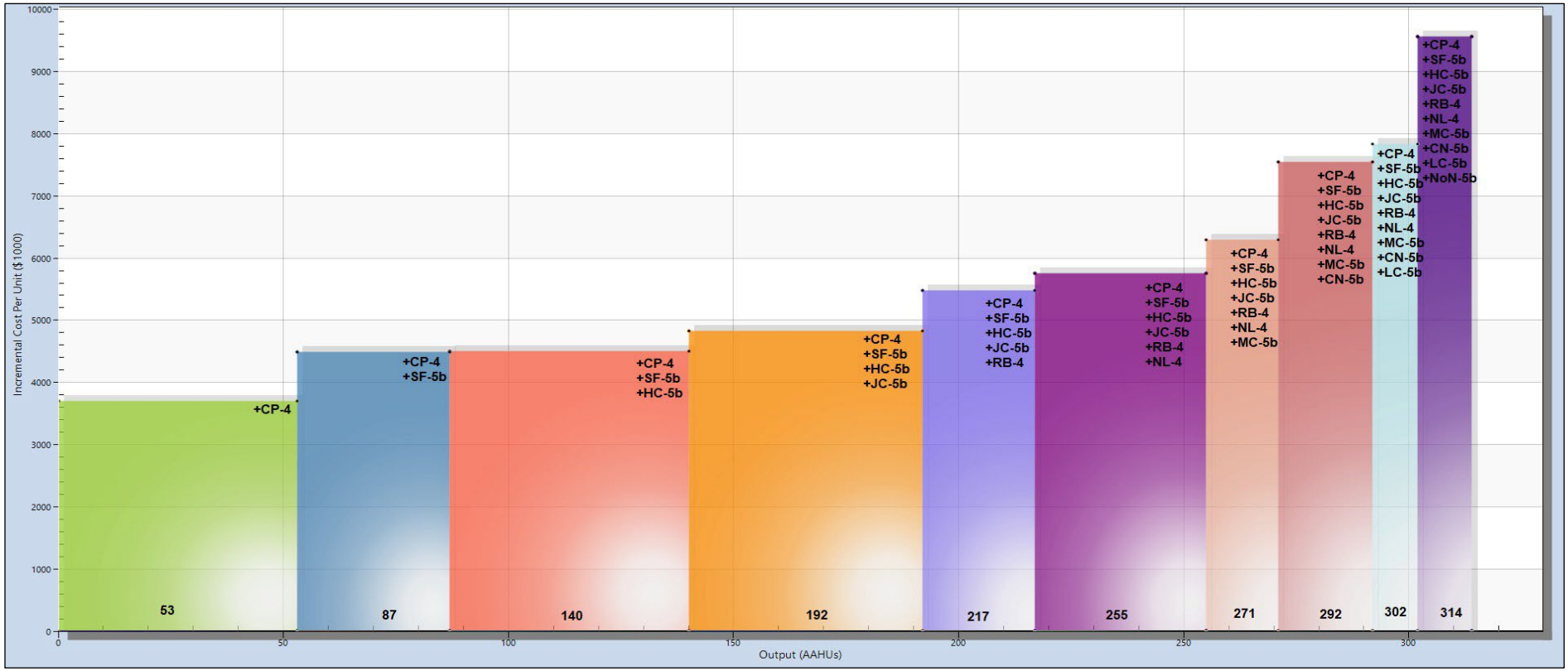

Figure 5-3. Incremental Cost Analysis of Ecosystem Restoration Alternatives

Table 5-6. Incremental Cost per Benefit (costs reported in 1000's)

Streams Restored (Best Buys)	Incremental cost	AAHU	benefits gained[1] (AAHU)
CP-4	$2,300	53	53
CP-4,**SF-5b**	$4,400	87	34
CP-4,SF-5b, **HC-5b**	$4,400	140	53
CP-4,SF-5b, HC-5b, **JC-5b**	$4,600	192	52
CP-4,SF-5b, HC-5b, JC-5b, **RB-4**	$5,400	217	25
CP-4,SF-5b, HC-5b, JC-5b, RB-4, **NL-4**	$5,500	255	38
CP-4,SF-5b, HC-5b, JC-5b, RB-4, NL-4,**MC-5b**	$6,200	271	16
CP-4,SF-5b, HC-5b, JC-5b, RB-4, NL-4,MC-5b, **CN-5b**	$7,400	292	21
CP-4,SF-5b, HC-5b, JC-5b, RB-4, NL-4,MC-5b, CN-5b, **LC-5b**	$7,900	302	10
CP-4,SF-5b, HC-5b, JC-5b, RB-4, NL-4,MC-5b, CN-5b, LC-5b, **Non-5b**	$9,500	314	12

[1]benefits gained reflects the quantity of average annual habitat units that would be achieved with addition of the last increment which is the stream restoration plan that is bolded in the "Streams Restored (Best Buys)" column

The most effective restoration plan is the Camp Creek restoration alternative (CP-4), which has an incremental cost of $2,300 per unit. The leaps made in incremental cost occur with the addition of Cane Creek (CN-5b) and Nonconnah Creek (NO-5b).

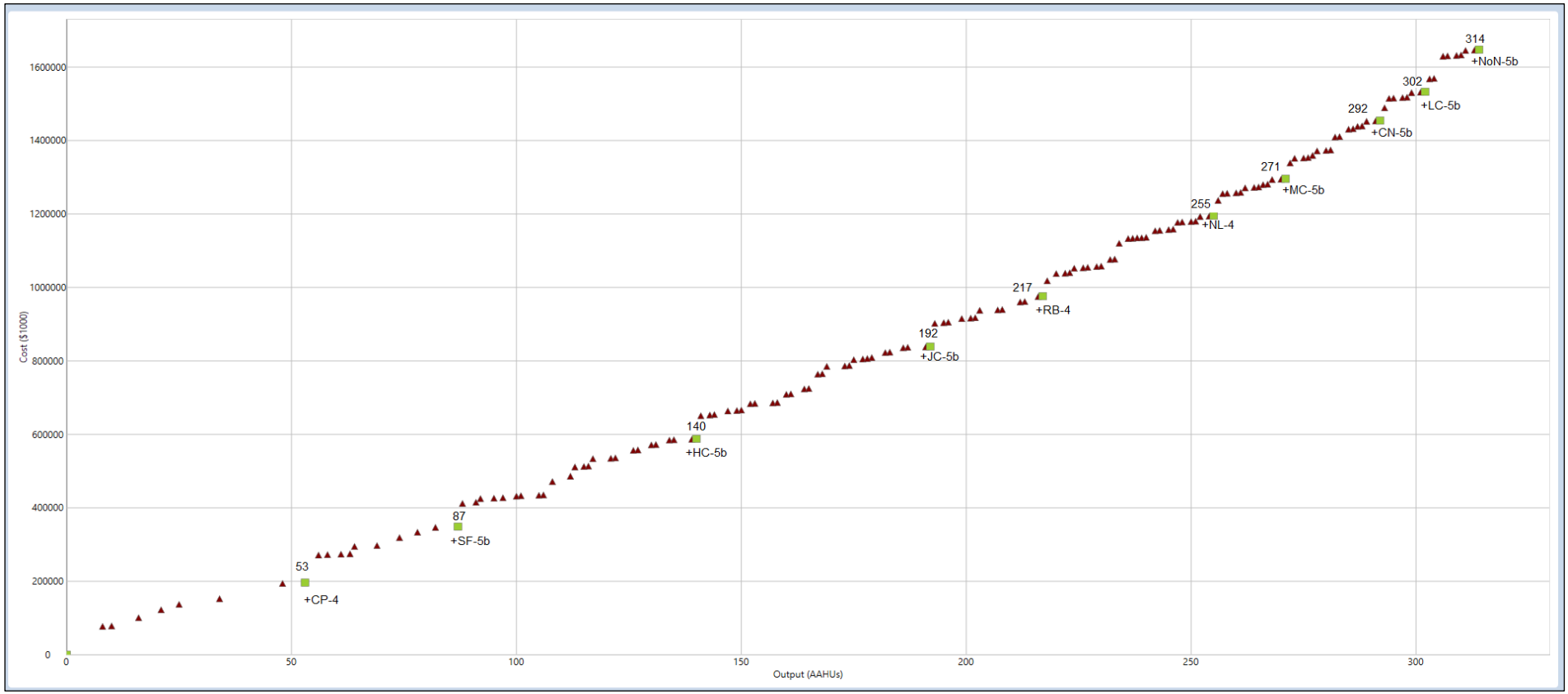

Figure 5-4. Cost Effectiveness of the Ecosystem Restoration Alternatives

5.9 AQUATIC ECOSYSTEM RESTORATION PROPOSED ACTION

The Aquatic Ecosystem Restoration (AER) Plan and RP (Table 5-7.) includes a combination of Alternatives 4 and 5 for a total of 74 grade control structures and 327 acres of riparian reforestation on 10 creeks to form the NER recommended plan. Alternative 4, grade control with associated riparian reforestation, would occur along the following streams: Camp Creek, Nolehoe Creek, and Red Banks Creek. Alternative 5, grade control with 10% of riparian reforestation along the stream length, would occur along the following streams: Johnson Creek, Cane Creek, Hurricane Creek, Lick Creek, Mussacuna Creek, Nonconnah Creek, and Short Fork Creek.

Table 5-7. Aquatic Ecosystem Restoration Plan

Stream	Alt #	Alternative Description	AAHUs	Cost of Construction[1]
Camp Creek	CP-4	7GCS + 47 riparian acres	53	$4,747
Cane Creek	CN-5b	9 GCS+ 26 riparian acres	21	$3,770
Hurricane Creek	HC-5b	9 GCS + 64 riparian acres	53	$5,937
Johnson Creek	JC-5b	11 GCS+ 49 riparian acres	52	$6,092
Lick Creek	LC-5b	3 GCS + 14 riparian acres	10	$1,748
Mussacuna Creek	MC-5b	3 GCS + 23 riparian acres	16	$2,333
Nonconnah Creek	NoN-5b	7 GCS + 20 riparian acres	12	$2,682
Nolehoe Creek	NL-4	11 GCS + 18 riparian acres	38	$5,224
Red Banks	RB-4	5 GCS + 24 riparian acres	25	$3,090
Short Fork	SF-5b	9 GCS + 42 riparian acres	34	$3,598
10 streams		**74 GCS+ 327acres**	**314**	**$39,222**

1. Costs include contingency, are in 1000's, (FY23 Price Level, 2.5% Discount Rate, Thousands)

5.9.1 Significance of the AER Plan-Is it Worth it?

The criteria used to select the AER recommended plan are:

- It is the most effective alternative in meeting the ecosystem restoration objectives
- It is a best buy and cost-effective plan for both watershed and instream aquatic outputs

- It meets all legal and policy requirements and includes all required features to succeed
- It restores scare habitat for special status and improves riparian and aquatic connectivity for migratory birds and fish, and increases biodiversity for native flora
- Risks related to not achieving desired ecological outcomes can be addressed through monitoring and adaptive management.

The most cost effective on each stream was determined to be either Alternative 4 or Alternative 5b. Table 5-5. identifies the most cost-effective alternative by stream. Each of these plans is a best buy and is cost effective for both watershed and instream aquatic outputs. The recommended aquatic ecosystem restoration plan would benefit ecological resources, determined as significant through technical, public and institutional recognition. The proposed actions would improve ecological resources in ten degraded streams throughout Desoto County. Nonconnah Creek, flows into the Mississippi River Basin, while the other 9 streams flow into the Coldwater River Watershed and eventually into Arkabutla Lake/Reservoir (a USACE flood risk management project). Degradation in these streams leads to severe erosion resulting in excessive sedimentation in the Mississippi River and Arkabutla Lake. Implementing NER on these streams, not only restores and protects critical habitats but also reduces sediment loading in these waterbodies thereby reducing dredging costs, reducing flooding, and preventing ecosystem degradation associated with excess sedimentation. The proposed actions along Camp and Hurricane Creeks appear to be the most cost-effective, providing the most ecological lift for the least cost. However, each stream restoration segment was determined to be cost-effective through the CE/ICA analysis described in Section 5.7, above. The most expensive stream to restore is Nonconnah Creek, which has an Average Annual Cost per Average Annual Habitat Unit (AAC/AAHU) of $8,765.

Institutional recognition of a resource or effect means its importance is recognized and acknowledged in the laws, plans and policies of government and private groups. Institutional significance of the proposed NER Plan is demonstrated through the restoration of bottomland hardwood forest and arresting the on-going degradation of the streams through stabilization. Bottomland hardwood forest is documented as important migratory bird habitat (Migratory Bird Treaty Act of 1918, Migratory Bird Conservation Act of 1929, as amended) and potential reproductive and summer roosting habitat for the northern long-eared bat (Endangered Species Act of 1973, as amended).

Public recognition indicates that some segment of the general public recognizes the importance of an environmental resource. Public significance is indicated through the interest the public and non-Federal sponsors have shown in the ecosystem restoration features and concerns with bank degradation and water quality. Technical recognition of a resource or an effect is based upon scientific or other technical criteria that establishes its significance. The NER Plan is significant based on the following resource characteristics: scarcity, representativeness, status and trends, connectivity, critical habitat, and biodiversity, each of which is further described below.

Scarcity is a measure of a resource's relative abundance within a specified geographic range. The proposed NER Plan would reforest approximately 327 acres of riparian buffers with native vegetation and stabilize and restore approximately 28 miles (approximately 187 acres) of in-stream habitat within the Mississippi Valley Loess Plain (MVLP) ecoregion.

Representativeness is a measure of a resource's ability to exemplify the natural habitat or ecosystems within a specified range. The proposed NER Plan would restore many of the streams in DeSoto County to a stable and representative condition of the MVLP.

Status and Trends is the occurrence and extent of the resource over time, how it has changed. The proposed NER Plan would arrest stream bed degradation and allow for the improvement of foraging, cover, and reproductive habitats for native fish, wildlife, and birds in the area.

Connectivity is the potential for movement and dispersal of species throughout a given area of an ecosystem, considered in the context of a landscape or watershed. The proposed NER plan would reconnect approximately 83 stream miles in DeSoto County; provide riparian corridors that could connect streams to larger forested blocks and wetlands; reconnect isolated stands of habitat to allow movement and dispersal of species throughout the project area; and the design of the grade control structures would improve fish passage in the streams.

Limiting Habitat is essential for the conservation, survival, or recovery of one or more special status species and biodiversity is a measure of the variety of distinct species and the genetic variability within them. Implementation of the proposed NER plan would provide limiting habitat such as stable, connected stream reaches and improve biodiversity. Stream stabilization would promote re-colonization of hydrophytic and riparian vegetation contributing to healthy and diverse ecotones; grade control and bank stabilization structures along with riparian habitats would provide structure and restore function for/with macroinvertebrates; reforestation would provide foraging habitat and introduce important coarse woody debris and organic materials into the streams. The proposed NER plan would protect or provide habitat that would benefit endemic and/or species in need of conservation, including the Yazoo darter and Yazoo shiner, Southern red-bellied dace, and Piebald madtom (currently petitioned for listing under the ESA); the northern long-eared bat (NLEB) would benefit from reforestation (roosting), and grade control and bank stabilization techniques as aquatic insect habitat and pooling habitat would be restored; and reforestation of acreage within the Mississippi Flyway is beneficial to neo-tropical migratory birds and would promote forage and resting habitat.

SECTION 6
Environmental Consequences

This section describes the environmental consequences associated with implementing the final array of alternatives and contains a brief summary of the effects of the proposed alternatives. The analyzed alternatives include flood risk management and aquatic ecosystem restoration plans. The Multi-Scale Watershed Approach (MSWA) was developed by ERDC and revised for use in DeSoto County, Mississippi. The MSWA established a means of utilizing readily available data and surface investigations to create an overall knowledge base focusing on watershed problems and opportunities. The outcome of MSWA was used as a principal component of the decision-making process and was used to make scientifically defensible decisions. It is the basis of categorizing and quantifying environmental impacts and benefits expected to be incurred from the final array of alternatives discussed below. From the watershed perspective, the cause-and-effect relationships between land use, water quality and quantity, in-channel and riparian conditions, and biotic responses are representative of the ecological condition of the watershed. Further information regarding the MSWA is included in Appendix A Watershed Assessment Model Documentation.

6.1 EVALUATION FLOOD RISK MANAGEMENT ALTERNATIVES

Table 6-1. compares the final array of Flood Risk Management Alternatives. Proposed plans are expected to have no effect on the following relevant resources that were discussed in Section 3. Existing Conditions: Mesic upland forests, threatened and endangered species, air quality, geology and soils, flood history, socio-economic resources, and prime and unique farmland. These resources are not discussed further in Section 6.1.

Table 6-1. Flood Risk Management Alternatives

Alt ID	Description
No Action	USACE would take no action to address flood risks
4A	0.04 AEP Nonstructural
5A	Extended Horn Lake Enlargement 18.6-19.4
6A	Extended Horn Lake Creek Channel Enlargement+ Lateral D Detention
7	Extended Horn Lake Creek Channel Enlargement + Cow Pen, Lat D, Rocky Detention+ 25 YR Nonstructural
8A	Levee and Floodwall System
8B (RP)	Levee and Floodwall System combined with Nonstructural dry floodproofing of 35 structures

6.1.1 No Action Alternative

This alternative would result in no project construction. The Horn Lake Drainage Basin is expected to be approximately 95% developed by the year 2027 and is expected to remain at this percentage until the year 2050 and beyond. This projection is based on proposed changes in land use and population increases. In proportion to this increase in development, the area is expected to see an increase in flow discharges. With implementation of the no action alternative, communities within the study area would continue to be at risk from high water events induced by stormwater inputs.

6.1.2 Plan 5A – Extended Channel Enlargement

Alternative 5A, as described in Section 4.3.3, would result in the construction of a channel enlargement which would increase the bottom width of Horn Lake Creek from approximately 15-25 feet to approximately 40 feet for approximately 0.8-mile from stream mile 18.86 to Mile 19.41. The creek banks would be constructed for stability at a slope of approximately 3-feet horizontal to 1-foot vertical (3:1). The enlargement and slope flattening would require approximately 95,000 cubic yards of excavation, all of which would be disposed off-site. Approximately 22,750 tons of riprap would be placed to prevent scour damage. The riprap would be placed in a 3-feet deep layer on the bottom and 5 feet up both banks. The riprap would be placed over approximately 6,000 tons of filter material. The upper banks would be protected with 18,780 square yards of turf reinforcing mat.

The current condition of the proposed enlargement area is a low to moderate quality stream with a moderate riparian corridor. The existing riparian SCI score for this section of stream is 0.31, and the in-channel score is 0.4. It is expected that the future without construction of the proposed project would see an increase in habitat value, estimated to increase the SCI to approximately 0.95 over a period of 50 years. A reduction of SCI to approximately 0.1 is expected with construction of the proposed project, resulting in an index reduction of approximately 0.85, or 8.5 AAHU, or a total of approximately 425 habitat units over 50 years is expected due to impacts from riparian tree clearing. The unit termed AAHUs the product of Stream Condition Index (SCI) scores and area of impact or improvement annualized over a 50-year period. Therefore, if constructed, this alternative would have required compensatory mitigation of approximately 8.5 AAHUs, or a total of approximately 425 habitat units to off-set a loss of ecosystem function.

Due to the improvement of channel planform, bank stability, habitat diversity, and fish cover, there is an SCI increase from 0.4 to approximately 0.7 resulting in a gain of 203 habitat units over a 50-year period. Water quality and aquatic resources would be expected to improve as compared to the existing conditions and future without project. While some aquatic habitat benefits would be realized from the construction of this alternative, those benefits were not included in the ER benefit calculations. As noted above, this alternative would cause a net-loss in habitat and would have required compensatory mitigation. As noted in Section 4.2.2, this alternative was screened as, “This plan does not address road closures, increase accessibility to critical infrastructure, or decrease life safety situations caused by flooding.”

6.1.2.1 Relevant Resources Affected

6.1.2.1.1 Wetlands and Bottomland Hardwood Forest

A reduction of the SCI to approximately 0.1 would be expected with construction of the alternative, resulting in an index reduction of approximately 0.85, or 8.5 AAHU, or a total of approximately 425 habitat units over 50 years is expected due to impacts from riparian tree clearing. This determination was made using the NLCD. Wetland delineations were not conducted.

6.1.2.1.2 Water Quality and Aquatic Resources

With construction of this alternative, water quality and aquatic resources would have been expected to improve as compared to the existing conditions and future without project. Due to the improvement of channel planform, bank stability, habitat diversity, and fish cover, a gain of approximately 397 AAHU over 50 years would have neem expected. These benefits were not included in the ER benefit calculations, this is simply noted as a way to describe all impacts, positive or negative, that would be expected to occur with the construction of each alternative.

Water quality within the stream including sedimentation, low dissolved oxygen, and excess nutrients would be expected to improve over time with the implementation of the project.

6.1.2.1.3 Wildlife

This alternative would require approximately 20 acres of tree clearing. This action would impact wildlife including a variety of migratory game and non-game birds, mammals, amphibians, and reptiles would occur due to a loss of forested habitat. As discussed previously, BLH loss and aquatic instability has impacted the Mississippi Flyway, and this alternative would continue the trend of habitat loss.

As tree clearing would occur along one bank, the stream would be left shaded avoiding a portion of the potential impacts to the stream and the associated wildlife. These impacts would require compensatory mitigation by reforesting an appropriate acreage adjacent to HLC, or within the HLC Basin. Beneficial management actions would include items such as protection of large diameter trees and snags, restoration of channel depth and flow, reintroduction of stream sinuosity and microtopography, and floodplain reconnection as described in the Mississippi SWAP. However, as this action is no longer included in the proposed RP, no compensatory mitigation is recommended for this action.

6.1.2.1.4 Cultural Resources

This alternative would be unlikely to impact known cultural resources. The majority of this alternative has been previously surveyed over the last 40 years and no eligible resources are located within the project area. The USACE developed and executed a programmatic agreement with the MS SHPO and Federally recognized Tribes to establish protocols for additional surveys prior to construction, see Appendix F for specifics on this consultation. If

necessary, additional impacts will be addressed following the provisions of the programmatic agreement.

6.1.2.1.5 Aesthetics

The proposed channel enlargement would be visible from Mississippi Highway 51 and adjacent, developed land uses. Approximately 0.5 miles of creek with forested banks would be cleared, widened, and lined with riprap. Vegetation and associated habitat would no longer interact at the water's edge in the creek as riprap would now clearly delineate the edge.

During construction, visual resources could be temporarily impacted by construction activities related to implementing the channel enlargement and by transport activities needed to move equipment and materials to and from the site. This temporary impact would most likely affect visual resources from the immediate roadways and adjacent, developed land uses.

Cumulative impacts to visual resources would be the additive combination of impacts by this and other Federal, state, local, and private flood risk management efforts, including, but not limited to the Mississippi River Levee and the Arkabutla Lake reservoir on the Coldwater River. Similar water training devices in waterways would continue to interrupt the interaction of vegetation and associated habitat at the water's edge as shorelines and banks are defined and reinforced by efforts to reduce flood risk.

6.1.2.1.6 Recreation

The proposed channel enlargement could directly impact land used by the City of Southaven's *Cherry Valley Park and Greenspace* located at 7505 Cherry Valley Drive. The proposed channel enlargement is on the southeast perimeter of land used by *Cherry Valley Park and Greenspace*. The channel enlargement footprint does not currently see a high level of user activity as most recreational use occurs in the northwest sector of the property.

Access to the Horn Lake Channel within the property is limited to foot traffic. See Appendix N, Figure N-3. for Recreation at Channel Enlargement.

The proposed channel enlargement could indirectly impact land used by *Cherry Valley Park and Greenspace*. During construction, recreational resources could be temporarily impacted by construction activities related to implementing the proposed channel enlargement and by transport activities needed to move equipment and materials to and from the site. Dust and associated noise may temporarily impact those recreational facilities that are in the vicinity of the proposed channel enlargement. Future feasibility and design of the proposed channel enlargement site would incorporate best management practices with sensitivity to recreational resources that may be impacted within the land used by the City of Southaven's *Cherry Valley Park and Greenspace.*

6.1.2.1.7 Environmental Justice

The HLC Channel Enlargement Extended alternative would not result in disproportionate significant direct environment or economic effects on areas of EJ concern. The location of the channel enlargement is shown as a red star on Figure 6-1. in relation to Areas of EJ Concern. A majority of residents in the Census Block Group immediately to the south of the proposed channel enlargement identify as minority and is an area of EJ concern. However, the types of impacts that the surrounding area could experience are expected to be temporary and minor and include noise from construction activities taking place in the channel Right of Way (ROW) and an increase in truck traffic delivering materials for the construction. The impacts are expected to occur during construction of the enlargement. In addition, the contractor, as a best management practice and as practicable, would restrict work to regular business hours (approximately 0700-1900) on weekdays to reduce potential effects from noise and increased truck traffic to the identified existing EJ community and general public. These conditions would be expected to return to normal after the channel work is completed.

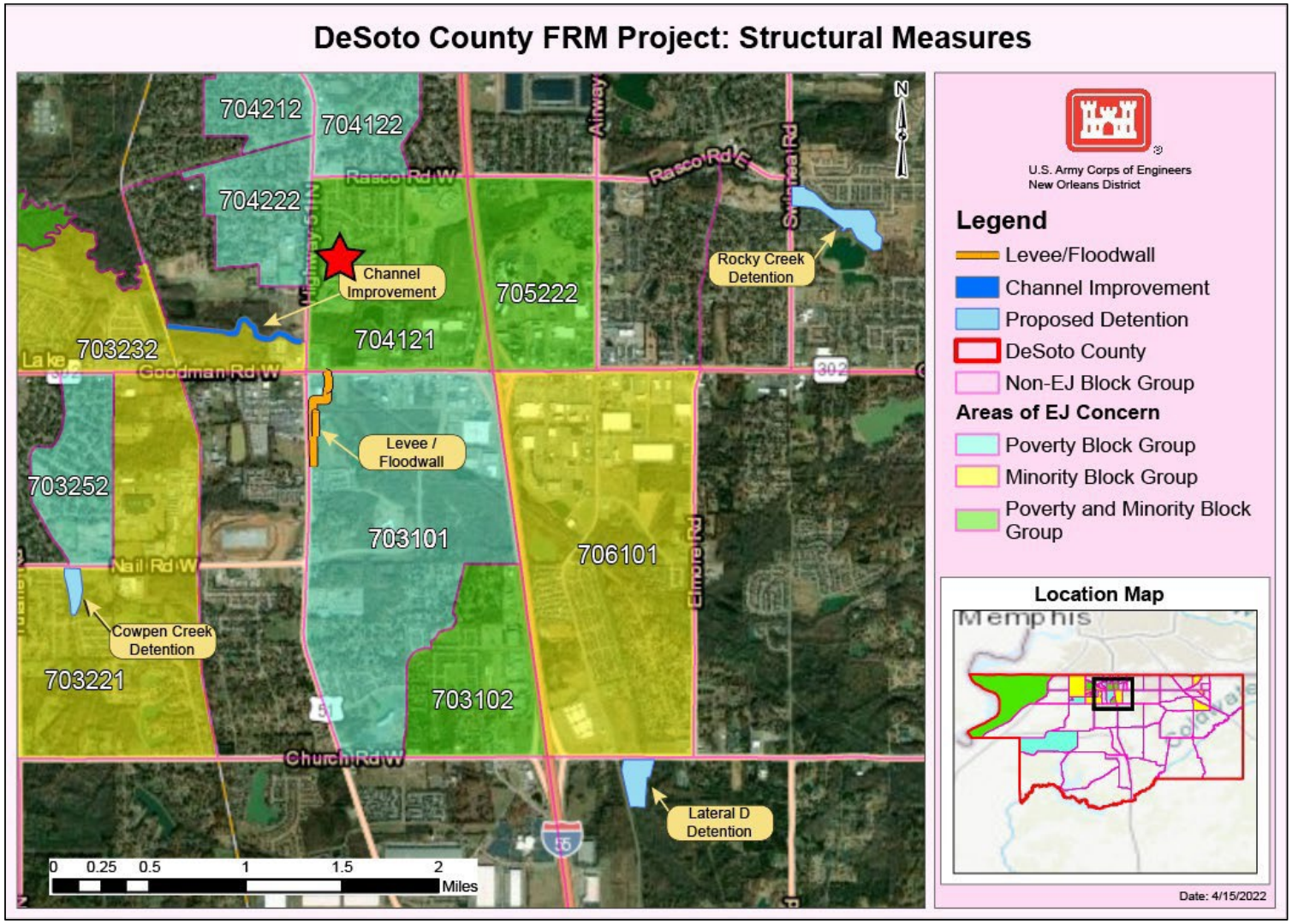

Figure 6-1. Desoto FRM, Plan 5A – HCL Extended Channel Enlargement Location and Areas of EJ Concern

Source: Map Census block group polygons and census data 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

The construction disruptions are temporary. There are no permanent high, adverse direct or indirect impacts from the HLC Channel Enlargement.

Areas of EJ concern near the channel enlargement and within the larger study area would experience the flood risk management benefits associated with the improvement.

6.1.3 Plan 6A – (Plan 5A with Lateral D Detention Basin)

Alternative 6A, as described in Section 4.3.4, would result in the extended channel enlargement along Horn Lake Creek described above, in addition to the construction of the Lateral D Detention Basin. The Lateral D Detention Basin would be in-line with the stream, a tributary to HLC. The full basin would encompass approximately 22 acres of mostly BLH forested land, the bottom area is approximately 16 acres. Tree clearing would be required for the full acreage mentioned, and excavation would be required to a depth of approximately 10 with 3-feet horizontal to 1-foot vertical side slopes. A 500-linear feet outlet embankment would be constructed to include a 48-inch reinforced concrete pipe (RCP) outlet with a 100-linear foot overflow spillway armored with approximately 2,000 tons of riprap over approximately 500 tons of filter material on the downstream side. The spillway would operate at elevation 300.0 (the 0.50 AEP event, or 2-year flood). The maximum storage of 177 acre-feet would require approximately 350,000 cubic yards of excavation.

The basin would be turfed and may include limited tree and shrub plantings at the edge of a low-flow channel. The excavated material is expected to be disposed of off-site. A gravel-surfaced access road and security fence would be installed along the perimeter of the basin. A new existing-conditions survey would provide the data necessary to finalize design elevations. Special consideration would be given to transitioning into and out of the detention basin, managing overflow, and protecting the channel from scour.

Currently, no environmental features have been incorporated into the design of the Lateral D detention basin; however, if this alternative had been selected as the RP, additional wetland features, microtopography work, and/or tree planting would have been incorporated to reduce the amount of off-site compensatory mitigation required. The existing condition of the proposed Lateral D detention basin is a moderate to high quality forested area with an SCI score of 0.8, producing approximately 17.7 AAHUs. It is expected that the future without construction of the proposed project would see an increase in habitat value, estimated to increase the SCI to approximately 0.95 over a period of 50 years. A reduction of SCI to approximately 0.1 would have been expected with construction of the proposed project, resulting in a reduction of habitat value to approximately 0.85(equating to a loss of approximately 18.7 AAHU) or a total of approximately 1,045 habitat units over 50 years.

Therefore, if constructed, this alternative would have required compensatory mitigation (as compared to Plan 5A) of approximately 18.7 AAHUs, to off-set a loss of ecosystem function. However, as noted in Section 4.2.2, this alternative was screened as, “This plan does not address road closures, increase accessibility to critical infrastructure, or decrease life safety situations caused by flooding.”

6.1.3.1 Relevant Resources Affected and Expected Impacts (Affected Environment and Environmental Consequences)

This alternative was determined to have no effect prime and unique farmland or; Upland Forest.

6.1.3.1.1 Wetlands and Bottomland Hardwood Forest

Impacts to relevant resources for the HLC channel enlargement are detailed previously in Section 5.4. A reduction of SCI to approximately 0.1 would be expected with construction of this alternative, resulting in an index reduction of approximately 0.85, or 18.7 AAHU, or a total of approximately 1,045 habitat units over 50 years is expected due to impacts from tree clearing. Therefore, compensatory mitigation for approximately 18.7 AAHUs, or a total of approximately 1,045 habitat units would have been required to off-set a loss of ecosystem function.

6.1.3.1.2 Water Quality and Aquatic Resources

Water quality and aquatic resources would be expected to improve as compared to the existing conditions and future without project, as the detention basins would be expected to assimilate pollution and store sediment from surrounding developed areas, improving downstream water quality.

Existing water quality problems within the stream including sedimentation, low dissolved oxygen and excess nutrient problems would be expected to improve over time with the implementation of the project. Erosion and bank failures associated with incision, head-cutting, and commercial and residential development would also be expected to improve.

6.1.3.1.3 Wildlife

Impacts to relevant resources for the channel enlargement are detailed above in Section 6.1.2.1.3, and are not reiterated here, but are included by reference for this alternative. Impacts to wildlife including a variety of migratory game and non-game birds, mammals, amphibians, and reptiles would occur due to a loss of forested habitat, as discussed above. As discussed previously, BLH loss and aquatic instability has impacted the Mississippi Flyway. Impacts to wildlife would be mitigated by reforesting an appropriate acreage adjacent to HLC, Lateral D, or within the HLC Basin. In addition, beneficial management actions may include items such as protection of large diameter trees and snags, restoration of channel depth and flow, reintroduction of stream sinuosity and microtopography, and floodplain reconnection as described in the Mississippi SWAP.

6.1.3.1.4 Cultural Resources

This alternative would be unlikely to impact known cultural resources. Most of area impacted by this alternative has been previously surveyed over the last 40 years and no eligible resources are located within the project area. The USACE has developed and executed a programmatic agreement with the MS SHPO and Federally recognized Tribes to establish

protocols for additional surveys prior to construction, see Appendix F for specifics on this consultation. If necessary, additional impacts will be addressed following the provisions of the programmatic agreement.

6.1.3.1.5 Aesthetics

Extended Horn Lake Channel Enlargement impacts are described in section 5.4.1.5, and impacts of the detention basin include:

During construction, visual resources could be temporarily impacted by construction activities related to implementing the smaller detention sites on Horn Lake Creek tributaries and by transport activities needed to move equipment and materials to and from the site.

This temporary impact would most likely affect visual resources from the immediate roadways and adjacent, developed land uses.

Cumulative impacts to visual resources would be the additive combination of impacts by this and other Federal, state, local, and private flood risk management efforts, including, but not limited to the Mississippi River Levee and the Arkabutla Lake reservoir on the Coldwater River. Deforestation of localized stands of forest vegetation for developed land uses would continue to drive woodland wildlife habitats further away from development.

6.1.3.1.6 Recreation

The proposed channel enlargement could directly impact land used by the City of Southaven's Cherry Valley Park and Greenspace located at 7505 Cherry Valley Drive. The proposed channel enlargement is on the southeast perimeter of land used by Cherry Valley Park and Greenspace. The channel enlargement footprint does not currently see a high level of user activity as most recreational use occurs in the northwest sector of the property.

Access to the Horn Lake Channel within the property is limited to foot traffic. See Appendix N, Figure N-3. for Recreation at Channel Enlargement.

The proposed channel enlargement could indirectly impact land used by Cherry Valley Park and Greenspace. During construction, recreational resources could be temporarily impacted by construction activities related to implementing the proposed channel enlargement and by transport activities needed to move equipment and materials to and from the site. Dust and associated noise may temporarily impact those recreational facilities that are in the vicinity of the proposed channel enlargement. Future feasibility and design of the proposed channel enlargement site would incorporate best management practices with sensitivity to recreational resources that may be impacted within the land used by the City of Southaven's Cherry Valley Park and Greenspace.

The proposed detention site at Lateral D should not have any impacts to recreational resources.

6.1.3.1.7 Environmental Justice

The EJ impacts associated with the extended channel enlargement are identified in section 6.1.2.1.7.

Detention basins are considered as measures to reduce the risk of flooding in the study area. The Lateral D Detention basin is a regional, below grade structure, designed to attenuate flood peaks and release downstream at non-damaging flow rates.

There are no direct impacts to EJ communities from construction of the Lateral D basin, shown as a red star on Figure 6-2. in relation to Areas of EJ Concern. Census Block Group 706101 is located immediately north of the proposed detention basin and is considered an area of EJ concern based upon the area being majority minority. To be clear, here are no residential communities on any side of the proposed site. However, just north of Church Road and the location of the proposed site is a wooded area and just north of the wooded area is the community that is part of the majority minority census block group.

Over 50 percent of the population within the census block group 706101 identifies as minority. This area is not a low-income community with well under 20 percent households in the area having incomes below poverty. The area though is considered an area of EJ concern based upon the minority criteria and may experience temporary indirect impacts from the construction of the Lateral D basin, which are not considered high, adverse impacts. Best Management Practices will be implemented that will minimize/reduce or avoid traffic and noise disturbances such as using traffic routes to reduce neighborhood disturbance or limiting construction activities to daytime to reduce noise impacts. Direct impacts may occur, for example, when the footprint of the structural alternative, the detention basin, encroaches onto privately-owned land which may be acquired to construct the basin. All the lands needed for the detention basin are currently vacant of residential structures and therefore there are no direct impacts. In addition, the contractor, as a best management practice, and as practicable, would restrict work to regular business hours (approximately 0700-1900) on weekdays to reduce potential effects from noise and increased truck traffic to the identified existing EJ community and general public. These conditions would be expected to return to normal after the channel work is completed.

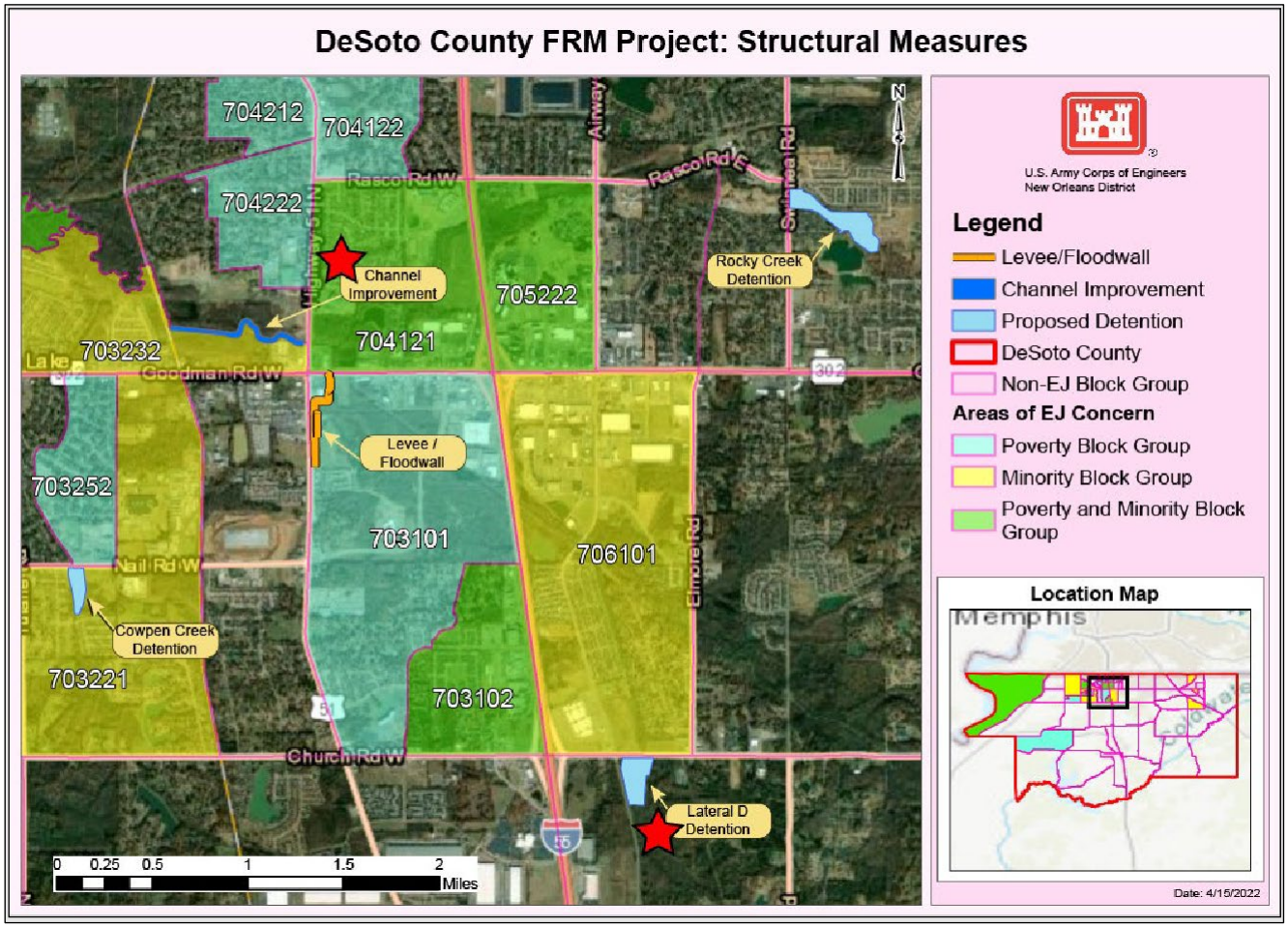

Figure 6-2. Desoto FRM Plan 6A and Areas of EJ Concern

Source: Map Census block group polygons and census data from Manson et al. 2021. ***http://doi.org/10.18128/D050.V1***

Positive indirect impacts include a decrease in risk of flood damage for minority and/or low-income populations in the study area. Adverse, indirect impacts to EJ communities may occur when the construction activities, such as transportation, noise, dust and air quality impacts, affect nearby minority or low-income communities near the site.

Construction activities that may impact transportation routes, possibly causing minor delays, would be temporary. Several impact avoidance features are included as integral components of the proposed action to minimize impacts to vehicular transportation. Specific routes would be designated for construction-related traffic to minimize residential disturbance and traffic congestion. USACE contracts would designate specific routes for construction-related traffic to avoid residential areas and EJ communities, to the maximum extent practicable, and staging areas for construction equipment and personnel would be located away from heavily populated areas. Streets that would serve construction-related traffic would be resurfaced, if needed and as appropriate, prior to initiation of construction activities, and maintenance of those streets would be provided during the project construction period. Appropriate detour signage would be placed in order to preserve access to local streets during construction activities. Off-street parking would be provided for construction workers, and shuttle vans would be used to transport construction workers to the work sites, if necessary. Streets that are damaged by any and all construction activities would be repaired.

Air quality Impacts to EJ communities are expected to be minor and short term. Temporary increases in air pollution could occur from the use of construction equipment (combustible emissions). Combustible emission calculations were made for standard construction equipment, such as bulldozers, excavators, pumps, front end loaders, backhoes, cranes, and dump trucks. Analyses were made for the type of equipment, duration of the total number of days each piece of equipment would be used, and the number of hours per day each type of equipment would be used. DeSoto County is currently designated by the Environmental Protection Agency as a maintenance area for ozone under the 2015 8-hour standard. DeSoto County has been classified as marginal, which is the least severe classification. None of Environmental Indicators, presented in the EJSCREE report for Desoto County in Appendix – M are above the 80th percentile in the State or USA, which is according to EPA, the percentile where one could expect environmental concerns.

6.1.4 Plan 7 – (Plan 6A with Rocky Creek and Cow Pen Creek Detention Basins)

Alternative 7 was initially proposed as the LPP and is described in Section 4.3.5. However, during feasibility level design this locally preferred plan was eliminated from further consideration when two-dimensional hydraulic data and subsequent economic analysis illustrated that neither the channel enlargement nor any of the four detention basins were effective at reducing flooding. This action would have resulted in the construction, benefits and impacts associated with Alternative 6A, along with two additional detention basins along Cow Pen Creek and Rocky Creek. Relevant resources and associated impacts for Alternative 6A are not reiterated here, but are summarized below, and included by reference.

The Rocky Creek in-line detention basin, if constructed, would total approximately 9 acres, require approximately 7.5 acres of tree clearing and excavation to a depth of approximately 10 feet. The pool bottom area would encompass approximately 6 acres. The detention basin would have a single pool elevation of approximately 302.0. Slopes would be constructed at approximately 3H:1V for stability. A downstream embankment would be constructed and extend approximately 500 linear feet. The embankment would include a 48-inch RCP outlet and 100- linear foot overflow spillway armored with approximately 6,000 tons of riprap placed over approximately 1,500 tons of filter material on the downstream side. The current design assumes replanting with native vegetation of approximately 10 percent, or 0.9 acre, of the area that would be cleared.

The existing condition of the area identified for the Rocky Creek detention basin is a moderate-quality forested area with an SCI score of 0.54, producing approximately 4.1 AAHUs. It is expected that the future without construction of the proposed project would see no increase or decrease in habitat value over a period of 50 years, as the adjacent areas are highly developed. A reduction of SCI to approximately 0.1 is expected with construction of the proposed project, resulting in an index reduction of approximately 0.4, or 3.3 AAHU, or a total of approximately 165 habitat units over 50 years is expected due to impacts from tree clearing. Therefore, if constructed, this alternative would have required additional compensatory mitigation (as compared to Plan 6A) of approximately 3.3 AAHUs, or a total of approximately 165 habitat units off-set a loss of ecosystem function.

The Cow Pen Creek detention basin would total approximately 20 acres in two pools (a 12-acre upstream pool and an 8-acre downstream pool) and would require approximately 8.5 acres of tree clearing (upstream pool only) and excavation to a depth of approximately 10 feet. The upper pool would have a bottom elevation of 262.0 with a bottom area of 10 acres, and slopes would be constructed at 3H:1V back to the existing grade. A 500-linear foot embankment would be constructed on the downstream end of the detention basin and would include a 48-inch RCP outlet and 100-linear foot overflow spillway armored with approximately 2,000 tons of riprap over approximately 500 tons of filter material on the downstream side. The spillway would operate at elevation 272.0, approximately at the 0.50 AEP event. The maximum storage of 108 acre-feet requires approximately 175,000 cubic yards of excavation which would be disposed of off-site. The current design assumes replanting with native vegetation of approximately 10 percent, or 1.2 acres, of the area that would be cleared.

The downstream Cow Pen detention basin would be offline and encompass approximately 8 acres. The basin would have a bottom elevation of 258.0 with a bottom area of approximately 6 acres. Slopes would be constructed up to the existing grade at 3H:1V. A 500-linear feet embankment would be constructed on the downstream end of the detention basin and would include a 48-inch RCP outlet and 100-linear foot overflow spillway armored with approximately 2,000 tons of riprap over approximately 680 tons of filter material. An inlet sill would require an additional 800 tons of riprap. The 100-foot-wide spillway would operate at elevation 268.0, approximately at the 0.50 AEP event. The maximum storage of 68 acre-feet requires approximately 115,000 cy of excavation which would be disposed of

off-site. The current design assumes replanting with native vegetation of approximately 10 percent, or 1.2 acres, of the area that would be cleared.

The existing condition of the proposed upstream detention basin is a low-quality forested area with an SCI score of 0.36, producing approximately 3.1 AAHUs. It is expected that the future without construction of the proposed project would see an increase in habitat value, estimated to increase the SCI to approximately 0.5 over a period of 50 years. A reduction of SCI to approximately 0.1 is expected with construction of the proposed project, resulting in an index reduction of approximately 0.4, or 3.4 AAHU, or a total of approximately 170 habitat units over 50 years is expected due to impacts from tree clearing. Therefore, if constructed, this alternative would have required additional compensatory mitigation (as compared to Plan 6A) of approximately 3.4 AAHUs, or a total of approximately 170 habitat units to off-set a loss of habitat due to the proposed construction of the Cow Pen Creek detention basin.

The downstream detention basin is currently the site of a baseball or softball field, and currently has little ecological value; therefore, no compensatory mitigation is proposed for that site. However, as noted in Section 4.2.2, this alternative was screened as, “This plan does not address road closures, increase accessibility to critical infrastructure, or decrease life safety situations caused by flooding.”

6.1.4.1 Relevant Resources Affected and Expected Impacts (Affected Environment and Environmental Consequences)

This alternative was determined to have no effect on the following resources: Prime and unique farmland; Upland Forest.

6.1.4.1.1 Wetlands and Bottomland Hardwood Forest

With implementation of the proposed channel enlargement with multiple detention basins, the USACE has determined that this alternative would require a total of approximately 48 acres of BLH tree clearing, if implemented. Implementation would cause a loss of approximately 8.5 AAHUs for the Horn Lake Creek channel enlargement. In addition, losses of 18.7 AAHUs within the Lateral D detention basin, 3.3 AAHUs within the Rocky Creek detention basin, and 3.4 AAHUs within the Cow Pen detention basin would have been incurred. If constructed, this alternative would have required total compensatory mitigation of approximately 33.9 AAHUs or approximately 1,695 habitat units over a period of 50 years to off-set the loss of ecosystem functions. No environmental features were incorporated into the design of the detention basins with the exception of the approximately 5.1 acres of replanting along the channels post-construction; however, if this alternative has been retained as the LPP, additional wetland features, microtopography work, and/or tree planting would have been incorporated to reduce, or the amount of off-site compensatory mitigation required for the detention basins. Gravel-surfaced access roads and security fences would have been installed along the perimeter of the basin for the safety and security of local residents. All excavated material would have been expected to be disposed of off-site and placed in an upland area where no impacts would occur. The channel enlargement and detention basin designs would have been optimized during feasibility-level design. A new existing-conditions survey would have been used to provide the data necessary to finalize

design elevations. Special consideration would have been given to transitioning into and out of the detention basins, managing overflow, and protecting the channel from scour.

6.1.4.1.2 Water Quality and Aquatic Resources

Overall, water quality and aquatic resources would be expected to improve as compared to the existing conditions and future without project. Due to the improvement of channel planform, bank stability, habitat diversity, and fish cover, a gain of 397 AAHU over 50 years for the HLC channel enlargement would have been expected. While there a total loss of 1,182 AAHUs would have been expected due to the tree clearing for the selected alternative, the water quality and aquatic resources would be expected to improve with the reduction of sedimentation and the assimilation of pollution.

6.1.4.1.3 Wildlife

This alternative would permanently impact approximately 48 acres of forested habitat, causing impacts to several species, as noted previously. In addition, temporary impacts from increased turbidity and disturbance would occur; however, the stream would return to normal post-construction. Compensatory mitigation would be required to fully mitigate impacts to wildlife. Beneficial management actions may include items such as protection of large diameter trees and snags, restoration of channel depth and flow, reintroduction of stream sinuosity and microtopography, and floodplain reconnection as described in the Mississippi SWAP.

6.1.4.1.4 Cultural Resources

This alternative would be unlikely have any impact on known cultural resources. The majority of this alternative has been previously surveyed for the last 40 years and no eligible resources are located within the project area. The USACE has developed and executed programmatic agreement with the MS SHPO and Federally recognized tribes to establish protocols for additional surveys prior to construction, see Appendix F for specifics on this document. If necessary, additional impacts will be addressed following the provisions of the programmatic agreement.

6.1.4.1.5 Aesthetics

Extended Horn Lake Channel Enlargement 18.6-19.4

The proposed channel enlargement would be visible from Mississippi Highway 51 and adjacent, developed land uses. Approximately 0.5 miles of creek with forested banks would be cleared, widened, and lined with riprap. Vegetation and associated habitat would no longer interact at the water's edge in the creek as riprap would now clearly delineate the edge.

During construction, visual resources could be temporarily impacted by construction activities related to implementing the channel enlargement and by transport activities needed to move equipment and materials to and from the site. This temporary impact would most likely affect visual resources from the immediate roadways and adjacent, developed land uses.

Cumulative impacts to visual resources would be the additive combination of impacts by this and other Federal, state, local, and private flood risk management efforts, including, but not limited to the Mississippi River Levee and the Arkabutla Lake reservoir on the Coldwater River. Similar water training devices in waterways would continue to interrupt the interaction of vegetation and associated habitat at the water's edge as shorelines and banks are defined and reinforced by efforts to reduce flood risk.

Detention site (Lateral D)

The proposed detention sites would directly impact visual resources as localized stands of forest vegetation would be removed and clear-cut detention basins would remain in place. These detention basins would be slightly recessed in grade and be vegetated with low-growing grasses. At times, these basins would detain water during high-water events long enough for water levels to recede. Visual resources from the immediate roadways and adjacent, developed land uses would be altered from woodland wildlife habitat to low-lying grasslands for foraging wildlife habitat. Waterfowl habitat may be present during high-water events.

During construction, visual resources could be temporarily impacted by construction activities related to implementing the smaller detention sites on Horn Lake Creek tributaries and by transport activities needed to move equipment and materials to and from the site.

This temporary impact would most likely affect visual resources from the immediate roadways and adjacent, developed land uses.

Cumulative impacts to visual resources would be the additive combination of impacts by this and other Federal, state, local, and private flood risk management efforts, including, but not limited to the Mississippi River Levee and the Arkabutla Lake reservoir on the Coldwater River. Deforestation of localized stands of forest vegetation for developed land uses would continue to drive woodland wildlife habitats further away from development.

6.1.4.1.6 Recreation

Extended Channel Enlargement

The proposed channel enlargement could directly impact land used by the City of Southaven's *Cherry Valley Park and Greenspace* located at 7505 Cherry Valley Drive. The proposed channel enlargement is on the southeast perimeter of land used by *Cherry Valley Park and Greenspace*. The channel enlargement footprint does not currently see a high level of user activity as most recreational use occurs in the northwest sector of the property.

Access to the Horn Lake Channel within the property is limited to foot traffic. See Appendix N, Figure N-3. for Recreation at Channel Enlargement.

The proposed channel enlargement could indirectly impact land used by *Cherry Valley Park and Greenspace*. During construction, recreational resources could be temporarily impacted by construction activities related to implementing the proposed channel enlargement and by transport activities needed to move equipment and materials to and from the site. Dust and

associated noise may temporarily impact those recreational facilities that are in the vicinity of the proposed channel enlargement. Future feasibility and design of the proposed channel enlargement site would incorporate best management practices with sensitivity to recreational resources that may be impacted within the land used by the City of Southaven's *Cherry Valley Park and Greenspace.*

Detention sites (Cow Pen, Lateral D and Rocky)

The proposed Cow Pen Creek detention site would directly impact the City of Horn Lake's Wooten Park, 2690 Nail Rd W, and *Kentwood North*, 2622 Brachton Cv E. Wooten Park features a playground, paved walking trails, pavilion with picnic tables, restrooms, swings and baseball fields which are within the footprint of the proposed Cow Pen Creek Detention site. Kentwood North offers swings, a slide and picnic tables which are within the footprint of the proposed Cow Pen Creek Detention site. The proposed Rocky Creek detention site would directly impact the City of Southaven's *Central Park* located at 7505 Stonegate Boulevard. *Central Park* features a playground, pavilion, backstops, disc golf, and walking trails which are partially within the footprint of the proposed Rocky Creek detention site. See Appendix N, Figure N-4. for Recreation at Cow Pen Creek Detention Site.

The proposed detention site at Lateral D should not have any direct impacts to recreational resources.

The proposed Rocky Creek detention site is east of Greenbrook Softball Complex located at 800 Stonewood Dr. and separated by Swinnea Road. Central Park is also partially within the footprint of the proposed Rocky Creek detention site. During construction, recreational resources could be temporarily impacted by construction activities related to implementing the proposed Rocky Creek detention site and by transport activities needed to move equipment and materials to and from the site. Dust and associated noise may temporarily impact those recreational facilities that are in the vicinity of the proposed detention site.

Future feasibility and design of the proposed site would incorporate best management practices with sensitivity to recreational resources that may be impacted within the City of Southaven's Central Park and Greenbrook Softball Complex. See Appendix N, Figure N-5. for Recreation at Rocky Creek Detention Site.

Cumulative impacts to recreational resources would be the additive combination of impacts by this and other Federal, state, local, and private flood risk management efforts, including, but not limited to the Mississippi River Levee and the Arkabutla Lake reservoir on the Coldwater River.

6.1.4.1.7 Environmental Justice

HLC Channel Enlargement (Extended)

Impacts to areas of EJ concern from construction of the HLC channel enlargement would be similar to the impacts discussed for Alternative 5A, Section 6.1.2.1.7. All communities would experience the flood risk management benefits associated with the improvement. The

indirect impact from construction activities to areas of EJ concern could create interruptions and noise to surrounding neighborhoods. Both EJ and non-EJ communities would be impacted by the temporary, indirect impacts of constructing the enlargement. Best Management Practices will be utilized to avoid and reduce these temporary and minor construction-relation impacts.

Three detention sites

Cow Pen, Lateral D and Rocky Creek detention basins are considered as measures in this alternative to reduce the risk of flooding in the study area and are shown in relation to Areas of EJ Concern on Figure 6-3. Detention basins are regional, below grade structures, designed to attenuate flood peaks and release downstream at non-damaging flow rates.

The detention basin measures would not result in disproportionate significant adverse environment effects on areas of EJ concern. The Lateral D and Cow Pen detention basins are near areas of EJ concern. The Lateral D Detention Basin is not located near areas of EJ concern.

Over 50 percent of the population within a census block group just north of the Lateral D basin identifies as being minority. Impacts to this area are discussed for Alternative 6A, Section 6.1.3.1.7. This area is not a low-income community with well under 20 percent households in the area having incomes below poverty. The community may experience temporary indirect impacts from the construction of the Lateral D basin and are not considered high, adverse impacts. Best Management Practices will be implemented that will minimize/reduce or avoid traffic and noise disturbances such as using traffic routes to reduce neighborhood disturbance or limiting construction activities to daytime to reduce noise impacts.

The Cow Pen detention basin site is situated among two areas of EJ concern. Census Glock Group 703221 surrounds the proposed site and is home to a majority of residents identifying as minority. Just north the proposed Cow Pen Creek detention basin is an area of EJ concern noted by over 20 percent of residents living below the poverty level. Similar types of impacts could be felt by residents in these communities as were discussed for the Lateral D detention Basin, Section 6.1.3.1.7.

Additionally, all the lands needed for the detention basins are currently vacant of residential structures. Positive indirect impacts include a decrease in risk of flood damage for minority and/or low-income populations in the study area. Alternative 7 would not result in adverse disproportionate significant direct environment or economic effects on areas of EJ concern. In addition, the contractor, as a best management practice, and as practicable, would restrict work to regular business hours (approximately 0700-1900) on weekdays to reduce potential effects from noise and increased truck traffic to the identified existing EJ community and general public. These conditions would be expected to return to normal after the channel work is completed.

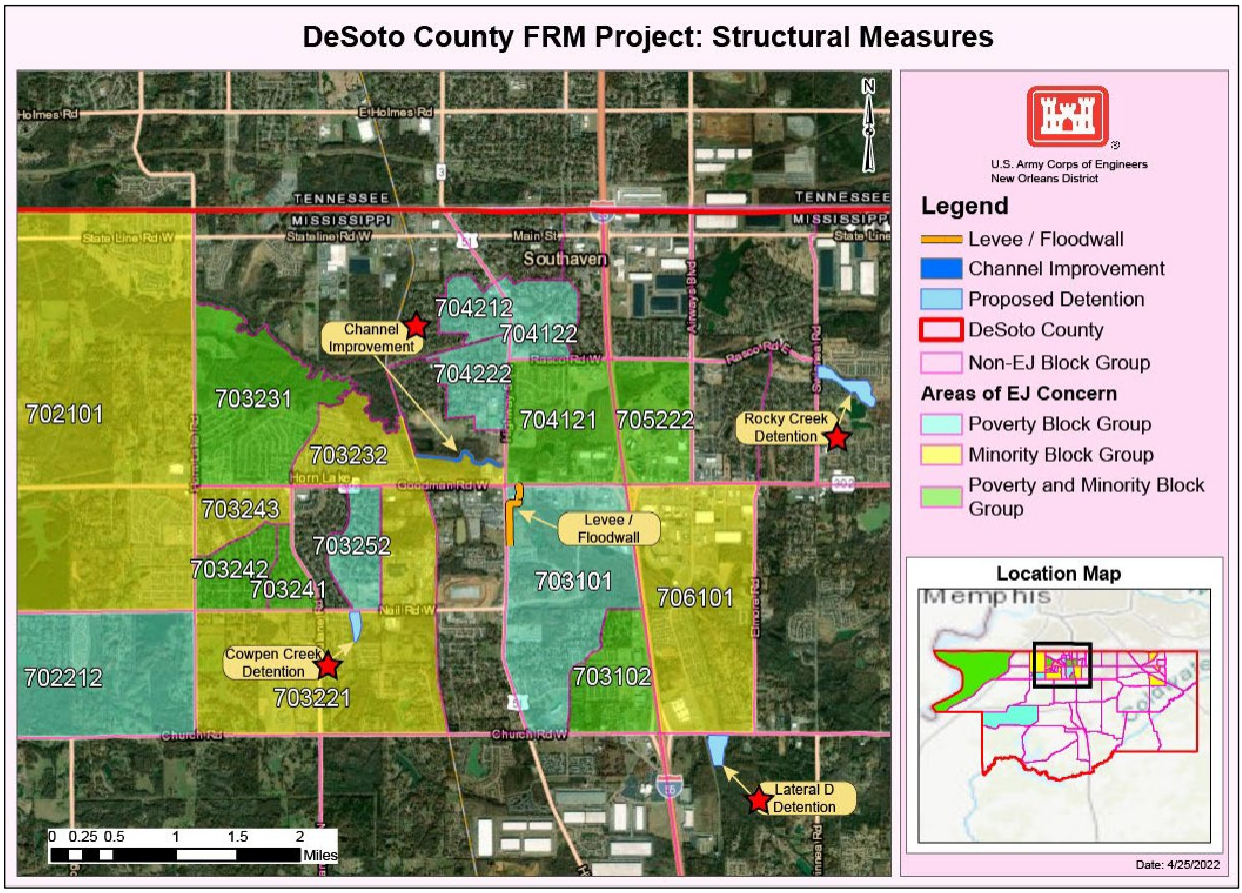

Figure 6-3. Plan 7 and Areas of EJ Concern

Source: Map Census block group polygons and census data from Steven Manson et al., IPUMS. 2021. http://doi.org/10.18128/D050.V16.0

6.1.5 Plan 8a – Levee and Floodwall System

Plan 8a includes the construction of an approximately 3,000 linear foot levee and floodwall system that would reduce flood risk to structures in Horn Lake, Mississippi from Highway 51, downstream to Goodman Road. The levee would be constructed with minimum 3-foot horizontal to 1-foot vertical (3H:1V) side slopes 12-foot crown width. The levee would run approximately 2,475 linear feet adjacent to US Highway 51 with an average height of 5 feet. A 600 linear foot ditch would drain a depression on the riverside of the levee. Where development makes the footprint of the levee infeasible, the levee would transition to a 525 linear foot floodwall. The floodwall would be constructed at a thickness of 18 inches thick and an 8-foot foundation width. The wall height is approximately 5 feet with approximately 3.5 feet above ground level. The levee construction would require approximately 14,000 cubic yards of earthen material, and the floodwall would require 300 cubic yards of reinforced concrete. This alternative would require the relocation of several utility poles and signs, removal and replacement of asphalt, and demolition of an existing building.

Two potential borrow areas have been identified that may provide the approximately 14,000 cubic yards of earthen material to construct the proposed levee, illustrated in figure 6-4. The first is an on-site borrow area, which would be designed to provide wetland and BLH functions once construction is complete. An on-site borrow source would also have a lower cost than an off-site source, with fewer social impacts, such as traffic due to hauling, aesthetics, and noise and dust due to construction. This site is currently the preferred proposed borrow site; however, further investigation is required during detailed design development. Another potential site has been identified and is located near Cow Pen Creek, in the southeast corner of the intersection of Nail and Hurt Roads. While these sites have been identified as potential locations for borrow, no detailed design has occurred. The material for the levee embankment must be constructed with clay or, at a minimum, a 2- foot clay cap to prevent seepage issues in the newly constructed levee. Additional borings at either site would be required to ensure the availability of appropriate material quality and quantity. Excavation depth must not extend to the depth of a pervious layer, as this could create direct seepage entrance condition to the levee. If it is determined that these sites do not meet the requirements for levee construction, additional sites would be identified.

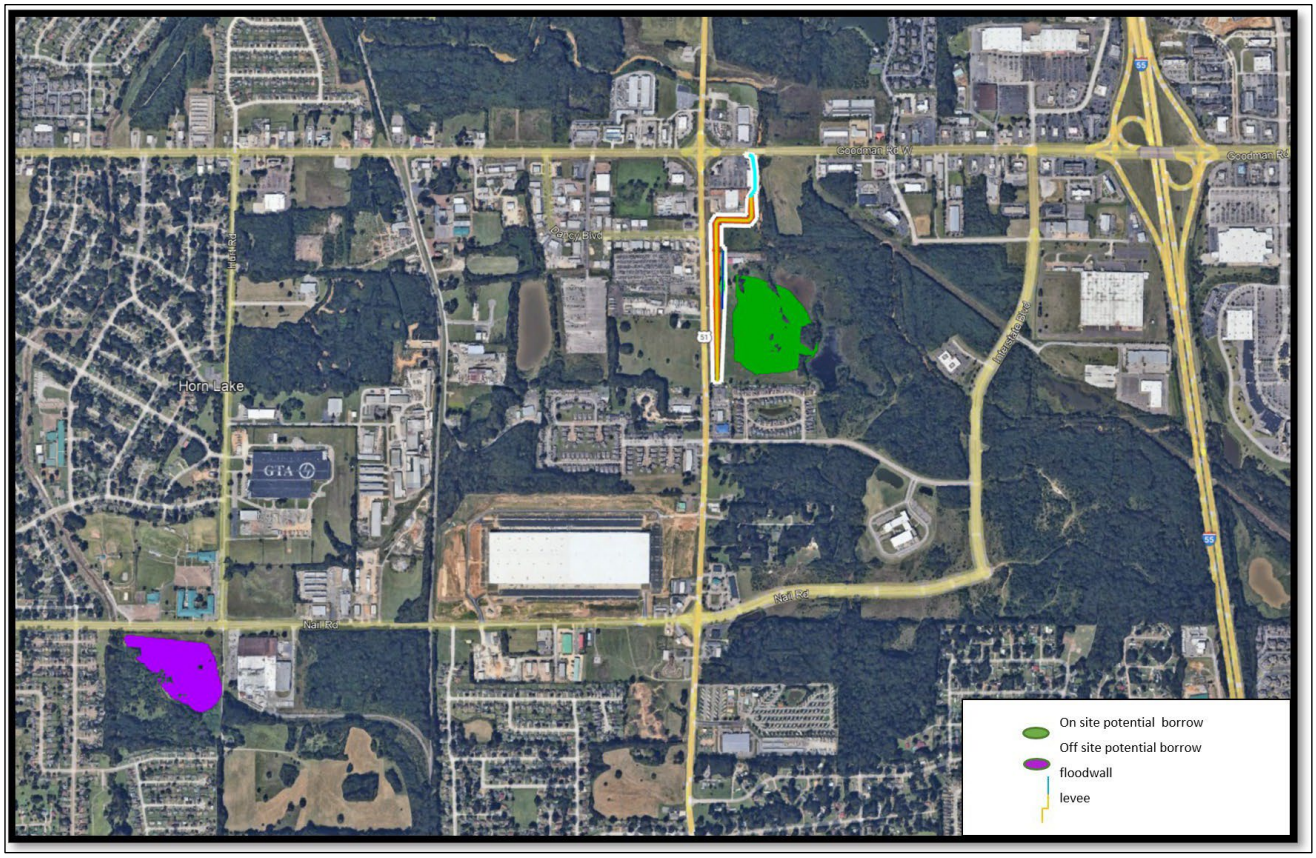

Figure 6-4. Potential Borrow Sites

6.1.5.1 Relevant Resources Affected and Expected Impacts (Affected Environment and Environmental Consequences)

This alternative was determined to have no effect on the following resources: Prime and unique farmland; Upland Forest.

6.1.5.1.1 Wetlands and Bottomland Hardwood Forest

With implementation of the Plan 8s USACE has determined that no significant impacts to wetlands or BLH forest would occur with the implementation of this alternative. While a small number of trees would likely be cleared, the overall environmental impact is negligible. The proposed borrow area would provide opportunities for ecosystem restoration. As detailed designs are developed, wetland features to include microtopography and reforestation would be incorporated into the proposed borrow area, improving the overall wetland and BLH acreage in Desoto County. Benefits for the NER plan for Horn Lake Creek are expected to be accrued along the riverside of the levee once the levee and floodwall construction is complete. If the proposed on-site borrow source is determined to be infeasible during detailed design, ecosystem restoration would still be feasible on the riverside of the levee.

6.1.5.1.2 Water Quality and Aquatic Resources

Water quality and aquatic resources would be expected to improve as compared to the existing conditions and future without project. The proposed floodwall construction would occur along a highly impacted reach of Horn Lake Creek. Commercial development and parking lot pavement currently exists to the top left descending bank of the stream immediately upstream (south) of Goodman Road. A substantial amount of storm-water runoff from parking lots and litter from the overflow of garbage bins occurs in the proposed floodwall reach of the stream which adversely impacts water quality. The majority of the proposed levee would be constructed near Highway 51 and spaced at a distance greater than approximately 450 feet from the stream, allowing native revegetation and reforestation. Detailed plans have not been developed, as use of the area as a borrow site has not been fully determined. Water quality and aquatic resources are expected to improve with the proposed FRM and NER actions.

6.1.5.1.3 Wildlife

Species biodiversity and wildlife habitat would be expected to improve as compared to the existing conditions and future without project. The proposed floodwall construction would not impact aquatic wildlife. Allowing native revegetation and reforestation on the riverside of the levee would improve the wildlife utilization in the area, providing a refuge from the urban development. Water quality and aquatic resources are expected to improve with the proposed.

6.1.5.1.4 Cultural Resources

This alternative would be unlikely to have any impact on known cultural resources. The majority of this alternative has been previously surveyed for the last 40 years and no eligible resources are located within the project area. The USACE has developed a programmatic agreement with the MS SHPO and Federally recognized tribes to establish protocols for additional surveys prior to construction, see Appendix F for specifics on this document. If

necessary, additional impacts will be addressed following the provisions of the programmatic agreement.

6.1.5.1.5 Aesthetics

The proposed levee and floodwall would parallel and be visible from Highway 51 and the intersection with Goodman Road. The proposed levee and floodwall would be constructed on approximately 8 acres of mostly open land, with the floodwall occurring behind a shopping center. There is also an abandoned building and parking lot in deteriorating condition that would be demolished and removed. The proposed levee, once constructed, would remain similarly vegetated as the existing condition, with regularly mowed grass for maintenance and inspection purposes. The reforestation, noted above, along the riverside of the levee would integrate the flood damage reduction system with the surrounding natural and human environment while creating a pleasant environment for human use and potential recreation opportunities. If it is determined that the area is suitable for use as a borrow source for the levee, the design would incorporate nature-based features such as microtopography and appropriate native vegetation to integrate aquatic resources with the landscape planting plan. The plan would respond appropriately to the visual character of the projects' urban context with respect to the characteristics of both the natural and built landscapes. The landscape planting plan would be fully coordinated with the local sponsor, interagency team and consulting Federally recognized Tribes during planning and design to determine the and incorporate needs and expectations. During construction, visual resources may be temporarily impacted by construction activities related to implementing the levee and floodwall and by transport activities needed to move equipment and materials to and from the site. This temporary impact would most likely affect visual resources from the immediate roadways and surrounding areas. This type of activity is regularly occurring in the Horn Lake area, as many commercial and industrial activities are under construction.

6.1.5.1.6 Recreation

The proposed levee floodwall would generate direct positive impacts for recreation. Imagine Horn Lake 20/20, the City's 2003-2013 Comprehensive Plan, strives to continue to maintain the favorable parkland to population ratio the city has achieved. "Fragile areas susceptible to degradation as a result of urban development, areas along streams/creeks/rivers, and areas that possess special scenic or recreational value should be conserved as open space." The area between the levee and the creek would be reforested which would provide additional wildlife habitat and opportunities for wildlife viewing. The proposed borrow area, located in the same area, would be designed for aquatic resources and environmental enhancements. Specific design guidelines for the borrow area can be found in "Environmental Design Considerations for Main Stem Levee Borrow Areas along the Lower Mississippi River, Lower Mississippi River Environmental Program, Report 4, April 1986." Design of the borrow area would be in accordance with this guidance and the Environmental Design of Borrow Areas found in the recreation appendix of this document, where practical. The borrow area would provide fishing habitat as well as scenic qualities creating recreational fishing activities.

The area proposed for construction of the levee and floodwall is not currently used for recreation; therefore, no impacts to recreation would occur. The reforestation, noted above, would improve opportunities for recreation creating a pleasant environment for human use and potential recreation opportunities such as wildlife observation and hiking trails.

6.1.5.1.7 Environmental Justice

Levee and Floodwall System

EO 14008, Tackling the Climate Crisis at Home and Abroad, Section 219, in part, directs Federal agencies to document project economic benefits to areas of EJ concern. This EJ analysis discusses project alternative and how areas of EJ concern benefit both directly and indirectly. The Justice 40 Initiative is also discussed (see section 3.2.1.2.4) as per the most recent Executive Order; however, a Justice 40 analysis is not presented for this project since the final interim guidance on implementation of Environmental Justice and the Justice40 Initiative, dated March 2022, was received after the draft report was completed.

Levee and Floodwall Flood Risk Management Positive Benefits to Structures and Roadways

There are no high, adverse disproportionate impacts associated with the construction or operation of the levee/floodwall project. Areas of EJ concern will benefit from the reduction in flood risk to residential and commercial structures located throughout the study area (Figure 6-4.). The structures that are shown on the map (green and blue dots) are expected to receive lower flood stages with the levee in place. There are 180 total structures that are expected to receive benefits from the levee/floodwall, 140 are residential and 40 nonresidential (34 commercial, 2 public, and 4 industrial).

Of the 140 residential structures benefiting from the levee, 24 structures are in areas of EJ concern. The lowering of the flood stage to residents in areas of EJ concern is a direct benefit of the project. Additionally, there are 38 non-residential properties in areas of EJ concern that will benefit from the levee/floodwall. Residents in the areas of EJ concern will indirectly benefit from the flood risk management as commercial businesses will be able continue to operate and provide goods and services to residents, when in the past they may be forced to close due to flooding. The local economy will also benefit from many of these commercial businesses no longer being shut down due to inundation; generating more revenue and taxes than if the levee is not built.

In all, 24 residential structures benefiting from the project area in areas of EJ concern, many of them are in Census Tract 705222, which is an area of EJ concern based upon both the minority and poverty threshold criteria. Thirty-eight non-residential structures in are in EJ block group number 703222. All of these properties will benefit from the risk management system due to a lowering of the flood stage.

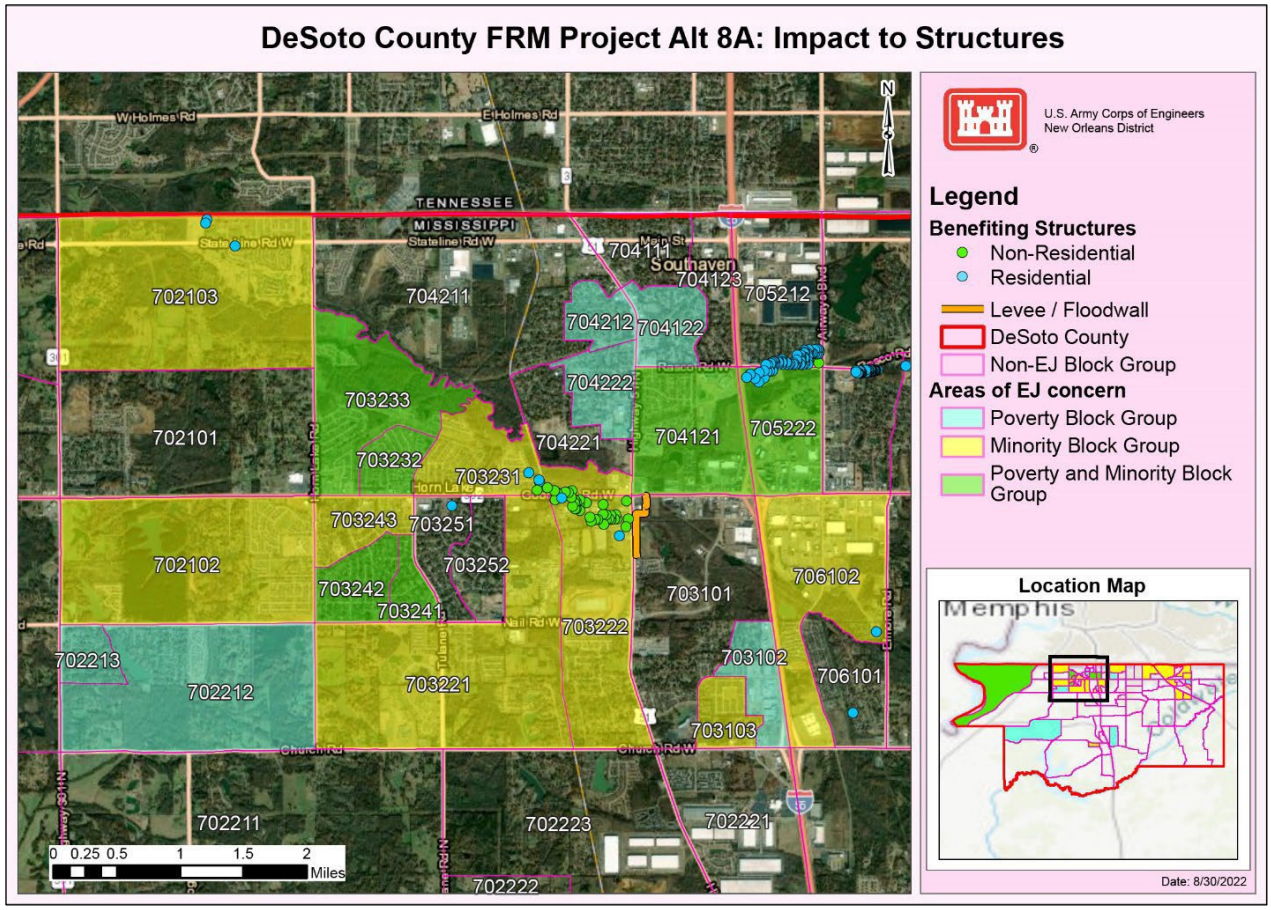

Figure 6-5. Alt 8a: Structures Benefited by the Levee and Floodwall System

Roadways, too, will benefit from the proposed levee project due to a lowering of the flood stage resulting in less flooding, road closures, and detours. Roadways expected to have a lowering flood stage with the levee in place are shown as purple lines on Figure 6-6., Census Tract 704222. Roadways shown in black will have residual flooding or flooding the continue to occur even after the levee/floodwall are constructed, Census Tract 704121.

Mitigation of the residual roadway floodway is expected to occur in the apartment complex north of Goodman Road along Sutton Place. The mitigation of residual roadway flooding is discussed below.

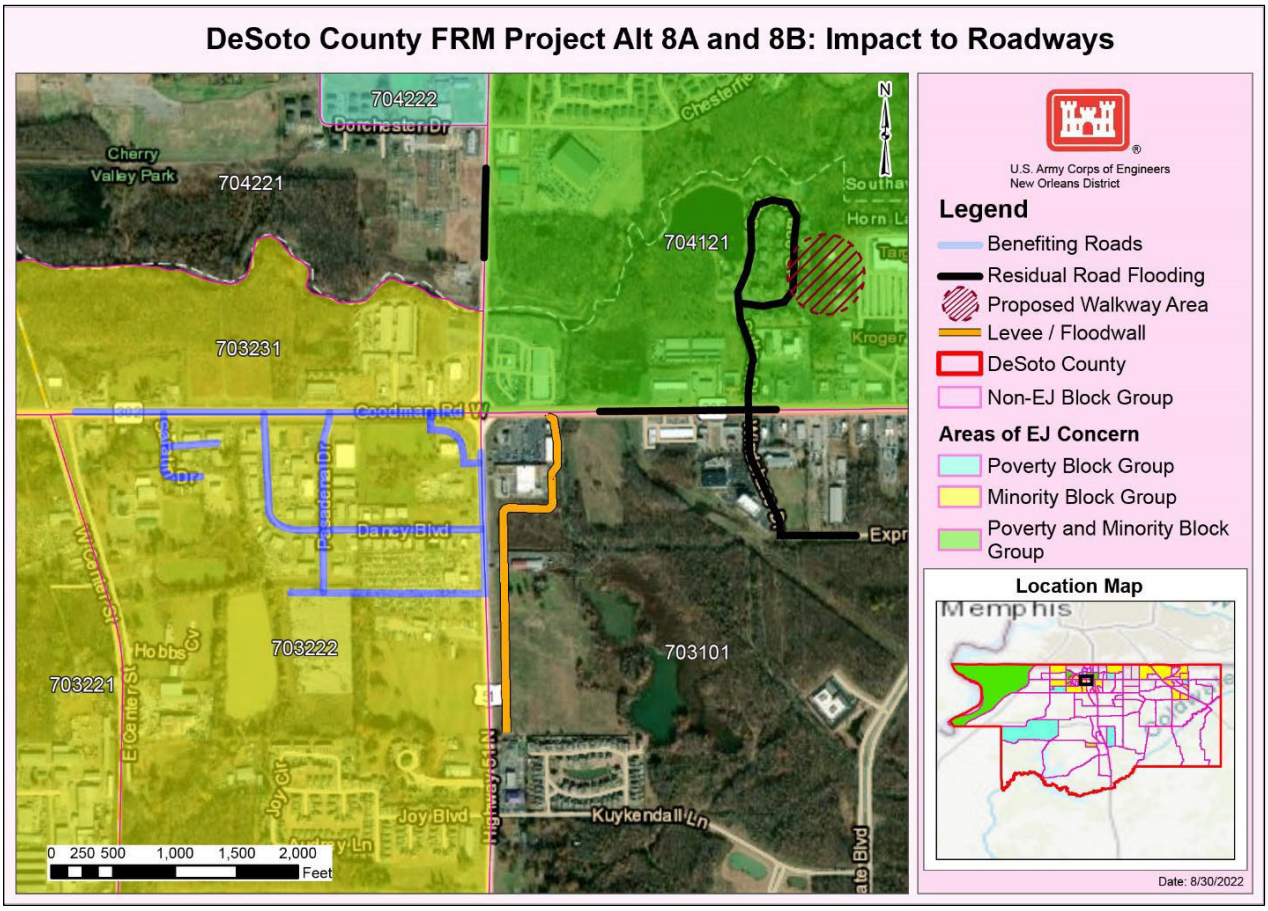

Figure 6-6. Alt 8a and 8b: Desoto FRM, Roadway Flood Stage Lowering

Source: Map Census block group polygons and census data from Manson et. al. IPUMS. 2021. http://doi.org/10.18128/D050.V16.0

Levee/Floodwall Adverse Impacts: Construction-Related Impacts to Areas of EJ Concern

As stated earlier, there are several Areas of EJ Concern near the proposed levee alignment that could be temporarily adversely affected by construction activities, including impacts to traffic and from construction noise. In general, the construction of the proposed levee may cause adverse temporary impacts on the road network near the site due to increased congestion, accelerated roadway wear-and-tear, and traffic delays resulting from re-routing major and local access roads. Temporary impacts on transportation due to increased congestion may occur and is dependent on road closures required to construct the levee.

Road closure, if required, will be for the short-term. On those segments of roads where traffic will be re-routed, minor to moderate delays, particularly during peak hours, may occur especially in more congested areas.

Noise along all segments of levee construction would increase due to the temporary operation of equipment and vehicles used in the construction of the levee. While noise impacts may cause a temporary inconvenience to Areas of EJ Concern and facilities in the

immediate area, noise levels associated with construction activities would be temporary and monitored to ensure acceptable standards are maintained. No permanent noise impacts as a result of construction are expected, and all noise emissions are expected to be short-term, lasting only as long as construction activities.

Mitigation of Construction-Related Impacts to Areas of EJ Concern:

Several impact avoidance features are included as integral components of the proposed action to minimize impacts to vehicular transportation. Specific routes would be designated for construction-related traffic to minimize residential disturbance and traffic congestion.

USACE contracts would designate specific routes for construction-related traffic to avoid residential areas, to the maximum extent practicable, and staging areas for construction equipment and personnel would be located away from heavily populated areas. Streets that would serve construction-related traffic would be resurfaced, if needed and as appropriate, prior to initiation of construction activities, and maintenance of those streets would be provided during the construction period. Appropriate detour signage would be placed in order to preserve access to local streets during construction activities. Off-street parking would be provided for construction workers, and shuttle vans would be used to transport construction workers to the work sites, if necessary. Streets that are damaged by any and all construction activities would be repaired.

No long-term indirect effects on noise are anticipated. Short-term noise impacts will be avoided, minimized or mitigated by use of the following best management practices and may include placement of temporary noise barriers adjacent to construction activities.

If machinery causing vibrations is used, the following noise and vibration monitoring language will be included in the contract specifications for specific Work Items: monitoring of noise levels to verify adherence to contract specifications; limiting pile driving activities associated with pile founded T-walls to daylight hours; and vibration monitoring equipment will measure surface velocity waves caused by equipment and monitor vibration up to a threshold value established and approved in writing by USACE. Such measurements would only be taken near residences and occupied buildings that could be adversely affected by excessive ground vibrations.

More information on Mitigation of Construction Activities, including Noise impacts, is provided in Appendix M.

Mitigation of Residual Roadway Flooding Impacts to Areas of EJ Concern:

The PDT worked to identify a plan that would minimize roadway flooding along Highway 51 and Goodman Road. However, no plan feature was effective at reducing roadway flooding. While the extent of the roadway flooding has not increased in the modeled future with the levee and floodwall project condition, the levee and floodwall system may increase the time that floodwater overtops Goodman Road during less frequent events (100 yr. and 500 yr.). The duration of flooding may increase by up to 2 hours in the future if the levee and floodwall

system is constructed. The PDT will continue to evaluate the frequency that the roadway is expected to overtop and identify alternative pathways to critical infrastructure.

6.1.6 Plan 8b – Levee and Floodwall System Combined with Dry Floodproofing 21 commercial structures and 14 residential structures, The RP

Plan 8b includes the construction of same levee and floodwall system identified in section 6.1.5 and 6.1.6. In addition, plan 8b includes dry floodproofing for 21 commercial structures and 14 apartment buildings included in an EJ community that are at risk of flooding in the future without project. Plan 8b provides significant flood risk management in terms of national economic development along with the added benefit of flood risk management to vulnerable and disadvantaged communities.

6.1.6.1 Relevant Resources Affected and Expected Impacts (Affected Environment and Environmental Consequences)

This alternative was determined to have no effect on the following resources: Prime and unique farmland; Upland Forest.

6.1.6.1.1 Wetlands and Bottomland Hardwood Forest

With implementation of the NED Plan, the USACE has determined that no significant impacts to wetlands or BLH forest would occur with the implementation of this alternative. While a small number of trees would likely be cleared, the overall environmental impact is negligible. The proposed borrow area would provide opportunities for ecosystem restoration. As detailed designs are developed, wetland features to include microtopography and reforestation would be incorporated into the proposed borrow area, improving the overall wetland and BLH acreage in Desoto County. Benefits for the NER plan for Horn Lake Creek are expected to be accrued along the riverside of the levee once the levee and floodwall construction is complete. If the proposed on-site borrow source is determined to be infeasible during detailed design, ecosystem restoration would still be feasible on the riverside of the levee.

6.1.6.1.2 Water Quality and Aquatic Resources

Water quality and aquatic resources would be expected to improve as compared to the existing conditions and future without project. The proposed floodwall construction would occur along a highly impacted reach of Horn Lake Creek. Commercial development and parking lot pavement currently exists to the top left descending bank of the stream immediately upstream (south) of Goodman Road. A substantial amount of storm-water runoff from parking lots and litter from the overflow of garbage bins occurs in the proposed floodwall reach of the stream which adversely impacts water quality. The majority of the proposed levee would be constructed near Highway 51 and spaced at a distance greater than approximately 450 feet from the stream, allowing native revegetation and reforestation. Detailed plans have not been developed, as use of the area as a borrow site has not been fully determined. Water quality and aquatic resources are expected to improve with the proposed FRM and NER actions.

6.1.6.1.3 Wildlife

Species biodiversity and wildlife habitat would be expected to improve as compared to the existing conditions and future without project. The proposed floodwall construction would not impact aquatic wildlife. Allowing native revegetation and reforestation on the riverside of the levee would improve the wildlife utilization in the area, providing a refuge from the urban development. Water quality and aquatic resources are expected to improve with the proposed.

6.1.6.1.4 Cultural Resources

This alternative would be unlikely to have any impact on known cultural resources. The majority of this alternative has been previously surveyed for the last 40 years and no eligible resources are located within the project area. The USACE has developed a programmatic agreement with the MS SHPO and Federally recognized tribes to establish protocols for additional surveys prior to construction, see Appendix F for specifics on this document. If necessary, additional impacts will be addressed following the provisions of the programmatic agreement.

6.1.6.1.5 Aesthetics

The proposed levee and floodwall would parallel and be visible from Highway 51 and the intersection with Goodman Road. The proposed levee and floodwall would be constructed on approximately 8 acres of mostly open land, with the floodwall occurring behind a shopping center. There is also an abandoned building and parking lot in deteriorating condition that would be demolished and removed. The proposed levee, once constructed, would remain similarly vegetated as the existing condition, with regularly mowed grass for maintenance and inspection purposes. The reforestation, noted above, along the riverside of the levee would integrate the flood damage reduction system with the surrounding natural and human environment while creating a pleasant environment for human use and potential recreation opportunities. If it is determined that the area is suitable for use as a borrow source for the levee, the design would incorporate nature-based features such as microtopography and appropriate native vegetation to integrate aquatic resources with the landscape planting plan. The plan would respond appropriately to the visual character of the projects' urban context with respect to the characteristics of both the natural and built landscapes. The landscape planting plan would be fully coordinated with the local sponsor, interagency team and consulting Tribes during planning and design to determine the and incorporate needs and expectations. During construction, visual resources may be temporarily impacted by construction activities related to implementing the levee and floodwall and by transport activities needed to move equipment and materials to and from the site. This temporary impact would most likely affect visual resources from the immediate roadways and surrounding areas. This type of activity is regularly occurring in the Horn Lake area, as many commercial and industrial activities are under construction.

6.1.6.1.6 Recreation

The proposed levee floodwall would generate direct positive impacts for recreation. Imagine Horn Lake 20/20, the City's 2003-2013 Comprehensive Plan, strives to continue to maintain the favorable parkland to population ratio the city has achieved. "Fragile areas susceptible to degradation as a result of urban development, areas along streams/creeks/rivers, and areas that possess special scenic or recreational value should be conserved as open space." The area between the levee and the creek would be reforested which would provide additional wildlife habitat and opportunities for wildlife viewing. The proposed borrow area, located in the same area, would be designed for aquatic resources and environmental enhancements. Specific design guidelines for the borrow area can be found in "Environmental Design Considerations for Main Stem Levee Borrow Areas along the Lower Mississippi River, Lower Mississippi River Environmental Program, Report 4, April 1986." Design of the borrow area would be in accordance with this guidance and the Environmental Design of Borrow Areas found in the recreation appendix of this document, where practical. The borrow area would provide fishing habitat as well as scenic qualities creating recreational fishing activities.

The area proposed for construction of the levee and floodwall is not currently used for recreation; therefore, no impacts to recreation would occur. The reforestation, noted above, would improve opportunities for recreation creating a pleasant environment for human use and potential recreation opportunities such as wildlife observation and hiking trails.

The nonstructural features would have no impact to recreational resources depending on the methods used. A direct impact from floodproofing recreational buildings is that recreational use would be temporarily unavailable during flood proofing work. An indirect impact of elevating structures is that building costs of future recreational buildings may limit the number of facilities being constructed.

6.1.6.1.7 Environmental Justice

Plan 8b-Levee and Floodwall System and Floodproofing 21 Commercial Structures and 14 residential structures

Alternative 8b includes floodproofing of 14 apartment buildings in an area of EJ concern that were not included in the NED plan. As discussed in the ASA 2022 March memorandum titled, "Implementation of Environmental Justice and the Justice40 Initiative", "….we will take a more proactive approach towards achieving environmental justice. This may take time to achieve, but the end result will be an approach to studies which will focus on a comprehensive evaluation of the total benefits of each plan including equal consideration of applicable benefit types in the study scope of work where the disadvantaged communities play a key role in the effort to advance their needs. This new approach goes beyond "doing no harm" to focus on putting disadvantaged communities at the front and center of studies". For this reason, Alternative 8b goes beyond the NED plan and includes an added measure of voluntary dry floodproofing for an area of EJ concern to reduce the risk from residual flooding for 14 residential and 21 adjacent commercial structures.

There are no high, adverse disproportionate impacts associated with the construction or operation of the levee/floodwall and the implementation of the NS plan. The following discussion details the benefits and adverse impacts of Plan 8b which includes the levee and

floodwall and the nonstructural measure (voluntary commercial and residential structure dry floodproofing).

Levee/Floodwall Flood risk management Positive Benefits to Structures and Roadways

Areas of EJ concern will benefit from the reduction in flood risk to residential and commercial structures located throughout the study area and a reduction in roadway flooding (Figure 6-6.). Benefits to 180 structures, some in areas of EJ concern, associated with the levee/floodwall are discussed under Alternative 8a in section 6.1.5.1.7 and would be the same for Alternative 8b since this alternative includes the structural measure (levee/floodwall). Additionally, Alternative 8b includes a NS plan which offers voluntary dry floodproofing to 35 structures in the study area.

The Nonstructural Plan Benefits to Areas of EJ Concern

Construction of the levee will not reduce all of the flooding that the study area may experience under the future without-project condition. There are 35 structures, 21 commercial structures south and west of Goodman Rd and Hwy 51 in Census Tract 704121 and 14 residential structures in Census Tract 704121, in an apartment complex north of Goodman Road along Sutton Place, that may continue to flood once the levee/floodwall is built. Because of this risk and uncertainty, these 35 structures are part of the non-structural plan which includes voluntary dry floodproofing to the owners of the 35 properties, shown as red and yellow dots on Figure 6-7. A portion of the 35 structures eligible for voluntary dry floodproofing are located in areas of EJ concern, particularly Census Tract 704121. This action would reduce any residual flooding. Floodproofing commercial structures will positively affect the economic fabric of the neighborhood and the resident's well-being by these businesses not continually flooding. Residential floodproofing will also directly impact the tenants of the apartment complex that may continue to flood once the levee/floodwall is built by reducing their flood risk. For more information on the voluntary dry floodproofing NS plan, see Appendix D. Nonstructural Implementation Plan.

Dry floodproofing consists of sealing all areas below the flood damage risk reduction level of a structure to make it watertight and ensure that floodwaters cannot get inside by making walls, doors, windows and other openings impermeable to water penetration. Generally, dry floodproofing can 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, and back-flow 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.

Each of the 35 structures will be assessed to make sure that certain eligibility requirements are satisfied. For more information on eligibility to volunteer for dry floodproofing, refer to Section 2.1, Section 3 and Section 5.

6.2 EVALUATING ECOSYSTEM RESTORATION (ER) ALTERNATIVES

Table 6-2. compares the final array of ecosystem restoration alternatives and the NER which plan which is a combination of alternative 4 and 5 reforestation acreages. The NER plan is a combination of alternatives 4 and 5 across the 10 degraded streams. This alternative was produced by the cost effectiveness-incremental cost analysis (CE/ICA) model as described in section 5.7. Proposed plans are expected to have no effect on the following relevant resources that were discussed in Section 3. Existing Conditions: mesic upland forests, air quality, geology and soils, flood history, and socio-economic resources. These resources are not discussed further in Section 6.2.

Table 6-2. Ecosystem Restoration Alternatives with Benefits and Average Annual Cost

Alternative #	Alternative Features	Grade Control (#)	Riparian Restoration (acres)	Average Annual Habitat Unit (AAHU)	Average Annual Cost
No Action	The streams will continue to degrade, and banks will erode	-	-	-	-
Alternative 1	Grade Control on 10 streams	74	0	105.7	$1,057
Alternative 4	Grade Control plus adjacent riparian restoration on 10 streams	74	255	280	$1,725
Alternative 5b	Grade Control plus 10% riparian restoration on 10 streams	74	309	313	$1,774
NER Plan[1]	Grade Control plus adjacent riparian restoration on Camp, Nolehoe, and Red Banks and Grade Control plus 10% riparian restoration on the remaining 7 streams	74	327	31	$1,519

[1]This plan was produced by identified by the CE/ICA analysis as the best buy plan

6.2.1 No Action Alternative

This alternative would result in no action being taken. All future without project conditions are discussed in Section 3. With the no action alternative, streams would continue to destabilize, widen, and banks would continue to erode causing continued impacts from sedimentation, excess nutrients, and low dissolved oxygen. In addition, the widening would cause continued impacts to infrastructure, such as bridges and roads as well as residential property. Without construction of the NER Plan, it is estimated that approximately 190 acres of land adjacent to the final array of streams could be lost due to erosion and bank failures.

6.2.1.1 Relevant Resources Affected and Expected Impacts (Affected Environment and Environmental Consequences)

6.2.1.1.1 Wetlands and Bottomland Hardwood Forest

Wetlands and BLH forests would continue to be impacted by the existing conditions of the streams and adjacent land in the project areas without the construction of the project. In addition, as erosion and bank failures continue additional BLH/riparian forests would continue to fall into the streams causing additional scouring.

6.2.1.1.2 Water Quality and Aquatic Resources

Water quality and aquatic resources would continue to be impacted by problems within the stream including sedimentation, low dissolved oxygen and excess nutrient problems would be expected to improve over time with the implementation of the project. Erosion and bank failures along with incision, head-cutting, and commercial and residential development would also be expected to continue.

6.2.1.1.3 Wildlife

Without construction of the project, wildlife would continue to be impacted by the instability of the habitat in streams and adjacent lands. Steep banks limit wildlife access to the stream and the lack of in-stream structure limits utilization by macroinvertebrates impacting the food chain, as well as the reproductive needs of several aquatic species. The lack of forested habitat would continue to impact the Mississippi Flyway and limit organic input into the streams (such as leaf pack). Lack of cover also impacts the ability of species to move between areas limiting species dispersal.

6.2.1.1.4 Threatened and Endangered Species

Without construction of the project, the northern long-eared bat, along with noted species of special concern and other native wildlife would continue to be impacted by the lack of connected and forested BLH/riparian corridors and stable aquatic habitat in streams and adjacent lands in Desoto County, Mississippi.

6.2.1.1.5 Cultural Resources

The no action alternative is not likely to have any impact on known cultural resources.

6.2.1.1.6 Aesthetics

With the no action alternative, 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. BLH forests would continue to decline and be lost as streams incise and erode.

6.2.1.1.7 Recreation

With the no action alternative, 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.

6.2.1.1.8 Environmental Justice

Under the no action alternative, no restoration or stabilization would occur. There would be no direct impact on minority and/or low-income population groups under this alternative.

6.2.1.1.9 Prime and Unique Farmland

With the no action alternative, prime and unique farmland would continue to experience trends noted by agricultural land in general, with development, both industrial and residential, driven by projected population increases, expected to continue.

6.2.2 Alternative 1 - Grade Control

Alternative 1 would result in the construction of a total of 74 low-drop GCS within 10 streams totaling approximately 105.7 AAHUs (Table 6-2.). Stream reaches that were determined to be degradational were determined using fluvial geomorphology, as described in Appendix A).

6.2.2.1 Relevant Resources Affected and Expected Impacts (Affected Environment and Environmental Consequences)

6.2.2.1.1 Wetlands and Bottomland Hardwood Forest

With implementation of Alternative 1, approximately 190 acres of land, largely BLH, would be retained over the 50-year period of analysis; while 28.3 acres of BLH clearing would occur for the construction of the GCS, resulting in a net retention of 161.7 acres of BLH.

6.2.2.1.2 Water Quality and Aquatic Resources

Introduction and/or rehabilitation of GCS within the study streams would prevent or reduce the further degradation of the stream bed, also reducing the uncontrolled widening of the streams. Grade control would reduce water quality problems within the streams including sedimentation, low dissolved oxygen and excess nutrients. Producing a total of approximately 105.5 AAHUs, the GCS also prevent the loss of stream bank habitat and adjacent land. Erosion and bank failures along with incision and head-cutting, would also be expected to decrease.

Fish passage is highly impacted in all streams included within the study area by perched culverts, scour at hardpoints, excessive sedimentation and other barriers. Design of the low-drop GCS and bank stabilization would allow for the improvement of fish passage in the streams. Alternative 1 would provide connection in approximately 83 stream miles in DeSoto County, reconnecting impacted, and degrading stream reaches to the Coldwater River, Lake Arkabutla, and the MAP ecoregion (depending on the geographic of the streams and the direction of flow).

6.2.2.1.3 Wildlife

Construction of Alternative 1 would contribute to habitat stability along the study area streams in DeSoto County. Stabilization of the stream banks would improve wildlife access to the stream and the improvement of in-stream structure would increase utilization by

macroinvertebrates improving the food chain, as well as the reproductive needs of several aquatic species.

6.2.2.1.4 Threatened and Endangered Species

While aquatic habitat stability provided by grade control would provide some benefit to species such as aquatic endemic and/or species in need of conservation to include the Yazoo darter and Yazoo shiner, red-bellied dace, and piebald madtom (currently petitioned for listing under the ESA), the Federally threatened species, reclassified to endangered effective March 31, 2023, (NLEB) would continue to be impacted by the lack of adjacent forested habitat along the riparian areas the channels. In addition, the streams would not realize the full benefit of restoration provided by the input of organic materials, coarse woody debris, shade, and cover that is provided by a forested riparian buffer.

6.2.2.1.5 Cultural Resources

This alternative would be unlikely to have any impact on known cultural resources. The majority of this alternative has been previously surveyed for the last 40 years and no eligible resources are located within the project area. The USACE has developed a programmatic agreement with the MS SHPO and Federally recognized tribes to establish protocols for additional surveys prior to construction, see Appendix F for specifics on this document. If necessary, additional impacts will be addressed following the provisions of the programmatic agreement.

6.2.2.1.6 Aesthetics

Grade control would typically have positive direct impacts on aesthetics as it restores natural and scenic properties intrinsic to streams. However, due to the rural setting of these small streams, access is limited, and visibility remains low. Generally, immediate roadway crossings provide the primary public views into these drainage corridors. Potential impacts on aesthetics would be short-term and coincide with the duration of construction activities.

6.2.2.1.7 Recreation

The 74 proposed GCS are to occur within 10 streams. The structures would maintain and improve wildlife that benefits from pooling habitat created behind the structures.

Recreational-riparian activities such as bird watching and fishing would be enhanced. The proposed work activities would cause adverse, short-term direct and indirect impacts to wildlife species within the work areas during construction, but these impacts would be minor and temporary, and should not adversely or significantly impact area wildlife over the long-term.

6.2.2.1.8 Environmental Justice

Grade control would not cause direct impacts to EJ communities in the study area. GCS would be placed in streams in suburban/urban areas not impacting adjacent homeowners. Indirect impacts would occur and relate to the materials and equipment used to construct the

plan causing temporary minor construction-related impacts to nearby residents. Positive long-term benefits would accrue to the area from enhanced stabilization of the creeks.

6.2.2.1.9 6.2.2.1.0 Prime and Unique Farmland

Alternative 1 would prevent the future loss of prime and unique farmlands adjacent to the stream through the placement of the grade control and other stabilization features.

6.2.3 Alternative 4 – Grade Control with Associated Riparian Plantings

Alternative 4 would result in the construction of a total of 74 low-drop GCS and reforestation of approximately 255 acres would be implemented within 10 streams totaling approximately 280 AAHUs (Table 6-2.). GCS combined with associated riparian restoration was identified as a component of the NER Plan. Reforestation was determined using NLCD estimates of land cover within 328 feet of the stream on both banks in the reach where grade control is proposed. The land-use types that are considered reforestable include cultivated cropland, hay/pasture, shrub/scrub, barren land, and herbaceous. Areas that were not considered reforestable include developed areas (i.e., residential and commercial), forested land, emergent wetlands, etc. As plans develop, additional information would be provided on where reforestation would occur. For each stream, the benefits of different percentages of reforestation (10%, 25%, 50%, 75%, and 100%) were calculated using the Multi-scale Watershed Assessment model. Screening of alternatives is described in Section 4. Steam reaches that were determined to be degradational were determined using fluvial geomorphology, as described in Appendix C). With implementation of Alternative 4, the degradational areas of the streams within the study area would be stabilized, reducing sedimentation. In addition, it is expected that excess nutrients may also be reduced as the erosion of adjacent lands would be reduced, although this is difficult to quantify. In addition, the widening of streams would be reduced, preventing damage to infrastructure, such as bridges and roads as well as residential property. With construction of the NER Plan, it is estimated that approximately 190 acres of land adjacent to the final array of streams would be saved due to erosion and bank failures.

6.2.3.1 Relevant Resources Affected and Expected Impacts (Affected Environment and Environmental Consequences)

6.2.3.1.1 Wetlands and Bottomland Hardwood Forest

With implementation of Alternative 4, approximately 255 acres of native BLH species would be planted along the 10 study streams within the stream reaches where grade control is proposed. Alternative 4 would provide riparian corridors that would connect isolated stands of suitable habitat to larger forested blocks and wetlands. Approximately 190 acres of land would be retained. The main land use adjacent to the streams is a combination of narrow riparian buffer strips and farmland. It is assumed that the majority of land lost would be the narrow riparian buffer strips that currently exist along the streams It is likely that some BLH clearing would occur for the construction of the GCS; however, that acreage is not yet determined and would be outweighed by the acreage that would be retained by the introduction of grade control in the streams.

For acreage and AAHUs of each stream, refer to Table 5-6. A total of approximately 280 AAHUs would be restored due to reforestation of the reforestable acreage associated with the implementation of grade control (discussed further in Section 5.8.1.2). Reforestation of these acres would improve the Mississippi Flyway by increasing the acreage of BLH (a limiting habitat type), improving forage capacity, and cover and reproductive habitat.

Alternative 4 would increase connectivity in the form of forested corridors and provide for an increase in biodiversity.

6.2.3.1.2 Water Quality and Aquatic Resources

Introduction and/or rehabilitation of GCS within the study streams would prevent or reduce the further degradation of the stream bed, also reducing the uncontrolled widening of the streams. Grade control, as well as reforestation, would reduce water quality problems within the streams including sedimentation, low dissolved oxygen and excess nutrients. Producing a total of approximately 105.5 AAHUs, the GCS also prevent the loss of stream bank habitat and adjacent land. Based on the acreage of land that is estimated to be retained due to the GCS, an additional 255 AAHUs are expected to be retained from benefits associated with BLH reforestation. Water quality and aquatic resources would improve with the construction of the low drop GCS. Erosion and bank failures along with incision and head-cutting, would also be expected to decrease.

Fish passage is highly impacted in all streams included within the NER Plan by perched culverts, scour at hardpoints, excessive sedimentation and other barriers. Design of the GCS and bank stabilization would allow for the improvement of fish passage in the streams. The NER Plan would provide connection in approximately 83 stream miles in DeSoto County, reconnecting impacted and degrading stream reaches to the Coldwater River, Lake Arkabutla, and the Mississippi Alluvial Plain (MAP) ecoregion (depending on the geographic of the streams and the direction of flow).

6.2.3.1.3 Wildlife

Construction of the Alternative 4 would contribute to habitat stability along the study area streams in DeSoto County. Stabilization of the stream banks would improve wildlife access to the stream and the improvement of in-stream structure would increase utilization by macroinvertebrates improving the food chain, as well as the reproductive needs of several aquatic species. Aquatic species endemic to the area as well as Federally threatened species, reclassified to endangered effective March 31, 2023, (NLEB) are impacted by systemic degradation of stream and adjacent habitat. Per 88 Federal Rule 4908, NLEB was reclassified from a threatened to an endangered species under the Endangered Species Act with an effective date of March 31, 2023. Endemic and/or species in need of conservation include the Yazoo darter and Yazoo shiner, red-bellied dace, and piebald madtom (currently petitioned for listing under the ESA) could utilize additional habitats that would become accessible through this project.

The increase of approximately 255 acres of forested habitat would improve the Mississippi Flyway and increase organic input into the streams (such as leaf pack). The NLEB as well as neo-tropical

migratory birds would benefit from the reforestation within the project area. The NLEB would benefit from the addition of GCS, which would increase habitat for aquatic insects and pooling habitat. An increase of cover also improves the ability of species to move between areas limiting species dispersal. Reforestation and the reduction of stream degradation would increase biodiversity and improve the ability of species to utilize the study area.

6.2.3.1.4 Threatened and Endangered Species

With the implantation of Alternative 4, the aquatic habitat stability provided by grade control would benefit species such as aquatic endemic and/or species in need of conservation to include the Yazoo darter and Yazoo shiner, red-bellied dace, and piebald madtom (currently petitioned for listing under the ESA). In addition to the stream stabilization, reforestation would benefit the Federally threatened species, reclassified to endangered effective March 31, 2023, (NLEB) through the increase in adjacent forested habitat along the channels. The benefits realized from the restoration provided by the input of organic materials, coarse woody debris, shade, and cover that is provided by a forested riparian buffer would provide an increase in habitat that is limiting the utilization of DeSoto County streams by special status species.

6.2.3.1.5 Cultural Resources

This alternative would be unlikely have any impact on known cultural resources. The majority of this alternative has been previously surveyed for the last 40 years and no eligible resources are located within the project area. The USACE has developed and executed a programmatic agreement with the MS SHPO and Federally recognized tribes to establish protocols for additional surveys prior to construction, see Appendix F for specifics on this document. If necessary, additional impacts will be addressed following the provisions of the programmatic agreement.

6.2.3.1.6 Aesthetics

The proposed riparian buffer strips and grade control would have positive direct impacts on aesthetics as it restores natural and scenic properties intrinsic to streams. However, due to the rural setting of these small streams, access is limited, and visibility remains low.

Generally, immediate roadway crossings provide the primary public views into these drainage corridors. Potential impacts on aesthetics would be short-term and coincide with the duration of construction activities.

6.2.3.1.7 Recreation

<u>Riparian Buffer Strips</u>

The proposed riparian buffer strips are to occur along land uses related to agriculture and land that is barren or unforested. The reforestation measure would maintain and improve wildlife habitat on 255 acres along 10 streams. Recreational activities such as bird watching, fishing, and hunting would be enhanced. The proposed work activities would cause adverse, short-term direct and indirect impacts to wildlife species within the work areas during

construction, but these impacts would be minor and temporary, and should not adversely or significantly impact area wildlife over the long-term.

Grade Control

The 74 proposed GCS are to occur within 10 streams. The structures would maintain and improve wildlife that benefits from pooling habitat created behind the structures.

Recreational-riparian activities such as bird watching, and fishing would be enhanced. The proposed work activities would cause adverse, short-term direct and indirect impacts to wildlife species within the work areas during construction, but these impacts would be minor and temporary, and should not adversely or significantly impact area wildlife over the long-term.

6.2.3.1.8 Environmental Justice

Grade control with associated riparian restoration would not cause direct impacts to EJ communities in the study area. Grade structures would be placed in streams in suburban/urban areas not impacting adjacent homeowners. Riparian plantings would take place along streams abutting agricultural lands or vacant lands. Indirect impacts would occur and relate to the materials and equipment used to construct the plan causing temporary minor construction-related impacts to nearby residents. Positive long-term benefits would accrue to the area from enhanced habitat creation and stabilization of the creeks.

6.2.3.1.9 Prime and Unique Farmland

The implementation of Alternative 4 would prevent the future loss of prime and unique farmlands adjacent to the stream through the placement of the grade control and other stabilization features. While the addition of approximately 255 acres of riparian reforestation would cause the permanent loss of up to 255 acres of farmland, some of which would be considered prime and unique, the benefits associated with the riparian reforestation would improve the stabilization expected from the grade control structures.

6.2.4 Alternative 5b – Grade Control combined with Restoration of 10 Percent of Reforestable Riparian Acreage

This alternative would result in the construction of a total of 74 low-drop GCS and reforestation of approximately 309 acres would be implemented within 10 streams totaling approximately 313 AAHUs (Section 5.6, Table 5-5.). GCS combined with 10 percent of the available riparian restoration was identified as a component of the NER Plan. Reforestation was determined using NLCD estimates of land cover within 328 feet of the stream on both banks. The land-use types that are considered reforestable include cultivated cropland, hay/pasture, shrub/scrub, barren land, and herbaceous. Areas that were not considered reforestable include developed areas (i.e., residential and commercial), forested land, emergent wetlands, etc. As plans develop, additional information would be provided on where reforestation would occur. For each stream, the benefits of different percentages of reforestation (10%, 25%, 50%, 75%, and 100%) were calculated using the Multi-scale Watershed Assessment model. Screening of alternatives is described in Section 4. Steam

reaches that were determined to be degradational were determined using fluvial geomorphology, as described in Appendix C). With implementation of the NER Plan the degradational areas of the streams within the study area would be stabilized, reducing sedimentation. In addition, it is expected that excess nutrients may also be reduced as the erosion of adjacent lands would be reduced, although this is difficult to quantify. In addition, the widening of streams would be reduced, preventing damage to infrastructure, such as bridges and roads as well as residential property. With construction of the NER Plan, it is estimated that approximately 190 acres of land adjacent to the final array of streams would be saved due to prevention of erosion and bank failures.

6.2.4.1 Relevant Resources Affected and Expected Impacts (Affected Environment and Environmental Consequences)

6.2.4.1.1 Wetlands and Bottomland Hardwood Forest

With implementation of the Alternative 5b, approximately 309 acres of native BLH species would be planted along the 10 study streams. The NER Plan would provide riparian corridors that would connect isolated stands of suitable habitat to larger forested blocks and wetlands.

For acreage and AAHUs of each stream, refer to Table 4-7. A total of approximately 313 AAHUs would be restored due to reforestation of 10 percent of the reforestable acreage along with the implementation of grade control (discussed further in Section 5.8.1.2.

Reforestation of these acres would improve the Mississippi Flyway by increasing the acreage of BLH (a limiting habitat type), improving forage capacity, and cover and reproductive habitat. Alternative 5b would increase connectivity in the form of forested corridors and provide for an increase in biodiversity.

6.2.4.1.2 Water Quality and Aquatic Resources

Introduction and/or rehabilitation of GCS within the study streams would prevent or reduce the further degradation of the stream bed, also reducing the uncontrolled widening of the streams. Grade control, as well as reforestation, would reduce problems within the streams including sedimentation, low dissolved oxygen and excess nutrients. Producing a total of approximately 105.5 AAHUs, the GCS also prevent the loss of stream bank habitat and adjacent land. Water quality and aquatic resources would improve with the construction of the low drop GCS. Erosion and bank failures along with incision and head-cutting, would also be expected to decrease.

Fish passage is highly impacted in all streams included within Alternative 5b by perched culverts, scour at hardpoints, excessive sedimentation and other barriers. Design of GC structures and bank stabilization would allow for the improvement of fish passage in the streams. The NER Plan would provide connection in approximately 83 stream miles in DeSoto County, reconnecting impacted and degrading stream reaches to the Coldwater River, Lake Arkabutla, and the MAP ecoregion (depending on the geographic of the streams and the direction of flow).

6.2.4.1.3 Wildlife

Construction of the Alternative 5b would contribute to habitat stability along the study area streams in DeSoto County. Stabilization of the stream banks would improve wildlife access to the stream and the improvement of in-stream structure would increase utilization by macroinvertebrates improving the food chain, as well as the reproductive needs of several aquatic species. Aquatic species endemic to the area as well as Federally threatened species (NLEB), reclassified to endangered effective March 31, 2023, are impacted by systemic degradation of streams and adjacent habitat. Endemic and/or species in need of conservation include the Yazoo darter and Yazoo shiner, red-bellied dace, and piebald madtom (currently petitioned for listing under the ESA) could utilize additional habitats that would become accessible through this project.

The increase of approximately 309 acres of forested habitat would improve the Mississippi Flyway and increase organic input into the streams (such as leaf pack). The NLEB as well as neo-tropical migratory birds would benefit from the reforestation within the project area. The NLEB would benefit from the addition of GCS which would increase habitat for aquatic insects and pooling habitat. An increase of cover also improves the ability of species to move between areas limiting species dispersal. Reforestation and the reduction of stream degradation would increase biodiversity and improve the ability of species to utilize the study area.

6.2.4.1.4 Threatened and Endangered Species

While aquatic habitat stability provided by grade control would provide some benefit to species such as aquatic endemic and/or species in need of conservation to include the Yazoo darter and Yazoo shiner, red-bellied dace, and piebald madtom (currently petitioned for listing under the ESA), the Federally threatened species, reclassified to endangered effective March 31, 2023, (NLEB) would continue to be impacted by the lack of adjacent forested habitat along the riparian areas the channels. In addition, the streams would not realize the full benefit of restoration provided by the input of organic materials, coarse woody debris, shade, and cover that is provided by a forested riparian buffer.

6.2.4.1.5 Cultural Resources

This alternative would be unlikely to have any impact on known cultural resources. The majority of this alternative has been previously surveyed for the last 40 years and no eligible resources are located within the project area. The USACE has developed and executed a programmatic agreement with the MS SHPO and Federally recognized tribes to establish protocols for additional surveys prior to construction, see Appendix F for specifics on this document. If necessary, additional impacts will be addressed following the provisions of the programmatic agreement.

6.2.4.1.6 Aesthetics

The proposed riparian buffer strips and grade control would typically have positive direct impacts on aesthetics as it restores natural and scenic properties intrinsic to streams.

However, due to the rural setting of these small streams, access is limited, and visibility remains low. Generally, immediate roadway crossings provide the primary public views into these drainage corridors. Potential impacts on aesthetics would be short-term and coincide with the duration of construction activities.

Environmental Commitments would be implemented to avoid and/or reduce potential impacts to aesthetics during construction. For all alternatives, these environmental commitments would include:

- Work and staging areas would be kept orderly and free of trash and debris.
- A storage area for collection and storage of recyclable and green waste materials would be kept within the work area. All trash and debris would be removed from the work area at the end of each day.
- Signs would be posted prohibiting trespassing within the “construction zone.”
- Confine vehicular traffic to routes of travel to and from the project site, and prohibit cross-country vehicle and equipment use outside designated work and storage-staging areas.
- Reduce visibility of construction activities and construction related equipment. Construction activities and construction related equipment, including staging areas, laydown areas, stockpiles, and equipment storage would be temporarily screened throughout construction when visible from roads, trails, or residences to the extent practicable. Screening would consist of temporary screening fences with colors and materials to reflect the natural surroundings.

6.2.4.1.7 Recreation

Riparian Buffer Strips

The proposed riparian buffer strips are to occur along land uses related to agriculture and land that is barren or unforested. The reforestation measure would maintain and improve wildlife habitat on 309 acres along 10 streams. Recreational activities such as bird watching, fishing, and hunting would be enhanced. The proposed work activities would cause adverse, short-term direct and indirect impacts to wildlife species within the work areas during construction, but these impacts would be minor and temporary, and should not adversely or significantly impact area wildlife over the long-term.

Grade Control

The 74 proposed GCS are to occur within 10 streams. The structures would maintain and improve wildlife that benefits from pooling habitat created behind the structures.

Recreational-riparian activities such as bird watching and fishing would be enhanced. The proposed work activities would cause adverse, short-term direct and indirect impacts to wildlife species within the work areas during construction, but these impacts would be minor and temporary, and should not adversely or significantly impact area wildlife over the long-term.

Environmental Commitments would be implemented to avoid and/or reduce potential impacts to recreation during construction. For all alternatives, these environmental commitments would include:

Provide notices and information on current recreation use status during the construction period through local media and signage.

All recreation uses would be detoured from construction areas for safety of workers and the public. USACE would coordinate with the DeSoto County, stakeholders, and lessees during the Pre-construction, Engineering, and Design (PED) phase and during the various phases of construction to notify them of closures and facilitate their provision of detours.

6.2.4.1.8 Environmental Justice

A system of GCS combined with 10 percent available riparian restoration would not cause direct impacts to EJ communities in the study area. Grade structures would be placed in streams in suburban/urban areas not impacting adjacent homeowners. Riparian plantings would take place along streams abutting agricultural lands or vacant lands. Indirect impacts would occur and relate to the materials and equipment used to construct this plan causing temporary minor construction-related impacts to nearby residents. Positive long-term benefits would accrue to the area from enhanced habitat creation and stabilization of the creeks.

6.2.4.1.9 Prime and Unique Farmland

Alternative 5b would prevent the future loss of prime and unique farmlands adjacent to the stream through the placement of the grade control and other stabilization features. While the addition of approximately 309 acres of riparian reforestation would cause the permanent loss of up to 309 acres of farmland, some of which would be considered prime and unique, the benefits associated with the riparian reforestation would improve the stabilization expected from the grade control structures.

6.2.5 NER Plan-Grade Control with a mix of Alternative 4 and Alternative 5 Riparian Planting Quantities

A mix of Alternative 4 and Alternative 5 across the 10 streams, the NER plan would result in the construction of a total of 74 low-drop GCS and reforestation of approximately 327 acres would be implemented within 10 streams totaling approximately 31 AAHUs (Table 6-2).

Reforestation was determined using NLCD estimates of land cover within 328 feet of the stream on both banks in the reach where grade control is proposed. The land-use types that are considered reforestable include cultivated cropland, hay/pasture, shrub/scrub, barren land, and herbaceous. Areas that were not considered reforestable include developed areas (i.e., residential and commercial), forested land, emergent wetlands, etc. As plans develop, additional information would be provided on where reforestation would occur. The NER plan includes implementation of Alternative 4 on Camp, Nolehoe, Lick and Red Banks Creek and Alternative 5 on Johnson, Cane, Hurricane, Mussacuna, Nonconnah, and Short Fork Creek the degradational areas of the streams within the study area would be stabilized, reducing

sedimentation. In addition, it is expected that excess nutrients may also be reduced as the erosion of adjacent lands would be reduced, although this is difficult to quantify. In addition, the widening of streams would be reduced, preventing damage to infrastructure, such as bridges and roads as well as residential property. With construction of the NER Plan, it is estimated that approximately 190 acres of land adjacent to the final array of streams would be preserved from future erosion and bank failures.

6.2.5.1 Relevant Resources Affected and Expected Impacts (Affected Environment and Environmental Consequences)

6.2.5.1.1 Wetlands and Bottomland Hardwood Forest

With implementation of the NER plan, approximately 327 acres of native BLH species would be planted along the 10 study streams within the stream reaches where grade control is proposed. This plan would provide riparian corridors that would connect isolated stands of suitable habitat to larger forested blocks and wetlands. Approximately 190 acres of land would be retained, some of which would include BLH; however, it is difficult to quantify that BLH acreage at this point in the study. It is likely that some BLH clearing would occur for the construction of the GCS; however, that acreage is not yet determined and would likely be outweighed by the acreage that would be retained by the introduction of grade control in the streams.

For acreage and AAHUs of each stream, refer to Table 5-6. A total of approximately 315 AAHUs would be restored due to reforestation of the reforestable acreage associated with the implementation of grade control (discussed further in Section 5.6.1.). Reforestation of these acres would improve the Mississippi Flyway by increasing the acreage of BLH (a limiting habitat type), improving forage capacity, and cover and reproductive habitat. The NER plan would increase connectivity in the form of forested corridors and provide for an increase in biodiversity.

6.2.5.1.2 Water Quality and Aquatic Resources

Introduction and/or rehabilitation of GCS within the study streams would prevent or reduce the further degradation of the stream bed, also reducing the uncontrolled widening of the streams. Grade control, as well as reforestation, would reduce water quality problems within the streams including sedimentation, low dissolved oxygen and excess nutrients. Producing a total of approximately 105.5 AAHUs, the GCS also prevent the loss of stream bank habitat and adjacent land. Water quality and aquatic resources would improve with the construction of the low drop GCS. Erosion and bank failures along with incision and head-cutting, would also be expected to decrease.

Fish passage is highly impacted in all streams included within the NER Plan by perched culverts, scour at hardpoints, excessive sedimentation and other barriers. Design of the GCS and bank stabilization would allow for the improvement of fish passage in the streams. The NER Plan would provide connection in approximately 83 stream miles in DeSoto County, reconnecting impacted and degrading stream reaches to the Coldwater River, Lake

Arkabutla, and the MAP ecoregion (depending on the geographic of the streams and the direction of flow).

6.2.5.1.3 Wildlife

Construction of the NER Plan would contribute to habitat stability along the study area streams in DeSoto County. Stabilization of the stream banks would improve wildlife access to the stream and the improvement of in-stream structure would increase utilization by macroinvertebrates improving the food chain, as well as the reproductive needs of several aquatic species. Aquatic species endemic to the area as well as Federally threatened species (NLEB), reclassified to endangered effective March 31, 2023, are impacted by systemic degradation of streams and adjacent habitat. Endemic and/or species in need of conservation include the Yazoo darter and Yazoo shiner, red-bellied dace, and piebald madtom (currently petitioned for listing under the ESA) could utilize additional habitats that would become accessible through this project.

The increase of approximately 327 acres of forested habitat would improve the Mississippi Flyway and increase organic input into the streams (such as leaf pack). The NLEB as well as neo-tropical migratory birds would benefit from the reforestation within the project area. The NLEB would benefit from the addition of GCS, which would increase habitat for aquatic insects and pooling habitat. An increase of cover also improves the ability of species to move between areas limiting species dispersal. Reforestation and the reduction of stream degradation would increase biodiversity and improve the ability of species to utilize the study area.

6.2.5.1.4 Threatened and Endangered Species

While aquatic habitat stability provided by grade control would provide some benefit to species such as aquatic endemic and/or species in need of conservation to include the Yazoo darter and Yazoo shiner, red-bellied dace, and piebald madtom (currently petitioned for listing under the ESA), the Federally threatened species, reclassified to endangered effective March 31, 2023, (NLEB) would continue to be impacted by the lack of adjacent forested habitat along the riparian areas the channels. In addition, the streams would not realize the full benefit of restoration provided by the input of organic materials, coarse woody debris, shade, and cover that is provided by a forested riparian buffer.

6.2.5.1.5 Cultural Resources

The NER Plan would be unlikely to have any impact on known cultural resources. The majority of this alternative has been previously surveyed for the last 40 years and no eligible resources are located within the project area. The USACE has developed and executed a programmatic agreement with the MS SHPO and Federally recognized tribes to establish protocols for additional surveys prior to construction, see Appendix F for specifics on this document. If necessary, additional impacts will be addressed following the provisions of the programmatic agreement.

6.2.5.1.6 Aesthetics

The proposed riparian buffer strips and grade control would typically have positive direct impacts on aesthetics as it restores natural and scenic properties intrinsic to streams.

However, due to the rural setting of these small streams, access is limited, and visibility remains low. Generally, immediate roadway crossings provide the primary public views into these drainage corridors. Potential impacts on aesthetics would be short-term and coincide with the duration of construction activities.

6.2.5.1.7 Recreation

Riparian Buffer Strips

The proposed riparian buffer strips are to occur along land uses related to agriculture and land that is barren or unforested. The reforestation measure would maintain and improve wildlife habitat on 327 acres along 10 streams. Recreational activities such as bird watching, fishing, and hunting would be enhanced. The proposed work activities would cause adverse, short-term direct and indirect impacts to wildlife species within the work areas during construction, but these impacts would be minor and temporary, and should not adversely or significantly impact area wildlife over the long-term.

The 74 proposed GCS are to occur within 10 streams. The structures would maintain and improve wildlife that benefits from pooling habitat created behind the structures.

Recreational-riparian activities such as bird watching and fishing would be enhanced. The proposed work activities would cause adverse, short-term direct and indirect impacts to wildlife species within the work areas during construction, but these impacts would be minor and temporary, and should not adversely or significantly impact area wildlife over the long-term.

6.2.5.1.8 Environmental Justice

Grade control with associated riparian restoration would not cause direct impacts to EJ communities in the study area. Grade structures would be placed in streams in suburban/urban areas not impacting adjacent homeowners. Riparian plantings would take place along streams abutting agricultural lands or vacant lands. Indirect impacts would occur and relate to the materials and equipment used to construct the plan causing temporary minor construction-related impacts to nearby residents. Positive long-term benefits would accrue to the area from enhanced habitat creation and stabilization of the creeks.

6.2.5.1.9 Prime and Unique Farmland

The AER plan would prevent the future loss of prime and unique farmlands adjacent to the stream through the placement of the grade control and other stabilization features. While the addition of approximately 327 acres of riparian reforestation would cause the permanent loss of up to 327 acres of farmland, some of which would be considered prime and unique, the

benefits associated with the riparian reforestation would improve the stabilization expected from the grade control structures.

6.3 RISKS POSED BY CLIMATE CHANGE ON ALTERNATIVE FEATURES

An assessment of the potential impacts of climate change on the structural features of the proposed FRM and AER alternatives showed that in the future increased precipitation may result in an increase in future flood volume and frequency. The levee and floodwall, and the grade control structures may be over-topped and erosion could increase the threat of failure as Table 6-3. below illustrates.

Table 6-3. Potential Impacts of Climate Change on FRM and AER Alternative Features

Feature	Trigger	Hazard	Harm	Qualitative Likelihood
Levee Floodwall (FRM Plans 8a and 8b)	Increased precipitation from larger, slower moving storms.	Future flood volumes may be larger than present. Large flood volumes may occur more frequently.	Flood water will exceed the levee height and flood the protected/leveed area causing damages	Possible, but not likely
Channel Enlargement (FRM Plans: 5a, 5b, 6a, 6b, 7)	Increased precipitation from larger, slower moving storms.	Future flood volumes may be larger than present. Large flood volumes may occur more frequently.	Flood water will exceed the channel capacity and inundate structures, causing damages.	Possible, but not likely
Detention basins (FRM Plans 6a, 6b, 7)	Increased precipitation from larger, slower moving storms.	Future flood volumes may be larger than present. Large flood volumes may occur more frequently.	Floodwater will exceed the detention capacity and overtop the impoundment structure.	Possible, but not likely
NER Plans (All plans)	Increased precipitation from larger, slower moving storms.	Future flood volumes may be larger than present. Large flood volumes may occur more frequently.	Floodwater will exceed the structure height. Erosion could occur and threaten a failure. Loss of property is possible.	Possible, but not likely

SECTION 7
Recommended Plan

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

7.1 FRM RECOMMENDED PLAN BENEFITS

The recommended FRM plan includes an approximately 3,000 linear foot levee and floodwall system combined with dry floodproofing to reduce the risk of flood damages to 21 commercial and 14 residential structures. The proposed levee and floodwall features would reduce the risk of flood damages to 180 structures (34 commercial, 4 industrial, 2 public, and 140 residential) in the southwest corner of the of the Highway 51 and Goodman Road intersection. In addition, the levee and floodwall would reduce flooding on Goodman Road west of its intersection with Highway 51 as well as flooding on Hwy 51 south of the intersection with Goodman Road. Nonstructural dry floodproofing measures are recommended for 21 commercial structures and 14 residential structures located on the east side of Hwy 51 and Goodman Road. This plan is estimated to produce $2.43 million in average annual benefits at an average annual cost of $944 thousand with a BCR of 2.57

In response to potential impacts due to climate change, various considerations can be made to improve features' resilience to future conditions. These conditions may include increases in variability of precipitation and changes to the frequency and magnitude of extreme flood and drought events. The RP is not the NED plan. The ASA CW may grant an exception when there are overriding reasons for selecting another plan based upon comprehensive benefits. Plan 8b provides benefits that exceed those in plan 8a by maximizing the other social effects (OSE) account, namely by providing an increment of resiliency thorough dry floodproofing. Plan 8b provides the best level of comprehensive flood risk management to Desoto County.

Table 7-1. Flood Risk Management National Economic Development Plan and Recommended Plan (costs reported in 1000's)

	National Economic Development Plan 8a	Nonstructural Increment	Recommended Plan 8b
Total Project Costs			
First Cost	$6,904	$18,128	$25,788
Interest During Construction	$155	$76	$244
Total Investment Cost	$7,059	$18,204	$26,031
			Estimated Annual Costs
Annualized Construction Costs	$249	$642	$918
Annual OMRR&R	$26	0	$26
Total Annual Costs	$275	$642	$944
			Average Annual Benefits
Total Equivalent Annual Benefits	$1,887	$193	$2,429
Net Annual Benefits	$1,612	($449)	$1,485
Benefit to Cost Ratio	**6.86**	**0.30**	**2.57**

(2023 Price Level; $ Thousands; 2.5% Discount Rate)

The intent of comparing alternative flood risk management plans in terms of NED is 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 NED costs and benefits for the final array are described in Table 4-8.

With no action, over a 30-year period, there is a 100 percent chance that Horn Lake Creek will exceed the target stage in Reach 13. With the levee in place, there is a 6 percent chance the target stage will be exceeded in a 10-year period in Reach 13. Over a 30-year period, there is a 17 percent chance of that target stage being exceeded in Reach 13. Additional Project Performance statistics are included in Economics Appendix L. Section 5.2

The flood risk that remains in the floodplain after the proposed alternatives are implemented is known as the residual flood risk. Table 7-1 rows 7-9 show the residual damages for the NED and Recommended FRM plan.

7.1.1 FRM Plan Components

The FRM Recommended Plan would include these structural features:

Horn Lake Creek Levee and Floodwall System

A new 3,000 linear foot levee and floodwall system would reduce flood risk on the left-bank of Horn Lake Creek upstream of Goodman Rd. The levee would be constructed with 3-foot horizontal to 1-foot vertical (3H:1V) side slopes and a 12-foot-wide crown. The levee will run approximately. 2,475 linear feet adjacent to US Highway. 51 with an average height between 5 to 7 feet. A 600-linear-foot ditch would drain a depression on the riverside of the levee.

Where development makes the levee footprint infeasible, the levee would transition to a 525 linear foot floodwall. The floodwall would be 18” thick with an 8-foot-wide foundation. The wall would be 5 feet high and protrude 3.5 feet above ground level. The levee would require approximately 14,000 cubic yards of fill, and the floodwall would require 300 cubic yards of reinforced concrete. This alternative would require relocation of several utility poles and signs, removal and replacement of asphalt, and demolition of an existing vacant structure.

Removal of the structure and setting back the levee would also support additional environmental habitat. The levee and floodwall system is illustrated in Figure 7-1.

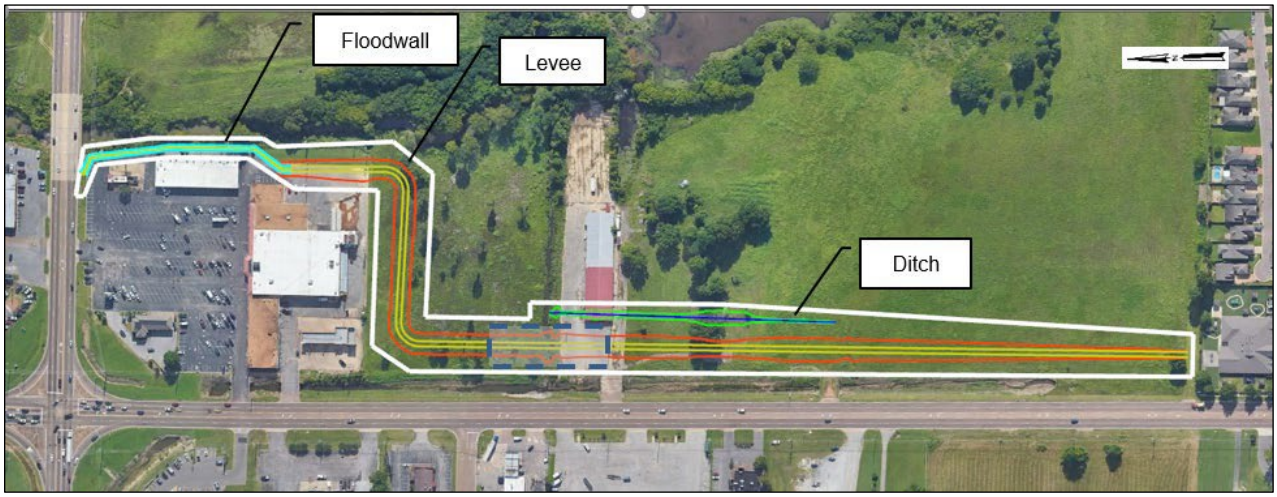

Figure 7-1. Levee and Floodwall System

Dry Floodproofing of 35 Structures

Dry floodproofing consists of sealing all areas below the flood damage risk management level of a structure to make it watertight and ensure that floodwaters cannot get inside by making walls, doors, windows and other openings impermeable to water penetration.

Generally, dry floodproofing can 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, and back-flow 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.

Dry floodproofing of non-residential structures must be performed in accordance with NFIP Technical Bulletin (TB) 3-93, Non-Residential Floodproofing—Requirements and Certification, and the requirements pertaining to dry flood-proofing of non-residential structures found in 44 C.F.R. § 60.3(b)(5) and 44 C.F.R. § 60.3 (c)(4). Additional details on the dry floodproofing plan can be found in Appendix D. Nonstructural Implementation Plan.

A structure-specific analysis will continue during the preconstruction engineering and design phase (PED) to determine final eligibility and the most appropriate and cost-effective floodproofing measures to be employed.

The dry flood proofed structures will experience less than .5 feet of flooding with minimal hydrostatic pressure. However, dry floodproofing measures will be designed to ensure a level of adaptability to provide a level of resilience in future with climate uncertainty. In response to potential impacts due to climate change, various considerations can be made to improve features' resilience to future conditions. These conditions may include increases in variability of precipitation and changes to the frequency and magnitude of extreme flood and drought events. While the structures have been identified as having flood risk less than .5 ft. the dry floodproofing will exceed that elevation and provide protection for up to 3 ft. of flood risk. At this point in the feasibility study, structure details are approximate and include only the most basic details required for a tier 3 cost analysis such number of doors, windows, sump pumps, drains, etc. The final report includes contingencies to reflect this. If during PED, with better data and modeling in hand, the PDT determines that there is a better design option, or more appropriate measures to reduce the risk to these residential structures those will be evaluated and applied. Actively moving vehicles to high ground is a reactive risk reduction measure that requires the presence and ability of a vehicle owner or user. There is inherent risk of failure in all risk reduction measures that rely on human reaction and that risk will be further evaluated during PED.

The potential risk to these apartments is expected water surface elevation of less than .5 ft of water. The Life Safety Analysis identified no additional life safety risk as a result of this federal action, however, further investigation through topographical surveys and refined hydraulic modeling will provide the fidelity of data required to support implementation decisions at PED.

This community is not part of the Community Rating System (CRS). It is recognized that 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 residential structures and may not be used under the NFIP for new or substantially damaged buildings.

7.1.2 FRM Recommended Plan Cost Estimate

Construction of the levee and floodwall would be expected to last three years and can be constructed concurrently. For the purposes of computing interest during construction (IDC), construction of the nonstructural components of the plans would be expected to begin in the year 2025 and would continue for a period of 2 years. Construction of each nonstructural feature for the purposes of IDC would be expected to last 3 months. There is no mitigation required.

The FRM Recommended Plan Cost estimate includes the following costs:

Table 7-2. FRM Plan Cost Estimate, Reported in 1000's

Levee and Floodwall + dry floodproofing 35 structures	
LERRDS	
Lands and Damages	$2,173
Relocation	$231
LERRD Subtotal	*$2,404*
Construction First Costs	
Levees and Floodwalls	$4,172
Buildings, Grounds and Utilities	$13,900
Construction Subtotal	*$18,072*
Administrative Costs	
Planning Engineering and Design	$2,655
Construction Management	$2,654
Administrative Subtotal	*$5,309*
FRM Plan First Cost	**$25,785**

(FY23 Price Level, 2.5% Discount Rate, Thousands)

7.1.3 FRM RP Lands, Easements, Rights-of-Way, Relocations and Disposal

The total real estate cost, for the FRM plan is $2.40 million. This includes the cost of acquiring levee and floodwall sites in fee simple, LERRD administrative costs, utility relocations, and contingencies.

7.1.4 FRM Operations, Maintenance, Repair, Rehabilitation, and Replacement (OMRR&R)

Both FRM and AER components are designed to be passively operated. Maintenance activities for the levee include mowing levee annually and slide repair every 10 years. This accounts for costs to repair after flood events as well. These estimates are based on maintenance requirements for similar USACE structures in the region. Regular inspection through the District's Inspection of Completed Works program will monitor the structures and

allow responsive maintenance to maintain expected performance. Cost estimates are included in Appendix J. OMRR&R costs associated with each of the structural measures was estimated by the cost engineering branch. OMRR&R is assumed to be a zero-dollar value when associated with the nonstructural measures.

7.1.5 FRM Project Risks

Risk and uncertainty are intrinsic in water resources planning and design. This section describes various categories of risk and uncertainty pertinent to the study.

This study uses a risk-based approach to plan formulation. Decisions are based on minimizing the probability and impact of risks using the most comprehensive data that can be acquired within the defined, relatively compressed study schedule and budget. The residual risk is assessed to be minimal – and appropriate for the study phase – though there are accuracy limitations that must be better understood and addressed prior to implementation.

In particular, error is found in the LiDAR elevation dataset used for hydraulic modeling and economic calculations. LiDAR elevations used for this study were determined to be accurate to ± 0.5 feet averaged over a wide area, but error increases as the area of concern decreases or as vegetation and structures increase. HEC-RAS generated water surface elevations averaged over the watershed are thus suitable to support broad impacts and measures, but do not necessarily provide the level of precision appropriate for site-specific implementation decisions. Further investigation through topographical surveys and refined hydraulic modeling will provide the fidelity of data required to support implementation decisions at PED. See additional discussion in Appendices G and I.

The levee will reduce a portion of the floodplain conveyance area and may result in increased flood stages in some regions. The location and amount depends on the frequency (magnitude) of a flood. The PDT followed ER 1105-2-100 and reviewed estimates of depth, duration, frequency, and corresponding uncertainties. It was estimated that additional measures would not be economically justified and would not be required to address a constitutional taking or to address life safety. Further evaluation would occur during PED to confirm this estimate.

Residual Damages and Residual Risks

Incorporating nonstructural alternatives in addition to the structural Recommended Plan is a plan formulation strategy being used to further reduce residual damages in areas where the levee and floodwall system is not effective at reducing flood stages. By incorporating the nonstructural plan in conjunction with the structural features, we are limiting the potential for high residual damages. The flood risk that remains in the floodplain after the proposed alternatives are implemented is known as the residual flood risk. For North DeSoto County, the residual risk is best illustrated in the Table below, which shows the residual damages for the final array of alternatives. Alternatives 8a and 8b are expressed in equivalent annual damages since base year and future year hydraulic models were provided, and all other

values are displayed in average annual damages estimated for the base year only. The Recommended plan, alternative 8b, is also the plan the minimizes residual risk.

The NED plan initiates a rise in water surface elevations due to prevention of floodwaters from accessing the left overbank on the southwest corner of Goodman Road and Hwy 51. The impacts are seen along the right descending bank of Horn Lake Creek opposite the NED levee and partially along Rocky Creek just upstream of its confluence with Horn Lake Creek. The NED levee potentially raises the water surface elevations on these structures over the current condition on the order of magnitude from 0.0-0.5 feet. Standard construction practices for structures in flood prone areas is to raise the finish floor elevations to be above the flood plain elevation. The LiDAR overbank used to map inundation has scrubbed building finish floor elevations, a standard procedure, and is not providing an accurate accounting of potential damages as many structures may be raised above modeled stages. The team rectified this by obtaining surveyed finish floor elevations and conducting interviews with property owners and store workers who were present during the September 2014 flood of record. The results of the finish floor survey and interviews removed many structures from potential damages. The structures that remained in this area designated as prone to flooding will be eligible to receive voluntary dry floodproofing.

Stages downstream of Hwy 51 return to existing conditions levels relatively quickly, within 0.5 miles. Overbank flooding has been reviewed to show that there are no potential damages to structures in this area. There is no anticipated transfer of risk to properties downstream of the NED levee.

The residual risk was assessed and determined to be minimal - and appropriate for the study phase- though there are accuracy limitations that must be better understood and addressed prior to implementation. The residual risks are accounted for in cost contingencies and non-structural remediations strategies. Table 7-3. Shares the average annual residual damages.

Error in the LiDAR dataset elevations used for the hydraulic modeling and economic calculations were determined to be accurate to ±0.5ft averaged over a wide area, but error increases as the area of concern decreases or as vegetation and structures increase. Appendix I provides greater detail regarding the analysis of damages and additional survey data that was obtained to calculate damages and mitigation strategies.

Table 7-3. Average Annual Residual Damages ($ Thousands)

Metric	NED Plan (Final 8a)	Recommended Plan Final 8b
Without Project Damages	$4,317	$4,317
Residual Damages	$2,431	$1,888
Benefits	$1,887	$2,429

(2022 Price Level; $ Thousands; 2.5% Discount Rate)

Impacts on the Recommended Plan from climate change were evaluated in Appendix H. The greatest threat to the recommended plan from climate change is from increases in precipitation from larger slower moving storms. The increase in flood volumes from these future storms have the possibility of exceeding the designed levee. While this is seen as a possibility it is considered not likely to occur based on the design considerations given to the RP. Refer to Table H:1-3. of Appendix H which highlights climate risks and triggers for each alternative and the RP. Any impacts due to construction would be minor and temporary and result in long-term benefits to the natural and human environments.

Incremental risk evaluations related to the levee in the RP showed that life loss in the with-project condition (breach and non-breach) is less than the without-project condition, so there is unlikely to be any additional risk of life loss from the levee. Indeed, the risk of life loss is likely reduced from the presence of the proposed levee. Furthermore, incremental life loss is approximately zero, suggesting there is little-to-no additional risk of life loss due to failure of the levee. Additional information can be found in the Life safety Appendix E.

7.1.6 FRM Cost Sharing

A NFS must support all phases of the project. Feasibility study costs are shared 50 percent Federal and 50 percent non-Federal for up to $3,000,000. Design and implementation phases are cost-shared, with the NFS providing a minimum of 35 percent and up to a maximum of 50 percent. Additionally, the NFS must provide all the lands, easements, rights-of-way, relocations and disposal areas (LERRDs). While the sponsor may receive credit toward this cost-share for work-in-kind and LERRDs, a minimum cash contribution of 5 percent is required for the structural components of the FRM portion of the project. Once a project has been implemented, OMRR&R of the project is a 100 percent non-Federal responsibility. In the event the LPP is recommended for construction, the Federal share of the cost of the project would be limited to the Federal share of the NED plan in accordance with the cost sharing provisions of Water Resource Development Act (WRDA) 1986, as amended. Table 7-4. estimates the FRM cost allocation.

Table 7-4 Flood Risk Management Plan Cost Allocation ($ Thousands)

Levee and Floodwall + Dry Floodproofing	Federal	Non- Federal	Total
Lands, easements, rights-of-way, relocations, and disposal areas (LERRD) 100%			
Lands and Damages	$30	$2,143	$2,173
Relocation		$231	$231
LERRDs Subtotal	*$30*	*$2,374*	*$2,404*
Construction First Cost			
Levees and Floodwalls	$2,795	$1,377	$4,172
Buildings, Grounds, and Utilities	$9,313	$4,587	$13,900
Construction First Cost Subtotal	$12,108	$5,964	$18,072
Administrative Cost			
Planning Engineering and Design	**$2,312**	**$343**	**$2,655**
Construction Management	$2,311	$343	$2,654
Administrative Subtotal	$4,623	$686	$5,309
FRM Plan Total Cost			
	$16,761	**$9,024**	**$25,785**

(FY23 Price Level, 2.5% Discount Rate, Thousands)

7.1.7 FRM Design and Construction

Construction would be in accordance with the USACE's regulations and standards. LERRDs would be the responsibility of the NFS. Work-In-Kind associated with the construction of the levee floodwall and dry floodproofing components of the Project will be negotiated with NFS, contingent upon approval at the Assistant Secretary of the Army for Civil Works (ASACW) or appropriate level in accordance with applicable guidance and regulations.

An Adaptive Management Plan is included in Appendix A. Environmental. The FRM RP would not cause significant adverse impacts to the environment, therefore a compensatory mitigation plan is not required for this proposed action. Any impacts due to construction would be minor and temporary. The FRM RP Construction Schedule is illustrated in Table 7- 4.

Table 7-5. Design and Construction Schedule

FRM Plan Features	Construction Start	Midpoint	Construction End
Buildings Grounds and Utilities	2/28/2024	2/20/2026	2/14/2028
Levees and Floodwalls	7/1/2024	1/3/2025	7/8/2025

7.1.8 FRM Environmental Commitments

NEPA Section 102(2)(c)(iv) and 40 CFR 1502.16 requires that an EIS include a discussion of the relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity. Short-term uses refer to the temporary phase of construction of the proposed project, while “long-term” refers to the operational life of the proposed project and beyond. Section 6 of this document evaluates the environmental consequences that could result from implementing the Recommended Plans.

Construction of the of the FRM (and AER) Recommended Plans would result in short-term construction-related impacts and would include, to some extent, interference with local traffic, minor limited air emissions, increases in ambient noise levels, dust generation, and minor disturbance of wildlife and increased turbidity. These impacts would be temporary and would occur only during construction and are not expected to alter the long-term productivity of the natural environment.

Implementation of the FRM Recommended Plan would not result in long-term adverse impacts and would benefit the long-term productivity of the natural environment, as noted in Section 6.1.6.1. Coordination with the interagency team has not resulted in any opposition to the proposed actions.

The Monitoring and Adaptive Management Plan is included in Appendix D of this document. Adaptive management planning would be continued throughout the study and through the PED phase. Adaptive management planning includes: 1) development of a Conceptual Ecological Model (CEM), 2) identification of key project uncertainties and associated risks, 3) evaluation of the ecosystem restoration projects for adaptive management needs and 4) the identification of potential adaptive management actions to ensure the constructed project meets identified success criteria. Costs for adaptive management actions may not exceed 3% of the total project cost. The adaptive management plan is a living document and would be refined as necessary as new project information becomes available.

Irreversible and Irretrievable Commitments of Resources

NEPA requires that environmental analysis include identification of “any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.” Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effects that the use of these resources have on future generations. Irreversible effects primarily result from use or destruction of a specific resource (e.g., energy and minerals) that cannot be replaced within a reasonable time frame. Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the action (e.g., extinction of a threatened or endangered species or the disturbance of a cultural site).

The proposed FRM plan would result in few direct and indirect commitments of resources; these would be related mainly to construction components. Most resource commitments are neither irreversible nor irretrievable. Impacts are short-term and insignificant.

A cultural resource programmatic agreement has been executed, signed by the MS SHPO, as of 2 September 2022, and is in routing to all other parties to be signed. This PA established the process USACE will follow for compliance with Section 106 of the NHPA in order to consider the effect of the Undertaking on Historic Properties.

7.2 AQUATIC ECOSYSTEM RESTORATION (AER) RECOMMENDED PLAN

The AER plan maximizes ecosystem restoration benefits compared to costs. The NER plan includes grade control and riparian restoration on 10 streams and is estimated to provide 31 AAHUs at an average annual cost of $5,248 per AAHU. The total annual cost of the NER plan is $1,648. Table 7-1. identifies the FRM/NED Plan while Table 7-2. identifies the recommended AER/NER Plan.

In response to potential impacts due to climate change, various considerations can be made to improve features' resilience to future conditions. These conditions may include increases in variability of precipitation and changes to the frequency and magnitude of extreme flood and drought events.

Diversifying native plantings improve the project's resiliency to changing future conditions and Climate Change. Other aspects of design to increase resilience will be considered during future engineering design phases of this project. In addition, the stream stabilization allows for the re-establishment of primary productivity and improvement of the complex aquatic food web. Riparian buffers and stabilized streams reduce and/or prevent the continuing degradation of streams, which is intensified with the more frequent and intense storm events. Risks to ecosystem function and form are expected as a result of climate change; however, the AER RP enables the MVLP environment to be more resilient to the impacts of climate change. In general, these ecosystems have been evolving and adapting to changes in the environment and can shift to a changing climate in the future depending on the extent to which the climate changes. In addition to these communities' natural resilience, the alternatives proposed reduce some of the non-climate related stressors such as urbanization, invasive species, and degraded stream form and function. Reducing these stressors allows for the various plant and animal communities to be more resilient to a changing climate.

Table 7-6. National Ecosystem Restoration Plan, Reported in 1000's

NER Plan- A system of GCS and riparian restoration on each of the 10 DeSoto County Creeks: Camp, Cane, Hurricane, Johnson, Lick, Mussacuna, Nolehoe, Nonconnah, Red Banks, and Short Fork Creek.	
First Cost	$40,152
Annual Cost	$1,648
Average Annual Habitat Units	31
Annual Average Cost/Annual Average Habitat Unit (AAC/AAHU)	$5
Average Annual Cost/Acre Restored (AAC/acre restored)	$5
Monitoring and Adaptive Management Cost	$745
Acres of Riparian Buffer Restored	327
Number of Grade Control Structures	74

(FY23 Price Level, 2.5% Discount Rate, Thousands)

7.2.1 AER Plan Components

Grade Control- 74 grade control structures (GCS) are proposed in the AER Plan. These GCS counteract head cutting that was observed in these streambeds. Structural improvements are designed to stabilize the streambed and reduce future head cutting, as well as improve aqueous and riverine habitat. The structures would typically be 3.5 feet high from the channel bottom. Larger 650 lb. stone would face upstream, with smaller 200 lb. stone protecting the downstream side. Side slope armoring and keys will reduce the risk of flanking or undercutting the structure. This design was adapted from ERDC loose rock riffle, with additional slope armor and keys to account for the erodibility of local soils. Design drawings of typical grade control structures can be found in Appendix I. Design, section 2.9.1.

Longitudinal Stone Toe Protection (LSTP)- The AER Plan proposes approx. 30,000 LF of LSTP with tiebacks in the 10 identified streams. These were not located in the field but are to be placed in proximity of identified GCSs. These would reduce damages to banks and protect top bank habitat. It would also reduce the ability of the river to meander and scour into the outside bend of the stream.

The application of LSTP consists of a windrow of stone placed at the toe of the slope, with tiebacks running up the banks at evenly spaced intervals. The toe protection provides protection against lateral erosion. The tiebacks provide a backstop to bank erosion, limiting it to the cell between tiebacks. Design drawings of LSTP can be found in Appendix I. Design, section 2.9.2.

Riser Pipes - Concentrated flows can create deep incisions in the bank. Select incisions will be mitigated by installing a pipe to convey and handle the grade change without scouring the bank. This will help to retain vegetation and reduce scour at these locations. Riprap at the pipe inlet will be added when warranted, and pipes will outlet onto stone toe protection. A total of 46 riser pipes were estimated, with an average length of 30 LF and diameter of 24".

The easements required for construction and maintenance overlap with the easements required for riparian buffer and/or stone toe protection. See Appendix I for design drawings of riser pipes.

Riparian Buffer- Land adjacent to the waterway would be converted to forest to provide a buffer from development and agriculture. There are no structural improvements associated with this measure; however, this could be paired with other measures to mitigate anticipated impacts. For instance, a parcel prone to flooding may be converted to riparian buffer, reducing the risk of damage to private property. A Riparian Buffer planting plan can be found in Appendix A. Environmental.

7.2.2 AER Recommended Plan Cost Estimate

The real estate cost for the proposed AER Plan is $7.85. This includes the cost of acquiring channel improvements in fee simple, road easements, riparian zones sites in fee simple, LERRD administrative costs, and contingencies.

7.2.3 AER Recommended Plan Lands, Easements, Rights-of-Way, Relocations and Disposal

The REP describing the real estate requirements and costs for the project can be found in Appendix K. The NFS would have the responsibility of acquiring all necessary real estate interests for the project.

7.2.4 AER Recommended Plan Operations, Maintenance, Repair, Rehabilitation, Replacement

Both FRM and NER components are designed to be passively operated. Maintenance of grade control structures and stone toe protection includes clearing access and replacing up to 10% of the stone every 10 years. This accounts for costs to repair after flood events as well. These estimates are based on maintenance requirements for similar USACE structures in the region. Regular inspection through the District's Inspection of Completed Works program will monitor the structures and allow responsive maintenance to maintain expected performance. Cost estimates are included in Appendix J.

7.2.5 AER Recommended Plan Project Risks

Uncertainties exist in any method when developing stabilization plans in fluvial systems for a number of reasons. Below is a list of potential uncertainties based on the data available for this study.

Fluvial systems are not static but dynamic in nature so existing conditions can change in a short period of time. For example, the PDT could decide to gather detailed channel survey data in June and within a few days after data collection, flow events may change the channel conditions and local morphology, possibly making the channel survey data obsolete.

Existing LiDAR data used for the analysis is approximately 10 years old and may not accurately reflect existing conditions. The data was used to identity channel stability issues

and locations within the watershed where those issues are occurring. The channel stability issues were qualitatively field identified on the 3 watersheds with no new channel survey data collected. However, the specific locations of these trends have likely changed since the LiDAR data was collected and will continue to change until construction of stabilization measures are complete.

Grade control structures were located based on channel slopes (determined from LiDAR data) and the locations will need to be adjusted in the field prior to final designs.

At this stage of the study the PDT has not yet determined exactly where access would be made to the riparian zones and GCS. The PDT provided a preliminary estimate of the acreage of access that would be needed for grade control structures as well as a rough order of magnitude was assumed (2 acres per riparian area) for access to the lands that would be reforested. It is assumed that the exact locations of the GCS can flex to maximize opportunities to work with willing private landowners.

7.2.6 AER RP Cost Sharing

A NFS must support all phases of the project. Feasibility study costs are shared 50 percent Federal and 50 percent non-Federal for up to $3,000,000. Design and implementation phases are cost-shared, with the NFS providing a minimum of 35 percent and up to a maximum of 50 percent. Additionally, the NFS must provide all the lands, easements, rights-of-way, relocations and disposal areas (LERRDs). The sponsor may receive credit toward this cost- share for work-in-kind and LERRDs. Once a project has been implemented, OMRR&R of the project is a 100 percent non-Federal responsibility. In the event the LPP is recommended for construction, the Federal share of the cost of the project would be limited to the Federal share of the NED plan in accordance with the cost sharing provisions of Water Resource Development Act (WRDA) 1986, as amended.

Table 7-7. Ecosystem Restoration Cost Allocation, Reported in 1000's

AER Plan Cost Allocation	Feature of Work	Federal	Non- Federal	Total
LERRDs	Real Estate		$7,160	$7,160
Administration of *LERRDs*		$690		$690
Subtotal		*$690*	*$7160*	*$7,850*
First Cost				
Fish and Wildlife Facilities	Riparian Buffers	$1,747	$347	$2,094
	Adaptive Management	$484	$261	$745
Bank Stabilization	Riprap	$18,326	$3,608	$21,934
Cultural Resources	Surveys	$144	$120	$264
Subtotal		*$19,391*	*$4,336*	*$25,037*
Administrative Cost				
Planning Engineering and Design		$2,351	$1,278	$3,629
Construction Management		$2,358	$1,272	$3,630
Subtotal		*$4,709*	*$2,550*	*$7,259*
AER Plan Total		**$26,100**	**$14,052**	**$40,152**

FY23 Price Level, 2.5% Discount Rate, Thousands

7.2.7 AER Recommended Plan Design and Construction

Construction would be in accordance with the USACE's regulations and standards. LERRD would be the responsibility of the NFS (Appendix C). Work-In-Kind associated with the construction of the bank stabilization and BLH reforestation components of the project will be negotiated with NFS, contingent upon approval at the Assistant Secretary of the Army for Civil Works (ASACW) or appropriate level in accordance with applicable guidance and regulations.

Table 7-8. AER Feature Design and Construction Schedule

AER Plan Feature	Activity Start	Midpoint	Activity End
Cultural Surveys	7/1/2024	12/30/2024	7/1/2025
Relocations	7/1/2024	1/3/2025	7/8/2025
Bank Stabilization	10/1/2024	9/19/2026	9/6/2028
Fish & Wildlife Facilities	7/1/2024	7/1/2026	7/1/2028
Monitoring and Adaptive Management	9/6/2028	9/6/2033	9/6/2038

7.2.8 AER Recommended Plan Environmental Commitments

Project plans and alternatives were developed in accordance with USACE planning guidance at ER 1105-2-100, which directs that ecosystem restoration projects be designed to avoid the need for compensatory fish and wildlife mitigation. Formulation of project alternatives was conducted in compliance with this guidance. Also, in accordance with USACE planning guidance, net ecosystem benefits expected to accrue if the proposed project is implemented may not be used as wetland banks or mitigation credit by the NFS.

The AER RP would assist in the long-term productivity in DeSoto County, Mississippi by improving aquatic habitat, reducing channel instability and erosion, and restoring BLH habitat. These long-term beneficial effects of the proposed RP would outweigh the minimal and mitigable short-term impacts to the environment resulting primarily from project construction.

As the case with the FRM RP, it has been determined that the AER RP would not result in permanent adverse impacts to the environment. Rather, the AER RP, in concert with the FRM features, would assist in the long-term productivity in DeSoto County, Mississippi by improving aquatic habitat, reducing channel instability and erosion, and restoring BLH habitat. Although, as with the FRM short-term, temporary, impacts to the environment resulting primarily from project construction are anticipated.

Coordination with USFWS has concluded that the AER RP would not warrant a formal Coordination Act Report. However, USFWS recommendations, including model use and application, streambank habitat creation, and revegetation techniques have been incorporated into plan features. Additionally, to meet Section 106 responsibilities, MVM developed a Programmatic Agreement (PA) that established procedures to address the potential to affect historic properties that are eligible for or listed in 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 that may be affected by this undertaking. The PA is included in Appendix F. Interagency and Tribal

Furthermore, USACE is committed to monitoring and, if needed, adaptively managing the overall project. A Monitoring and Adaptive Management Plan is included in Appendix A and would be continued throughout the study and through the PED phase.

7.3 COMBINED FRM AND AER RECOMMENDED PLAN COSTS

The cost allocation of the recommended FRM and AER plan combined is included in Table 7-9.

Table 7-9. Combined FRM and AER Plan, Cost Reported in 1000's

FRM+AER cost allocation	Federal	Non- Federal	Total
Lands, easements, rights-of-way, relocations, and disposal areas (LERRD) 100% Responsibility of NFS			
Lands and Damages	$720	$9,303	$10,023
Relocation		$231	$231
LERRDs Subtotal	***$720***	***$9,534***	***$10,254***
Construction First Cost			
Levees and Floodwalls	$2,795	$1,377	$4,172
Buildings, Grounds, and Utilities	$9,313	$4,587	$13,900
Fish and Wildlife Facilities (Riparian Restoration)	$1,747	$347	$2,094
Fish and Wildlife Facilities (Adaptive Management)	$484	$261	$745
Bank Stabilization	$18,326	$3,608	$21,934
Cultural Resources	$144	$120	$264
Construction First Cost Subtotal	***$32,809***	***$10,300***	***$43,109***
Administrative Cost			
Planning Engineering and Design	$4,663	$1,621	$6,284
Construction Management	$4,669	$1,615	$6,284
Administrative Subtotal	***$9,332***	***$3,236***	***$12,568***
FRM Plan Total Cost			
FRM+AER Recommended Plan Costs	**$42,867**	**$23,070**	**$65,937**

[1]The NFS is responsible for 5% of funds allocated for the FRM structural features in cash; FY23 Price Level, 2.5% Discount Rate, Thousands.

7.4 FEDERAL RESPONSIBILITIES

The Federal government would be responsible for Pre-Engineering Design (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.

7.5 NON-FEDERAL SPONSOR RESPONSIBILITIES

Federal implementation of the project would be subject to the NFS agreeing in a binding written agreement to comply with applicable Federal laws and policies, and to perform the following non-Federal obligations, including, but not limited, to:

a. Provide 35 percent of total project costs as further specified below:
    1. Provide the required non-Federal share 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, during the first year of construction, a contribution of funds equal to 5% of construction costs of the FRM structural features and any additional funds necessary to pay the full non-Federal share of design costs;
    3. Provide all lands, easements, and rights-of-way, including those required for relocations, the borrowing of material, and the disposal of dredged or excavated material; perform or ensure the performance of all relocations; and construct all improvements required on lands, easements, and rights-of-way to enable the disposal of dredged or excavated material, all as determined by the Government to be required or to be necessary for the construction, operation, maintenance, repair, rehabilitation and replacement of the project;
    4. Provide, during construction, any additional funds necessary to make its total contribution equal to 35 percent of total project costs;
b. Shall not use funds from other Federal programs, including any non-Federal contribution required as a matching share therefore, to meet any of the non-Federal obligations for the project unless the Federal agency providing the funds verifies in writing that such funds are authorized to be used to carry out the project;
c. Not less than once each year, inform affected interests of the extent of protection afforded by the project;
d. Agree to participate in and comply with applicable Federal floodplain management and flood insurance programs;
e. Comply with Section 402 of the Water Resources Development Act of 1986, as amended (33 U.S.C. 701b-12), which requires a non-Federal interest to prepare a floodplain management plan within one year after the date of signing a project partnership agreement, and to implement such plan not later than one year after completion of construction of the project;
f. 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 protection levels provided by the project;

g. Prevent obstructions or encroachments on the project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) such as any new developments on project lands, easements, and rights-of-way or the addition of facilities which might reduce the level of protection the project affords, hinder operation and maintenance of the project, or interfere with the project's proper function;
h. Comply with all 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. 4601- 4655), and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way required for construction, operation, and maintenance of the project, including those necessary for relocations, the borrowing of materials, or the disposal of dredged or excavated material; and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act;
i. For so long as the project remains authorized, OMRR&R the project or functional portions of the project, including any mitigation features, at no cost to the Federal government, in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and State laws and regulations and any specific directions prescribed by the Federal government; provided, however, that the NFS shall have no obligation to address loss of risk reduction due to relative sea level rise through the repair, rehabilitation or replacement of localized storm surge risk reduction components associated with the construction of large ring berms around groups of residential structures, nor shall the NFS be obligated to OMRR&R those flood proofing measures that constitute elevation of individual residential structures or construction of small ring berms around individual non-residential or light industry/warehouse structures.
j. Give the Federal government a right to enter, at reasonable times and in a reasonable manner, upon property that the NFS owns or controls for access to the project for the purpose of completing, inspecting, operating, maintaining, repairing, rehabilitating, or replacing the project;
k. Hold and save the United States free from all damages arising from the construction, operation, maintenance, repair, rehabilitation, and replacement of the project and any betterments, except for damages due to the fault or negligence of the United States or its contractors;
l. Keep and maintain books, records, documents, or other evidence pertaining to costs and expenses incurred pursuant to the project, for a minimum of 3 years after completion of the accounting for which such books, records, documents, or other evidence are required, to the extent and in such detail as would properly reflect total project costs, and in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments at 32 CFR Section 33.20;
m. Comply with all applicable Federal and State laws and regulations,

including, but not limited to: Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d) and Department of Defense Directive 5500.11 issued pursuant thereto; Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army"; and all applicable Federal labor standards requirements including, but not limited to, 40 U.S.C. 3141-3148 and 40 U.S.C. 3701 – 3708 (revising, codifying and enacting without substantial change the provisions of the Davis-Bacon Act (formerly 40 U.S.C. 276a et seq.), the Contract Work Hours and Safety Standards Act (formerly 40 U.S.C. 327 et seq.), and the Copeland Anti-Kickback Act (formerly 40 U.S.C. 276c et seq.);

n. Perform, or ensure performance of, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Public Law 96-510, as amended (42 U.S.C. 9601-9675), that may exist in, on, or under lands, easements, or rights-of-way that the Federal government determines to be required for construction operation, and maintenance of the project, including those lands, structures and interests necessary for the implementation of all of the localized storm surge risk reduction components of the Project as described in this Report. However, for lands that the Federal government determines to be subject to the navigation servitude, only the Federal government shall perform such investigations unless the Federal government provides the NFS with prior specific written direction, in which case the NFS shall perform such investigations in accordance with such written direction;
o. Assume, as between the Federal government and the NFS, complete financial responsibility for all necessary cleanup and response costs of any hazardous substances regulated under CERCLA that are located in, on, or under lands, easements, or rights-of-way that the Federal government determines to be required for construction, operation, and maintenance of the project, including those lands, structures and interests necessary for the implementation of all of the localized storm surge risk reduction components of the Project as described in this Report;
p. Agree, as between the Federal government and the NFS, that the NFS shall be considered the operator of the project for the purpose of CERCLA liability, and to the maximum extent practicable, operate, maintain, repair, rehabilitate, and replace the project in a manner that would not cause liability to arise under CERCLA; and
q. Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended (42 U.S.C. 196two-dimensional-5b), and Section 103(j) of the Water Resources Development Act of 1986, Public

Law 99-662, as amended (33 U.S.C. 2213(j)), which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until each non-Federal interest has entered into a written agreement to furnish its required cooperation for the project or separable element.

r. Shall not use any project features or lands, easements, and rights-of-way required for such features as a wetlands bank or mitigation credit for any other project;
s. Pay all costs due to any project betterments or any additional work requested by the sponsor, subject to the sponsor's identification and request that the Government accomplish such betterments or additional work, and acknowledgement that if the Government in its sole discretion elects to accomplish the requested betterments or additional work, or any portion thereof, the Government shall so notify the NFS in writing that sets forth any applicable terms and conditions.

7.6 ENVIRONMENTAL OPERATING PRINCIPLES

The United States Army Corps of Engineers Environmental Operating Principles were developed to ensure that Corps of Engineers missions include totally integrated sustainable environmental practices. The Principles provided corporate direction to ensure the workforce recognized the Corps of Engineers role in, and responsibility for, sustainable use, stewardship, and restoration of natural resources across the Nation and, through the international reach of its support missions. The Environmental Operating Principles relate to the human environment and apply to all aspects of business and operations. Re-committing to these principles and environmental stewardship will lead to more efficient and effective solutions and will enable the Corps of Engineers to further leverage resources through collaboration. This is essential for successful integrated resources management, restoration of the environment and sustainable and energy efficient approaches to all Corps of Engineers mission areas. It is also an essential component of the Corps of Engineers' risk management approach in decision making, allowing the organization to offset uncertainty by building flexibility into the management and construction of infrastructure.

The re-energized Environmental Operating Principles are:

- Foster sustainability as a way of life throughout the organization.
- Proactively consider environmental consequences of all Corps activities and act accordingly.
- Create mutually supporting economic and environmentally sustainable solutions.
- Continue to meet our corporate responsibility and accountability under the law for activities undertaken by the Corps, which may impact human and natural environments.
- Consider the environment in employing a risk management and systems approach throughout the life cycles of projects and programs.
- Leverage scientific, economic, and social knowledge to understand the environmental context and effects of Corps actions in a collaborative manner.

- Employ an open, transparent process that respects views of individuals and groups interested in Corps activities.

The NED and NER RPs have been developed using the Environmental Operating Principles to guide and improve the development, formulation, and evaluation of alternatives under this study effort. Consideration of the environment has been essential in ensuring flood risk management and ecosystem restoration missions are developed appropriately, are responsive to area problems and needs, and are supportable by the public and stakeholders.

7.7 VIEWS OF THE NFS

The non-Federal sponsor has expressed support for the FRM and AER recommended plans. A letter of support specifically addressing the RP dated January 23, 2023, states that "Desoto County, acting through Desoto County Board of Supervisors, is pleased to offer its continuing support of the North Desoto County Flood Study Project. This study is a critical component of The Desoto County 2030 Comprehensive Plan for sustainable development and growth and will provide critical insight on flood risk management and aquatic ecosystem restoration measures for the study area" The letter goes on to say that the County "understands that the cost-sharing of flood risk management and aquatic ecosystem restoration measures are to be thirty-five percent (35%) non-federal and that the costs of operation, maintenance, repair, replacement, and rehabilitation (OMRR&R) of such measures shall be one hundred percent (100%) non-federal sponsor responsibility, all in accordance with Section 103 of the Water Resource Development Act of 1986, as amended. We are also aware that the USACE's and Desoto County's further responsibilities will be delineated in the Project Partnership Agreement (PPA), which both parties will execute before design and construction commences. Furthermore, the County acknowledges the responsibilities of the non-federal sponsor and will support the Board of Supervisor's role as such for the design, construction, and OMRR&R phases of the project, if authorized. However, since the project is within the jurisdictional boundaries of local municipalities and levee districts and other political subdivisions with delegated local statutory responsibility for flood control, the County notes that it may request that local entities be included as co-sponsors for the project, including Horn Lake, Southaven, Olive Branch, Walls, Hernando, Horn lake Drainage District, Lake Cormorant Drainage District, Camp Creek Drainage District, Short Fork Drainage District, Northwest Mississippi Drainage District and Cane Mussucuna Drainage District. "

SECTION 8
Environmental Compliance

The laws, regulations, and policies, and plans related to the resources discussed in Section 3.0 are summarized herein. The proposed project compliance status is also discussed below.

8.1 EXECUTIVE ORDER 11988 FLOODPLAIN MANAGEMENT

The USACE is in compliance with Executive Order 11988. 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 RP represents the least environmentally damaging alternative to accomplish the needed flood risk management.

DeSoto County has experienced significant population, employment, and income growth since 1990 and forecasts show this growth is expected to continue. Given continued growth, it is expected that development will continue to occur in the study area with or without riverine flood risk management measures and will not conflict with EO 11988. The overall growth rate is anticipated to be the same with or without the project in place. Thus, the project will not induce development, but would rather reduce the risk of the population being displaced after a major riverine flood event.

8.2 CLEAN AIR ACT OF 1970, AS AMENDED

The USACE is in compliance with the Clean Air Act of 1970.The Clean Air Act (CAA), 42 U.S.C. Section 7401, et. seq., sets goals and standards for the quality and purity of air. It requires the EPA to set National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to public health and the environment. The study area is in DeSoto County, Mississippi, which is currently in attainment for NAAQS. The transportation conformity rule (40 CFR part 93) establishes policy, criteria, and procedures for demonstration and assuring conformity of transportation activities. 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.

8.3 CLEAN WATER ACT OF 1972, AS AMENDED, SECTION 401 AND 404I

Compliance with the Clean Water Act of 1972, as amended, would be achieved once Section 401 permitting is completed in coordination with the MDEQ. This would occur, when and if the project(s) are approved and funded for construction. The Clean Water Act (CWA), 33 U.S.C. Section 1251, et. seq., establishes the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters. Section 401 of the CWA requires a Water Quality Certification from the Mississippi Department of Environmental Quality (MDEQ) ensuring the proposed project does not violate established effluent limitations and water quality standards. On June 1, 2020, the EPA finalized the “Clean Water Act Section 401 Certification Rule” to implement the water quality certification process consistent with the text and structure of the CWA. The final rule was published in the *Federal Register* on July 13, 2020, and became effective on September 11, 2020. Section 404 of the CWA requires that a permit be obtained from USACE when an action would result in discharge of dredged or fill material into wetlands and waters of the

U.S. Under Section 404, USACE regulates such discharges and issues individual and/or general permits. Before USACE can issue a permit, it must be determined that the project is in compliance with the CWA Section 404(b)(1) guidelines, which specifies that “no discharge of dredged or fill material shall be permitted if there is a practical alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences” (40 CFR 230.10[a]).

When conducting its own civil works projects, USACE does not issue permits to itself. Rather, USACE complies with the guidelines and substantive requirements of the CWA, including Section 404 and Section 401.

Coordination with MDEQ is on-going, and State Water Quality Certification would be requested at a later date as plans progress and detailed designs are completed.

A Section 404(b)(1) evaluation to assess the short- and long-term impacts associated with the placement of fill materials into waters of the United States resulting from the proposed project is included in Appendix E. The MDEQ has not indicated any items that would prevent the issuance of State Water Quality Certification pending review of detailed plans, when available.

8.4 ENDANGERED SPECIES ACT OF 1973, AS AMENDED

The USACE is in compliance with the Endangered Species Act of 1973, as amended. The purpose of the Endangered Species Act of 1973 (ESA), 16 U.S.C. 1531, et. seq., is to protect and recover threatened and endangered (T&E) species of fish, wildlife, and plants and the ecosystems upon which they depend. It is administered by the USFWS. The USFWS has primary responsibility for terrestrial and freshwater organisms.

Under the ESA, species may be listed as either endangered or threatened. A listing of endangered means a species is in danger of extinction throughout all or a significant portion

of its range. A listing of threatened means a species is likely to become endangered within the foreseeable future. All species of plants and animals, except pest insects, are eligible for listing as endangered or threatened. For the purposes of the ESA, Congress defined species to include subspecies, varieties, and, for vertebrates, distinct population segments. Under the ESA, a permit to "take" a listed species is required for any Federal action that may harm a listed species. ESA, Section 7 prohibits Federal agencies from authorizing, funding, or carrying out activities that are likely to jeopardize the continued existence of a listed species or destroy or adversely modify its critical habitat. By consulting with USFWS before initiating projects, agencies review actions to determine if they could adversely affect listed species or their habitat and design their programs and projects to conserve listed and proposed species.

USACE has coordinated with USFWS to ensure the protection of those T&E species under their respective jurisdictions. An official (updated) species list was requested on 19 April 2022 from the USFWS Information Planning and Consultation website. In response, the threatened NLEB (Myotis septentrionalis) was listed as potentially occurring within the proposed project area. However, on November 30, 2022, USFWS published a final rule, 87 FR 73488, 50 CFR 17, which reclassified the NLEB as endangered under the Endangered Species Act with an effective date of January 30, 2023. Per 88 Federal Rule 4908, the effective date is now March 31, 2023.

Pursuant to Section 7 of the Endangered Species Act, as amended, the USACE has determined that implementation of the proposed action may affect but is not likely to adversely affect the NLEB, resulting from the potential for minor tree clearing. Habitat for the NLEB is expected to improve with the implementation of the NER Plan. Although as the species designation has been recently updated, USACE will continue to coordinate with USFWS throughout plan development to maintain Section 7 compliance.

8.5 FISH AND WILDLIFE COORDINATION ACT OF 1934, AS AMENDED

The USACE is in compliance with the Fish and Wildlife Coordination Act of 1934, as amended. The Fish and Wildlife Coordination Act (FWCA) provides the basic authority for USFWS 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 consult with the USFWS (and the National Marine Fisheries Service in some instances) and state fish and wildlife agencies regarding anticipated impacts on fish and wildlife resources and measures to mitigate these impacts.

It was determined on 19 April 2022 that, due to the minimal and temporary nature of the impacts, that this proposed action does not rise to the level of a formal Coordination Act Report. The USFWS is in support of the proposed action and the requirements of the Fish and Wildlife Coordination Act have been met, Coordination with the USFWS, as well as a letter of support is included in Appendix F. of this report.

8.6 HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE

The USACE is in compliance with the Resource Conservation and Recovery Act (42 USC 6901, et. seq.). The Resource Conservation and Recovery Act (42 USC 6901, et. seq.) enables EPA to administer a regulatory project that extends from the manufacture of hazardous materials to their disposal, thus regulating the generation, transportation, treatment, storage, and disposal of hazardous waste at all facilities and sites in the U.S. The proposed project would comply with this Act when transporting or disposing of hazardous material found in the project area.

The USACE is in compliance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980 (42 USC §9601). The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980 (42 USC

§9601) was passed to facilitate the cleanup of toxic waste sites. In 1986, the Act was amended by the Superfund Amendment and Reauthorization Act Title III (community right-to-know laws). Title III states that past and present owners of land contaminated with hazardous substances can be held liable for the entire cost of the cleanup, even if the material was dumped illegally when the property was under different ownership. The term “HTRW” means hazardous, toxic, and radioactive wastes, which includes any material listed as a “hazardous substance” (See 42 U.S.C.9601(14)) regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (hereinafter “CERCLA”) (42 U.S.C. 9601-9675) and any other regulated material in accordance with applicable laws and regulations. ER 1165-2-132 and Division Regulation 1165-2-9 established policies for conducting Hazardous, Toxic, and Radioactive Waste (HTRW) review for USACE Civil Works Projects. USACE is obligated under ER 1165-2-132 to assume responsibility for the reasonable identification and evaluation of all HTRW contamination within the vicinity of proposed actions. ER 1165-2-132 states that HTRW policy is to avoid the use of project funds for HTRW removal and remediation activities.

A Phase I Environmental Site Assessment (ESA) is required for all USACE Civil Works Projects, to facilitate early identification and appropriate consideration of potential 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.

A preliminary HTRW Phase 1 ESA was conducted for the IFR-EIS. This preliminary ESA was conducted to facilitate early identification and consideration of HTRW issues.

Several potential HTRW issues were identified in this ESA; however, a full Phase I ESA would be conducted on the RP and would be included in the final IFR-EIS. The preliminary ESA also identified the presence of several active, inactive, and plugged and abandoned oil/gas wells, several injection wells, and several oil and gas pipelines within the study area. Several industrial facilities such as chemical plants and refineries were also noted in the study area. There is a low probability of encountering HTRW from the wells, pipelines, and

industrial facilities during construction of the project. The Army's longstanding policy is that the NFS is responsible for providing a clean site for construction of the project and that USACE is prohibited for undertaking HTRW work on behalf of the NFS. Should the parties initiate or continue construction, the NFS shall be solely responsible, as between the Government and the NFS, for the performance and costs of cleanup and response of the HTRW, including the costs of any studies and investigations necessary to determine an appropriate response to the contamination.

8.7 MIGRATORY BIRD TREATY ACT OF 1918 & MIGRATORY BIRD CONSERVATION ACT OF 1929, AS AMENDED

The USACE is in compliance with the Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703, et seq.). The MBTA (16 U.S.C. 703, et seq.) is the primary legislation in the United States established to conserve migratory birds (USFWS 2004). The MBTA prohibits taking, killing, or possessing of migratory birds unless permitted by regulations promulgated by the Secretary of the Interior. The USFWS and the Department of Justice are the Federal agencies responsible for administering and enforcing the statute.

The study area is known to support colonial nesting wading/water birds (e.g., herons, egrets). Based on review of existing data, site visits, and with the use of USFWS guidelines, the USACE finds that implementation of the RP would have no effect on colonial nesting water/wading birds or shorebirds. USFWS and USACE biologists would survey the proposed project areas prior to construction because suitable habitat and the potential for nesting may exist within the proposed project areas. If active nesting exists within 1,000 feet (water birds) of construction activities then USACE, in coordination with USFWS, would develop specific measures to avoid 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 of the project footprint in order to avoid adverse impacts to these species. If a nesting prevention plan is necessary, it would be prepared in coordination with USFWS.

8.8 THE BALD AND GOLDEN EAGLE PROTECTION ACT, AS AMENDED

The USACE is in compliance with the Bald and Golden Eagle Protection Act (BGEPA).The BGEPA was enacted in 1940 and prohibits anyone without a permit issued by the Secretary of the Interior, from "taking" bald or golden eagles, including their parts, nests, or eggs. The BGEPA defines "take" as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb." In addition to immediate impacts, this definition also covers impacts that result from human-induced alterations initiated around a previously used nest site during a time when eagles are not present, if, upon the eagle's return, such alterations agitate or bother an eagle to a degree that interferes with or interrupts normal breeding, feeding, or sheltering habits, and causes injury, death or nest abandonment.

The American bald eagle was removed from the T&E Species List in August 2007 by the USFWS, but continues to be protected under the BGEPA, as amended. No known bald eagle nests occur within the proposed project locations. A USACE biologist and/or USFWS biologist would survey project areas for nesting birds prior to the start of construction. If nests are observed, further

coordination would occur with the USFWS to avoid impacts during the nesting season, and construction would take place outside of USFWS buffer zones.

8.9 EXECUTIVE ORDER 12898 ENVIRONMENTAL JUSTICE

The USACE is in compliance with Executive Order 12898. 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, with no group bearing a disproportionate burden of environmental harms and risks. Executive Order 12898 of 1994, as amended, 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. 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 % of minorities in an affected area either exceeds 50 percent or is meaningfully greater than in the general population. Low-income populations as of 2017 are those whose income are $24,600 for a family of four and are identified using the Census Bureau's statistical poverty threshold. The Census Bureau defines a "poverty area" as a census tract or block group with 20 percent or more of its residents below the poverty threshold and an "extreme poverty area" as one with 40 percent or more below the poverty level.

The Environmental Consequences section (Section 6) assess the study area to identify EJ communities that could be directly, indirectly, and cumulatively impacted by the Federal action. Mitigation measures should be developed specifically to address potential disproportionately high and adverse effects to minority and/or low-income communities.

When identifying and developing potential mitigation measures to address environmental justice concerns, members of the affected communities would be consulted. Enhanced public participation efforts would also be conducted to ensure that effective mitigation measures are identified and that the effects of any potential mitigation measures are fully analyzed and compared. Mitigation measures may include a variety of approaches for addressing potential effects and balancing the needs and concerns of the affected community with the requirements of the action or activity. If there are no high, adverse impacts or if there are high, adverse impacts that are not disproportionate, mitigation is not required.

The RPEDS conducted an EJ analysis focusing on the potential for disproportionately high and adverse impacts from the construction and normal operation of the proposed flood risk management system and the ecosystem restoration plan. A disproportionately high and adverse effect means the 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 EJ assessment found no disproportionately high and adverse effects to environmental or human resources with any of the alternatives.

8.10 NATIONAL HISTORIC PRESERVATION ACT OF 1966, AS AMENDED

NEPA calls for the consideration of a broad range of historic and cultural resources, including Native American resources. The consideration of impacts to historic and cultural resources is mandated under Section 101(b)4 of NEPA as implemented by 40 CFR, Parts 1501-1508. The National Historic Preservation Act (NHPA) of 1966 (54 U.S.C. 300101 et seq.) requires Federal agencies to consider the effects of a proposed undertaking on properties determined to be eligible for, or included in, the National Register of Historic Places (NRHP). The goal of the NHPA is to have Federal agencies act as responsible stewards of our national resources when their actions affect historic properties. Section 106 applies when two thresholds are met: (1) there is a Federal or Federally licensed action, including grants, licenses, and permits; and (2) that action has the potential to affect properties listed in or eligible for listing in the National Register of Historic Places.

Compliance with Section 106 of the National Historic Preservation Act (NHPA) is specifically mandated but takes a narrow focus on historic properties. The Section 106 process, implemented by regulations of the Advisory Council on Historic Preservation (ACHP), 36 CFR 800, requires agencies to define a project's Area of Potential Effects (APE), identify historic properties that area that may be directly or indirectly affected by the project, assess the potential for adverse effects, resolve those adverse effects, and provide the ACHP a reasonable opportunity to comment on the undertaking.

Cultural resources include historic properties, archeological resources, and Native American resources including sacred sites and traditional cultural properties. Cultural Resources are a broad pattern of material and non-material sites or objects that represent contemporary, historic, and pre-historic human life ways or practices. Common cultural resource sites include prehistoric Native American archeological sites, historic archeological sites, shipwrecks, and structures such as bridges and buildings. Historic properties have a narrower meaning and are defined in § 101(a)(1)(A) of the NHPA; they include districts, sites (archaeological and religious/cultural), buildings, structures, and objects that are listed in or determined eligible for listing in the NRHP.

Section 106 of the NHPA requires Federal agencies to consider their effects on historic properties (i.e., historic and cultural resources) and allow the Advisory Council on Historic Preservation (ACHP) an opportunity to comment. Historic properties are identified by qualified agency representatives in consultation with the SHPO, Tribes, and other consulting parties. USACE is addressing any potential impacts to historic properties through the "Section 106 consultation process" of the NHPA as implemented through 36 CFR, Part 800.

USACE has determined that the effects on historic properties cannot be fully determined before plan approval, and in accord with ER 1105-2-100, paragraph C-4(d)(5)(d)(2), USACE has elected to fulfill its obligations under Section 106 of the NHPA through the execution and implementation of a Programmatic Agreement (PA).

The Memphis District of USACE (CEMVM) has developed a Programmatic Agreement (PA) that establishes procedures to satisfy the MVM's Section 106 responsibilities pursuant to 36 Code of Federal Regulations (CFR) Part 800.14(b) with regard to the programmatic review

of this study. The PA allows the CEMVM 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 NEPA, as amended (42 U.S.C. § 4321 et seq.). The PA addresses the potential to affect historic properties that are eligible for or listed in 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. USACE has developed a process-specific PA in furtherance of the CEMVM's Section 106 responsibilities for this undertaking. The PA governs CEMVM's NHPA compliance efforts. Following the execution of the PA on September 2, 2022, the CEMVM may proceed with issuing a Record of Decision (ROD) in compliance with Section 106 of the NHPA and in coordination with NEPA.

8.11 EXECUTIVE ORDER (EO) 13175 CONSULTATION AND COORDINATION WITH INDIAN TRIBAL GOVERNMENTS

It is the policy of the Federal government to consult with Federally recognized Tribal Governments on a Government-to-Government basis as required in EO 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 lands for "any activity that has the potential to significantly affect protected tribal resources, tribal rights (including treaty rights), and Indian lands" finds its basis in the constitution, Supreme Court cases, and is clarified in later planning laws. The USACE Tribal Consultation Policy, 1 Nov 2012, specifically implemented this E.O. and later Presidential guidance. The 2012 USACE Tribal Consultation Policy and Related Documents provide definitions for key terms, such as tribal resources, tribal rights, Indian lands, consultation, as well as guidance on the specific trigger for consultation (Table 8-1.).

While DeSoto County has a long history of occupation by Native American communities, prior to its establishment and throughout its history, there are currently no protected tribal resources, trial rights, or Indian lands that have the potential to be significantly affected by the proposed actions within in the study area. In partial fulfillment of \E.O. 13175, NEPA, Section 106 of the National Historic Preservation Act, and 36 CFR Part 800, consultation was initiated in July 2019 with these Federally recognized Tribes: Alabama-Coushatta Tribe of Texas, Jena Band of Choctaw Indians, Mississippi Band of Choctaw Indians, The Chickasaw Nation, The Choctaw Nation, The Muscogee Nation, The Quapaw Nation, and the Tunica Biloxi Indian Tribe. Consultation has been ongoing throughout the study. The PA has been executed.

Table 8-1. 2012 USACE Consultation Policy Definitions

Category	Definition

Tribal rights:	Those rights legally accruing to a Federally recognized Tribe or tribes by virtue of inherent sovereign authority, unextinguished aboriginal title, treaties, statutes, judicial decisions, executive orders or agreement and that give rise to legally enforceable remedies.
Tribal lands:	Any lands title to which is: either held in trust by the United States for the benefit of any Federally recognized Indian tribe or individual or held by any Federally recognized Indian tribe or individual subject to restrictions by the United States against alienation.
Protected Tribal resources	Those natural resources and properties of traditional or customary religious or cultural importance, either on or off Tribal lands, retained by, or reserved by or for, Federally recognized Tribes through treaties, statutes, judicial decisions or executive orders.

8.12 PUBLIC INVOLVEMENT

Public involvement is an important part of planning and decision-making. Agencies, non-governmental organizations, and citizens provided valuable input for the final recommendation. The NEPA provides people, organizations, and governments an opportunity to review and comment on proposed major Federal actions. Engaging and receiving input from the public, interested parties, stakeholders, government agencies, and nongovernmental organizations regarding the content of the Integrated Report and EIS in all stages is critical to achieving the USACE objective of enhancing trust and understanding with customers, stakeholders, teammates, and the public through strategic engagement and communication. Public participation efforts began with the NEPA scoping process and continues through to the conclusion of the formal comment period on the Final Integrated Report and EIS.

Verbal comments received during the public scoping meeting were made part of the Public Scoping Meeting Transcript (Appendix F, Annex 2).

Verbal comments fell into these main points: consider flows to neighboring lands; consideration of archaeological resources; and ecological management of the river.

The initial draft IFR-EIS was released to the public for a 45-day comment period in May 2021. After release of the draft, subsequent analysis showed that the flood risk management plan required reformulation. Following the reformulation and identification of a new TSP , a revised draft document was prepared and released in May 2022 for a 2nd 45-day public review period. The release of the revised draft IFR-EIS was announced in a public notice that was published in appropriate local paper(s), on the study website, and through the Federal Register. Preparation of this final IFR-EIS has been coordinated with appropriate Congressional, Federal, Tribal, state, and local interests, as well as environmental groups and other interested parties.

Feedback from these meetings and report reviews showed that the public and officials in the local area recognized the need for flood risk management, stream stabilization and ecosystem restoration in the area.

SECTION 9
Conclusion

Information in this document was developed for feasibility analysis, with input from agencies and comments from the public, to help refine potential solutions to flood risk in North DeSoto County and channel instability countywide. Public involvement is an important part of planning and decision-making. Agencies, non-governmental organizations, and citizens provided valuable input for the recommended plan.

A Notice of Availability for the revised draft report was published in the Federal Register on May 06, 2022 and circulated for a 45-day public review period to Federal, state, and local agencies and organizations and individuals who have an interest in the project. All comments received during the public review period were considered and incorporated into this final report and all written comments are included in Appendix F-public, Interagency and Tribal Coordination. While no written public comments were received during the revised draft IFR-EIS review period themes voiced at the public meeting included: who has maintenance responsibility for plan features, grade control impact on flood risk, and development interest overlapping the footprint of the levee and floodwall.

A Notice of Availability of the final report for a 30-day state, agency, and public review period would be published in the Federal Register. All comments received during this period would be considered prior to USACE making a final decision on the RP and in preparing the ROD.

9.1 RECOMMENDATION

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

The Recommended FRM Plan is to construct a levee and floodwall system, as well as dry floodproof 21 commercial structures and 14 residential structures.

The Recommended FRM Plan reduces flood risks by 56% and produces $1.49M in net annual benefits with a benefit-to-cost ratio of 2.57 The Recommended AER Plan is to construct 74 grade control structures paired with riparian reforestation on 10 streams. The Recommended AER Plan preserves 272 acres of BLH forest, which would be lost without the plan and restores another 328 acres including over 20 miles of stream restoration reconnecting over 83 stream miles for aquatic species migration. The Recommended AER

Plan is expected to produce 31 average annual habitat units at an incremental cost of $5K per incremental average habitat unit.

CEMVM has assessed the environmental impacts of the RP on relevant resources in this FR and EIS. The RP would have only temporary impacts to these resources.

For planning purposes, construction was scheduled to begin in 2024. The project would require 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 DeSoto County Board of Supervisors in order to fund the detailed design phase and fully fund construction contracts.

If this project receives authorization and appropriations, the NFS, and the Department of the Army would enter into a PPA. After the signing of a PPA, the NFS can 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 achieving the project schedule. At the completion of construction, or functional portions thereof, the NFS would be fully responsible for OMRR&R of the project or of the completed functional portion of the project.

Brian Sawser
Colonel, EN
Commanding

9.2 PATH FORWARD

The USACE will conduct a 30-day State and agency review on the final IFR/EIS.

After the final feasibility report is submitted to USACE headquarters, a Chief's Report will be developed for review and approval by the Chief of Engineers, with such modifications as the Chief of Engineers deems necessary. Once the Chief of Engineers signs the report, the Chief of Staff signs 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 is also provided to the Office of the Assistant Secretary of the Army for Civil Works for review by the Administration.

The USACE submitted the RP for authorization as a Federal project at the discretion of the Commander, Headquarters, USACE. The NFS, DeSoto County Board of Supervisors, supports the RP, a letter of support was shared with CEMVM on January 23, 2023.

The USACE recognizes the project authority and formulation methodology is limited in what it can provide. It is recommended that the sponsor and other entities consider additional actions in a holistic approach to further mitigate flood risk damages and increase overall resiliency.

SECTION 10
List of Preparers

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Jon Korneliussen	Civil Engineer, Technical Lead
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Jack Killgore	Multi-scale Watershed Assessment Model (Stream Condition Index)
Todd Slack	Multi-scale Watershed Assessment Model (Stream Condition Index)
Christopher Haring	Fluvial Geomorphology
David Biedenharn	Fluvial Geomorphology

SECTION 11
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SECTION 12
List of Acronyms and Abbreviations

A	
ACHP	Advisory Council on Historic Preservation
AEP	Annual Exceedance Probability
AER	Aquatic Ecosystem Restoration
APE	Annual Probability Event
B	
BCR	Benefit to Cost Ratio
BGEPA	Bald and Golden Eagle Protection Act
BLH	Bottomland Hardwood
C	
CEMVN	USACE New Orleans District
CEMVM	USACE Memphis District
CE/ICA	Cost Effectiveness/Incremental Cost Analysis
CEQ	Council on Environmental Quality
CNO	Choctaw Nation of Oklahoma
CWA	Clean Water Act
D	
DIFR	Draft Integrated Feasibility Report
DEIS	Draft Environmental Impact Statement
E	
EC	Engineer Circular

EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EJ	Environmental Justice
EM	Engineering Manual
EO	Executive Order
EPA	Environmental Protection Agency
EQ	Environmental Quality
ER	Ecosystem Restoration
ESA	Endangered Species Act
F	
FCSA	Feasibility Cost Sharing Agreement
FEMA	Federal Emergency Management Agency
FMC	Fish Management Counsel
FRM	Flood Risk Management
FWCA	Fish and Wildlife Coordination Act
FWCAR	Coordination Act Report
FWOP	Future with Out Project
G	
GCS	Grade Control Structure
H	
H&H	Hydraulics and Hydrology
HTRW	Hazardous, Toxic, and Radioactive Waste
I	
IFR	Integrated Feasibility Report
L	
LERRD	Lands, Easements, Rights-of-Way, Relocations, and Disposal

LORR	Level of Risk Reduction
LWCF	Land and Water Conservation Fund
M	
MBCI	Mississippi Band of Choctaw Indians
MBTA	Migratory Bird Treaty Act
MCN	Muscogee (Creek) Nation
MDEQ	Mississippi Department of Environmental Quality
MEMA	Mississippi Emergency Management Agency
MSC	Major Subordinate Command
MVLP	Mississippi Valley Loess Plain
N	
NAAQS	National Ambient Air Quality Standards
NED	National Economic Development
NER	National Ecosystem Restoration
NEPA	National Environmental Policy Act
NFS	Non- Federal Sponsor
NHPA	National Historic Preservation Act
NLCD	National Land Cover Database
NMFS	National Marine Fisheries Service
NNBF	Natural and Nature Based Features
NRHP	National Register of Historic Places
NRCS	Natural Resources Conservation Service
NSI	National Structure Inventory
O	
O&M	Operation and Maintenance
OMRR&R	Operations, Maintenance, Repair, Rehabilitation, and Replacemer
OSE	Other Social Effects

P

P&G	Policy and Guidance
PA	Programmatic Agreement
PDT	Project Delivery Team
PED	Pre-construction Engineering and Design
PPA	Project Partnership Agreement

R

RED	Regional Economic Development
ROD	Record of Decision
ROE	Right of Entry
RP	Recommended Plan
RPEDS	Regional Planning and Environmental Division South

S

SCI	Stream Condition Index
SHPO	State Historic Preservation Officer
SNO	Seminole Nation of Oklahoma

T

T&E	Threatened and Endangered
TSP	Tentatively Selected Plan

U

USACE	United States Army Corps of Engineers
USDA	US Department of Agriculture
USFWS	**US Fish and Wildlife Service**
USGS	**United States Geological Survey**