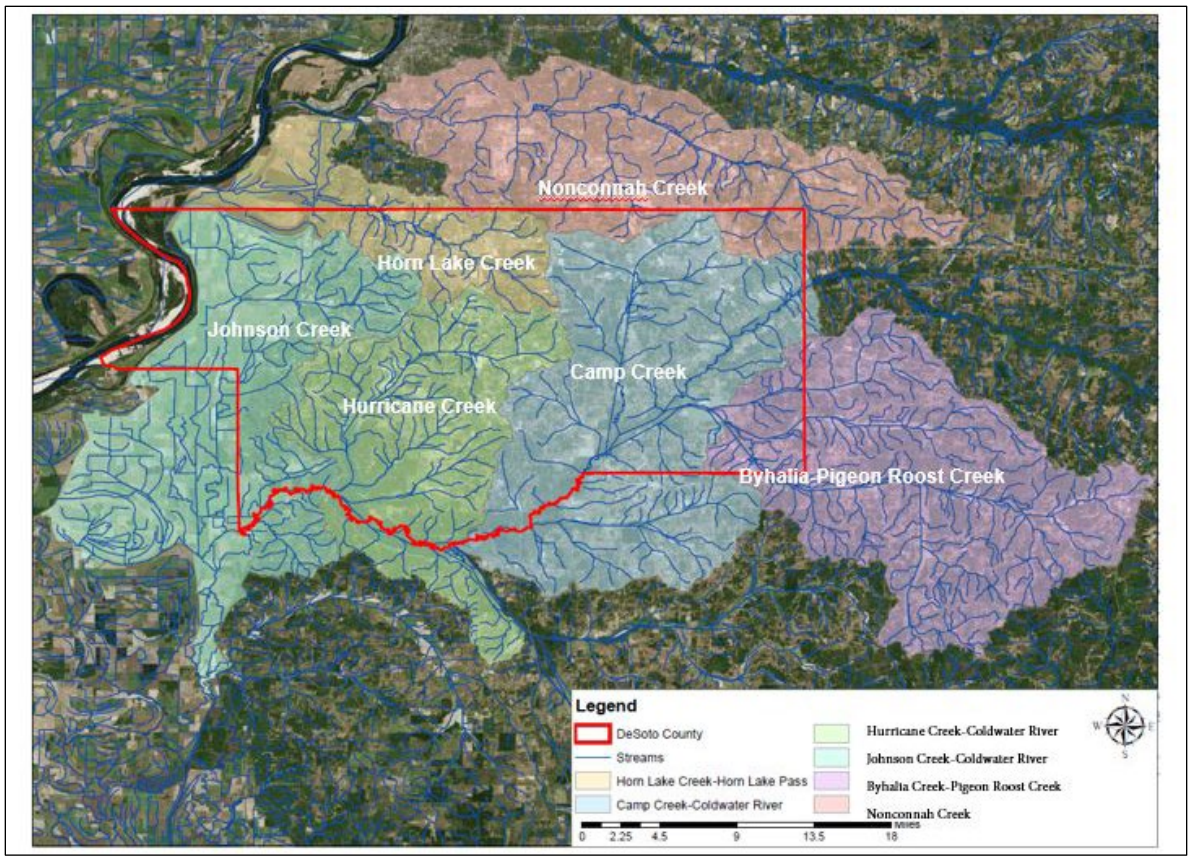
Mississippi Valley Division,
Regional Planning and Environment Division South

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



Revised Draft Feasibility Report with Integrated Environmental Impact Statement

May 2022

Cover Page

County: DeSoto County, Mississippi

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

Non-Federal Sponsor: DeSoto County Board of Supervisors

Cooperating Agencies: The United States Fish and Wildlife Service (USFWS), U.S. Environmental Protection Agency (USEPA).

Abstract: This Revised Draft Integrated Feasibility Report and Environmental Impact Statement documents the analysis of proposed actions related to the feasibility of flood risk reduction and ecosystem restoration alternatives within DeSoto County, Mississippi. Alternatives, including the proposed Tentatively Selected Plans and the No Action Alternative, are discussed.

All comments on this Revised Draft Integrated Feasibility Report and Environmental Impact Statement must be received by June 20, 2022.

For further Information please contact:
Memphis District United States Army Corps of Engineers
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167 North Main Street
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Estimated Cost of Preparing Draft: $2,800,000

Executive Summary

The U.S. Army Corps of Engineers (USACE), Mississippi Valley Division, Memphis District (CEMVM), prepared this revised draft Integrated Feasibility Report and Environmental Impact Statement (draft 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 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. 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. A Feasibility Cost Sharing Agreement with DeSoto County Board of Supervisors (sponsor) was executed on September 21, 2018. The draft IFR-EIS and the Tentatively Selected Plan (TSP) reflect sponsor, agency, stakeholders, and public input. It presents solutions to reduce damages from flood risk and channel instability as well as to improve aquatic habitat in DeSoto County, Mississippi (Figure ES-1).

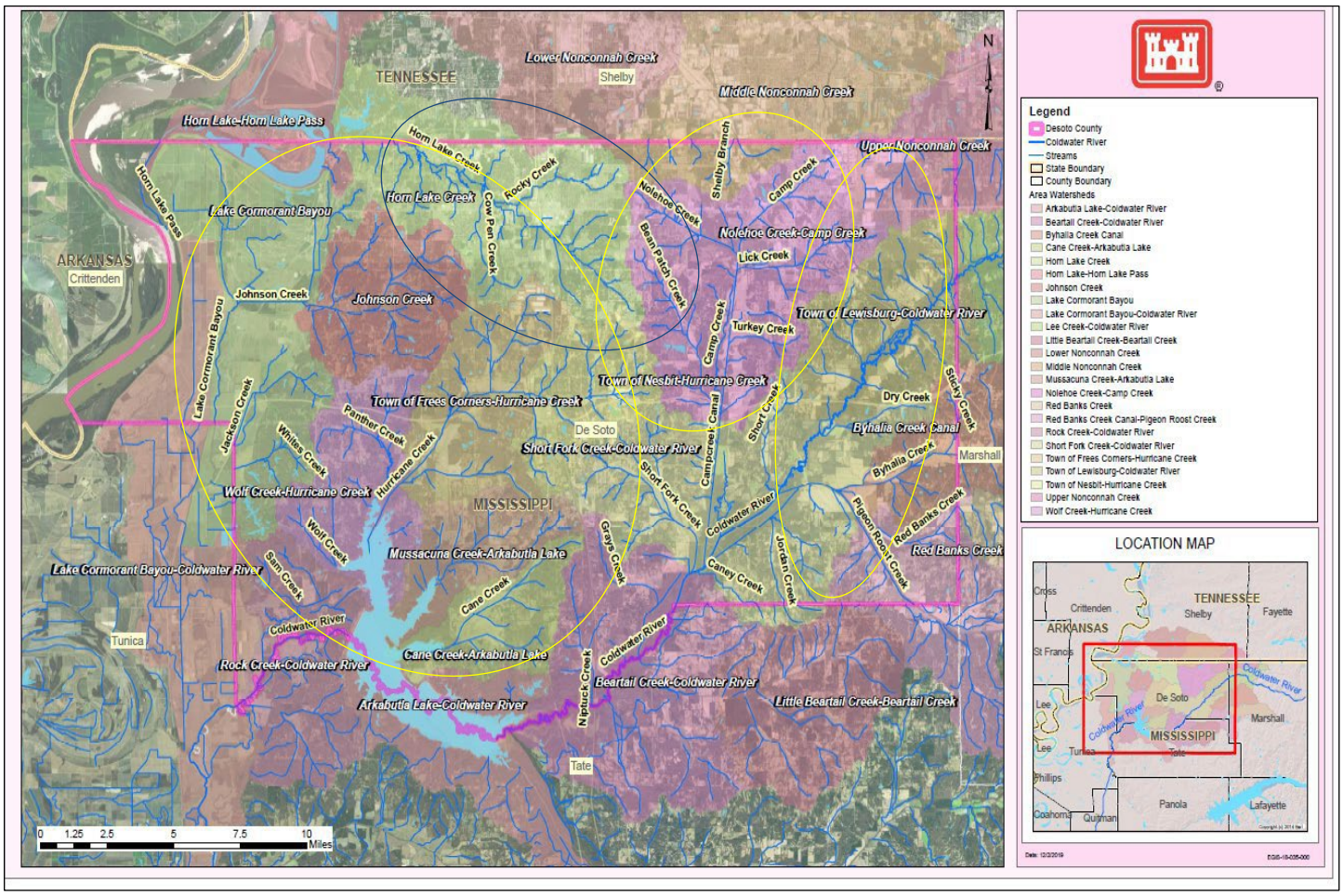

Figure ES-1. Study Area

Note: The Horn Lake Creek Watershed (circled in blue) is where flooding is concentrated. Horn Lake Creek as well as 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, and critical infrastructure. The study would also address road closures; increase accessibility to critical infrastructure; and decrease life safety situations caused by flooding. In addition, the purpose of the ecosystem restoration component of the study 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.

Plan Formulation

The planning process went through several iterations and evaluated alternatives. A nonstructural assessment was also completed that looked at the effectiveness of implementing measures such as structure elevations, relocations, or flood-proofing, as well as measures such as flood warning systems or evacuation plans. The range of study alternatives was refined based on preliminary analyses of effectiveness and cost. Twenty-six flood risk management (FRM) measures were evaluated based on the planning objectives, constraints, and opportunities discussed above. The final array of alternatives includes a levee and floodwall on the east side of Hwy 51 immediately south of the intersection of Goodman Road. In addition, the project delivery team (PDT) evaluated a channel enlargement feature that would be located along Horn Lake Creek between River Mile 18.6-19.4, 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 and one along Lateral D; and nonstructural alternatives to include residential raises and dry flood-proofing for commercial structures.

Three aquatic ecosystem restoration measures were evaluated based on the planning objectives and constraints. The final array of alternatives included grade control alone, as well as grade control and various quantities of reforested bottomland hardwood riparian zones.

Flood Risk Management Tentatively Selected Plan

Per USACE guidance (Principles and Guidelines,1983), the PDT identified the alternative that reasonably maximizes net economic benefits consistent with protecting the nation's environment. This National Economic Development (NED) plan was initially determined to include a channel enlargement on Horn Lake Creek, a single detention basin on Lateral D (a tributary of Horn Lake Creek), as well as a nonstructural aggregation to address residual flooding. However, when the PDT moved from the use of a 1 dimensional (1D) hydraulic model to the use of a 2D hydraulic model, a more effective NED plan was determined to include an approximately 3,000 linear foot levee and floodwall feature combined with a nonstructural aggregation to address residual flooding.

During the selection of the Tentatively Selected Plan (TSP), the DeSoto County Board of Supervisors initially (May 2021) identified a larger plan that appeared to maximize annual benefits and reduce roadway flooding. This locally preferred plan (LPP) included the channel enlargement, four detention basins, and a nonstructural aggregation. However, during feasibility level design, the 2-D hydraulic data illustrated that the channel enlargement and detention basins were not economically justified, which eliminated the initial NED and LPP from further consideration in this study.

After reformulation, FRM TSP is the new NED plan which includes a levee-floodwall feature along with a nonstructural aggregation that will both reduce residual risks and address induced flooding (Figure ES-2). This is estimated to produce approximately $1.97 million in

annual benefits at an average annual cost of $1.05 million, for a Benefit to Cost Ratio (BCR) of 1.87.

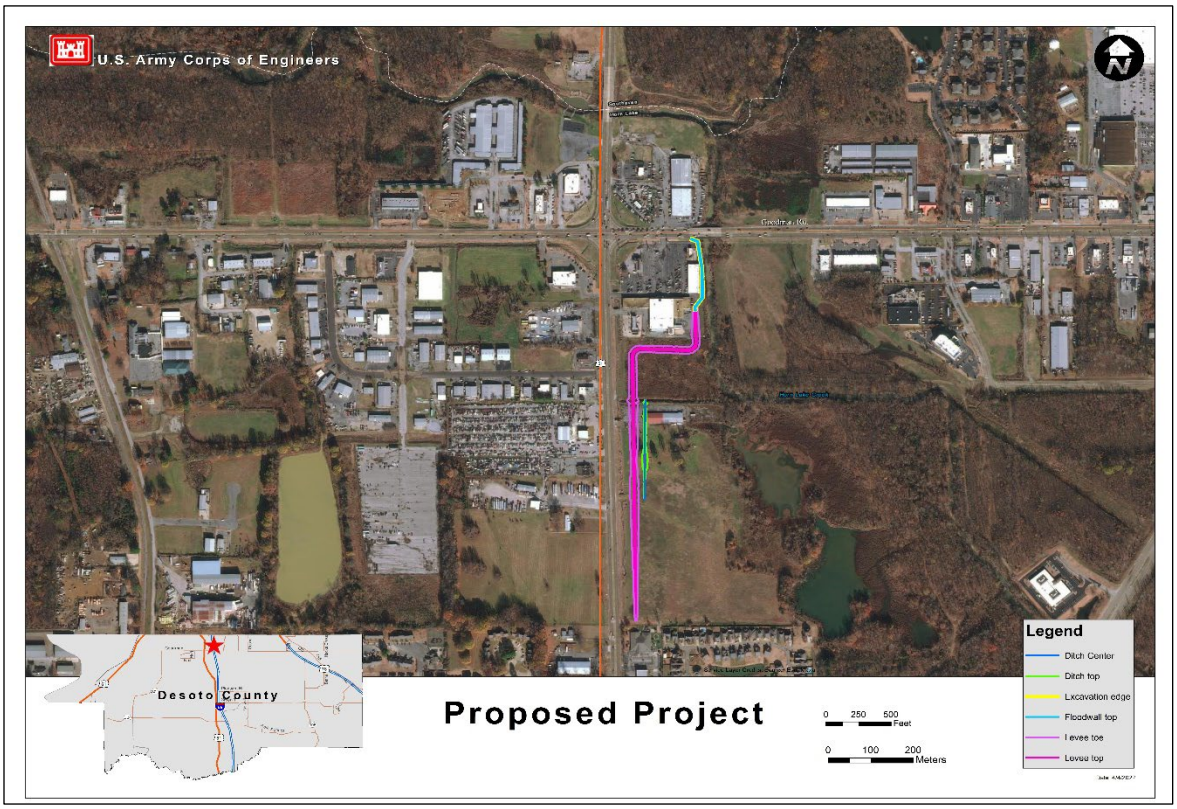

Figure ES-2. Levee and Floodwall

The structural features of the FRM TSP are illustrated in Figure ES-2. Nonstructural features of this plan include commercial dry floodproofing of 29 structures northeast of this feature and acquisition of one structure.

Ecosystem Restoration Tentatively Selected Plan

This study authorization included both flood risk management and ecosystem restoration. Ecosystem restoration is one of the primary missions of the USACE Civil Works program, meant to contribute to national ecosystem restoration (NER). Contributions to NER (NER outputs) are increases in the net quantity and/or quality of desired ecosystem resources. Measurement of NER is 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 maximizes ecosystem restoration benefits compared to costs. The NER plan includes a bank stabilizing system of eighty-eight (88) grade control structures (GCS) coupled with three hundred forty-four (344) acres of riparian restoration on eleven streams (Camp, Cane, Horn Lake, Hurricane, Johnson, Lick, Mussacuna, Nolehoe, Nonconnah, Red Banks, and Short Fork Creeks), as depicted in

Figure ES-3. The NER plan is estimated to provide 378 Average Annual Habitat Units (AAHUs) at an average annual cost of $3.7K per AAHU. The total annual cost of the NER plan is $1.2 million. This plan will stabilize and restore approximately 28 miles of stream, support connectivity of an estimated 90 stream miles, and provide 344 acres of bottomland hardwood (BLH) riparian restoration.

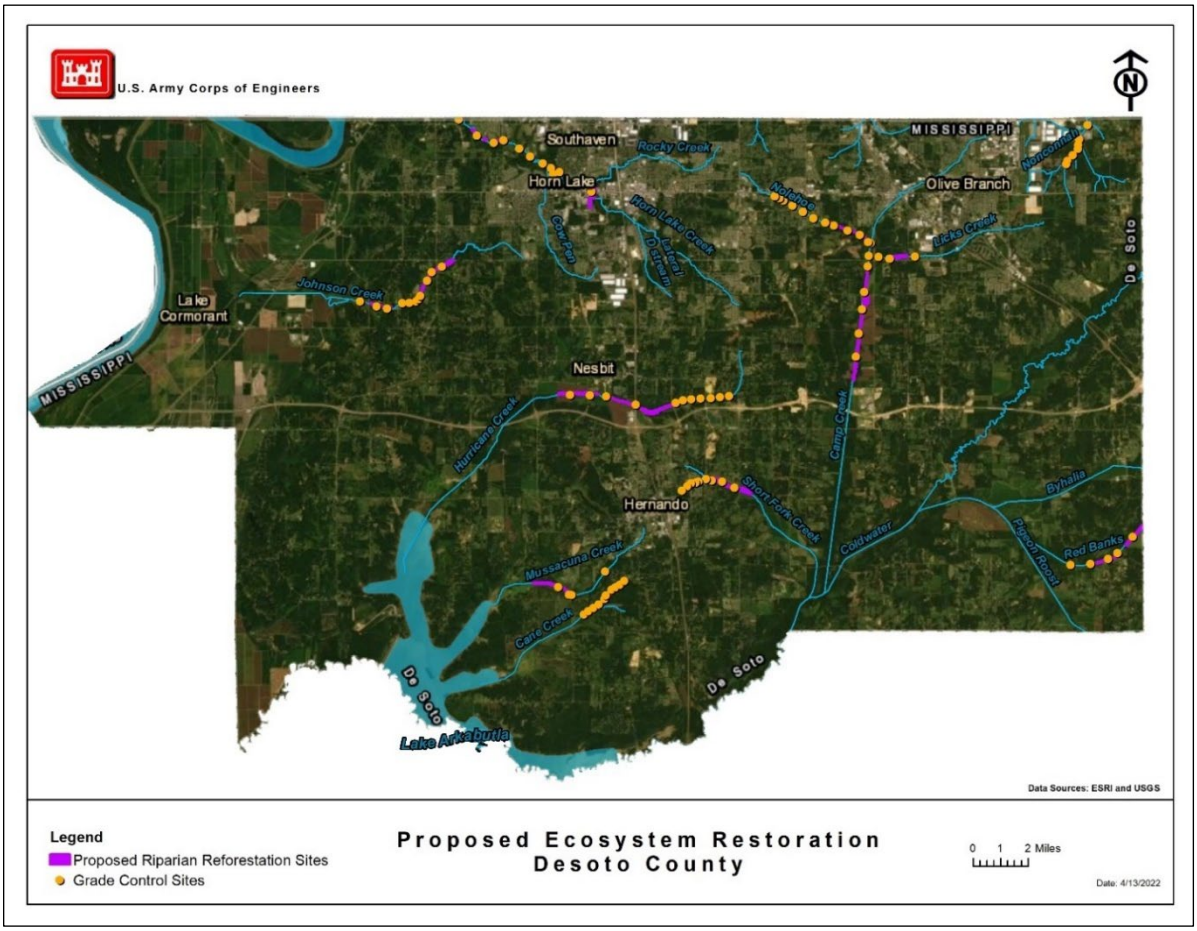

Figure ES-3. Ecosystem Restoration Tentatively Selected Plan

Significant Resources and Environmental Considerations

Section 6 describes the impacts of significant resources associated with the Final Array of alternatives. The tentatively selected plan (TSP) will have no adverse impacts on the environment; therefore, a draft conceptual mitigation plan is not needed. 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 NS plan; and 3) reduced flooding on roadways around low income or minority

communities. Inducements would adversely impact certain segments of roadways that residents of areas of EJ concern may use, but these inducements for the 100-year event are minor based on the current modeling. Also, see the 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).

Views of the Public, Agencies, Stakeholders and Tribes

A Notice of Intent (NOI) to prepare an 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, and on June 29,2021, a public meeting was held 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 still on-going, and no significant concerns on threatened or endangered species, water quality certification, or other items have been raised. While the initial FRM plan identified environmental impacts which would have required mitigation, the current tentatively selected plan requires no compensatory mitigation.

Cooperating Agencies include the following agencies agreed to be cooperating agencies and participate in the National Environmental Policy Act (NEPA) process: the United States 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 SHPO consultations began in September 2019. Four consultation meeting have been held to date. The Chickasaw Nation has agreed to be a signatory to the cultural programmatic agreement while the Cherokee Nation has agreed to be a consulting party. The draft programmatic agreement is in its final stages 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.

Unresolved Issues/Areas of Controversy

The FRM goal is to develop alternatives to reduce the severity of flood risk and damages to residential, business, 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 (.01 AEP). It is anticipated that road closures will be required at the .01 AEP event.

In addition, the levee-floodwall system appears to cause some increase in water surface elevation to the northeast, which could increase the depth and duration of water on property and roadways in Horn Lake Creek. The tentatively selected plan includes mitigation for structures in this area by providing dry floodproofing. Continued evaluation will be completed prior to the final report which will allow the project delivery team (PDT) to identify takings. Survey data, which would be obtained during Pre-Construction Engineering and Design (PED), will reduce the uncertainty in the depth and duration of these potential inducements.

Reviews

This Revised Draft Integrated Feasibility Report and Environmental Impact Statement has been reviewed by a USACE District Quality Control team, as well as Memphis District Office of Counsel. Pending release of the draft IFR-EIS, several concurrent reviews will occur. These reviews include Agency Technical Review, Public Review and Comment Period, Interagency Review, Section 106 review, and Policy and Legal Compliance Review.

Timeline

This revised draft IFR-EIS is available for public review and comment beginning May 06, 2022. The official closing date for receiving comments is June 20, 2022, which is 45 days from the date on which the notice of availability of this draft IFR-EIS was published in the Federal Register during the review period. Comments may be mailed to the address listed below or dropped off in person during business hours (Monday through Friday 8 a.m. to 5 p.m. local time). Comments may also be emailed to the email address listed below.

For further information contact the point of contact below before June 20, 2022:

U.S. Army Corps of Engineers
Attention: Environmental Compliance Branch
167 North Main Street
Memphis, TN 38023
Email: CEMVM-DeSoto-Comments@usace.army.mil

Privacy Notice: Persons submitting comments are advised that all comments received will be available to the public, to include the possibility of posting on a publicly accessible website. Commenters are requested not to include personal privacy information, such as home addresses, or home phone numbers, in their comments unless they do not object to such information being made available to the public.

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Section 1
Introduction

The U.S. Army Corps of Engineers (USACE), Mississippi Valley Division, Regional Planning and Environment Division South (RPEDS), prepared this draft Integrated Feasibility Report and Environmental Impact Statement (draft IFR-EIS) for the Memphis Metropolitan Stormwater, DeSoto County, Mississippi Feasibility Study. 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 draft IFR-EIS and the TSP reflect sponsor, agency, stakeholders, and public input. This draft IFR-EIS analyzes the environmental impacts associated with implementing alternatives, reviews the process for identifying the TSP and concludes with recommendations for project implementation. This draft IFR-EIS presents solutions to reduce damages from flood risk, channel instability 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 rational framework for sound 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 throughout the County. The study scope was determined based on the Study Authority, included below, and specifically referenced the need for flood risk management, environmental restoration, water quality, and related purposes associated with storm water runoff and management.

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 Non-Federal Sponsor (NFS), and the Department of the Army would enter into a Project Partnership Agreement (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 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.

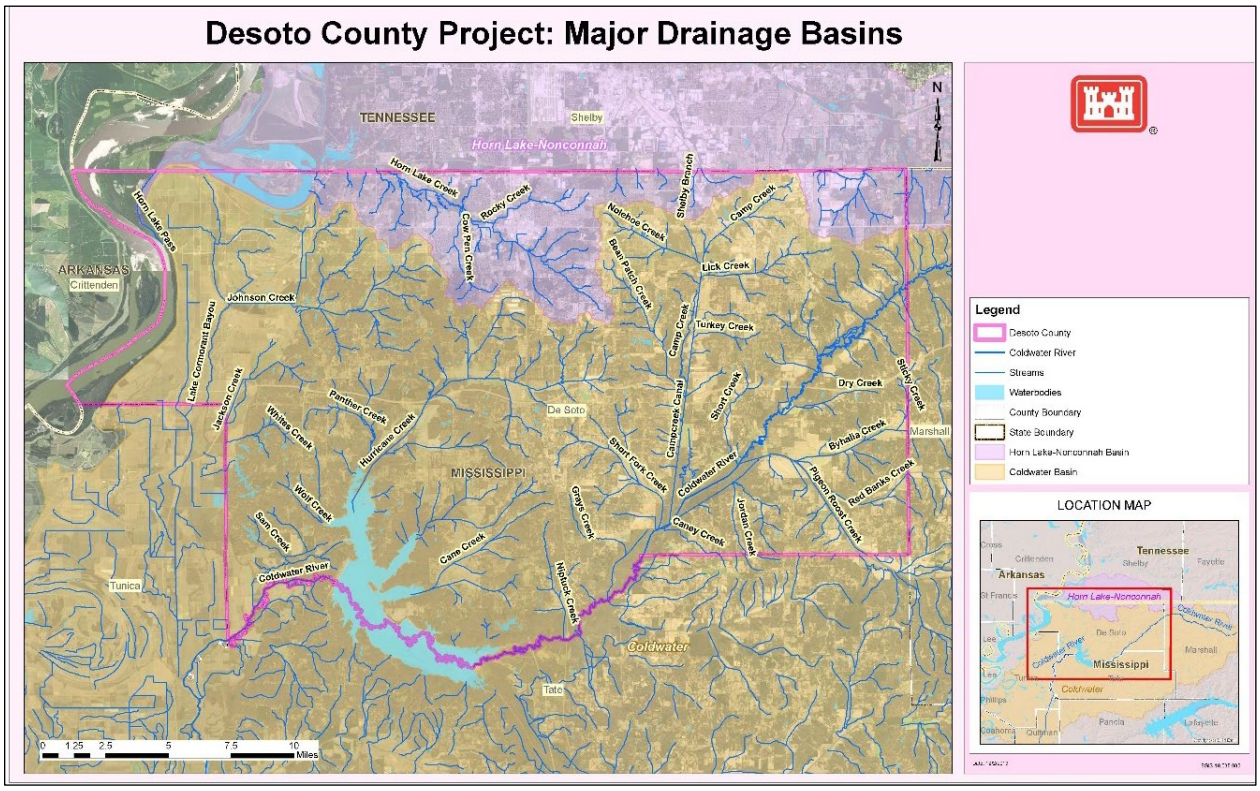


Figure 1-1. DeSoto County Study Area

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 makes up the specific project area that the team studied and to which the flood risk reduction measures were applied (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.

These significant features are in the study and project area:

- Interstate 55 bisects the area north to south
- I-69 corridor bisects it east to west
- U.S. Highways 51 and 61 lie in the project area
- Three major rail lines run north-south through the area
- Several large underground pipelines
- An overhead Tennessee Valley Authority transmission line is in the project area
- The study area lies approximately 2 miles south of the runways at Memphis International Airport.

Description of NER Component Project Area:

The full extent of the Study Area (DeSoto County, Mississippi, Figure 1-1) was investigated for ecosystem restoration opportunities. The streams that were evaluated were noted by the NFS or the Public as heavily impacted. 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.

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 USACE Constructed 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. Surveys and H&H modeling will be completed on 13 streams in the Coldwater River basin. Streams that may be investigated as part of both the MMS-North DeSoto County study as well as DHP include Red Banks Creek, Camp Creek, and Lick Creek.

1.5.2 Local Ordinances

1.5.2.1 DeSoto County Flood Damage Prevention 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 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. The U.S. Small Business Administration provided Federal assistance after the 2014 flood. 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. Flooding directly caused three documented deaths in April 1994, November 2011, and December 2002 in DeSoto County.

The purpose of the FRM component is to evaluate opportunities to provide FRM alternatives to reduce the risks of flooding to the public and commercial, residential, and critical infrastructure. The study addresses road closures, and accessibility to critical infrastructure, and life safety situations resulting from flooding.

Specific problems regarding the aquatic ecosystem in DeSoto County include reduced and degraded bottomland hardwood forested (BLH) and in-stream habitat largely due to development, channel alterations and channel bed degradation. Development in DeSoto County has occurred over the decades as population has increased requiring 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 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; 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 ER 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 2025 to 2075.

2.2.1 Flood Risk Management Planning Goals and Objectives

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

The FRM planning objectives include:

- Objective 1. Reduce flood damages to residential and commercial infrastructure in DeSoto County.
    - *Metric 1*: The Project Delivery Team (PDT) will evaluate structure damage at the eight frequency events ranging from .99 AEP (1 yr.) to 0.002 AEP (500yr.);

- Objective 2. Reduce risks to critical infrastructure.
    - *Metric 2*: The PDT will evaluate changes in water surface elevation as well as timing of the peak stage;

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

2.2.2 Ecosystem Restoration Planning Goals and Objectives

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.

The ecosystem restoration planning objectives include:

- Objective 4. Support aquatic habitat by reducing channel degradation such as instability and erosion.
    - *Metric 4*: The PDT will 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*: The PDT will 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 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, and culvert sizing, residential flooding, and wastewater treatment facility locations. Public outreach efforts are ongoing. Less than 10 members of the public attended the meetings. No responses by regular Postal Service mail were received. Due to the magnitude of changes in the TSP, as described in Section 4.3 of this report, all public comments received in 2021 and with this draft report will be answered during this public comment period. 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. Coordination with the interagency team is still on-going, and no significant concerns on threatened or endangered species, water quality certification, or other items have been raised. The MDEQ is concerned with on-going development in DeSoto County without in-depth 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.

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. Appendix L, Section 1.2 Figure L: 1-1 shows the structure inventory and the boundaries of the county.

3.1.2 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 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

3.1.3 Climate and 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."

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. There is the consensus and evidence pointing to an increasing precipitation trend and less evidence in observed data pointing to trends in temperature or temperature maximums in the region. There is some evidence that hydrology and streamflow are increasing in the region, but unclear evidence whether temperature is increasing or decreasing.

Projections indicate a strong consensus of an increase in projected temperature of approximately 2 to 4 degrees Celsius by the late 21st century. There is some consensus that precipitation extremes may increase in future both in terms of intensity and frequency, however, in general projections of precipitation have been shown to be highly variable across the region. There is some consensus that streamflow is projected to decrease in the region. However, very few conclusions can be drawn regarding future hydrology in the region largely due to the substantial amount of uncertainly in these projections when coupling climate models with hydrology models.

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 outlet for commercial and residential development in the Memphis, Tennessee metropolitan area. 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 by the year 2027. With development expected to continue at this rapid pace, future flooding problems are expected to increase.

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

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

Source: USGS National Land Cover Database

3.2 EXISTING CONDITIONS

3.2.1 Relevant Resources

This section describes the historic and existing conditions for relevant environmental resources for the natural and human environment including wetlands and bottomland hardwood 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 important 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. Appendix N, Table N-1 provides summary information of the institutional, technical, and public importance of these resources.

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:

> Bottomland hardwood (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. Wildlife species and utilization varies from the highly urbanized, to rural, to forested, 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 north 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, northern long-eared bat (discussed in more detail below), are scarce. In addition, BLH loss and aquatic instability within the MVLP has impacted the Mississippi Flyway. Species such as warblers, herons, waterfowl, raptors, and many other priority species listed by Audubon, 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.

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 control 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 and 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 more numerous faunae.

According to results 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.

The federally threatened NLEB has been heavily impacted by white-nose syndrome (WNS) and as a result, was listed as threatened by USFWS in January 2016. 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. No NLEB hibernacula exist within the study area. 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 maternity colonies or roost trees are known to exist within the study area.

The NLEB is listed as threatened and USFWS has issued a rule under Section 4(d) of the Endangered Species Act (ESA). “Section 4(d) of the Endangered Species Act directs the Service to issue regulations deemed “necessary and advisable to provide for the conservation of threatened species.” The 4(d) rule is used to target the take prohibitions to those that provide conservation benefits for the species. This targeted approach can reduce ESA conflicts by allowing some activities that do not harm the species to continue, while focusing efforts on the threats that make a difference to the species’ recovery.” (https://www.fws.gov/Midwest/endangered/mammals/nleb/4drule.html). On March 23, 2022, the USFWS published a proposal to reclassify the NLEB as endangered under the ESA. The U.S. District Court for the District of Columbia has ordered the Service to complete a new final listing determination for the NLEB by November 2022 (Case 1:15-cv-00477, March 1, 2021).

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 Mississippi Valley Loess Plain (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 *Flood History*

DeSoto County experienced significant flooding and flash flooding during the 10-year period from 1994 to 2004. Appendix N, Table N-3 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.

3.2.1.2.2 *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 (22DS500 and 22DS509), 14 ineligible lithic and ceramic scatters, and 1 unknown aboriginal. 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 22DS746, 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 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. The majority 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-4 and N-5 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

3.2.1.2.3 *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 control 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, the majority 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.

3.2.1.2.4 *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-6 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 (9) 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)

3.2.1.2.5 *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

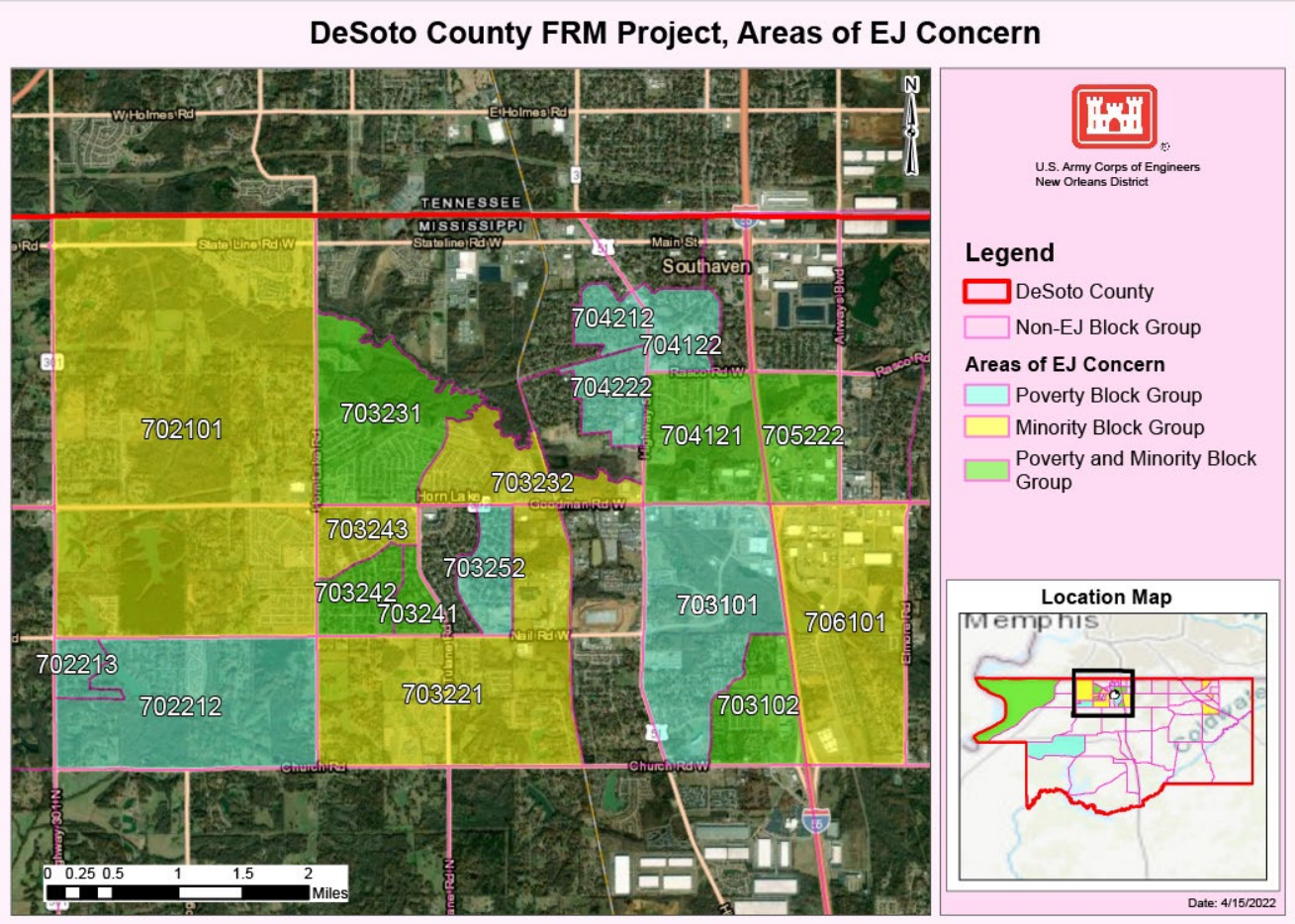
EJ Outreach will be conducted during the public comment period when the draft report is released to the public to gain insight from residents in areas of EJ concern about the proposed project and potential positive and adverse impacts. More information about EJ outreach can be found in the EJ Appendix 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, 2015-2019. For purposes of consistency with EO12898, 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, if a majority of residents identify as a person of color (minority) or if 20 percent or more of the residents live below poverty level,

which in 2019 was $25,750 for a family of four, the block group is considered an area 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. Block Groups (shown on Figure 3-1 as numbers) are smaller geographic areas for which the U.S. Census Bureau provides demographic data. The county is majority white with 35 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. In the study area, 15 Census Block Groups are majority minority (areas of EJ concern) and are shown in Table M-1 in Appendix M and on Figure 3-1 below. 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 3-1, Census Block Groups, Areas of EJ Concern (Minority and Low-Income)



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

While 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 2019 was $25,750 for a family of four. However, some areas within the County are low-income, as identified by the 20% or more threshold, and are shown in Table M-2 in Appendix M and on Figure 3-1 above. All the block group areas shown in Table M-2 in Appendix M have 20 percent or more of the population living below the poverty threshold are considered areas of EJ concern.

The second source for information that can be used to identify areas of EJ concern (termed disadvantage communities by CEQ) is CEQ's recently released Climate and Economic Justice Screening Tool (CEJST). In this database, CEQ identifies Census Tracts throughout the nation that meet its definition of a disadvantaged community. The purpose of the tool is to help Federal agencies identify disadvantaged communities that are marginalized, underserved, and overburdened by pollution. This CEJS tool goes beyond using just the minority and low-income status as a determinate of being a disadvantaged community. The current version of the tool provides socioeconomic, environmental, and climate information to identify and inform decisions that may affect these communities. The tool identifies disadvantaged communities through publicly available, nationally-consistent datasets. The tool developed an excel table revealing every census tract in the United States and if it qualified under CEQ's criteria as a disadvantage community. Desoto County consists of 33 census tracts, of which 3 are identified in the CEQ database as being disadvantaged. The three Census Tracts (CT) in Desoto County that are identified as being disadvantaged communities are CT 70324 (Block Groups 1, 2 and 3), 70325 and 70422. The Census Tracts meet one of the 25 criteria used to identify disadvantaged communities. Each of these CT meets the criteria: "low-income and has a lower percentage of higher education students". The Census Tracts that CEQ designates as disadvantage communities are also identified using the first approach to identifying Areas of EJ Concern (minority and low-income thresholds).

3.2.1.2.6 *Socioeconomics*

3.2.1.2.6.1 Population and Housing

Table 3-3 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 3-4) also shows a steady increasing trend from 1970 to 2010 and projections through 2040.

Table 3-3 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 3-4 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

3.2.1.2.6.2 Employment, Business, and Industrial Activity

Table 3-5 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 3-6 and 3-7 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 3-5. 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 3-6. Labor Force, Employment, Unemployment, and 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 3-7. Labor Force, Employment, Unemployment, and 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)

3.2.1.2.6.3 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 3-8 shows the growth in per capita since 1970 and projections through 2040.

Table 3-8. 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.

3.2.1.2.7 *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).

Prime and unique farmlands are located within DeSoto County, Mississippi. Coordination regarding exact acreage and locations is on-going.

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

NEPA requires that in analyzing alternatives to a proposed action, a federal agency must consider an alternative of "No Action." The future without project (FWOP) describe conditions if the proposed action is not implemented. Appendix G, Figures 61 through 68 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 proposed projects are currently in construction, and if they were implemented, would have only localized flood risk reduction within the study area. The projects/programs would have the potential to reduce the number of eligible structures for the nonstructural portion of the TSP. 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 100-year floodplain 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.
- The Horn Lake Drainage Basin 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 proportion to this increase in development, the area is expected to see an increase in flow discharges. Table 3-9 shows a comparison of the 100-year discharges at various locations for 2002 existing conditions versus 2027 future without project conditions.

Table 3-9 Comparison of 100-year Discharges

Location	Stream Mile	Drainage Area (Square Mile)	100-Year Discharges	
			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 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 reduction benefits, etc. would not be achieved (No Action Alternative).

3.3.1.1 Natural Environment

3.3.1.1.1 *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 280 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.

3.3.1.1.2 *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.

3.3.1.1.3 *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.

3.3.1.1.4 *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.

3.3.1.1.5 *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.

3.3.1.1.6 *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.

3.3.1.1.7 *Geology and Soils*

Under the FWOP conditions, significant erosion would continue to impact land adjacent to streams. It is expected that approximately 280 acres of land could be lost across Desoto County without appropriate erosion prevention.

3.3.1.2 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.

3.3.1.2.1 *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, but show some evidence of increased precipitation, hydrology, and stream flow (as described in section 3.1.3). Future flood risk is expected to increase in a future with no action.

3.3.1.2.2 *Cultural Resources*

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

3.3.1.2.3 *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.

3.3.1.2.4 *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.

3.3.1.2.5 *Environmental Justice and Other Social Effects*

Under the FWOP conditions, there would be no Federal action (construction of flood risk reduction 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.

3.3.1.2.6 *Socioeconomics*

3.3.1.2.6.1 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.

3.3.1.2.6.2 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.

3.3.1.2.7 *Prime and Unique Farmland*

Under the FWOP, prime and unique farmland would continue to be impacted by the uncontrolled widening of streams.

Section 4
Formulate Alternative Flood Risk Management Plans

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

The initial plan formulation strategy was to focus on regional solutions (e.g., dams, detention basin, and 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 protection. 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 TSP, 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. 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, both of which would be measurable by evaluation of changes to water surface elevation at flood prone intersections. The critical infrastructure present includes hospitals, schools, electric substations, and emergency services (fire, police, EMS). The PDT identified the critical work plan areas, or 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 was screened, many of the individual measures of that alternative were retained. The PDT evaluated five types of structural measures (detention basins, channel modifications, re-routing flows, levees and removing constrictions) and both physical and non-physical nonstructural measures.

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 first TSP milestone was held in May 2021, and it included an NED plan with both structural and nonstructural features (channel enlargement, detention and 25 year nonstructural) as well as a Locally Preferred Plan (LPP) which included the NED plan plus three additional detention basins. The LPP was selected as the TSP and was presented to the public for review. Further analysis of this plan during feasibility level design showed that it was not effective nor economically justified. As a result, the PDT evaluated modified flood risk management features including a levee and floodwall along Highway 51 south of Goodman Road, as well as flood inducement mitigation measures consisting of nonstructural dry flood proofing of commercial structures and road closures. This plan is described in detail below.

4.1 FLOOD RISK MANAGEMENT MEASURES

The plan formulation process utilized the best available information early in the study to identify a TSP. However, during feasibility level design, additional analyses was completed to refine the design and cost estimates of the features included in the TSP. The revised design and costs were incorporated into 2D Hydraulic numerical modeling, and the Economic analysis was revised in order to develop an accurate assessment of the performance and cost-effectiveness of the plan which would be included in the Final IFR & EIS. The remaining portion of this Section (4.1) and Section 4.2 outline the first iteration of plan formulation. Section 4.3 outlines the final iteration.

The PDT developed a mixture of nonstructural and structural measures 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. Twenty-six nonstructural and structural measures (Table 4-1) were evaluated. The unshaded cells in the table are the measures that were carried forward and used to create alternatives. 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 alternatives could be used in conjunction with any of the structural flood mitigation alternatives to optimize the cost/benefit ratio.

- Non-physical: Consists of flood warning system/evacuation plans. Adequate land use and floodplain management development regulations already exist and do not warrant further evaluation.
- Physical: Consists of property acquisition (buyouts), relocation, elevation, and/or flood proofing of structures.

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 reduction or water conveyance could be constructed to protect 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

Advancing best practices within the USACE involves identifying actions that can be taken to better align and integrate engineered and natural systems to produce more socially acceptable, economically viable, and environmentally sustainable projects. 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 efficiently and sustainably deliver economic, environmental, and social benefits 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, direct the USACE to consider natural and nature-based features during the plan formulation of feasibility studies. 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 SCREENING

The PDT developed a mixture of nonstructural and structural measures 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. Twenty-six

measures (Table 4-1) were evaluated including both nonstructural and structural measures. Measures were screened based on their ability to deliver on the objectives and their cost effectiveness (if costs far outweighed benefits and the Benefit-cost ratio was less than 1). Nonstructural 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.

Twenty-six individual flood risk reduction measures were considered and of those, 16 were screened and removed from consideration. Measures were screened if they were incomplete and did not meet one of the study objectives, cost more than they benefited (or had a B/C<1), or violated a constraint. 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	Type	Location	Reduces Damage or Risks to			Reason for Screenin
			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 single large capacity reserv site was unavailable
Detention at Sewerage Lagoon site	Detention to handle inducements from the 2005 plan	NW of Bullfrog Corner				This site should be avoided 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 v limited capacity to hold mo water
Airways and I-55	Detention	Airways and I-55	X			volume limited and high co excavation made this alter no longer economically jus
Detention with berms	Detention with berms	Same measure 9-12				berms could create life safe risk
Bridge Removal	Remove and replace	Railroad, Hwy 51, Elmore Rd.				minimal reduction in WSE, cost
Clearing and Snagging	dredge, clear and snag	HLC and tributaries		,		very minimal reduction in W
Zoning Ordinances	FEMA/Sponsor responsibility	HLC and Coldwater				
Buy Outs	If qualify	HLC and Coldwater	X			

Measure Description	Type	Location	Reduces Damage or Risks to			Reason for Screening
			Commercial & Residential infrastructure	Critical Infrastructure	Life Safety	
Flood Proofing Commercial Structures	Wet or Dry	HLC and Coldwater	X			
Elevate Residential Structures	25, 50, 100 yr.	HLC and Coldwater	X			
Elevate Roads and Bridges		HLC and Coldwater		Will share frequency of roadway inundation with MDOT		Not within USACE authority
Rocky Creek Ring Levee at Shelby Apartments	Around Communities	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	Around Communities	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	Around Communities	HLC b/w Airways and Elmore	X			Does not address access to critical facilities/road flooding
Horn Lake Creek Levee 2 around bullfrog corner	Around Communities	HLC @ Hwy 51 and Goodman	X			would not address flooding on roadways
Horn Lake Creek Drainage Ditch Levee	levee ringing Bullfrog Corner	from I55 S. of Goodman Rd to RR		X		Blocks flows down Bull Frog 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	with concrete lining	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, including alternatives for no-action and nonstructural. 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 eight nonstructural, eight structural, and two combined nonstructural/structural alternatives. These 18 alternatives were further evaluated using the screening criteria identified in Table 4-3. The initial array of alternatives was further refined into an intermediate array of alternatives and as more detail was provided the intermediate array was evaluated and reduced to a final array of alternatives. The unshaded cells in Table 4-2 are the alternatives that were carried forward.

Table 4-2. Initial Array of Alternatives

Alt ID	Description	Measures Included	Primary Screening Criteria	Initial B/C Ratio
NS - 25yr	0.04 AEP Nonstructural Aggregation	Elevating Residential and Flood proofing Commercial Structures	Most efficient and effective nonstructural aggregation (highest net benefits)	1.34
NS-50yr	0.02 AEP Nonstructural Aggregation	Elevating Residential and Flood proofing Commercial Structures	0.04 AEP Nonstructural had the highest net benefits	1.02
NS-100yr	0.01 AEP Nonstructural Aggregation	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

Alt ID	Description	Measures Included	Primary Screening Criteria	Initial B/C Ratio
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
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	Rocky Creek Detention, Cow Pen Creek Detention and Lateral D Detention	NFS requests retaining each detention to address roadway flooding	.85
21	Three Detention sites+ Horn Lake Creek Channel Enlargement 18.86-19.41	Rocky Creek Detention, Cow Pen Creek Detention and Lateral D Detention+ HLC Channel Enlargement with Rip Rap	Maximizes Net Benefits-efficient and effective, acceptable	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
25	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 not carried forward during the screening process. Screening of Alternatives

4.2.2 Flood Risk Management Alternative Plan Screening

Corps 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

Twelve alternatives were retained during initial screening (Table 4-4, unhighlighted cells). Those were combined to develop an immediate array of flood risk reduction alternatives. Alternative 1A-Rocky Creek, Cow Pen Creek and Lateral D detention basins, was identified as inefficient and incomplete. However, all other alternatives, including those that included these basins in combination with nonstructural (1B), or channel enlargement (2A) were found to be efficient, effective, and acceptable. The intermediate array of flood risk alternatives is identified in Table 4-4.

Table 4-4 Intermediate Array of Flood Risk Alternatives

Alt ID	Description	Effective	Efficient	Acceptable	Complete
No Action	USACE would take no action to address flood risks				
1A	3 detention sites (Cow Pen, Lateral D and Rocky)				
1B	3 detention sites (Cow Pen, Lateral D and Rocky), plus 25 YR Nonstructural			X	
2A	3 detention sites (Cow Pen, Lateral D, and Rocky) plus HLC Channel Enlargement 18.86-19.41	X			
3A	Channel Enlargement RM 18.86-19.41	X	X		
3B	Channel Enlargement RM 18.86-19.41 plus 25 YR Nonstructural	X	X	X	
4A	25 YR Nonstructural Aggregation		X	X	
4B	50 YR Nonstructural Aggregation				
5A	Extended Horn Lake Creek Channel Enlargement 18.6-19.4	X	X		
5B	Extended Horn Lake Creek Channel Enlargement+ 25 YR Nonstructural	X	X		
6A	Extended Horn Lake Creek Channel Enlargement+ Lateral D Detention	X	X	X	
6B	Extended Horn Lake Creek Channel Enlargement+ Lateral D Detention+ 25 YR Nonstructural	X	X	X	X
7A	Extended Horn Lake Creek Channel Enlargement + Cow Pen, Lat D, Rocky Detention+ 25 YR Nonstructural	X	X	X	X

4.3 FRM ALTERNATIVES INCLUDING THE PROPOSED ACTION

The final array of FRM alternatives carried forward for consideration are presented in Table 4-8 and the location of the structural alternatives are presented in Figure 4-1. The PDT initially identified the channel enlargement as the most efficient and effective measure to reduce flooding on Horn Lake Creek. However, channel enlargement alone was identified as incomplete because it would not reduce flood damages on the tributaries of Horn Lake Creek. Nonstructural flood-proofing and detention basins were combined with the channel enlargement in the NED plan to address flooding on the tributaries.

In May 2021, a final array of alternatives (see Table 4-5) were all identified as being efficient, effective, and acceptable.

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	4% AEP Nonstructural	1.34
5A	Extended Horn Lake Enlargement 18.6-19.4	2.35
5B	Extended Horn Lake Channel Enlargement+ 25 YR (0.04 AEP) Nonstructural	1.29
6A	Extended Horn Lake Channel Enlargement+ Lateral D Detention	1.64
6B	Extended Horn Lake Channel Enlargement+ Lateral D Detention+ 25 YR Nonstructural	1.66
7A	Extended Horn Lake Channel Enlargement + Cow Pen, Lat D, Rocky Detention+ 25 YR Nonstructural	1.12

High risks and uncertainty in data accuracy led the PDT to update the hydraulic analysis from 1-dimensional (1D) to 2-dimensional (2D) H&H analysis (HEC-RAS). Subsequent economic analysis (HEC-FDA) was completed in November 2021. This updated analysis indicated that none of the original final array plans identified in Table 4-5 were effective or economically justified. Plan reformulation (Table 4-6) identified only a single plan, a levee and floodwall system (plan 8) that was efficient, effective, and acceptable.

Table 4-6. Reformulated Final Array of Flood Risk Management Plans (2022)

Alt ID	Description	B/C
No Action	USACE would take no action to address flood risks	N/A
4A	4% AEP Nonstructural	.22
5A	Extended Horn Lake Enlargement 18.6-19.4	.89
6A	Extended Horn Lake Channel Enlargement+ Lateral D Detention	.35
7A	Extended Horn Lake Channel Enlargement + Cow Pen, Lat D, Rocky Detention	.37
8	Levee + Floodwall + Nonstructural (dry floodproofing)	1.87

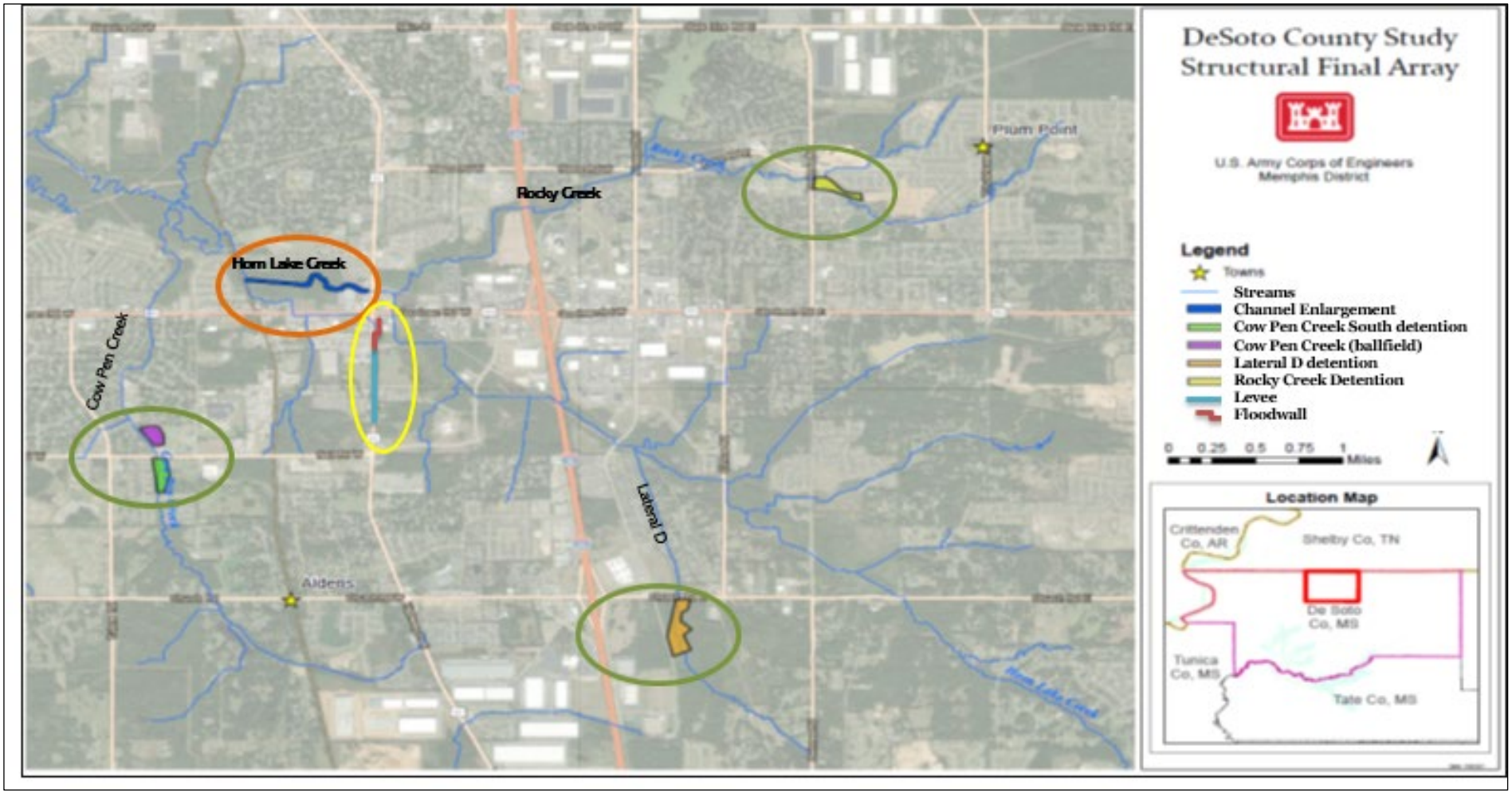


Figure 4-1. DeSoto County Flood Risk Management Structural Final Array

4.3.1 No Action Alternative

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

4.3.2 Plan 4A - Nonstructural Alternative Plan

A nonstructural assessment (Appendix L-Economics section 1.6) was completed to evaluate the effectiveness of implementing measures such as structure elevations, relocations, and flood-proofing. An inventory of residential and non-residential structures was developed using the National Structure Inventory (NSI) version 2.0 for the portions of the study area impacted by flooding. Independent aggregated floodplains were analyzed using HEC-FDA for nonstructural measures. The 0.04 Annual Exceedance Probability (AEP), or 25-year floodplain, was initially identified as the optimal nonstructural plan.

This alternative addressed every structure receiving damages at the existing 0.04 AEP event under the 1D hydraulic analysis. This alternative when implemented alone assumed that:

- 104 residential structures would be raised to the future 100-year stage up to 13 feet.
- 38 nonresidential structures would be floodproofed up to 3 feet.

However, the updated 2D hydraulic and subsequent economic analysis allowed for finer detail in the existing terrain and location of structures. The result was that although the water surface elevations near certain structures did not change dramatically, the structure elevations did change. Many structures thought to be flooded under previous modelling and analysis were shown to be on high ground in the updated economic analysis, thereby reducing the existing damages and the proposed benefits. As a result, the nonstructural flood-proofing plan was determined to be inefficient and ineffective as a standalone alternative. This plan would not reduce the risks of flooding to the public and commercial, residential, and critical infrastructure. Nor would it address road closures, or increase accessibility to critical infrastructure, and decrease life safety situations caused by flooding.

4.3.3 Plan 5A - Extended Channel Enlargement

A channel enlargement along Horn Lake Creek (HLC) would be constructed downstream of Goodman Road in Horn Lake, Mississippi. The channel bottom would be enlarged from stream mile 18.6 to mile 19.41 (0.8-mile) from the current approximated width of 15-25 feet to 40 feet. The creek banks would be constructed for stability at a slope of approximately 3-foot horizontal to 1-foot vertical (3H:1V). The HLC channel enlargement would require tree clearing of approximately 20 acres along one bank of HLC for access, bank stabilization, and excavation. 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 channel bottom and 5 feet up both streambanks. 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.

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 .05 Annual Exceedance Probability (AEP) event upstream of Goodman Road and Hwy 51 and the enlarged channel. As anticipated, the 1D analysis did not define how water flows between the modeled cross-sections. The 2D 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 1D hydraulic. Based on this updated H&H and subsequent economic analysis, the channel enlargement was deemed ineffective. This plan would reduce some risks of flooding to however, the risk reduction is limited. This plan does not address road closures, or increase accessibility to critical infrastructure, and decrease life safety situations caused by flooding.

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

The plan 5A, extended channel enlargement measure, is the same as described in section 4.3.3 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 bottomland hardwoods (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 annual exceedance probability (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.

4.3.5 Plan 7A -Plan 6A with Rocky Creek, and Cow Pen Creek Detention Basins, coupled with nonstructural

Plan 7A was initially (May 2021) identified as the LPP and the TSP. This plan added two detention basins and nonstructural 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.

4.3.6 Plan 8-Levee and Floodwall system with Nonstructural; Proposed Action

Plan 8 includes a levee and floodwall system along with nonstructural aggregation that would both address flood inducements and reduce residual risks. 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 approx. 2,475 linear feet adjacent to US Hwy. 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 a levee infeasible, flood risk reduction would transition to a 525 linear feet floodwall.

The proposed borrow area for the levee 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 would still be feasible on the riverside of the levee.

This plan is the proposed action and is the only efficient, effective, and acceptable flood risk management alternative that reduces the risks of flooding to the public, commercial, and residential infrastructure. The plan would be made complete with road closures along Goodman Rd. during less frequent (100 and 500 yr.) events. During feasibility level design and prior to the final integrated report and environmental impact statement the life safety analysis

4.4 SYSTEM OF ACCOUNTS-FLOOD RISK MANAMGEMENT EVALUATION

To facilitate alternative evaluation and comparison of the alternatives, the P&G lays out four Federal accounts that are used to assess the effects of the final array of alternatives. The accounts are National Economic Development (NED), Environmental Quality (EQ), Regional Economic Development (RED), and Other Social Effects (OSE). Table 4-7 compares the four Federal accounts against the economically justified alternatives in the revised final array. This is a summary of the highest-ranking alternatives by account:

- **NED Account** - The intent of comparing alternative flood risk reduction plans in terms of NED account was to identify the beneficial and adverse effects that the plans may have on the national economy. Beneficial effects were considered to be increases in the economic value of the national output of goods and services attributable to a plan. Increases in NED were expressed as the plans' economic benefits, and the adverse NED effects were the investment opportunities lost by committing funds to the implementation of a plan. Alternative 8 ranked highest (ranked #1) in this account based on the higher net benefits captured.
- **EQ Account** - The EQ account was another means of evaluating the plans to assist in making recommendations. The EQ account was intended to display the long-term effects that the alternative plans may have on relevant environmental resources. The Water Resources Council defined 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. Alternative 4A ranked highest (rank 1) due to the lower number of environmental impacts and no need for environmental mitigation
- **RED Account** - The RED account was intended to illustrate the effects that the proposed plans would have on regional economic activity, specifically, regional income and regional employment. Alternative 8 ranked highest (rank 1) due to the increased amount of economic development in DeSoto County.
- **OSE Account** - The OSE account typically includes long-term community impacts in the areas of public facilities and services, recreational opportunities, transportation and traffic and man-made and natural resources.

Table 4-7 compares the completeness and effectiveness by measurement of the four accounts (national economic development, environmental quality, regional economic development, and other social effects). None of the plans identified removed flooding from Goodman Road and Hwy 51. During reformulation the PTD evaluated adding eight 4 feet by 12 feet box culvers 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. During feasibility level design a life safety analysis (HEC-Life Sim) would be completed to confirm the frequencies that would cause the inundation of Hwy 51 and Goodman Road. This analysis would allow the PDT to evaluate: the effectiveness of various flood warning systems, alternative evacuation planning scenarios due to road closures, potential life loss from various flood events, and potential high-risk areas due to flooding both on roads and in structures. It is anticipated that road closures will be required at the 100 AEP event.

There is not a single plan that maximizes net benefits across all accounts. There are trade-offs with each of the plans. The levee floodwall (plan 8) has the greatest net benefits and as such is the NED plan. Plan 7A has the highest impact on the regional economy and the largest number of local jobs created, and as such ranks highest and in Regional Economic Development (RED) metrics. The levee floodwall combined with dry floodproofing (plan 8) and nonstructural (plan 4A) is the only plan that requires no environmental mitigation, and the area east of the levee is identified as a potential wetland benefit which results in plan 8 ranking slightly higher than plan 5A in the Environmental Quality (EQ) account. The other social effects account remains unranked because none of the plans are successful at reducing roadway flooding.

Table 4-7. System of Four Accounts

Final Array of FRM Alternatives 2022	National Economic Development (NED)	Environmental Quality (EQ)	Regional Economic Development (RED)	Other Social Effects (OSE)
5A - Extended Channel Enlargement	Avg. Annual Benefits $615K Avg. Annual Costs $652K Net benefits $-37K BCR .94 **Rank 2**	Second smallest construction footprint **Rank 2**	Total Local Economic Impact $8.3M Total Local Jobs Created 64 **Rank 4**	Reduces stages on Horn Lake Creek, but many commercial structures remain at risk of flooding. Roadways remain at risk of inundation.
6A - Extended Channel Enlargement + Lateral D Detention	Avg. Annual Benefits $502K Avg. Annual Costs $1.29M Net benefits $-792K BCR .39 **Rank 4**	Detention Basin requires removal of mature trees **Rank 3**	Total Local Economic Impact $25 M Total Local Jobs Created 193 **Rank 3**	Reduces flood stages in the Bullfrog Corner area, but many commercial structures remain at risk of flooding. Roadways remain at risk of inundation.
7A- Extended Channel Enlargement + Lateral D +Rocky Creek +Cow Pen Detention	Avg. Annual Benefits $1.19M Avg. Annual Costs 3.12M Net benefits $-1.92K BCR .38 **Rank 3**	Largest Construction Footprint **Rank 4**	Total Local Economic Impact $69.5M Total Local Jobs Created 534 **Rank 1**	This plan may reduce stages over roadways in the Cow Pen Creek watershed, but leaves structural damage risk
Plan 8-Levee and Floodwall+ Dry Floodproofing of 29 structures	Avg. Annual Benefits 1.97 M Avg. Annual Costs 1.05M Net benefits 912K BCR 1.87 **Rank 1**	Does not require environmental mitigation, potential added benefits **Rank 1**	Total Local Economic Impact: $26.5M Total Local Jobs Created:204 **Rank 2**	This plan reduces structure damages but also adds water over both Goodman Road east of Hwy 51 as well as on Hwy 51 North of Goodman Rd. during low frequency events (100 and 500 year) and on 13 commercial structures by up to 6 inches for up to an additional 2 hours of time.

M: Millions, K: Thousands

4.5 BENEFIT/COST ANALYSIS-FRM

The cost analysis of the FRM plans was completed utilizing HEC-FDA. The parametric cost table comparing the final array of FRM alternatives is reflected in Table 4-8.

Table 4-8. 2022 Update Final Array of FRM Alternatives

Plan Identification	Plan 5 Channel Enlargement	Plan 6 Channel Enlargement + Lateral D Detention	Plan 7 Channel Enlargement + 4 Detention Basins (2D)	Plan 8 Levee-Floodwall+ Nonstructural (Commercial dry floodproofing for 29 structures)
First Cost	$8,458,000	$17,817,000	$51,967,000	$18,887,000
Interest During Construction	$191,000	$402,000	$1,173,000	$426,000
Total Investment Cost	$8,649,000	$18,219,000	$53,140,000	$19,313,000
Annualized Project Costs	$290,000	$611,000	$1,781,000	$647,000
Annual OMRR&R	$362,000	$683,000	$1,337,000	$407,000
Total Annual Costs	$652,000	$1,294,000	$3,118,000	$1,054,000
Total Annual Benefits	$615,000	$502,000	$1,199,000	$1,966,000
Net Annual Benefits	($37,000)	($792,000)	($1,919,000)	$912,000
Benefit to Cost Ratio	0.94	0.39	0.38	1.87

4.6 PROPOSED ACTION-TENTATIVELY SELECTED PLAN

The proposed action is the National Economic Development (NED) plan identified from the final array of FRM alternatives. It includes a combination of a levee and floodwall system located on the eastern side of Hwy 51 just south Goodman Road combined with a nonstructural aggregation, which would include dry floodproofing of 29 commercial structures that include both inducement mitigation and residual risk reduction (Figure 4-2). This plan is the only efficient, effective, and acceptable alternative that reduces the risks of flooding to the public, commercial, and residential infrastructure. During feasibility level design a life safety analysis (HEC-Life Sim) will be completed to confirm the frequencies that would cause the inundation of Hwy 51 and Goodman Road. This analysis will allow the PDT to evaluate: the effectiveness of various flood warning systems, alternative evacuation planning scenarios due to road closures, potential life loss from various flood events, and potential high-risk areas due to flooding both on roads and in structures. It is anticipated that road closures will be required at the 100 AEP event.

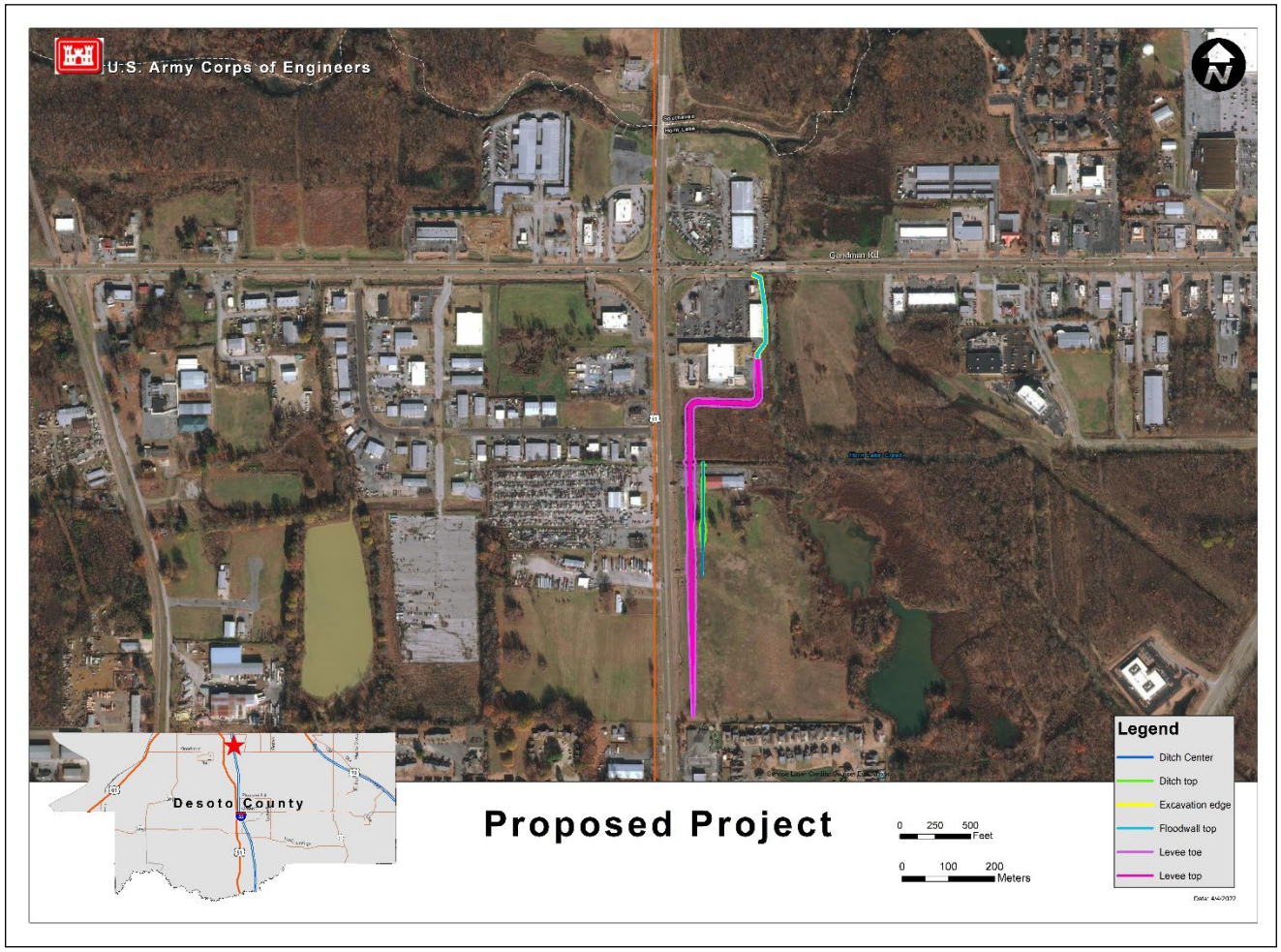


Figure 4-2. Flood Risk Management Structural Tentatively Selected Plan

Section 5

Formulate Alternative Ecosystem Restoration Plans

Ecosystem Restoration (ER) is a primary mission of the USACE Civil Works program. Ecosystem restoration 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 be 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 partially re-establish the attributes of a naturalistic, functioning, and self-regulating system.

Ecosystem restoration in the Civil Works program uses an ecosystem approach to assess and address ER needs and opportunities. 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 philosophy behind the PDT 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 solutions 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, 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 WRDA 2016 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.

Seventeen 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 the Figure 5-1

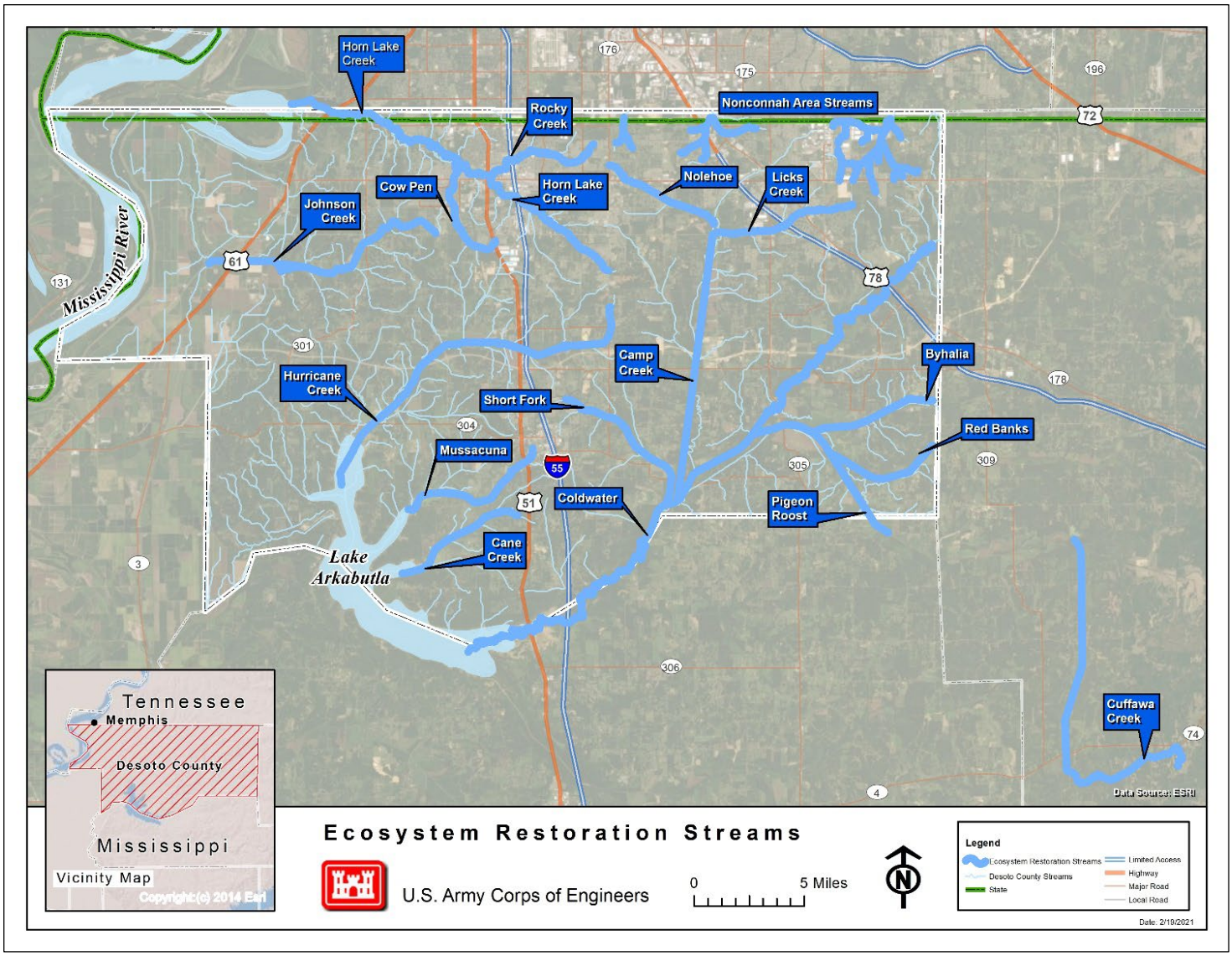


Figure 5-1. DeSoto County Streams Evaluated for Ecosystem Restoration

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, inclusion of 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. Nine ER measures were considered by the PDT (Table 5-1) and are described below.

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)
Grade Control	ER-1	Low Drop Structures	R
	ER-2	High Drop Structures	S
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

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 nine streams that were degradational. Further conversations with stakeholders representing the six drainage districts in the region added five additional streams into consideration. Of the added five only four flowed within the boundary of DeSoto County, the stream was not within the study area was screened. Of the four remaining four streams, only two 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

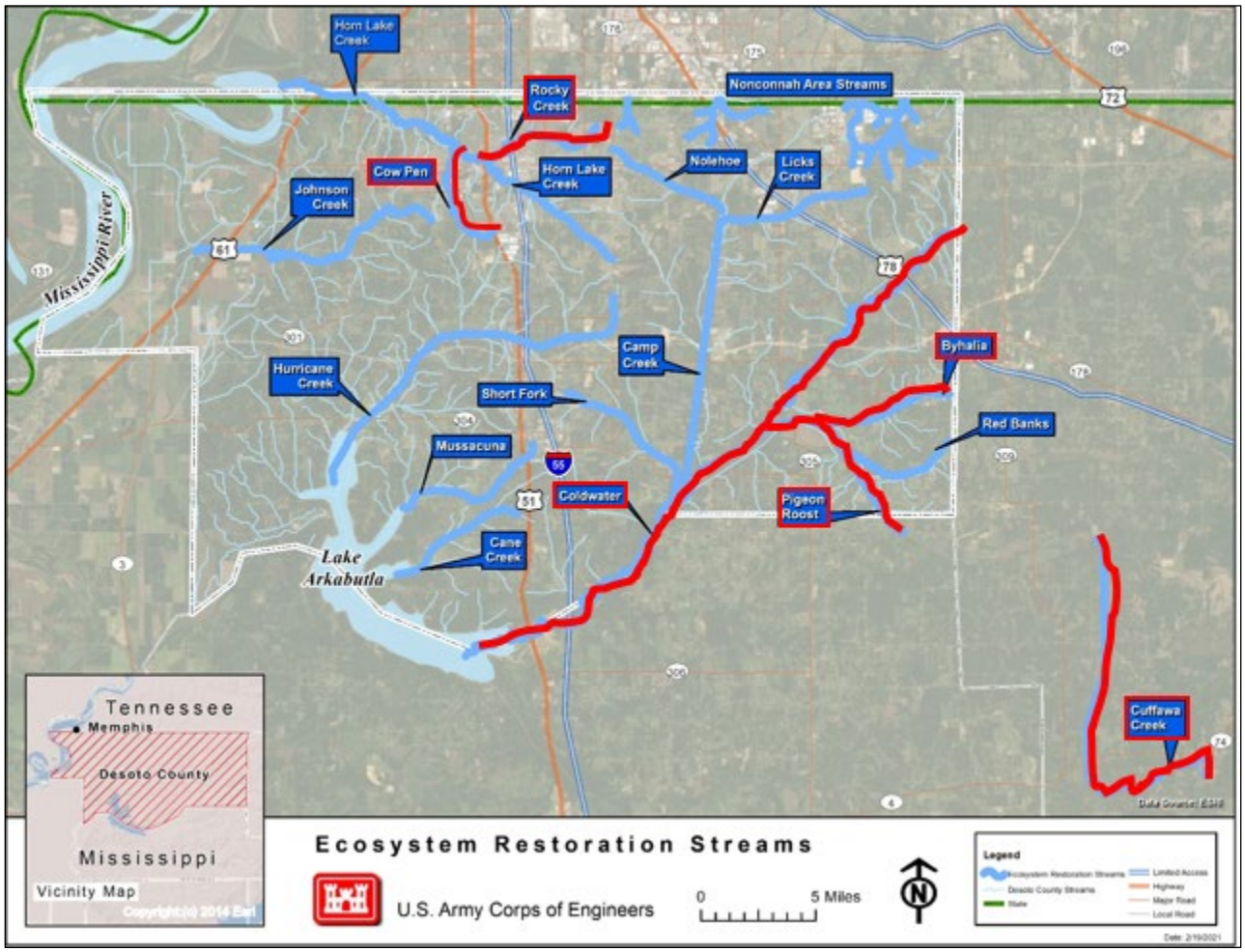


Figure 5-2. DeSoto County Streams Screened (in red) for Ecosystem Restoration

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.

Measure ER 7 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.
2. Reforestation of the maximum available acreage, as identified using National Land Classification Data mapping, with no stabilization.
3. System of grade control structures and channel stabilization along with riparian reforestation.

Alternative 3. was further optimized into three individual alternatives with varying riparian reforestation quantities:

3. System of grade control structures with maximum riparian reforestation identified using NLCD data
4. System of grade control structures with riparian reforestation adjacent to and within 100 ft of the GCS system along one bank line.
5. System of grade control structures with 25% of the available riparian reforestation within 100m 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. NER Screening Criteria

Ecosystem Restoration Screening Criteria	Plan 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 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; 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 280 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.

5.6 FINAL ARRAY OF ECOSYSTEM RESTORATION PLANS

Stakeholder engagement helped the PDT 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, B, and C) to determine whether each stream was degradational and in need of ecosystem restoration.

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 282 acres of land adjacent to the final array of streams could be lost due to erosion and bank failures.

5.6.2 Alternative 4 – Alternative 1 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. 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	20	17
Hurricane	HN-4	9	62	60
Lick	LC-4	3	15	11
Nonconnah	NO-4	7	5	5
Mussacuna	MC-4	3	9	9
Horn Lake	HL-4	14	17	53
Nolehoe	NL-4	11	18	38
Johnson	JC-4	11	43	48
Red Banks	RB-4	5	24	25
Short Fork	SF-4	9	12	14
11 streams		88	272 acres	333 AAHUs

5.6.3 Alternative 5 – Alternative 1 with Restoration of 25 Percent of Reforestable Riparian Acreage

Alternative 5 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. As noted in Section 5.6, 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 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.”

Therefore, this plan was optimized to include the reforestation of 10 percent of the reforestable land along each stream. A combination of 10 percent 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

Stream	Alt. ID	# GCS	Riparian Reforestation (acres)		# AAHU 25%	# AAHU 10%
			25%	10%*		
Camp	CP-5	7	98	39	98	48
Cane	CN-5	9	66	26	45	21
Hurricane	HN-5	9	160	64	133	62
Lick	LC-5	3	36	14	20	11
Nonconnah	NO-5	7	107	20	75	13
Mussacuna	MC-5	3	57	23	33	23
Horn Lake*	HL-5	14	64	20	55	55
Nolehoe	NL-5	11	32	13	47	35
Johnson	JC-5	11	122	49	113	52
Red Banks	RB-5	5	48	19	40	21
Short Fork	SF-5	9	106	42	70	34
11 streams		**88**	**896**	**329**	**729**	**375**

* Optimized acreage=329, with an AAHU return of 375.

5.7 NATIONAL ECOSYSTEM RESTORATION PROPOSED ACTION

The National Ecosystem Restoration (NER) Plan and TSP (Table 5-5) includes a combination of Alternatives 4 and 5 for a total of 88 grade control structures on the 11 creeks and 344 acres of riparian reforestation to form the NER TSP. Alternative 4, grade control with associated riparian reforestation, would occur along the following streams: Camp Creek, Horn Lake 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 5-5. National Ecosystem Restoration Plan

Stream	Alt #	Alternative Description	AAHUs	Cost of Construction[1]
Camp Creek	CP-4	8 GCS + 47 riparian acres	53	$3,166,536
Horn Lake Creek	HLC-4	14 GCS+ 17 riparian acres	53	$6,982,973
Johnson Creek	JC-5b	11 GCS+ 49 riparian acres	52	$4,033,823
Cane Creek	CN-5b	9 GCS+ 26 riparian acres	21	$2,461,923
Hurricane Creek	HC-5b	5 GCS + 64 riparian acres	62	$4,084,715
Lick Creek	LC-5b	2 GCS + 14 riparian acres	11	$1,014,851
Mussacuna Creek	MC-5b	2 GCS + 23 riparian acres	16	$1,516,149
Nonconnah Creek	NoN-5b	6 GCS + 20 riparian acres	13	$1,502,193
Nolehoe Creek	NL-4	11 GCS + 18 riparian acres	38	$3,251,283
Short Fork	SF-5b	9 GCS + 42 riparian acres	34	$2,773,875
Red Banks	RB-4	5 GCS + 24 riparian acres	25	$2,647,779
11 streams		**88 GCS+ 344 acres**	**378**	**$33,436,100**

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 each of the 11 degraded streams. The NER (Table 5-6) plan has a total cost of $33,436,100 with a benefit of 378 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 $3,771 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 88 grade control structures on the 11 creeks and 344 acres of riparian reforestation to form the NER TSP. The technical 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.

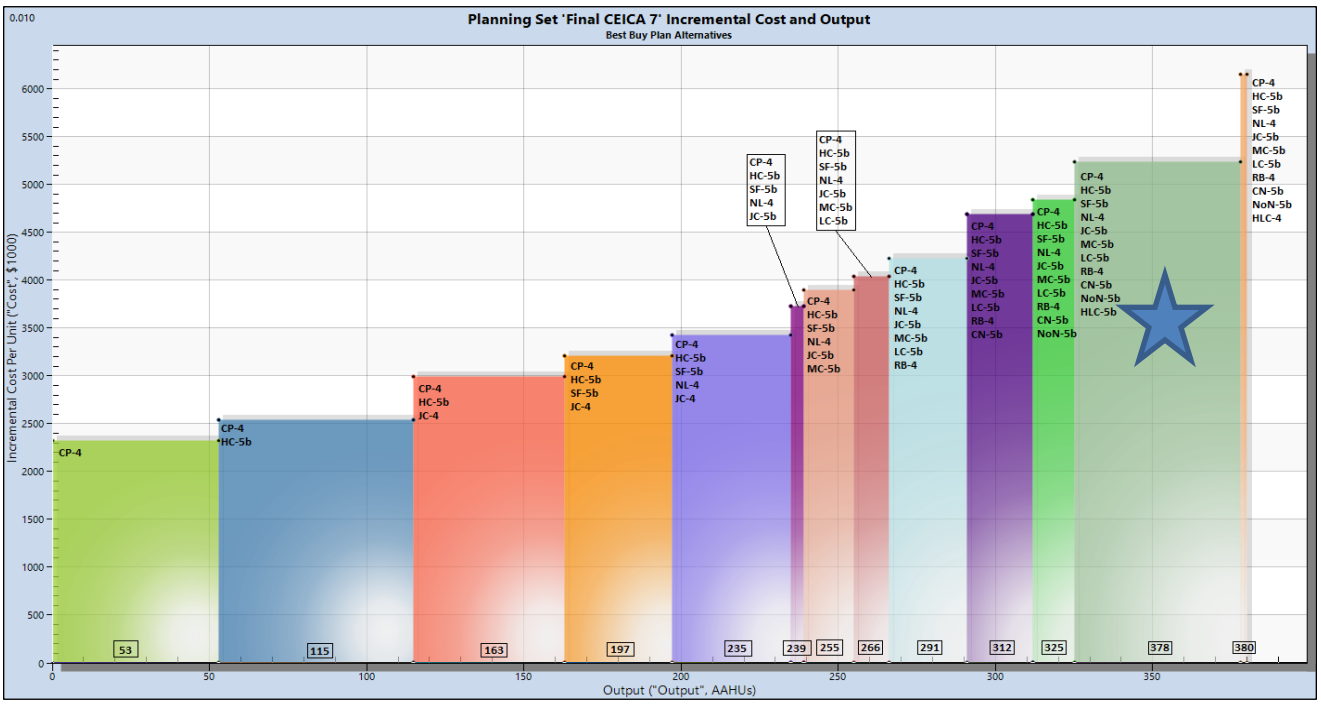


Figure 5-3. CEICA Incremental Cost Analysis, Starred Plan was Identified as the NED Plan

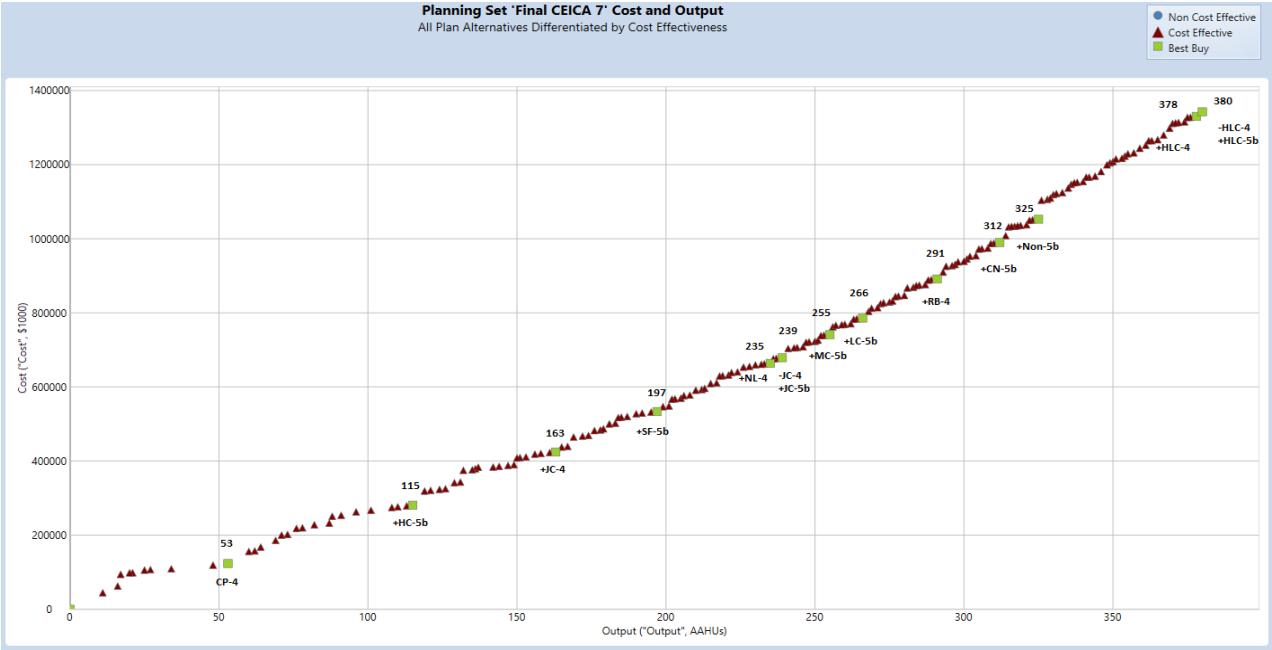


Figure 5-4. Cost Effectiveness of the Ecosystem Restoration Alternatives

Technical Significance of the NER Plan

Technical recognition means that the resource qualifies as significant based on its "technical" merits, which are based on scientific knowledge or judgement of critical resource characteristics. This NER Plan is considered to be significant based on the following concepts: scarcity, representativeness, status and trends, connectivity, critical habitat, and biodiversity, described below.

Scarcity is a measure of a resource's relative abundance within a specified geographic range. The proposed NER Plan would reforest approximately 344 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. Implementation of the proposed NER Plan would arrest stream bed degradation and allow for the improvement of foraging, cover, and reproductive habitats in the area.

Connectivity is the potential for movement and dispersal of species throughout a given area of ecosystem, considered in the context of a landscape or watershed. Implementation of the proposed NER plan would reconnect approximately 90 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 finally, the design of structures would allow for the improvement of fish passage in the streams.

Limiting Habitat is essential for the conservation, survival, or recovery of one or more species. Implementation of the proposed NER plan would provide stream stabilization that 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.

Biodiversity is a measure of the variety of distinct species and the genetic variability within them. Implementation of the 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 FRM and ER 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 can become the principal component of the decision-making process enabling water resource managers to make scientifically defensible decisions and 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 of this document.

6.1 EVALUATING FLOOD RISK MANAGEMENT (FRM) ALTERNATIVES

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 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 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. Feasibility level design would require careful attention to this site.

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 Average Annual Habitat Units (AAHU), or a total of approximately 425 habitat units over 50 years is expected due to impacts from riparian tree clearing. The unit termed Average Annual Habitat Units (AAHU) is the product of Stream Condition Index (SCI) scores and area of impact or improvement annualized over a 50-year period. Therefore, approximately 8.5 AAHUs, or a total of approximately 425 habitat units must be replaced to prevent a loss of ecosystem function due to the proposed construction of the Horn Lake Creek channel enlargement.

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.

6.1.2.1 Relevant Resources Affected

6.1.2.1.1 *Wetlands and Bottomland Hardwood Forest*

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 Average Annual Habitat Units (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 National Land use Classification Data. Wetland delineations were not conducted. Further fieldwork may result in a determination that some portion of the forested area is not forested wetland, adjustment of compensatory mitigation may be required as more detailed fieldwork is conducted.

6.1.2.1.2 *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. Due to the improvement of channel planform, bank stability, habitat diversity, and fish cover, there is a gain of 397 AAHU over 50 years.

Water quality within the stream including sedimentation, low dissolved oxygen, and excess nutrient 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 TSP, no compensatory mitigation is recommended for this action.

6.1.2.1.4 *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. Currently, USACE is developing 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 coordination.

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 reduction 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 ROW and an increase in truck traffic delivering materials for the construction. The impacts are expected to occur during construction of the enlargement. Conditions are expected to return to normal after the channel work is completed.

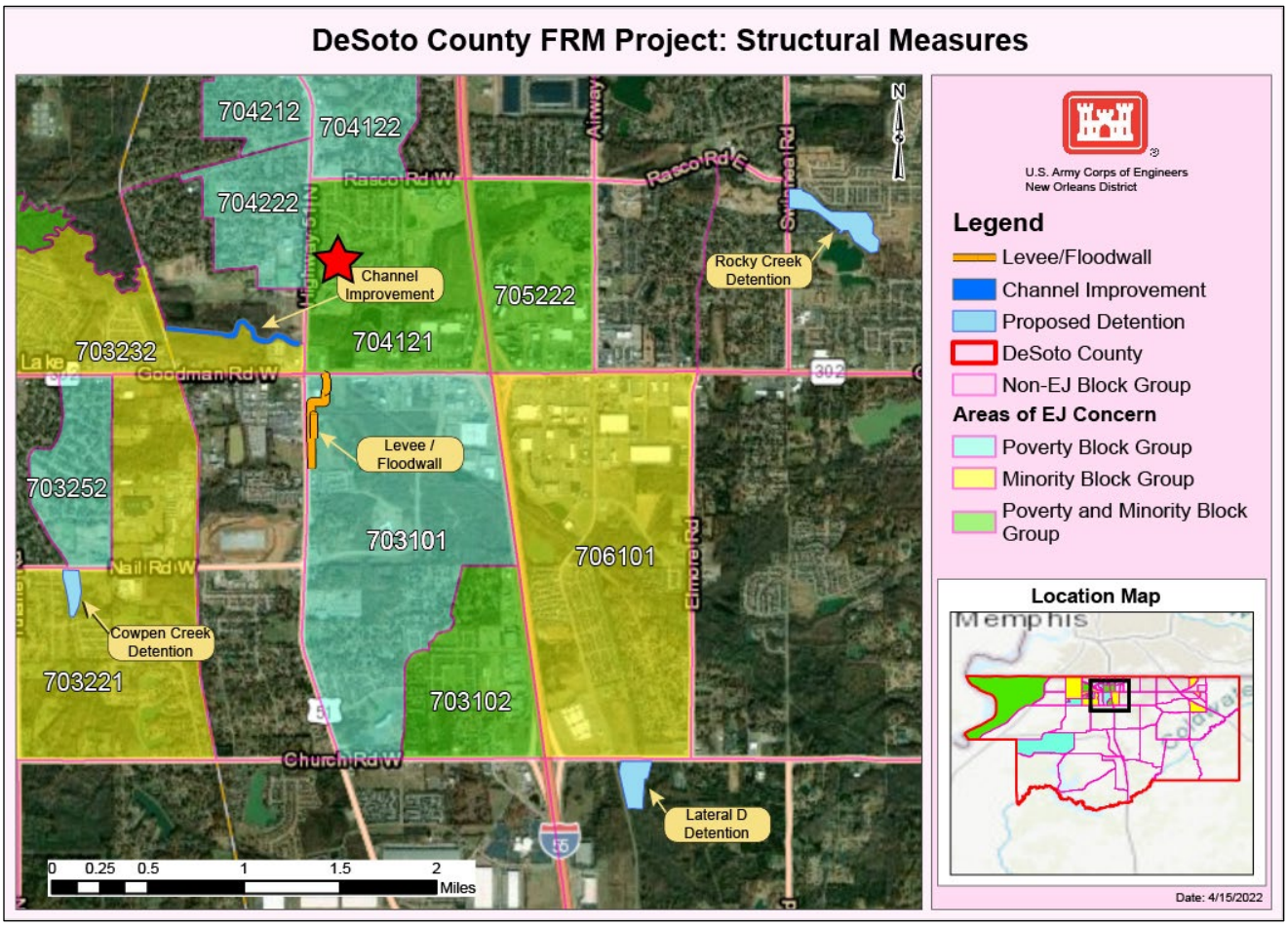


Figure 6-1. Desoto FRM, Plan 5A – HCL Extended Channel Enlargement Location and Areas of EJ Concern

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 reduction 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. The detention design would be optimized during feasibility-level design. 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, as the project progresses, additional wetland features, microtopography work, and/or tree planting may be incorporated, reducing 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 is expected with construction of the proposed project, 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, approximately 18.7 AAHUs, or a total of approximately 1,045 habitat units must be replaced to prevent a loss of ecosystem function due to the proposed construction of the Lateral D detention basin.

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

This alternative was determined to have no effect on: Prime and unique farmland; 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, and are not reiterated here, but are included by reference for this alternative. 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 18.7 AAHU, or a total of approximately 1,045 habitat units over 50 years is expected due to impacts from tree clearing. Therefore, approximately 18.7 AAHUs, or a total of approximately 1,045 habitat units must be replaced to prevent a loss of ecosystem function due to the proposed construction of the Lateral D detention basin.

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 have any impact on known cultural resources. Most of area impacted by this alternative has been previously surveyed for the last 40 years and no eligible resources are located within the project area. Currently, USACE is developing 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.

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 reduction 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.

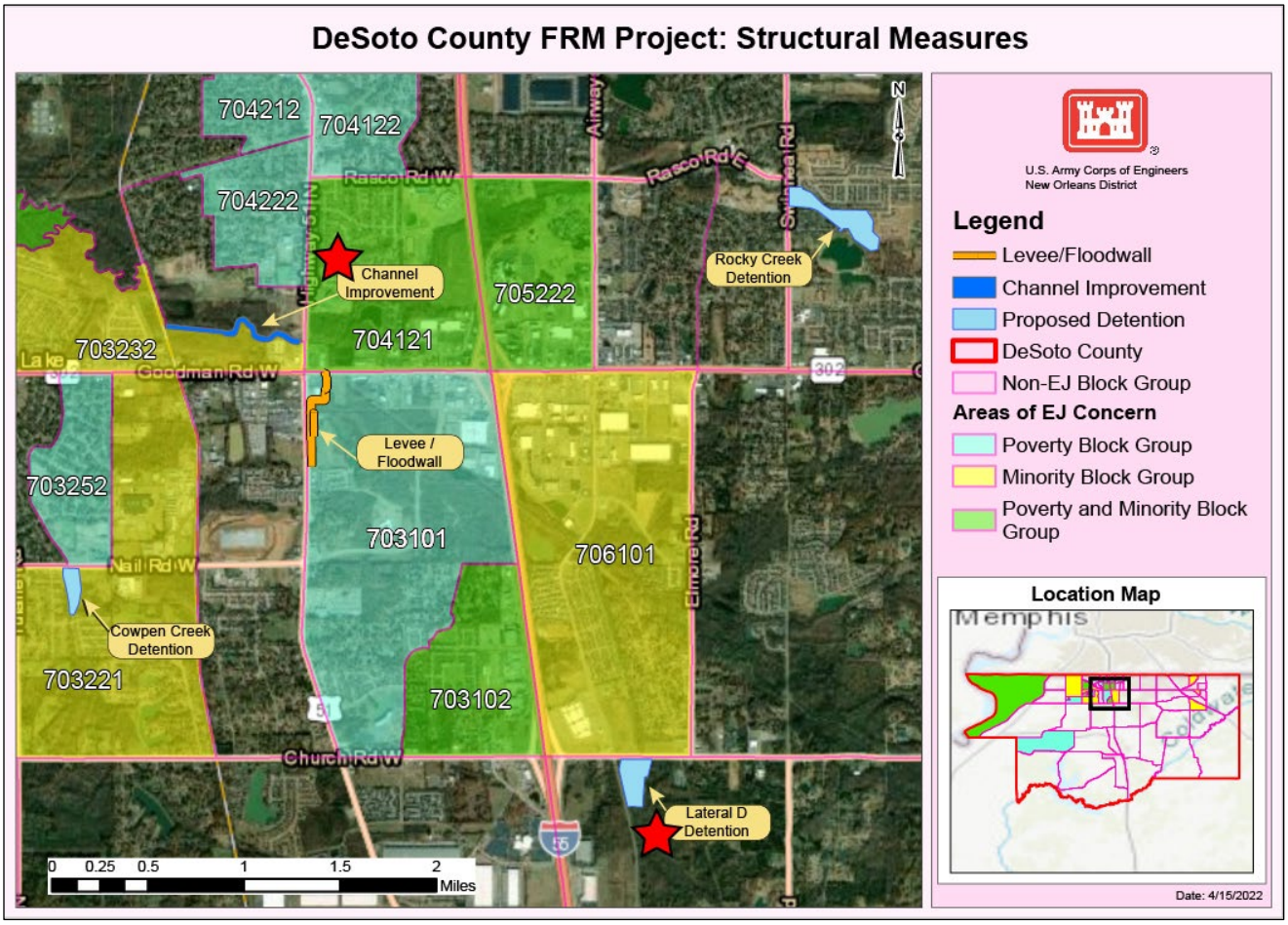


Figure 6-2. Desoto FRM Plan 6A – HCL with Lateral D Detention Basin Location and Areas of EJ Concern

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**

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

Alternative 7A was initially 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 2-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 result in the plan 6 along with two additional detention basins along Cow Pen Creek and Rocky Creek. Relevant resources and associated impacts for plan 6 are not reiterated here, but are summarized below, and included by reference.

The Rocky Creek in-line detention basin would total approximately 9 acres and would 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 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, approximately 3.3 AAHUs, or a total of approximately 165 habitat units must be replaced to prevent a loss of ecosystem function due to the proposed construction of the Rocky Creek detention basin.

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, approximately 3.4 AAHUs, or a total of approximately 170 habitat units must be replaced to prevent 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.

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 LPP, the USACE has determined that a total of approximately 48 acres of BLH tree clearing would be required. As a result of the implementation of the LPP approximately 8.5 AAHUs for the Horn Lake Creek channel enlargement would be lost due to tree clearing. 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 be incurred. A total of approximately 33.9 AAHUs or approximately 1,695 habitat units over a period of 50 years would be required to be replaced with compensatory mitigation actions to prevent the loss of ecosystem functions. Currently, no environmental features have been 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, as the project progresses, additional wetland features, microtopography work, and/or tree planting may be incorporated, reducing, or possibly eliminating, the amount of off-site compensatory mitigation required for the detention basins. Gravel-surfaced access roads and security fences would be installed along the perimeter of the basin for the safety and security of local residents. All excavated material is expected to be disposed of off-site and is assumed to be placed in an upland area where no impacts would occur. The channel enlargement and detention basin designs would be optimized during feasibility-level design. 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 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, there is a gain of 397 AAHU over 50 years for the HLC channel enlargement. While there is a total loss of 1,182 AAHUs due to the tree clearing for the selected alternative, the water quality and aquatic resources are 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 would 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. Currently, USACE is developing 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.

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 reduction 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 reduction 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 reduction 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 reduction 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

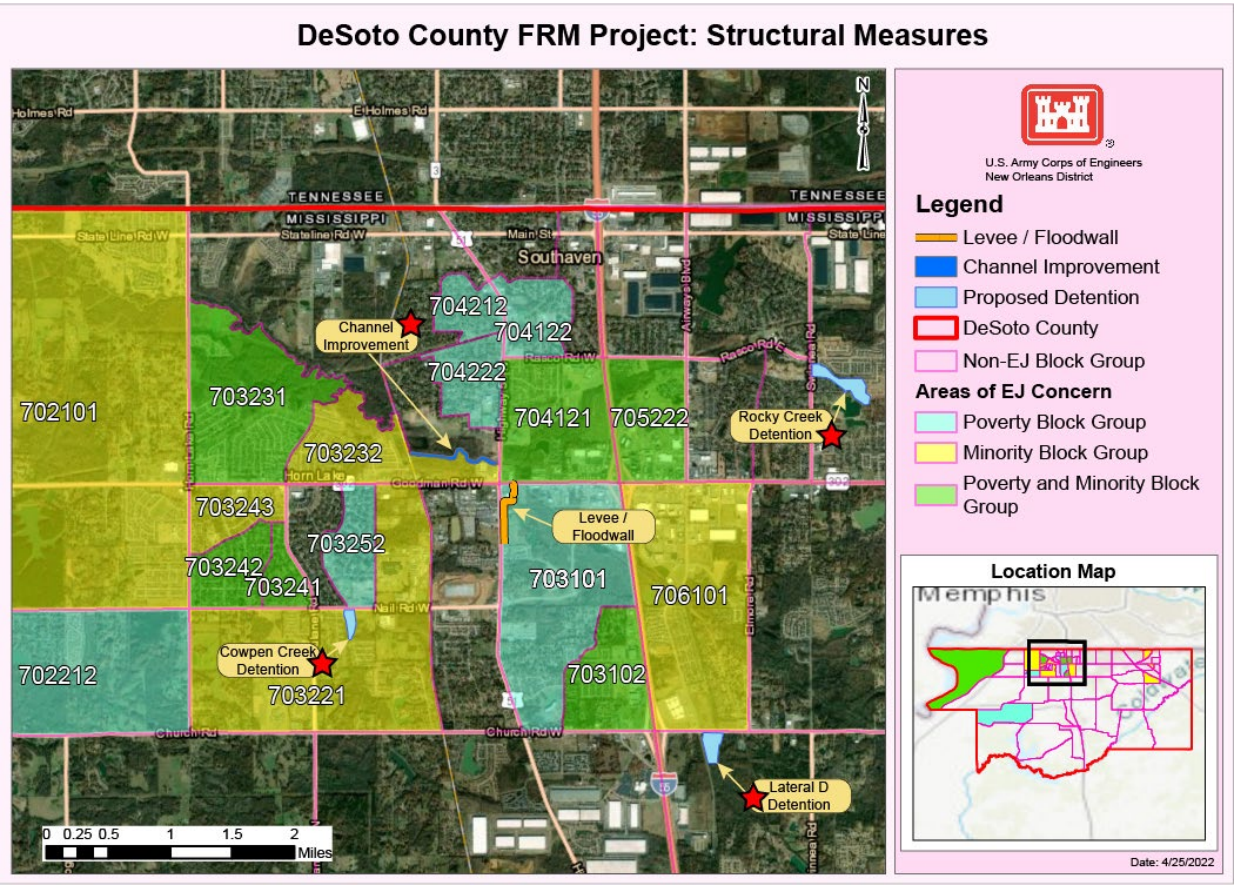
are near areas of EJ concern. The Lateral D Detention Basin is not located near areas of EJ concern.

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 7A would not result in adverse disproportionate significant direct environment or economic effects on areas of EJ concern.

Figure 6-3: Plan 7A – HCL and Lateral D, Rocky Creek and Cow Pen Creek Detention Basins 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**

6.1.5 Plan 8 – Levee and Floodwall System Combined with Nonstructural

Plan 8 is the reformulated National Economic Development Plan (NED) and the TSP. This plan includes the construction of an approximately 3,000 linear foot levee and floodwall system that would protect structures in Horn Lake, Mississippi from Highway 51, downstream toto 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 a levee infeasible, protection 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. This structural feature will be combined with non-structural aggregation to reduce residual risk as well as address inducements.

Two potential borrow areas have been identified that may provide the approximately 14,000 cubic yards of earthen material to construct the proposed levee. 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.

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 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.

6.1.5.1.2 *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 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.

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 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

Nonstructural

The nonstructural features would have no impact to recreational resources depending on the methods used. A direct impact from flood proofing 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.

6.1.5.1.7 *Environmental Justice*

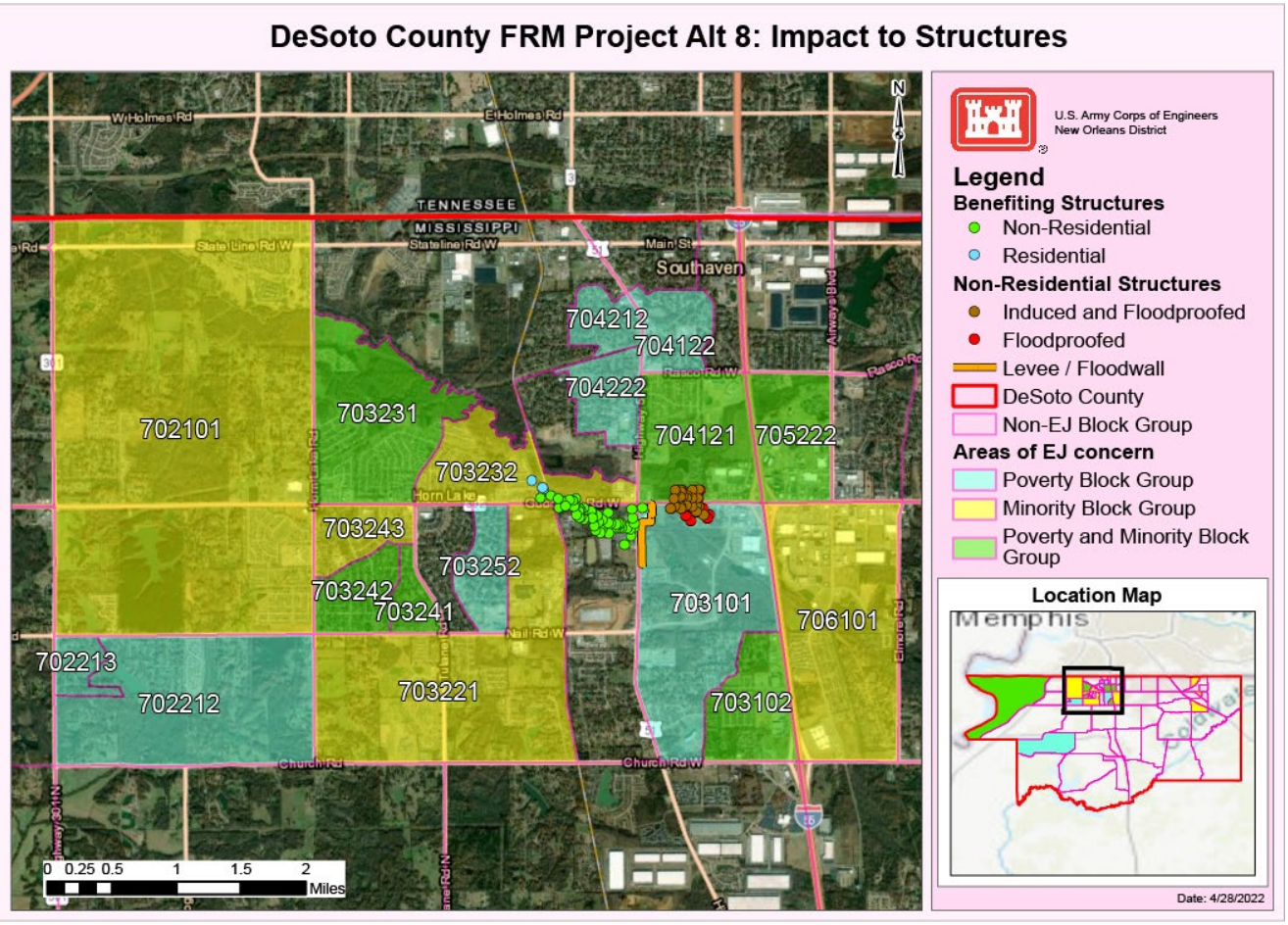
Levee and Floodwall System and NS Plan

Since Alternative 8 is the NED Plan and TSP, a more detailed EJ analysis is provided that shows specifically how Areas of EJ Concern are benefiting from the proposed measures and how they are being adversely impacted. The following discussion details the benefits and adverse impacts of Plan 8 which includes the levee/floodwall and the NS measure (commercial structure floodproofing).

Levee/Floodwall Flood Risk Reduction 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 (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. Three residential and 53 commercial structures will benefit from the project due to a lowering of the flood stage. Residents in the areas of EJ concern will indirectly benefit from the flood risk reduction 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. Finally, there are three residential structures (figure 6-4) located in areas of EJ concern (Block Group 70323) that will benefit from the risk reduction system due to a lowering of the flood stage.

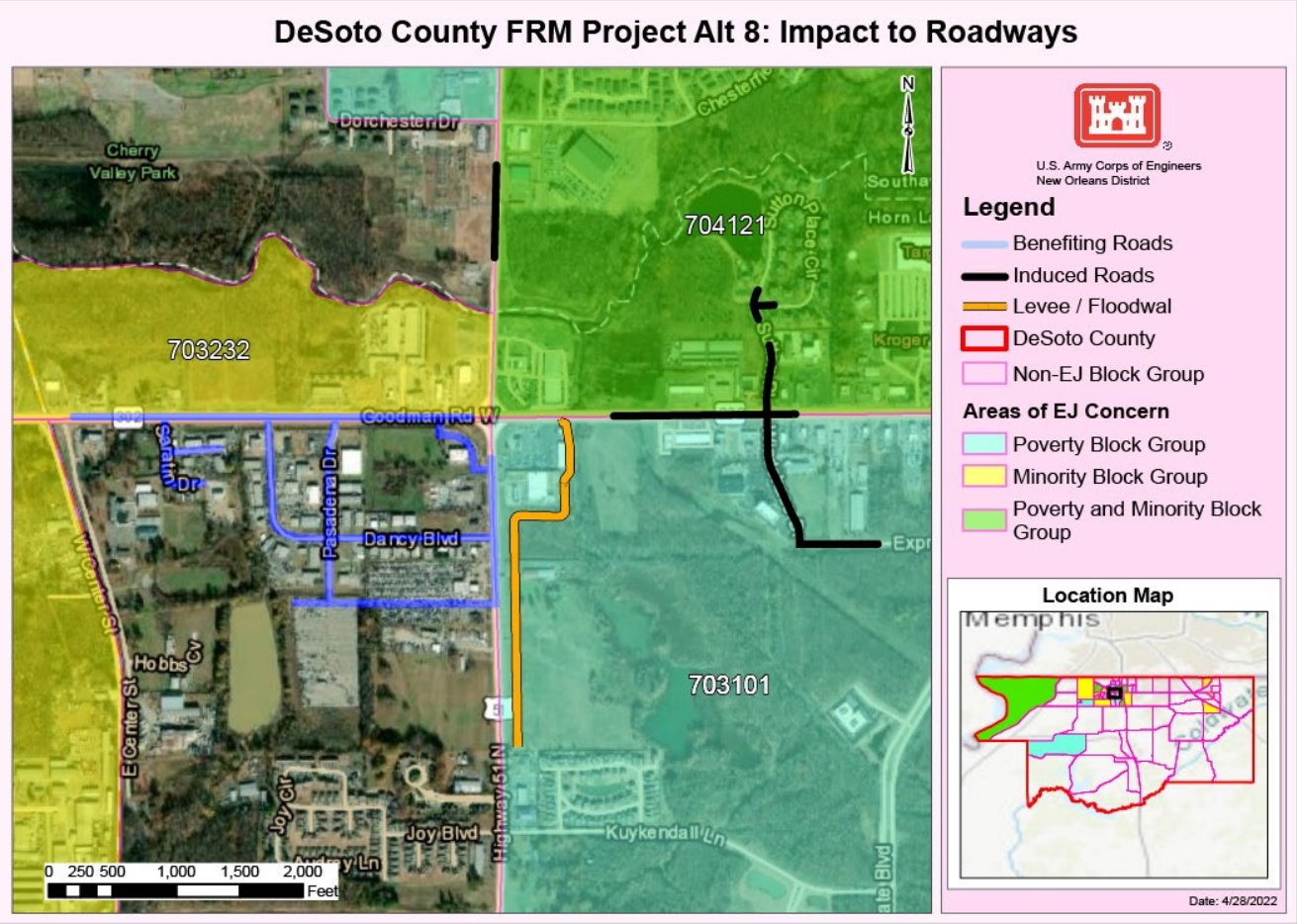
Figure 6-4 Alt 8: Structures impacted by the levee-floodwall system.



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**

Roadways, too, will benefit from the 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 blue lines on Figure 6-5.

Figure 6-5: Alt 8: Desoto FRM, Roadway Flood Stage Lowering and Inducements



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**

Levee/Floodwall Measure Adverse Impacts: Induced Flooding Effect on Areas of EJ Concern

Construction of the levee will induce flooding (considered if inducements are greater than 0.25 feet) impacting 23 commercial structures (Figure 6-4) shown as brown dots and several roadways near Goodman W and Westchase Blvd could see inducements (Map 6-5) shown as black lines. Map 6-4 shows the commercial structures as brown dots that could receive up to a half foot of induced flooding from the 100-year flood event. Additionally, for the 100-year event, a few segments of the roads shown as black lines on Map 6-5 could also receive inducements. Residential structures will not have induced flooding. Some of the roads receiving induced flooding are in areas of EJ concern. The amounts of induced flooding on the roadways and some parking lots is considered minor.

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 is anticipated, and all noise emissions are expected to be short-term, lasting only as long as construction activities.

Mitigation of Induced 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.

In addition, the levee floodwall system adds water into parking lots and on structures that are already experiencing flooding. This induced flooding will be mitigated through the NS Plan, which is dry floodproofing. There are 29 structures identified in the nonstructural aggregation, located to the east of the intersection of Highway 51 and Goodman Road that experience flooding in the existing condition. Many (23) of these 29 structures will see some increase in flooding if the levee and floodwall system is constructed. To address these potential flood inducements these commercial structures and those neighboring them (6) will be dry flood proofed. This action must be taken to reduce any induced risk posed by an increase in water surface elevation. This will positively affect the economic fabric of the neighborhood and the resident’s well-being by these businesses not continually flooding.

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.

Alternative 8 would not result in adverse disproportionate significant direct environment or economic effects on areas of EJ concern.

6.2 EVALUATING ECOSYSTEM RESTORATION (ER) ALTERNATIVES

Table 6-1 compares the final array of ecosystem restoration alternatives and the National Ecosystem Restoration (NER) which plan which is a combination of Alternative 4 riparian restoration quantities and Alternative 5 riparian restoration quantities. The NER plan is a combination of alternatives 4 and 5 across the 11 degraded streams. This alternative was produced by the cost effectiveness-incremental cost analysis (CE-ICA) model as described in section 5.7.

Table 6-1. 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 11 streams	88	0	146.5	$1,135,447
Alternative 4	Grade Control plus adjacent riparian restoration on 11 streams	88	272	333	$1,279,384
Alternative 5	Grade Control plus 10% riparian restoration on all 11 streams	88	329	379	$1,333,180
NER Plan[1]	Grade Control plus adjacent riparian restoration on Camp, Nolehoe, Horn Lake and Red Banks and Grade Control plus 10% riparian restoration on the remaining 7 streams	88	344	378	$1,224,616

[1]This plan was produced by identified by the CEICA analysis as the best buy plan

6.2.1 No Action Alternative

This alternative would result in no features of the project being constructed. 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 282 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 *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. Currently, USACE is developing 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.

6.2.1.1.5 *Aesthetics*

With the no action alternative, communities within the study area would continue to be at risk from high water events induced by rainfall events. 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.

6.2.1.1.6 *Recreation*

With the no action alternative, 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.

6.2.1.1.7 *Environmental Justice*

Under the No Action Alternative, no risk reduction would occur. There would be no direct impact on minority and/or low-income population groups under this alternative.

6.2.2 Alternative 1 - Grade Control

Alternative 1 would result in the construction of a total of 88 low-drop GCS within 11 streams totaling approximately 136 AAHUs (Table 5-6). 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 282 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.

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 149 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 2 would provide connection in approximately 90 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 2 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) 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.

6.2.2.1.4 *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. Currently, USACE is developing 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.

6.2.2.1.5 *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

6.2.2.1.6 *Recreation*

The 88 proposed GCS are to occur within 11 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.

6.2.2.1.7 *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.

6.2.3 Alternative 4 – Grade Control with Associated Riparian Plantings

Alternative 4 would result in the construction of a total of 88 low-drop GCS and reforestation of approximately 272 acres would be implemented within 11 streams totaling approximately 333 AAHUs (Table 5-6). 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 percent, 25 percent, 50 percent, 75 percent, and 100 percent) 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 282 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 272 acres of native BLH species would be planted along the 11 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 282 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 333 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 136 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 197 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 90 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 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) 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 272 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 *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. Currently, USACE is developing a programmatic agreement with the MS SHPO and federally recognized tribes to establish protocols for additional surveys prior to construction.

6.2.3.1.5 *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.

6.2.3.1.6 *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 272 acres along 11 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 88 proposed GCS are to occur within 11 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.

6.2.3.1.7 *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.

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

GCS combined with 10 percent of the available riparian restoration was identified as a component of the NER Plan. This alternative would result in the construction of a total of 88 low-drop GCS and reforestation of approximately 329 acres would be implemented within 11 streams totaling approximately 375 AAHUs (Section 5.6, Table 5-5). 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 percent, 25 percent, 50 percent, 75 percent, and 100 percent) 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 282 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 NER Plan, approximately 344 acres of native BLH species would be planted along the 11 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 678 AAHUs would be restored due to reforestation of 25 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. The NER Plan 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 149 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 228 AAHUs are expected to be retained from BLH. 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 GC structures and bank stabilization would allow for the improvement of fish passage in the streams. The NER Plan would provide connection in approximately 90 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).

6.2.4.1.3 *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) 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 344 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 *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. Currently, USACE is developing a programmatic agreement with the MS SHPO and federally recognized tribes to establish protocols for additional surveys prior to construction.

6.2.4.1.5 *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.

6.2.4.1.6 *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 960 acres along 11 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 88 proposed GCS are to occur within 11 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.

6.2.4.1.7 *Environmental Justice*

A system of GCS combined with 25 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.

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 149 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 2 would provide connection in approximately 90 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).

6.2.4.1.8 *Wildlife*

Construction of Alternative 2 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) 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.

6.2.4.1.9 *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. Currently, USACE is developing 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.

6.2.4.1.10 *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

6.2.4.1.11 *Recreation*

The 88 proposed GCS are to occur within 11 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.

6.2.4.1.12 *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.

6.2.5 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 11 streams, the NER plan would result in the construction of a total of 88 low-drop GCS and reforestation of approximately 344 acres would be implemented within 11 streams totaling approximately 378 AAHUs (Table 5-6). 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 percent, 25 percent, 50 percent, 75 percent, and 100 percent) 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 on Camp, Horn Lake, Nolehoe, and Red Banks Creek and Alternative 5 on Johnson, Cane, Hurricane, Lick, 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 282 acres of land adjacent to the final array of streams would be saved due to 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 344 acres of native BLH species would be planted along the 11 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 282 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 180 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 149 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 135 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 90 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).

6.2.5.1.3 *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) 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 344 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 *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. Currently, USACE is developing a programmatic agreement with the MS SHPO and federally recognized tribes to establish protocols for additional surveys prior to construction.

6.2.5.1.5 *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.

6.2.5.1.6 *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 344 acres along 11 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 88 proposed GCS are to occur within 11 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.

6.2.5.1.7 *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.

6.2.6 Alternative 5 - Alternative 1 with Restoration of 25 Percent of Reforestable Riparian Acreage

GCS combined with 25 percent of the available riparian restoration was identified as the NER Plan and is the tentatively selected plan TSP for the ecosystem restoration component of the project. This alternative would result in the construction of a total of 81 low-drop GCS and reforestation of approximately 896 acres would be implemented within 11 streams totaling approximately 827 AAHUs (Table 5-6) 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 percent, 25 percent, 50 percent, 75 percent, and 100 percent) 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 282 acres of land adjacent to the final array of streams would be saved due to prevention of erosion and bank failures.

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

6.2.6.1.1 *Wetlands and Bottomland Hardwood Forest*

With implementation of the NER Plan, approximately 344 acres of native BLH species would be planted along the 11 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 5-6. A total of approximately 678 AAHUs would be restored due to reforestation of 25 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. The NER Plan would increase connectivity in the form of forested corridors and provide for an increase in biodiversity.

6.2.6.1.2 *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 149 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 228 AAHUs are expected to be retained from BLH. 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 GC structures and bank stabilization would allow for the improvement of fish passage in the streams. The NER Plan would provide connection in approximately 90 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).

6.2.6.1.3 *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) 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 344 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.

6.2.6.1.4 *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. Currently, USACE is developing a programmatic agreement with the MS SHPO and federally recognized tribes to establish protocols for additional surveys prior to construction.

6.2.6.1.5 *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.

6.2.6.1.6 *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 approximately 544 acres along 11 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 88 proposed GCS are to occur within 11 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.

6.2.6.1.7 *Environmental Justice*

A system of GCS combined with 25 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.

Section 7
Tentatively Selected Plan

The TSP as previously discussed in Section 4 includes an FRM plan (Alternative 8), which is the NED plan, and an NER plan (a mixture of Alternative 4 and 5 across the 11 degraded streams) that maximizes ecosystem benefits. The NED plan includes a levee and floodwall system combined with a nonstructural aggregation (dry floodproofing of up to 29 commercial structures) is estimated to produce $912 thousand in average annual benefits at an average annual cost of $1.05 million for a BCR of 1.87. The NER plan maximizes ecosystem restoration benefits compared to costs. The NER plan includes grade control and riparian restoration on 11 streams and is estimated to provide 378 Average Annual Habitat Units at an average annual cost of $3,771 per AAHU. The total annual cost of the NER plan is $1.23 million. Table 7-1 identifies the NED Plan while Table 7-2 identifies the tentatively selected NER Plan.

Table 7-1. Flood Risk Management National Economic Development Plan

FRM-NED plan	**Levee and Floodwall system on the south eastside side of Bullfrog Corner (left descending bank of Horn Lake Creek) combined with a Nonstructural aggregation**
First Cost	$18,887,000
Annual Cost	$1,054,000
Annual Benefits	$1,966,000
Net Annual Benefits	$912,000
Benefit to Cost Ratio	1.87
Number of Structures Protected	56 structures are protected by the levee and floodwall system, three structures are residential while 53 are commercial structures.
Impacts/Mitigation Proposed to offset impacts	29 structures included in the nonstructural aggregation which includes dry floodproofing of commercial structures on the east side of Hwy 51. 23 of the 29 structures experience increased water surface elevation as a result of the levee and floodwall (all less than 7”) and require mitigation. There is one abandoned structure, on the east side of the proposed levee, which would be acquired.

Table 7-2. National Ecosystem Restoration Plan

NER Plan- A system of GCS and riparian restoration on each of the unstable 11 DeSoto County Creeks: Camp, Cane, Horn Lake, Hurricane, Johnson, Lick, Mussacuna, Nolehoe, Nonconnah, Red Banks, and Short Fork Creek.	
First Cost	$33,436,100
Annual Cost	$1,224,616
Average Annual Habitat Units	378
Annual Average Cost/Annual Average Habitat Unit (AAC/AAHU)	3,771
Acres of Riparian Buffer Restored	344
Number of Grade Control Structures	88

7.1 NATIONAL SIGNIFICANCE OF THE PROJECT

The intent of comparing alternative flood risk reduction plans in terms of NED is to identify the beneficial and adverse effects that the plans may have on the national economy. Beneficial effects 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.

7.1.1 Real Estate

The proposed flood risk management (FRM) plan for the DeSoto County Feasibility Study includes an approximately 3,000 linear foot levee and floodwall system (structural portion) combined with dry-floodproofing measures (nonstructural aggregation) to reduce the risk of flood damages and to mitigate flood inducements. The proposed plan would reduce the risk of flood damages to 57 structures (3 residential, 54 commercial) in the southwest corner of the of the Highway 51 and Goodman Road intersection. Nonstructural floodproofing measures would benefit 29 commercial structures (23 of which experience inducements) located on the east side of Hwy 51 and Goodman Road.

The total real estate cost, for the structural portion of the FRM component is $2,774,280. This includes the cost of acquiring levee and floodwall sites in fee simple, LERRD administrative costs, utility relocations, and contingencies.

The total estimated cost for the non-structural aggregation of the FRM component carries significant uncertainty and as such includes high contingencies (43 percent). The estimated total cost of the dry floodproofing of 29 structures at this stage is $6,814,803. Acquisition of non-standard estates will be required for the nonstructural component of the NED plan. The

total cost of those estates is currently under investigation. The administrative cost to acquire a non-standard estate and obtain the rights necessary to dry floodproof those structures is $857,400.00.

A takings analysis to determine if flowage easements are required as a result of flood inducements and possible Public Law (PL) 91-646 benefits is nearing completion. If required, the real estate costs would be updated and provided in the final REP. An updated economic analysis with non-standard estate cost would also be required. The final Real Estate Plan (REP) will include non-standard estate costs and the updated economic analysis.

The National Ecosystem Restoration Plan (NER) consists of 11 streams with a system of grade control structures (GCS) and a riparian reforestation feature totaling approximately 344 acres. The total real estate cost for the proposed NER Plan is $ 8,690,922. This includes the cost of acquiring channel improvements in fee simple, road easements, riparian zones sites in fee simple, LERRD administrative costs, and contingencies.

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.

7.1.2 Design

The FRM TSP (Plan 8) would include these structural features:

Horn Lake Creek Levee and Floodwall System

A 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 be constructed with 3-foot horizontal to 1-foot vertical (3H:1V) side slopes and a 12-foot-wide crown. The levee will run approx. 2,475 linear feet adjacent to US Hwy. 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 a levee infeasible, protection would transition to a 525 linear foot floodwall. The floodwall would be 18” thick with an eight-foot-wide foundation. The wall would be five feet high and protrude 3.5 feet above ground level. The levee would require approx. 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 Appendix I, Figure I:11.

The Ecosystem Restoration Tentatively Selected Plan Includes These Features:

NER measures proposed include grade control, bank armoring, riser pipes, and riparian buffers (nonstructural). Improvements are proposed for 11 steams and are described in detail in Appendix A. These measures provide environmental benefits such as reduced scour and deposition. These measures were not evaluated for FRM benefits. Additional field investigation, modeling, and analysis would be completed in PED prior to detailed design, any ancillary benefits identified would be noted at that time.

Grade Control-Up to 88 GCS are proposed. These GCS counteract head cutting that was observed in these streambeds. Structural improvements are designed to stabilize the streambed and reduce future head cutting. The structures would typically be 3.5 feet high off the channel bottom (see Appendix I figures 14 and 15). Larger 600-pound stone would face upstream, with smaller 200-pound stone protecting the downstream side. Side slope armoring and keys would 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.

Riparian Buffers-344 acres of 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 (such as lateral stone toes or pipe drops) 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.

7.1.3 Construction Method

Construction of the structural alternatives, including the levee and floodwall would be expected to last 2 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.

7.1.4 Operations, Maintenance, Repair, Rehabilitation, and Replacement

The OMRR&R is currently under development. 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. Residential structures are recommended to be elevated to the future year (2075) 1 percent AEP stage and; therefore, it is assumed that future increases in water surface elevation would not require future elevations.

7.1.5 Adverse Effects

The FRM TSP 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 and result in long-term benefits to the natural and human environments.

7.1.6 Relationship of Short-term Uses and Long-term Productivity

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. This section describes how the proposed action would affect the short-term use and the long-term productivity of the environment. 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 the TSP.

Construction of the of the FRM and NER TSP 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 TSP 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 NER TSP 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 TSP would outweigh the minimal and mitigable short-term impacts to the environment resulting primarily from project construction.

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 TSP 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

7.1.7 Monitoring and Adaptive Management

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 non-Federal sponsor.

The Monitoring and Adaptive Management Plan is drafted and included in Appendix D of this document. Adaptive management planning would be continued throughout the Study and through the PED phase of the Study. 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.

7.1.8 Cost Sharing Requirements

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 of the total. 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. 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.

7.1.9 Federal Responsibilities for the Tentatively Selected Plan

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.

7.1.10 Non-Federal Responsibilities for the Tentatively Selected Plan

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, 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. 1962d-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.

Table 7-3 and Table 7-4 share the FRM TSP Cost Allocation and the Ecosystem Restoration TSP Cost Allocation.

Table 7-3. Flood Risk Management Plan TSP Cost Allocation

Civil Works Work Breakdown Structure (CWWBS)	Federal	Non-Fed	Total
Lands, easements, rights-of-way, relocations, and disposal areas (LERRD)		**100%**	
Lands and Damages		$2,555,000	$2,555,000
Relocation		$175,000	$175,000
LERRDs Subtotal		*$2,730,000*	*$2,730,000*
Construction First Cost LPP	**65%**	**35%**	
Mitigation	$2,325,050	$1,251,950	$3,577,000
Nonstructural	$5,210,122	$1,604,681	$6,814,803
Levees and Floodwalls	$1,901,900	$1,024,100	$2,926,000
Construction First Cost LPP Subtotal	*$9,437,072*	*$3,880,731*	*$13,317,803*
Administrative Costs			
Planning Engineering and Design	$1,420,000		$1,420,000
Construction Management	$1,420,000		$1,420,000
Administrative Subtotal	*2,840,000*		*$2,840,000*
Total Cost Share	**65%**	**35%**	
TOTAL	**$12,277,072**	**$6,610,731**	**$18,887,803**

Table 7-4. Ecosystem Restoration Cost Allocation

CWWBS	Feature of Work	Fed	Non-Fed	Total
LERRDs	Real Estate	$ -	$ 7,966,545	$ 7,966,545
	Relocations	$ -	$ -	$ -
First Cost		65%	35%	
Fish and Wildlife Facilities	Riparian Buffers	$ 296,340	$ 159,568	$ 455,908
Bank Stabilization	Riprap	$ 12,499,770	$ 6,730,646	$ 19,230,416
Cultural Resources	Surveys	$ 138,905	$ 74,795	$ 213,700
Subtotal		$ 12,935,015	$ 14,931,553	$ 27,866,568
Planning Engineering and Design		$ 1,810,098	$ 974,668	$ 2,784,766
Construction Management		$ 1,810,098	$ 974,668	$ 2,784,766
Administrative Cost		65%	35%	
Subtotal		$ 3,620,196	$ 1,949,336	$ 5,569,532
Total		$ 16,555,211	$ 16,880,889	$ 33,436,100

7.1.11 Risk and Uncertainty

Risk and uncertainty are intrinsic in water resources planning and design. This section describes various categories of risk and uncertainty pertinent to the study. Risk and uncertainty would be further considered during feasibility-level design and analysis.

7.1.11.1 Residual Damages and Residual Risks

Incorporating nonstructural alternatives in addition to the TSP is a plan formulation strategy being used to further reduce residual damages in areas where 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. Appendix L section 5.4 describes the residual risks. The residual damages for the NED plan (Plan 8) are described in Appendix L.

7.1.11.2 Potential Induced Flooding

The NED plan causes minor inducements east and northeast of the levee floodwall alignment. These inducements may be mitigated with nonstructural dry floodproofing of commercial facilities. Inducements will be further investigated and a takings analysis is underway and will be completed prior to the final report release. Any additional takings would impact the cost and benefits of the TSP going forward.

7.1.11.3 Ecosystem Restoration study and data uncertainties

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 identified willing sellers nor determined exactly where access will 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.

7.1.12 Public Involvement

Public involvement is an important part of planning and decision-making. Agencies, non-governmental organizations, and citizens provided valuable input during alternative development. 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 draft IFR-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 would continue through to the conclusion of the formal comment period on the final IFR-EIS.

The initial draft IFR-ESI was released to the public for a 45-day comment period in May 2021. Subsequent analysis showed that flood risk management plan reformulation was required. A public notice will be published in appropriate local paper(s) for the 45-day comment period starting with the public release of this revised draft IFR-EIS in May 2022. Preparation of this revised draft IFR-EIS has been coordinated with appropriate Congressional, Federal, Tribal, state, and local interests, as well as environmental groups and other interested parties.

7.2 VIEWS OF THE NON-FEDERAL SPONSOR

The NFS has been actively involved in all of the planning milestone meetings with the vertical team and critical stakeholder meetings held since the beginning of the study. The NFS supports both the FRM and ER TSP.

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

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 TSP represents the least environmentally damaging alternative to accomplish the needed flood risk reduction.

8.2 CLEAN AIR ACT OF 1970, AS AMENDED

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.

Based on the scope of the project, transportation conformity is not warranted.

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

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 will 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 determine that the project is in compliance with the CWA Section 404(b)(1) guidelines, which specify 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 Mississippi Department of Environmental Quality (MDEQ) is in coordination with the USACE and will provide comments to this draft report. 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 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 U.S. Fish and Wildlife Service (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.

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 northern long-eared bat, due to the potential for minor tree clearing and the recent proposal by the USFWS (on March 23, 2022) to reclassify the northern long-eared bat as endangered rather than threatened under the ESA. Habitat for the northern long-eared bat is expected to improve with the implementation of the NER Plan.

8.5 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 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 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 draft 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 TSP 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 Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703, et seq.) is the primary legislation in the United States established to conserve migratory birds (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 TSP 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) or 1,300 feet (shorebirds) 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 Bald and Golden Eagle Protection Act (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

Environmental Justice (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 percentage of minorities in an affected area either exceeds 50 percent or is meaningfully greater than in the general population. Low-income populations as of 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 (5.1) 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 Regional Planning and Environmental Division South 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 reduction 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 that no disproportionately high and adverse effects to environmental or human resources with any of the alternatives. As mentioned above, Inducements will be further investigated and a takings analysis is underway and will be completed prior to the final report release. These inducements may be mitigated with nonstructural dry floodproofing of commercial facilities or structures and any additional takings would be further evaluated under EJ. Survey data, which would be obtained during Pre-Construction Engineering and Design (PED), will reduce the uncertainty in the depth and duration of these potential inducements, as well as any identified takings

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 more 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) is engaged in developing a Programmatic Agreement (PA) that would establish 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 would 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 (as defined in 36 CFR § 800.16(x)) that may be affected by this undertaking. USACE would continue to develop a process-specific PA in furtherance of the CEMVM's Section 106 responsibilities for this undertaking. The PA would then govern the CEMVM's subsequent NHPA compliance efforts. Following the execution of

the PA, the CEMVM may proceed with issuing a Record of Decision (ROD) in compliance with Section 106 of the NHPA and in coordination with NEPA.

8.10.1 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 Executive Order (EO) 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. At this time, USACE intends to address any potential issues through the Section 106 process.

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.

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 tentatively selected plan.

A Notice of Availability for this draft report would be published in the Federal Register 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 would be considered and incorporated into the final report, as appropriate.

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 TSP and in preparing the Record of Decision (ROD).

9.1 RECOMMENDATION

The recommendation that follows is tentative, pending feasibility level design, reviews and resolutions of internal comments. The recommended plan is to construct a levee and floodwall system and dry floodproof up to 29 commercial structures and to construct 88 grade control structures paired with riparian reforestation on 11 streams, as described in section 7.

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

For planning purposes for this study, construction was scheduled to begin in 2025. 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 Project Partnership Agreement (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.

9.2 PATH FORWARD

The DEIS is available for public review beginning May 6, 2022. The official closing date for the receipt of comments is June 20, 2022, which is 30 days from the date on which the draft EIS will be mailed out during this review period. Comments may be mailed or emailed to:

U.S. Army Corps of Engineers
Attention: Environmental Compliance Branch
167 North Main Street
Memphis, TN 38023
Email: CEMVM-DeSoto-Comments@usace.army.mil

Section 10
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Section 11
References and Resources

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Section 12
List of Acronyms and Abbreviations

A	
ACHP	Advisory Council on Historic Preservation
ACS	American Community Survey
ACE	Annual Chance Exceedance
ADCIRC	Advanced Circulation
AEP	Annual Exceedance Probability
AQCR	Air Quality Control Region
B	
BCR	Benefit to Cost Ratio
BGEPA	Bald and Golden Eagle Protection Act
BMP	Best Management Practices
C	
CAR	Coordination Act Report
CDP	Census of Designated Places
CEMVN	USACE New Orleans District
CEMVM	USACE Memphis District
CEQ	Council on Environmental Quality
CNO	Choctaw Nation of Oklahoma
CWA	Clean Water Act
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	Engineer Regulation
ESA	Endangered Species Act
F	
FCSA	Feasibility Cost Sharing Agreement
FDR	Federal Discount Rate
FEMA	Federal Emergency Management Agency
FMC	Fish Management Counsel
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
NMFS	National Marine Fisheries Service
NRHP	National Register of Historic Places
NRCS	Natural Resources Conservation Service
NS	Nonstructural
NSI	National Structure Inventory

O

O&M	Operation and Maintenance
OMRR&R	Operations, Maintenance, Repair, Rehabilitation, and Replacement
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
RPEDS	Regional Planning and Environmental Division South
S	
SHPO	State Historic Preservation Officer
SNO	Seminole Nation of Oklahoma
STF	Seminole Tribe of Florida
T	
TBTL	Tunica-Biloxi Tribe of Louisiana
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
W	
WMA	Wildlife Management Area
WVA	Wetland Value Assessment