



**US Army Corps
of Engineers®**
Kansas City District



MISSOURI
DEPARTMENT OF
NATURAL RESOURCES



Lower Missouri River Jefferson City L-142 Flood Risk Management Feasibility Study

Final Feasibility Report and Integrated Environmental Assessment

July 2026

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LIST OF ACRONYMS

1D	One Dimensional
2D	Two Dimensional
AAHU	Average Annual Habitat Unit
ACHP	Advisory Council on Historic Preservation
ADA	Americans with Disabilities Act
ADM	Agency Decision Milestone
AEP	Annual Exceedance Probability
AMM	Alternatives Milestone Meeting
APE	Area of Potential Effects
BCC	Birds of Conservation Concern
BCSD	Bias Corrected, Spatially Disaggregated
BA	Biological Assessment
BCR	Benefit Cost Ratio
BGEPA	Bald and Golden Eagle Protection Act
BGS	Below Ground Surface
BMPs	Best Management Practices
BO	Biological Opinion
BSNP	Bank Stabilization and Navigation Project
CA	Combined Alternatives
CEQ	Council on Environmental Quality
CE/ICA	Cost-Effectiveness and Incremental Cost Analysis
CFR	Code of Federal Regulations
cfs	Cubic feet per second
CHAT	Comprehensive Hydrology Assessment Tool
CMIP5	Coupled Model Intercomparison Project Phase 5
CONUS	Continental United States
CST	Central Standard Time
CSRA	Cost and Schedule Risk Analysis
CSVR	Content to Structure Value Ratios
CV	Capital View
CWA	Clean Water Act
CWMS	Corps Water Management System
DDT	Dichlorodiphenyltrichloroethane
EA	Environmental Assessment
EAD	Equivalent Annual Damages
EC	Engineering Circular
ECB	Engineering and Construction Bulletin
EGM	Economic Guidance Memorandum
EJ	Environmental Justice
EM	Engineering Manual
EO	Executive Order
EOP	Environmental Operating Principals
EPA	Environmental Protection Agency
ER	Engineering Regulation
ESA	Endangered Species Act
ESM	Earth Systems Model
ETL	Engineering Technical Letter
EQ	Environmental Quality
FAA	Federal Aviation Administration
FCSA	Federal Cost Share Agreement
FDA	Flood Damage Analysis
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study

FONSI	Finding of No Significant Impact
FR	Feasibility Report
FRM	Flood Risk Management
ft	Feet
FS	Feasibility Study
FWCA	Fish and Wildlife Coordination Act
FWOP	Future without Project
FWP	Future with Project
FY	Fiscal Year
GI	General Investigation
GCM	Global Climate Model
GPS	Global Positioning System
GRR	General Re-evaluation Report
HEC	Hydrologic Engineering Center
HEC-FDA	Hydrologic Engineering Center Flood Damage Reduction Analysis software
HEC-RAS	Hydrologic Engineering Center River Analysis System software
HTRW	Hazardous, Toxic, and Radioactive Waste
HUC	Hydrologic Unit Code
HWM	High Water Marks
I&A	Interest and Amortization
IDC	Interest During Construction
in	Inches
IPAC	Information for Planning and Consultation
IPR	In Progress Review
IWR	Institute of Water Resources
kcfs	Thousand Cubic Feet per Second
LEDPA	Least Environmentally Damaging Practical Alternative
LERRD	Lands, Easements, Rights-of-Way, Relocations, and Disposal Areas
LPP	Locally Preferred Plan
LOCA	Localized Constructed Analogs
LOMO	Lower Missouri River
LSAC	Levee Safety Action Classification
MCACES	Micro-Computer Aided Cost Estimating System
MDC	Missouri Department of Conservation
MoDNR	Missouri Department of Natural Resources
MFA	Missouri Farmers Association
MGS	Missouri Geologic Survey
MO	Missouri
MOA	Memorandum of Understanding
MoDOT	Missouri Department of Transportation
MRBCA	Missouri Risk-Based Corrective Action
MRFFS	Missouri River Flow Frequency Study 2023
MRLS	Missouri River Levee System
NAA	No Action Alternative
NAVD88	National American Vertical Datum of 1988
NCA	National Climate Assessment
NED	National Economic Development
NEPA	National Environmental Policy Act
NFS	Non-Federal Sponsor
NFIP	National Flood Insurance Program
NGVD 29	National Geodetic Vertical Datum of 1929
NHPA	National Historic Preservation Act
NLCD	National Land Cover Dataset
NLD	National Levee Database
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System

NRCS	Natural Resource Conservation Service
NRHP	National Registry of Historic Places
NSI	National Structure Inventory
NWD	U.S. Army Corps of Engineers, Northwest Division
NWK	U.S. Army Corps of Engineers, Northwest Division, Kansas City District
NWS	National Weather Service
OMRR&R	Operations, Maintenance, Repair, Replacement, and Rehabilitation
OSE	Other Social Effects
PAS	Planning Assistance to States
PCBs	Chlordane and Polychlorinated Biphenyls
PDT	Project Delivery Team
PED	Pre-construction Engineering and Design
PFM	Potential Failure Mode
PL	Public Law
PPA	Project Partnership Agreement
PR&Gs	Principals, Requirements & Guidelines
RCB	Reinforced Concrete Barrell
RCP	Reinforced Concrete Pipe
RCP	Representative Concentration Pathway
RECONS	Regional Economic System
RED	Regional Economic Development
RFFA	Reasonably Foreseeable Future Actions
RIP	Rehabilitation and Inspection Program
RM	River Mile
ROW	Right(s)-of-Way
RSMo	Revised Statues of Missouri
RTK	Real Time Kinematic
S&A	Supervision and Administration
SEMS	Superfund Enterprise Management System
SHPO	State Historic Preservation Office
SLRA	Screening Level Risk Assessment
SSP	Shared Economic Pathway
TMDL	Total Maximum Daily Load
TRG	Tolerable Risk Guideline
TSP	Tentatively Selected Plan
TST	Time Series Toolbox
UMRSFFS	Upper Mississippi River System Flow Frequency Study 2003
US	United States
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USCS	Unified Soils Classification System
USGS	United States Geological Survey
USFWS	United States Fish and Wildlife Service
UTC	Coordinated Universal Time
VA	Vulnerability Assessment
VIC	Variable Infiltration Capacity
WRDA	Water Resources Development Act
WSP	Water Surface Profile
WWTP	Wastewater Treatment Plant

EXECUTIVE SUMMARY

Introduction

This Feasibility Report and Integrated Environmental Assessment (FR/EA) presents the results of a U.S. Army Corps of Engineers (USACE) Flood Risk Management (FRM) feasibility study undertaken to identify and evaluate alternatives to improve life safety and reduce damage to property in Jefferson City on the north bank of the Missouri River. The study is performed in partnership with the Missouri Department of Natural Resources (MoDNR), the study's non-federal sponsor (NFS).

Authority

The proposed levee is an unconstructed unit of the Missouri River Levee System (MRLS) authorized by the 1941 (Public Law 228, 77th Congress, 1st Session) and 1944 Flood Control Acts (Public Law 534, 78th Congress, 2nd Session). In December 1973, Unit L-142 was classified "inactive" because the 1960's re-study indicated it was not economically justified. The current study was authorized by Section 216 of the Water Resources Development Act (WRDA) of 2020. The authorization stated:

"...the Secretary shall expand the scope of such study to investigate and provide recommendations relating to modifications to projects in Iowa, Kansas, Nebraska, and Missouri authorized under the Pick-Sloan Missouri River Basin Program....and the Missouri River Bank Stabilization and Navigation project.... including modifications to the authorized purposes of such projects to further flood risk management and resiliency..."

Purpose and Need

Flooding has been a recurring problem for many years within the study area. The purpose of this study is to explore opportunities to reduce flood damages to properties and businesses along the left bank of the Missouri River near River Mile (RM) 142. At this location, the existing Capital View (CV) Levee has a 17% annual exceedance probability (AEP) of overtopping. Each alternative is evaluated against the project objectives and Principles, Requirements, and Guidelines (PR&Gs) criteria of effectiveness, efficiency, completeness, and acceptability. This report identifies the preferred alternative for reducing recurring flood damages in the project area and the federal interest in constructing that alternative. It also documents the formulation and selection process for the Recommended Plan.

The impacts of levee failure have resulted in local, regional, and statewide disruptions. During the 1993 flood, the CV Levee was overtopped and subsequently breached in 13 locations. In 1998, 2001 and 2013 the levee was fully loaded. Most recently, the 2019 flood caused extensive damages to agriculture and infrastructure in communities in the states of Iowa, Nebraska, Kansas, and Missouri. At Jefferson City, the CV Levee overtopped and breached in seven locations and the leveed area was inundated. In the aftermath of the flood, the four states formed the Flood Recovery Advisory Working Group to identify actions that could reduce systemwide flood risk, reduce reoccurring damages, and improve system resilience. In addition to the system-wide evaluations as described in **Section 1.4**, Jefferson City was identified as a priority area for flood risk evaluation, prompting this site-specific feasibility study. The study area is the existing leveed area of the CV Drainage District on the left descending bank of the Missouri River and extends from the upstream tieback at Turkey Creek (approximately 1/2 mile upstream of the U.S. Highway 54/U.S. Highway 63 bridge) to the downstream tieback (approximately 4 miles downstream of the U.S. Highway 54/U.S. Highway 63 bridge). While the study area does not include a full flood risk management study of the Missouri River right bank opposite of the CV Drainage District it does consider potential impacts of study alternatives to adjacent areas, such as Wears Creek.

The Missouri River is the predominate flood source at the study area. **Figure 1** shows the levee districts, tributaries, and other features in the study area. The study area is within Northwestern Division, Kansas City District (NWK). Policy review and approval will be conducted by the Northwestern Division (NWD). The study area falls within the 3rd Congressional district of Missouri.

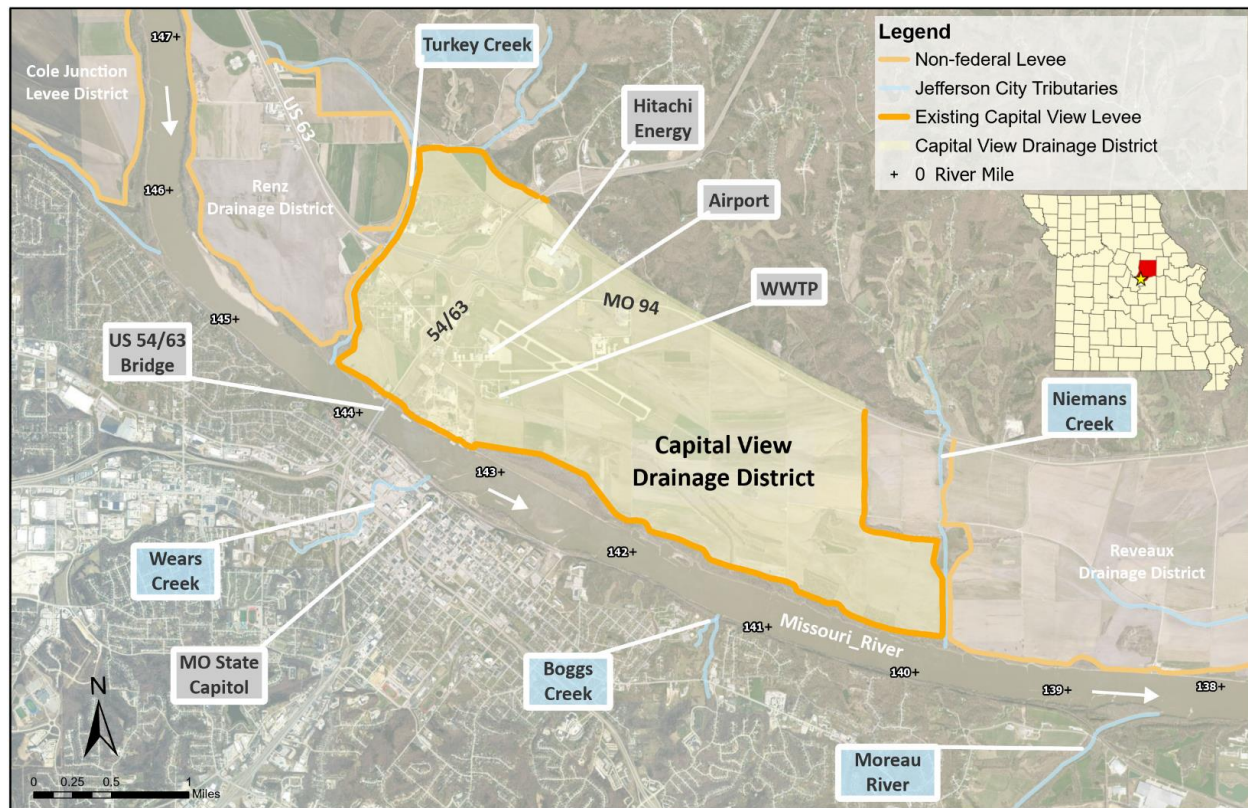


Figure 1. Jefferson City L-142 Study Area

Plan Formulation

Development of the Future Without-Project (FWOP) condition included detailed engineering and economic evaluations to quantify flood risk and prepare for the comparison of alternatives. In the CV Area, the analysis of National Economic Development (NED) flood risk damages estimated \$20M in annual expected damages. The plan formulation process identified 37 initial measures for consideration. These measures were then organized into seven Alternative Themes (not including the No Action Alternative): Nonstructural, Natural & Nature Based, Channel Modification, Infrastructure Improvement, Improved Resilience, Existing Levee Modifications, and New Structural Measures. Thirty-seven measures were screened against the project objectives and four PR&G criteria of effectiveness, efficiency, completeness, and acceptability. Additionally, measures were evaluated against the project constraint, or the degree to which a measure avoids or minimizes disproportionate impacts to economically disadvantaged and socially vulnerable populations in the study area and screened accordingly. The remaining measures were combined into 13 Combined Alternatives (CA1 through CA13). These CAs were further screened down to a final array of three plans:

- CA0: No Action
- CA11: Nonstructural
- CA13: Hybrid Alignment, 41-ft Stage, Partial CV Levee Removal

Recommended Plan

The plan with federal interest for further development in the design and construction phases of the project CA13, includes a federal levee system designed to have an overtopping frequency based on the 1% AEP Missouri River event. CA13 includes constructing 31,400 linear feet of new earthen levee set back

approximately 1,500 to 3,000 feet from the Missouri River, increasing conveyance of the river for the most frequent overbank flow scenarios, and decreasing the frequency in which the levee would get loaded compared to the existing CV Levee. The new L-142 federal levee would have a minimum top of levee elevation set at the profile produced by the 590,000 cfs (based on the 1% AEP event as identified at the time of this study), plus one foot of additional height for uncertainty. Upstream of the Missouri River bridge abutment, an extra foot of levee height was added to ensure initial overtopping downstream, consistent with ECB 2019-8 Managed Overtopping of Levee Systems. This design is expected to flood at less than 1% AEP with a 54% assurance of passing the 1% AEP event. The design would be based on a 1% AEP for overtopping, making it more in line with other levees that reduce flood risk in urban areas with similar infrastructure (major manufacturing, airport, critical facilities, major roadways). A federal levee system would have the added benefit to stakeholders of being a predictable, engineered system designed and constructed to applicable design standards as listed in the **Appendix A3** reference list.

The alignment seeks to maximize public right-of-way (ROW) and property for the levee footprint with real estate considerations, while providing setbacks at hydraulically critical locations and protecting access to critical infrastructure and vital transportation corridors. The alignment and overtopping event of the levee was iterated multiple times by the project delivery team (PDT), local stakeholders, and the non-federal sponsor (NFS). The alternative would not seek a levee design to meet minimum National Flood Insurance Program (NFIP) regulatory standards, which would require an additional three feet of levee height above the Recommended Plan. Therefore, this project would not result in a request to reduce the leveed area's flood risks associated with the 1% annual exceedance probability (AEP) flood event delineated by the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM).

The plan with federal interest also includes removal of the portion of the CV Levee west of U.S. Highway 54/U.S. Highway 63 to decrease hydraulic impacts from Turkey Creek on adjacent levee systems and the federal levee tiebacks and to provide environmental benefits to the area. The federal project would leave the CV Levee east of U.S. Highway 54/U.S. Highway 63 in place. With the construction of a federal levee system within the same drainage district, the existing CV Levee that remains would no longer be eligible for federal assistance for repair under P.L. 84-99. However, the new federal levee would be eligible for repairs of flood damages through the P.L. 84-99 program without a local cost share.

As anticipated with any project modifying drainage patterns within the floodplain, hydraulic pattern changes are anticipated with construction of a new federal levee that requires mitigation for induced flooding. The federal interest plan includes mitigation for unavoidable induced flooding impacts from the construction of the new levee to an estimated 26,000 acres of land. A preliminary real estate takings analysis determined the least cost mitigation option would be the purchase of permanent flowage easements across portions of 1,700 parcels spanning four counties in central Missouri. A Real Estate Plan has been prepared that addresses the fee acquisition, easements and other necessary components required for implementation of the plan. Not all parcels riverward or outside of a new levee would need to modify land use in the same manner – some landowners may sell, retain ownership and continue farming, enroll in a Natural Resource Conservation Service (NRCS) program, or pursue other options. A preliminary cost estimate for the real estate necessary to mitigate the induced flooding is \$15,199,900 this includes 90% of the average fair market value for newly inundated areas and 5% of the average fair market value for areas that currently experience flooding. The total real estate, including the project footprint, is \$72,276,376, which includes land costs, NFS incidentals, and utility relocations. Additional funds to acquire the necessary real estate are estimated at \$3,937,500 for Federal real estate administrative oversight.

The MoDNR is the NFS for the study, while the City of Jefferson City, Missouri has agreed to serve as the cost-sharing NFS for project implementation. Although the City can acquire and hold title to land outside its jurisdictional boundaries, it lacks the power of eminent domain beyond its city limits. Consequently, the City cannot fully execute all NFS implementation responsibilities. To date, an additional NFS with the necessary real estate acquisition authority outside the city limits has not been identified. Due to the lack of a NFS capable of fully executing the acquisitions, the FR/EA identify the No Action Alternative as the Recommended Plan, despite a demonstrated Federal interest in project implementation. A map of the federal interest plan is shown below in **Figure 2**.

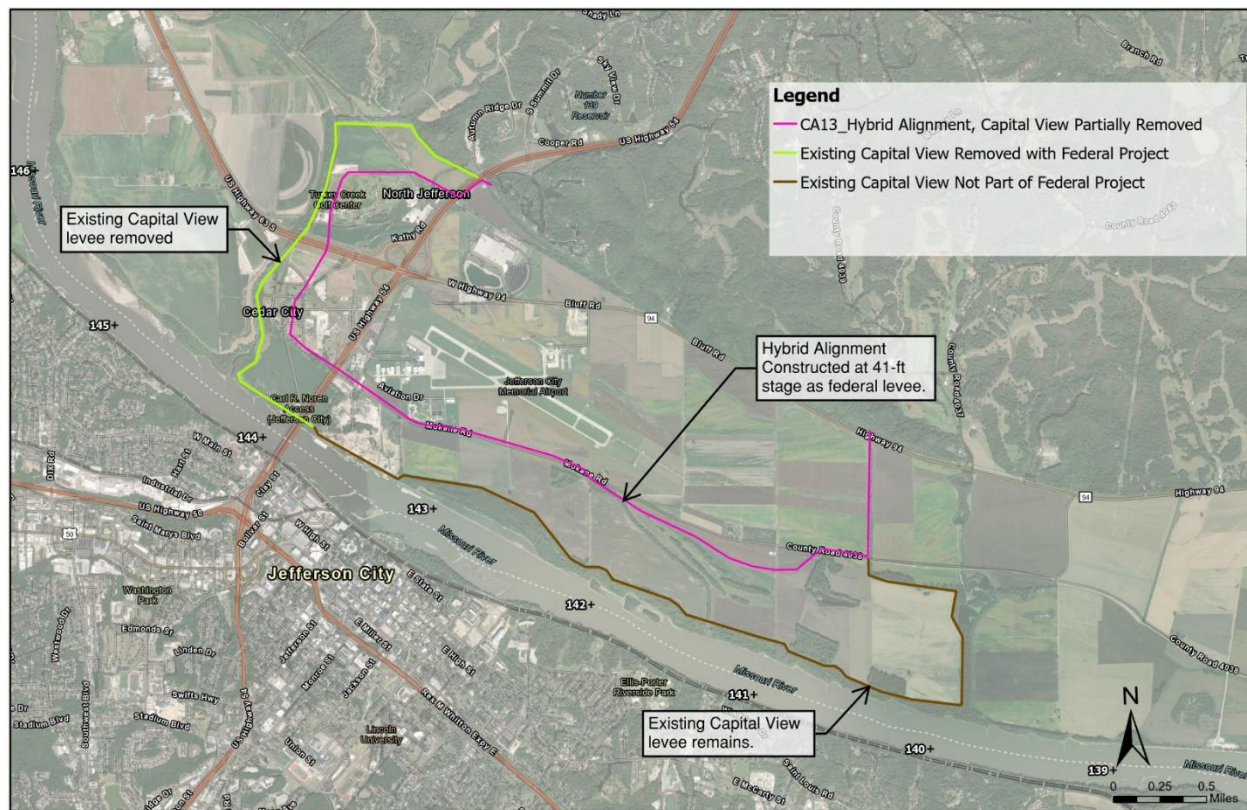


Figure 2. Federal Interest Plan (CA13) Levee Alignment

Initial cost estimates were completed for nine of the thirteen CAs, and a detailed cost estimate was completed for the plan with federal interest. The Project First Cost of the plan is \$291,000,000 (FY 2026 price level). Escalated to the expected mid-point of construction and/or design, the Total Project Cost (fully funded) is \$360,000,000. **Table 1** below shows the economic summary for the plan with federal interest (CA13).

Table 1. CA13 Economic Summary

CA13 Economic Summary	*Cost (FY 2026) in \$1,000s
Mean Annual Benefits	\$15,136
Total Annualized Investment Cost	\$13,928
Mean Annual Net Benefits	\$1,208
Mean Benefit-Cost Ratio	1.09

**Discrepancies in totals due to rounding. Oct 2025 (FY26) price level.*

Significant Resources / Environmental Considerations

The implementation of the federal interest plan would result in a variety of environmental commitments. To comply with the Clean Water Act, a Section 401 Water Quality Certification and NPDES permit would need to be acquired prior to project implementation. Mitigation would be needed for unavoidable impacts to wetlands within the study area. CE/ICA determined the most cost-effective way to mitigate these impacts would be to purchase wetland mitigation credits from a mitigation service, such as a credit bank or an in-lieu fee program (see **Appendix C1**). USACE would evaluate and identify which mitigation service would be most cost effective in PED phase.

Based on the CE/ICA results, USACE also recommends on-site mitigation of 45.4 acres to natural floodplain forest habitat within the CV Area borrow site. This mitigation would be accomplished by allowing the site to naturally regenerate native tree species adapted to floodplain conditions, such as eastern cottonwood, silver maple, and American sycamore. To facilitate the successful implementation of this recommendation, USACE drafted a monitoring and adaptive management plan for this habitat mitigation (see **Appendix C1**). Monitoring for the excessive establishment of invasive species would also be included.

To avoid impacts on federally listed tree roosting bats or federally protected migratory bird species, tree removal activities would need to abide by seasonal restrictions to avoid incidental take. The planning aid letters developed by USFWS make several recommendations that USACE would follow to the extent practicable. Design implementation would require coordination with MoDOT to ensure that construction activities were scheduled so that alternative routes would be available for any potential road closures that would need to occur.

Plan Implementation

The federal interest plan is not comprised of separable elements and therefore it is assumed that the project would be completed as a whole, assuring temporary flood protection as necessary. Following authorization of the Chief's Report in WRDA 2026, the Design Phase would be anticipated to commence in Q2 of FY27 and be completed within two years. Duration of construction would be expected to be four years, beginning in FY30, assuming a typical construction crew works 8 hours per day 5 days per week. Additional details on design and implementation are discussed in **Appendix B**.

Views of the Public, Agencies, Stakeholders, and Tribes

The feasibility study NFS, MoDNR, and the implementation sponsor, City of Jefferson City, Missouri both support the federal interest plan. However, even though the City can acquire and hold title to land outside its jurisdictional boundaries, it lacks the power of eminent domain beyond its city limits. Consequently, the City cannot fully execute all NFS implementation responsibilities. A letter of intent to participate in and in support of the federal interest plan has been received from Jefferson City. Throughout the process, stakeholders have been engaged in discussions about the future of the project and the various effects on landowners, businesses, residents, and others. Continued coordination would be necessary if the project progresses into the next design phase to ensure all voices are heard and considered. The Osage Nation was a cooperating agency on the Study and was consulted throughout the process. State and Federal agencies were also consulted and provided feedback as necessary.

Reviews

The report has undergone reviews according to the approved Review Plan. A targeted District Quality Control (DQC) of Hydrology and Hydraulics and Economics was completed in November 2024. DQC of the Draft Report was completed in December 2024 and Agency Technical Review on the Draft Report was completed January 2025. DQC of the final report was completed in April 2026.

Unresolved Issues / Areas of Controversy

The project includes a non-standard estate (NSE) for mitigation of induced impacts. This NSE was coordinated with HQ-USACE and the OASA-CW for policy and applicability to this feasibility study. As a NFS seeks real estate acquisition, this NSE would be expected to be used. Although the City can acquire and hold title to land outside its jurisdictional boundaries, it lacks the power of eminent domain beyond its city limits. Consequently, the City cannot fully execute all NFS implementation responsibilities. The flowage easements would need to be acquired across 25 miles spanning 4 counties. This creates a substantive risk to project implementation.

1.0 Introduction

This Feasibility Report and Integrated Environmental Assessment (FR/EA) presents the results of the Lower Missouri River Jefferson City L-142 flood risk management (FRM) study, completed by the U.S. Army Corps of Engineers (USACE) Kansas City District (NWK) in partnership with the Missouri Department of Natural Resources (MoDNR) who is the non-federal study sponsor. The NWK-prepared FR/EA integrates plan formulation with documentation of environmental effects, provides potential alternatives for FRM within the Jefferson City study area, outlines the process used for selecting the Tentatively Selected Plan (TSP), and concludes with development of a Recommended Plan for project implementation. This report facilitates acceptance of the study conclusions and recommendations by the sponsor, public, state and local agencies, Tribes, and the federal government.

1.1 U.S. ARMY CORPS OF ENGINEERS (USACE) PLANNING PROCESS

The USACE planning process follows Risk Informed Planning, which uses a six-step process as defined in Engineering Regulation (ER) 1105-2-103 Policy for Conducting Civil Works Planning Studies. This process is a structured approach to problem solving, which provides a rational framework for sound risk informed decision making while strategically reducing uncertainty. This process is usually expressed in a sequential manner. However, it can also be iterative in practice. This report will mirror the sequential manner of the process. These steps start with scoping, which includes identifying problems and opportunities, inventorying study area resources, and forecasting conditions as identified in the first two chapters. Chapter 3 starts with the formulation of ways to solve water resource problems and contains portions of how to evaluate these solutions. Evaluation cannot be completed without fully understanding the effects and consequences of these solutions as described in Chapter 4. Plan comparison and selection within Chapter 5 comprises steps 5 and 6. The remainder of this report describes the TSP in Chapter 6, the plan's environmental compliance in Chapter 7, the Recommended Plan in Chapter 8, the district engineer's recommendation in Chapter 9, and a list of those involved in report preparation in Chapter 10.

This report integrates the EA to document compliance with the National Environmental Policy Act (NEPA) of 1969.

1.2 STUDY AUTHORITY

Section 216 of the Water Resources Development Act (WRDA) of 2020 authorizes modifications to projects in Iowa, Kansas, Nebraska, and Missouri authorized under the Pick-Sloan Missouri River Basin Program and the Missouri River Bank Stabilization and Navigation Project, including modifications to the authorized purposes of such projects to further flood risk management and resilience (for the purposes of this document the terms resilience and resiliency may be used interchangeably). The authorization states:

“...the Secretary shall expand the scope of such study to investigate and provide recommendations relating to modifications to projects in Iowa, Kansas, Nebraska, and Missouri authorized under the Pick-Sloan Missouri River Basin Program....

and the Missouri River Bank Stabilization and Navigation project.... including modifications to the authorized purposes of such projects to further flood risk management and resiliency...”.

The proposed L-142 Unit in Jefferson City is within the authorized scope of WRDA 2020. Additionally, Jefferson City was identified within the Memorandum for Commanding General, U.S. Army Corps of Engineers (USACE) Subject: Implementation Guidance for Section 216 of WRDA 2020, Lower and Upper Missouri River Comprehensive Flood Protection as a spin-off study that was coordinated with the non-federal sponsor for consideration for implementation.

1.3 STUDY AREA (PLANNING AREA)

The Jefferson City levee study area is at the southern edge of Callaway County, Missouri, along the left bank of the Missouri River from Turkey Creek (river mile 144.5) on the west to the approximate area of Niemans Creek (river mile 140.5) on the east.

Much of the area has been incorporated into the city limits of Jefferson City and is known informally as North Jefferson City.

There are no federal flood risk management projects in or near the study area. The Missouri River upstream and downstream of Jefferson City, Missouri is lined with a patchwork of non-federal levee systems including some that are active in the USACE Rehabilitation and Inspection Program (RIP), authorized under Public Law 84-99 (P.L. 84-99); privately constructed levees that have no USACE affiliation; and areas with no structural flood risk management features. The RIP is commonly referred to as the P.L. 84-99 program, which is the terminology adopted in this report. The current study area is within the leveed area of CV Levee (Error! Reference source not found.). The CV Levee is operated and maintained by the CV Drainage District and is active in the RIP. Immediately upstream of the CV Levee on the left bank is the Renz Levee and immediately downstream on the left bank is the Reveaux Levee. These are also non-federal levees active in the RIP. Critical infrastructure within the existing leveed area includes the Jefferson City Memorial Airport and the city's regional wastewater treatment plant.

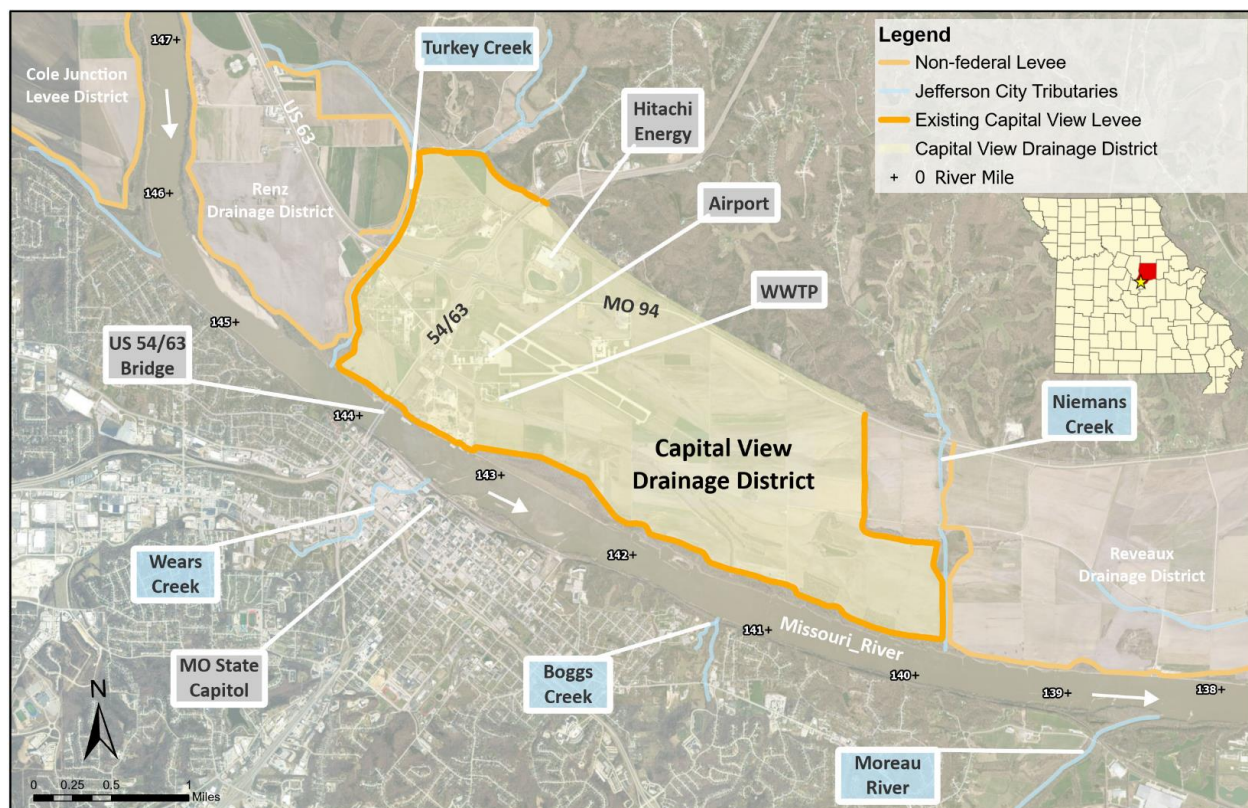


Figure 3. Jefferson City L-142 Study Area

Jefferson City, Missouri is located across the river from the study area on the right bank. It sits high on a bluff with much of the city at little to no risk of Missouri River flooding. However, a tributary of the Missouri River, Wears Creek, can be impacted by Missouri River water surface elevations. Wears Creek is a right bank tributary of the Missouri River, entering the river at mile 143.4 and draining 14.1 square miles as outlined in **Figure 4**. The Wears Creek drainage area is subject to flooding incurred from both shorter duration storms overwhelming the City's stormwater infrastructure from Wears Creek watershed runoff

and slower backwater floods of a longer duration from the Missouri River. Wears Creek basin flooding has been analyzed separately from the Lower Missouri Jefferson City L-142 FRM Study by both USACE and the State of Missouri with recommendations that have not been implemented to date. A summary of past Wears Creek studies is included **Section 1.4**. Due to the complexity of the Wears Creek basin, the Jefferson City feasibility study assesses, and documents impacts to Wears Creek in relation to the change of water surface elevation in the Missouri River profile at the Wears Creek confluence.

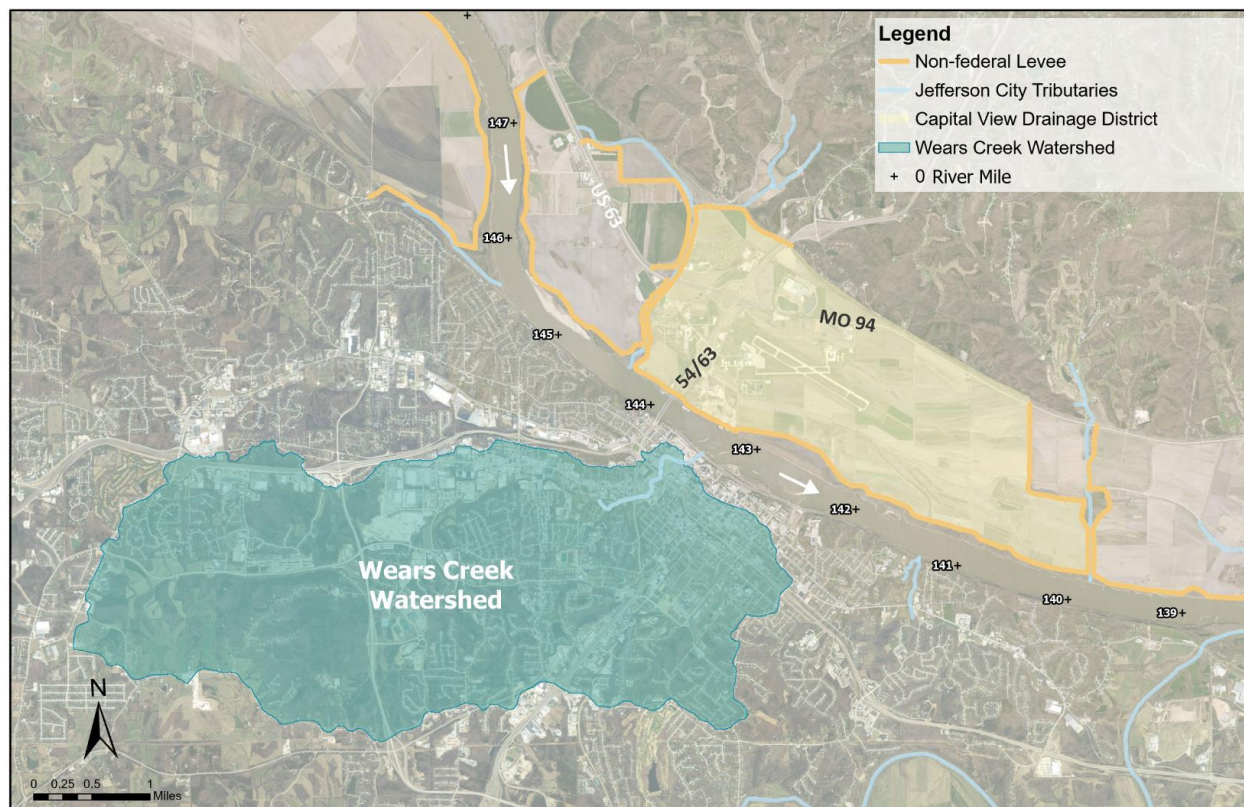


Figure 4. Wears Creek Watershed

1.4 BACKGROUND AND HISTORY

Unit L-142 is an unconstructed levee of the Missouri River Levee System (MRLS) authorized by the 1941 and 1944 Flood Control Acts (Public Law 228, 77th Congress, 1st Session, and Public Law 534, 78th Congress, 2d Session) on the left bank of the Missouri River at Jefferson City. In December 1973, Unit L-142 was classified "inactive" because the 1960's re-study indicated it was not economically justified. The area that would have been behind Unit L-142 now sits behind the non-federal CV Levee.

Flooding has been a recurring problem for many years within the study area. The CV Levee was constructed prior to 1970 to alleviate the recurring flood damages. The CV Levee is on the left descending bank of the Missouri River and extends from the upstream tieback at Turkey Creek (approximately 1/2 mile upstream of the U.S. Highway 54/U.S. Highway 63 bridge) to the downstream tieback (approximately 4 miles downstream of the U.S. Highway 54/U.S. Highway 63 bridge). During the 1993 flood, the CV Levee was overtopped and subsequently breached in 13 locations. The CV Levee also overtopped and breached in 13 locations in 1995 and in 7 locations in 2019. In 1998, 2001 and 2013 the levee was fully loaded but did not breach.

As a result of the 1993 and 1995 floods, a General Re-Evaluation Report (GRR) was initiated on Unit L-142 and completed in 2001 with a recommendation to construct a federal levee on the left bank to an elevation of 564.0 feet National Geodetic Vertical Datum of 1929 (NGVD29). At the time, this correlated to

approximately a 0.1% (1/1,000 year) annual exceedance probability (AEP) of overtopping. This levee would be slightly landward of and shorter in length than the existing CV Levee. The project moved forward to design but was paused in 2007 when the sponsor declined to sign the Project Partnership Agreement (PPA).

Most recently, the 2019 flood caused extensive damages to agriculture and infrastructure in communities in the states of Iowa, Nebraska, Kansas, and Missouri. Specifically at Jefferson City, the CV Levee overtopped and breached in numerous locations and the leveed area was inundated. In the aftermath of the flood, the State of Missouri formed the Flood Recovery Advisory Working Group, and the four impacted states urged USACE to take a comprehensive look at the Lower Missouri River to identify actions that could reduce systemwide flood risk, reduce reoccurring damages, and improve system resilience. In addition to the system-wide evaluations as described below, Jefferson City was identified as a priority area for flood risk evaluation, prompting this site-specific feasibility study.

The Flood of 1993 remains the flood of record at Jefferson City, with a recorded maximum stage of 38.7 feet and discharge of 750,000 cfs at the Jefferson City Missouri River gage, corresponding to a roughly 0.2% (1/500 year) AEP flow. The 2019 flood recorded a maximum river stage of 33.4 feet and discharge of 366,000 cfs, an approximate 10% (1/10 year) AEP flow. **Figure 5** shows the difference in inundation between the 2019 and 1993 flood events at the CV Drainage District leveed area.

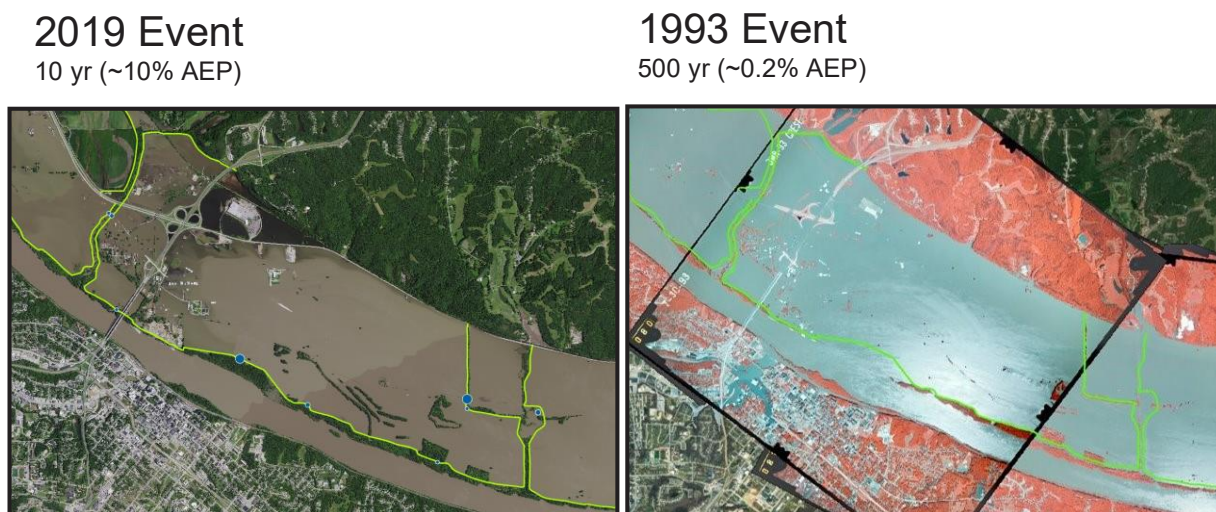


Figure 5. Inundation Extent Comparison at the Capital View Levee for 2019 and 1993 flood events.

In addition to this study, several other assessments within the study area have been recently completed or are in progress. A summary of studies most relevant to the study area follows. Additional history within the study area is included in the Hydrology and Existing Conditions **Appendix A1 – Part 1**.

Lower Missouri River Flood Risk Resiliency Plan Section 22 PAS (2022)

The *Considerations and Analysis for Flood Risk Resiliency for the Lower Missouri River (Nebraska, Iowa, Kansas, and Missouri) Section 22 Planning Assistance to States (PAS)* study investigated conceptual measures and strategies to lessen flood risk vulnerability and improve flood risk resilience throughout the Lower Missouri River Basin. The four state partners assisted in prioritizing areas between Sioux City, Iowa and St. Louis, Missouri for potential action. The PAS study analyzed vulnerable locations on the Lower Missouri River and conducted stakeholder outreach to better understand recurrent problem areas and impacts. Jefferson City was identified as one of the critical areas to be considered for feasibility-level study from this analysis.

Lower Missouri River Flow Frequency Study (2023)

The *Missouri River Flow Frequency Study—Yankton, South Dakota to Hermann, Missouri* was completed in June 2023 and incorporates new data and statistical analysis and applies state of the practice methodologies to update the Lower Missouri River flow frequencies, including flow and annual exceedance probabilities, at 10 gages. This study extends the period of record and replaces the Missouri River flow frequencies developed with the 2003 Upper Mississippi River System Flow Frequency Study.

Lower Missouri River Stage Frequency Analysis (Expected in 2026)

The Lower Missouri River Stage Frequency analysis will update hydraulic modeling and associate 2023 Flow Frequency study flows to determine stage frequencies at select river locations. The stage analysis of the Lower Missouri River was not complete at the time of this study and is anticipated to be complete in 2026.

Lower Missouri River Flood Risk & Resilience Study (Expected in 2026)

This feasibility study will evaluate the Lower Missouri River system over 735 river miles from Sioux City, Iowa to the mouth near St. Louis, Missouri. In partnership with Missouri, Kansas, Iowa, and Nebraska the study will create a vision for a more resilient future for the Lower Missouri River, with a focus on flood risk management. Outcomes of the study will include system analysis providing context to the initial studies, identify and recommend any additional spin-off feasibility studies and their locations, and identify potential policy recommendations that would support the system and potential actions for local stakeholders. The study is scheduled to be completed in July 2026. The Jefferson City study is not directly tied to the findings of the system plan, but many of the same resources will be used in the development of both analyses.

Wears Creek Studies (1953, 1974, 1980, 1986, 2003)

Wears Creek is a right-bank tributary to the Missouri River with a confluence located 0.5-mile downstream of the U.S. Highway 54/63 bridge, directly across the river from the existing CV Levee. The drainage area encompasses 14.1 square miles, delineated in **Figure 4. Wears Creek Watershed**, and is routed through Jefferson City as an open channel, with many bridges and a couple of enclosed sections. The Wears Creek system is subject to two very different types of flooding including flash runoff floods from the upstream watershed and backwater floods from the Missouri River (USACE 1974). The scope of this study does not extend to the right bank of the Missouri River but will document the effects of proposed left-bank alternatives.

Past studies, conducted by both USACE and the State of Missouri, have been produced to assess feasibility of reducing flooding in the Wears Creek basin since 1928. The most recent findings are documented in a General Design Memorandum issued in 1986 by USACE, Kansas City District. The report concluded that feasible alternatives for the reduction or elimination of flood damages in the developed Wears Creek basin do not exist. Considered alternatives for past USACE studies are summarized in **Table 2**.

Table 2. Summary of USACE Wears Creek Flood Risk Management Studies

Date	Recommendation	Outcome
January 1953	Interception and diversion of Wears Creek North and East Branches to the Missouri River and provision of a gated outlet at the mouth of Wears Creek.	Not submitted to Congress for authorization due to lack of local support

Date	Recommendation	Outcome
September 1974	Series of closed conduits for Wears Creek and portions of the Frog Hollow and East and North Branch tributaries to pass the 1% AEP Wears Creek flood. Filling the floodplain downstream of the Whitten Expressway to the Missouri River Urban Design Flood elevation and filling the floodplain between the Witten Expressway and U.S. Highway 54 to above the 1% AEP flood elevation. Other considered alternatives included Zoning and Building Code Requirements, Floodproofing, Evacuation of the Floodplain, Pressurized Conduit, Upstream Impoundments, and Open channel alternatives (\$48M 1979 cost).	Plan was not economically justified using standard USACE benefit/cost analysis due to removal of existing infrastructure to make way for new. Project defined as an urban renewal effort and authorized for further evaluation for federal interest instead of construction.
March 1980	Recommendation of a closed conduit.	Project is not economically justifiable due to land use changes in the floodplain. Jefferson City action to convert floodplain to compatible uses.
January 1986	Study to determine if federal interest could be found for targeted flood protection measures for the most developed reach of Wears Creek including Closed Conduit, Earthen Levees, Channel Improvements, Floodwall, and Floodproofing.	The only alternative that would meet project goals of flood risk management for both Wears Creek and Missouri River flooding was the floodwall alternative, which would be cost prohibitive in relation to the flood damages reduced. The city removed much of the flood-prone development prior to the study, and USACE recommendation is to continue flood damage reduction efforts.

The most recent report lead by the State of Missouri was completed by HDR, Inc. in 2003, titled Wears Creek flood Mitigation Study Phase II Project No. 00025-01. This study considered alternatives for providing flood protection to key infrastructure within the Capital Complex area and performed hydrologic and hydraulic evaluations to define risk of flooding from Missouri River backwater, Wears Creek runoff, and coincidental flooding. Two conceptual designs were considered to provide a 1-ft freeboard above the 0.2% AEP (1/500 year) Missouri River flood event and 1% AEP (1/100 year) interior pumping facility for the Wears Creek drainage area. Conceptual designs included an alternative for a levee, flood gate, and pumping facilities at the mouth of Wears Creek totaling \$76 Million, or an alternative consisting of site-specific floodwalls, gates, and pumping facilities at the Truman Building, State Health Laboratory, and Capital Plaza Hotel totaling \$5 Million. Neither alternative was implemented.

1.5 PURPOSE AND NEED

Flooding has frequently damaged the area on the left bank of the Missouri River near Jefferson City. The purpose of the proposed federal action is to reduce the potential risk for loss of life as well as reduce economic damages due to flooding. This area has seen repeated flood events that overtop and breach the existing CV non-federal levee. Although life loss has not been recorded to date, there is still life loss potential. While overtopping events of the levee generally have days of warning time, breaches prior to overtopping can happen suddenly. Once the CV Levee overtops (or breaches), those in the immediate vicinity of the airport have only about 2 hours to safely complete any evacuations. In addition to property and structures in the leveed area, U.S. Highway 54 is a major thoroughfare for the region. The highway closes when the water surface reaches an elevation of 557.9 feet NGVD29, an approximate 37-foot flood stage at Jefferson City.

The existing CV Levee protects important infrastructure that provides local, regional, and statewide benefits. Some of the negative impacts during flood events include:

- Hitachi Energy is a manufacturer of electrical transformer components that employs 1,200 people, many of whom are not paid their hourly wage when they are unable to get to work.

- Capital Sand provides materials for construction for the region, including for sites as far as Springfield, Missouri, one of the fastest growing areas in the state of Missouri. Lack of material impacts construction and maintenance of public goods in this service area.
- The Jefferson City Memorial Airport serves not only private and contract aviation, but also essential state government services. These services are suspended during flood events.
- The Missouri National Guard has an Army Aviation Support Facility affected by the recurring flooding, which is unable to operate once CV Levee overtops.
- Regional transportation routes supporting the economy, agricultural production, and emergency services routes are impacted by flooding, resulting in costly detours and delays.
- Loss of access to the Jefferson City Regional Wastewater Treatment Plant can impact basic public services such as clean water and sanitary sewer operations.
- Businesses and public enterprises in the area continue to suffer structural deterioration and loss of market value due to flooding.

USACE Kansas City District is the lead federal agency for this study. The non-federal sponsor (NFS) of this study is the Missouri Department of Natural Resources (MoDNR). However, MoDNR has indicated they will not be the implementation sponsor for the study. Therefore, several key stakeholder groups have been involved and engaged with the study progress including the CV Drainage District, Missouri Corn Growers, Missouri Farm Bureau, Jefferson City Memorial Airport, the city of Jefferson City, and the Jefferson City Regional Economic Partnership. Landowners, businesses, and residents in Jefferson City proper are also providing feedback to the PDT. Public Involvement conducted as part of the study is detailed in **Appendix F**. The city of Jefferson City has officially been identified as the non-federal sponsor for the implementation of the Recommended Plan.

The Osage Nation is a cooperating agency for this study.

1.6 PROBLEMS AND OPPORTUNITIES

The problems for the study include the following:

- There are frequent and reoccurring economic and infrastructure damages on the north bank of the Missouri River in Jefferson City, Missouri due to repetitive flooding, including damage to an airport, Missouri National Guard Army Aviation Support Facility, major roadways, wastewater treatment facilities, businesses, and ~2,100 acres of agriculture production land.
- The existing non-federal levee, the CV Levee, has repeated resilience concerns, which include overtopping, interior drainage, under seepage, slope and crown erosion and stability, and does not provide adequate flood risk reduction for the area.

While addressing the identified problems, there are opportunities to achieve the following:

- To reduce flooding, which currently damages trails and limits recreational access, opportunities, and connectivity with surrounding communities and the environment such as the Katy Trail.
- To preserve, restore, or enhance the aesthetic and environmental qualities of the study area.
- Allow greater floodplain connectivity. Wetlands located riverward of Mokane Road may be enhanced as they derive hydrology from the Missouri River and have the potential to support fair to minimal benefits to area wildlife.
- To sustain and improve community cohesion through measures to better protect existing critical infrastructure in leveed area (wastewater treatment facility, airport).
- Identify other opportunities and actions for other agencies, local entities, or sponsors to implement independently to provide flood risk resilience for the area.

- Potential addition of Church Farm Conservation Area (CFCA) (**Figure 6**Figure 6) as upstream retention. The CFCA, owned by the State of Missouri and leased by the Missouri Department of Conservation (MDC) since 2016, is 1,277 acres of bottomland along the Missouri River's right bank. MDC maintains the 3.75-mile-long Prison Farm levee (also referred to as Church Farm levee). Numerous scour holes due to past flooding, along with a natural slough that hold water seasonally, provide bird habitat that could be enhanced with additional water retention to benefit the project.

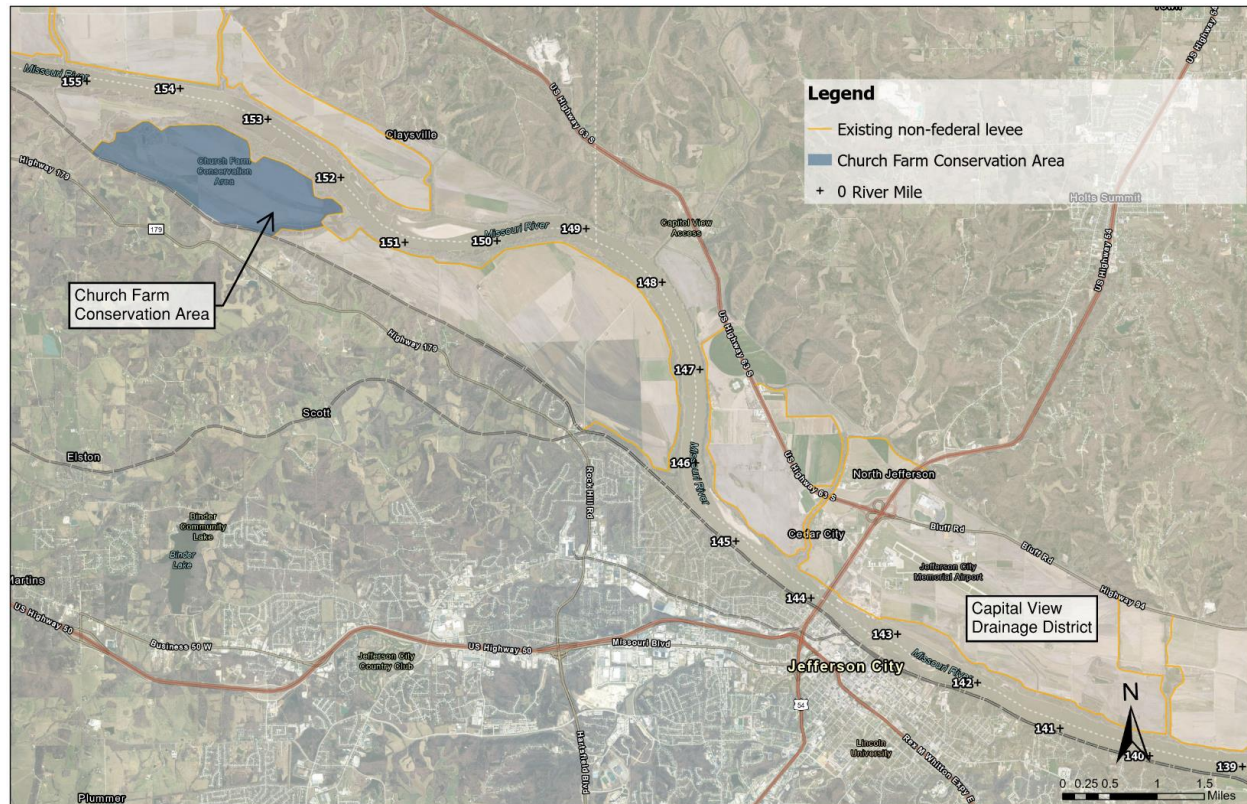


Figure 6. Church Farm Conservation Area Map

1.7 OBJECTIVES AND CONSTRAINTS

The study objectives listed below were used to compare each alternative and select a plan partially based on its effectiveness in meeting these objectives. They are:

- Reduce the risk of flood damage and/or improve resilience for property, businesses, agriculture, and infrastructure (including critical facilities) near Jefferson City for the 50-year period of analysis beginning in 2035.
- Reduce the risk of flooding on human life and safety for the 50-year period of analysis beginning in 2035.
- Consider the project as part of the overall Lower Missouri River (LoMo) Flood Risk and Resiliency study (System Plan) planning objectives for system conveyance and flood risk planning in the future.
 - Reduce economic damages to property, businesses, agricultural operations, critical facilities, and infrastructure in the LoMo over a 50-year period of analysis,
 - Reduce the risk of flooding to human life and public safety in the LoMo over a 50-year period of analysis, and
 - Improve the economic vitality of rural communities in the LoMo.

Constraints are substantial barriers or restrictions that limit the extent of the planning process. Plans are formulated to meet the planning objectives and avoid violating the constraints. Considerations are those issues or matters that should be considered during the planning process, but do not necessarily limit the extent of the process as do constraints. Only one true constraint was identified during the planning process:

- Avoid increasing bird/wildlife air strike hazard in accordance with the USACE Memorandum of Agreement with the Federal Aviation Administration (FAA).

This constraint was discussed at length with both the airport's local leadership as well as the FAA Regional Administrator to determine the proper consideration of this constraint. The following decision criteria were used when planning around this constraint:

- Limit all borrow activities within five miles of the airport to the extent practicable. In particular, borrow sites located in-line with runways are to be avoided if possible.
- If the PDT determines that it is necessary to collect borrow material within five miles of the airport, coordination with the FAA would occur to minimize bird attractants. Preventing the formation of pools of water is particularly important to avoid attracting large flocks of waterfowl.
- Any restored habitat within five miles of the airport should be wooded. Habitat characterized by open water or herbaceous vegetation may attract flocks of geese which are especially problematic for airports.
- Borrow activities or land use changes more than five miles away from the airport are considered to have no meaningful impact on airport operations.

Other considerations for the study include:

- Avoid impacts to the authorized purposes of the Bank Stabilization and Navigation Project (BSNP).
- Avoid, minimize, or mitigate impacts to cultural sites in the project area.
- Avoid, minimize, or mitigate impacts to jurisdictional wetlands in the project area.
- Consider the status of CV Levee in the P.L. 84-99 program (ER 500-1-1).
- Consider proposed plans with the Missouri River Recovery Program (MRRP).
- Avoid, minimize, or mitigate increased flood profiles upstream/downstream or induced substantial damages on opposite bank of project site unless mitigation as appropriate is included to offset.

1.8 STUDY SCOPE AND COORDINATION

The Lower Missouri River Jefferson City L-142 FRM General Investigation (GI) Feasibility Study identifies the problems, opportunities, objectives, and constraints related to the flooding concerns in the Jefferson City area, specifically the non-federal CV leveed area. For the purpose of analysis, a 50-year time horizon is used to develop water management policies and adaptation strategies. The study also identifies and evaluates potential alternatives for FRM that would reduce property damage and economic loss for government, local businesses, agricultural producers, and residents. The No Action Alternative (NAA) is included in the array of potential alternatives to document existing conditions and assess potential positive or negative effects of proposed FRM actions. Scoping is an early and open process for determining the range of issues to be addressed and for identifying the significant concerns related to a proposed federal action. During the planning process, a variety of communication methods with the affected public, agencies, and stakeholders occurred.

USACE conducted scoping and coordination with the following state and federal agencies and other interested parties:

- Missouri Department of Natural Resources (non-federal sponsor)
- U.S. Fish and Wildlife Service (USFWS)
- U.S. Environmental Protection Agency (USEPA)
- Federal Aviation Administration (FAA)
- Federal Emergency Management Agency (FEMA)
- U.S. Department of Agriculture - Natural Resources Conservation Service (USDA-NRCS)
- Missouri Department of Conservation (MDC)
- Missouri Department of Transportation (MoDOT)
- State Historic Preservation Office (SHPO)
- Tribal Nations to include:
 - Ho-Chunk Nation
 - Iowa Tribe of Kansas and Nebraska
 - Kaw Nation
 - Miami Tribe of Oklahoma
 - Omaha Tribe of Nebraska
 - Osage Nation
 - Otoe-Missouria Tribe
 - Peoria Tribe of Indians of Oklahoma
 - Ponca Tribe of Nebraska
 - Ponca Tribe of Oklahoma
 - Sac and Fox Nation of Missouri in Kansas and Nebraska
 - Sac and Fox Nation of Oklahoma
 - Sac and Fox Tribe of the Mississippi in Iowa

In February 2023, USACE identified federal and state agencies that may have interest in the study based on their jurisdiction by law or other special expertise. The Osage Nation is a cooperating agency for this study. The input received during scoping and coordination meetings provided useful data for USACE to make holistic, informed decisions throughout the study process. See **Section** Error! Reference source not found. for additional information. See **Appendix F** – Agency and Public Correspondence, for related documents.

Problems, opportunities, and potential FRM measures were discussed at numerous coordination meetings from March 2023 to January 2025. While not comprehensive, the following meetings are examples of coordination:

- Pre-Charette Scoping Meeting
- Scoping Charette Meeting
- Interagency Meetings
- Cooperating Agency Meetings

- Public Landowner Meetings
- Non-Federal Sponsor Meetings
- Levee District Meetings
- Interagency Team Meetings
- Public Review Meetings

1.9 MODELING TOOLS

USACE certified models were developed and used for the LoMo Jefferson City L-142 study area to include necessary upstream and downstream river reaches. **Table 3** below provides a listing of the models developed for use within this feasibility study to assess existing, FWOP, and FWP conditions.

Table 3. List of USACE Certified Feasibility Study Models

Model Name & Version	Model Description	Certified
Infrastructure and Installation Resilience Applications	The Comprehensive Hydrology Assessment Tool (CHAT) is targeted at providing a means of visualizing modeled, future hydrology and meteorology in comparison to modeled, historic period hydrology and meteorology. The Time Series Toolbox is an online analytic tool for preliminary analysis of time series data, where standard analytic approaches can be applied to a variety of datasets of similar structure. The USACE Vulnerability Assessment Tool evaluates vulnerability across multiple sites to inform strategic decision-making, while project scale assessments provide users the ability to evaluate the vulnerability of project area features like measures, plans, and infrastructure.	Yes
Regional Economic System (RECONS) 2.0	Provides accurate and defensible estimates of regional economic impacts and contributions associated with Corps projects, programs, and infrastructure across Corps Civil Works business lines. Regional economic impacts and contributions are measured as economic output, jobs, income, and value added. The model was developed to help project co-sponsors and other stakeholders better understand regional-level economic implications of Corps water projects and evaluations.	Yes
LifeSim 2.1.3	Provides estimations of potential life loss from natural, dam, and levee failure flood events associated with existing and proposed projects. Simulates the entire warning and evacuation process for estimating potential life loss and direct economic damages resulting from floods. Modeling provides a graphical user interface, agent-based modeling, evacuation simulation, uncertainty, graphics, and reporting.	Yes
HEC-Flood Damage Reduction Analysis (FDA) 2.0.1	Provides the capability to perform an integrated hydrologic engineering and economic analysis during the formulation and evaluation of USACE projects. Uses hydrologic, hydraulic, and economic data to compute expected annual damage (EAD) and equivalent annual damage (EqAD) for use in comparing proposed FRM plans.	Yes
Functional Assessment of Wetlands (FACWet) 3.0	A hydrogeomorphic and rapid bio-assessment tool based for wetlands, streams and floodplain/riparian areas. Assesses functions of wetlands and riparian habitats by analyzing structural, physical, chemical, and biological components. Provides reconnaissance level characterization of habitat conditions to document baseline and proposed alternative conditions.	Yes

Model Name & Version	Model Description	Certified
Institute for Water Resources (IWR) Planning Suite 2.09	A water resources investment decision support tool for the formulation and evaluation of ecosystem restoration plans using cost effectiveness and incremental cost analysis (CE-ICA) for identification of efficient and effective alternatives for potential implementation or mitigation. If needed, the CE-ICA analyses would be used to compare alternative mitigation plans and identify a recommended plan for implementation.	Yes

2.0 Existing and Future Without Project Conditions

This chapter provides both the existing conditions (a baseline), as well as a forecast of the FWOP conditions, which together provide the basis for a 50-year plan formulation. The existing conditions presented in this chapter also represent the affected environment as required for NEPA purposes. The affected environment includes the human environment, which is subdivided into the natural, physical, economic, and built environments.

The FWOP condition is a forecast of future conditions of the No Action Alternative for the life of the planning project; it is forecasted over the 50-year planning period of analysis.

2.1 PERIOD OF ANALYSIS

The period of analysis for this study, beginning in 2035, is 50 years, which is the standard length for USACE feasibility studies.

2.2 GENERAL SETTING

The study area's general setting is largely comprised of Missouri River floodplain around Jefferson City, Missouri (see Error! Reference source not found.). The two areas of particular focus are the locations in and around the CV Levee and the CFCA. The study area features a variety of land uses and developments. Most of the study area is developed for row crop agriculture, though more intensive developments (e.g., Jefferson City Memorial Airport, Hitachi Energy manufacturing plant, Capital Sand Company quarry) can be found around the western side of the CV Area. This part of the study area also contains some residences and much of the area's recreational development. The few undeveloped places in the study area are generally represented by forested lands on the riverward side of levees.

2.3 NATURAL ENVIRONMENT

Aquatic Habitat and Resources

The Missouri River is the longest river in the United States, with a watershed that encompasses one-sixth of the country. Historically, the channel geometry of the Missouri River and flows across the riverbed varied widely. The width of the main channel ranged from roughly 1,000 to 10,000 feet during normal flow periods and 25,000 to 35,000 feet during floods (Schneiders 1999), resulting in a wide floodplain. The channel geometry continuously changed as varying flows and sediment loads in the river resulted in frequent erosion, deposition, degradation (i.e., lowering of the channel bed), and aggradation (i.e., raising of the channel bed); the formation of sandbars, mudflats, chutes, pools, log jams, whirlpools, and backwaters; and the development of meanders and cut-off channels (Skalak et al. 2013). The thalweg (i.e., primary flow channel) was narrow and highly variable in both location and depth. Most of these changes occurred during flood events.

The present-day Missouri River has been heavily modified from these historic conditions. USACE has been modifying the Missouri River to facilitate navigation since the 1800s, in part by removing snags or other obstructing habitat features in the river. The major modification to the Missouri River within Missouri

is the Bank Stabilization and Navigation Project (BSNP). The BSNP consists mainly of rock pile structures and revetments along the outsides of bends and transverse dikes along the insides of bends to force the river into a channel alignment that is self-maintaining or self-scouring. This is different from most inland navigation systems, which are managed through the use of locks with some associated dredging. Training structures permit an open condition for the entire length of the project with no dredging required under normal flow conditions. Other impacts of the BSNP on the Missouri River include increased flow velocities, degradation of the riverbed, and a reduction of the size of the floodplain.

The Missouri River has a vast number of tributary streams. The CV Area is bordered on the upstream end by Turkey Creek and on the downstream end by Niemans Creek. Like the Missouri River, these two tributaries have also been altered from their historic condition. In particular, these streams have been channelized and, because they are generally bounded on either side by levees, have lost most of their access to the historic floodplain. Workman Creek, which is a Missouri River tributary located in the Church Farm area, also has been degraded by channelization and disconnection from most of its floodplain.

None of the surface water features located in or along the study area are listed as impaired waters in the 2022 Section 303(d) List for Missouri (MoDNR, 2022). The Missouri River is subject to a Total Maximum Daily Load (TMDL) for chlordane and polychlorinated biphenyls (PCBs) in fish tissue.

The CV Area and CFCA are both located within the Missouri River's floodplain. Flooding in the CV Area has caused greater economic and infrastructure damage than flooding in the CFCA because the former has been developed to a far greater degree. The CV Area has been impacted by flooding in 1993, 1995, 2007, and 2019. Floodplain infrastructure at this location is protected by the non-federal CV Levee, which is an 8.8-mile-long earthen levee that reduces flood risk to approximately 3,300 acres (USACE, 2023). This levee has repeated resilience concerns, which include overtopping, interior drainage, under seepage, slope and crown erosion and stability. The CFCA is protected by the non-federal Prison Farm Levee, locally referred to as the Church Farm Levee, which is a 3.8-mile-long earthen levee that reduces flood risk to approximately 998 acres (USACE, 2022).

In the absence of a flood risk management project, no substantial changes to aquatic habitat or related resources would be expected under the FWOP condition. The BSNP and CV Levee would remain in place, and the altered condition of the study area's aquatic resources would be maintained. It is reasonable to expect additional levee breaches in the next fifty years under the FWOP, and the assumption is that those breaches would continue to be repaired.

Wetlands

Historically, the Missouri River floodplain exhibited a substantial number of wetlands of various kinds, such as riparian bottomland forests, oxbows, and emergent marshes. Large swaths of these wetlands have been eliminated or degraded by development and other land use practices, and the study area is no exception. Nevertheless, the modern-day study area still features wetlands, though at a reduced quantity and quality compared to historic conditions. Much of the land capable of supporting wetland species within the study area is currently used for farmland.

Missouri River floodplain wetlands dominated by herbaceous plant species have historically corresponded with the Eastern North American Marsh, Wet Meadow, and Shrubland ecological system (NatureServe, 2024b). The hydrology of these areas is generally characterized by seasonal flooding, though the length of time that these areas stay wet over the year can vary. Certain topographical features (e.g., depressional basins) can prolong the length of time a particular wetland maintains standing water, for example. Water depth in these wetlands can vary considerably as well. The vegetation in these areas is generally dominated by graminoids such as sedges (*Carex* spp.) and cattails (*Typha* spp.), as well as forbs.

Historically, most of the wetlands in the study area would have been dominated by woody species, as ecological succession would cause the dominance of herbaceous species to be supplanted by shrubs

and saplings and then trees over a relatively short timeframe. These wooded areas are discussed further in **Section 2.3.3** as part of a broader discussion on floodplain forest habitat.

The presence of levees greatly restricts the natural flow of surface water from the main channel of the Missouri River to potential floodplain wetlands. Most of the study area has been developed for row crop agriculture, and so many of the historical wetlands in the area have been drained by ditches and other features. While degraded, many of these farmed wetlands have not entirely lost their hydrological character due to topography (e.g., depressional basins) and other factors. When these farmed areas are too saturated for cultivation, they may be left fallow and serve as disturbed wetland habitat. On the other hand, areas that have experienced intensive development (e.g., industrial areas) have generally lost their historic wetlands altogether. Some herbaceous wetlands are currently maintained as roadside ditches, which exhibit weedy species and are prevented from developing into wooded habitat by regular road maintenance and mowing activities.

Table 4 summarizes the acreage and relative ecological value of wetlands and other habitats within the study area. Additional information about these habitats is provided in **Appendix C1**

Table 4. Summary of Study Area Habitat under Future without Project Conditions

Habitat Variable	Terrestrial Habitat	Wetland Habitat	Farmed Wetlands
Acres of Existing Habitat in the CV Area	205.6	207.6	276.8
CV Area AAHUs	183.6	156.6	57.0
Acres of Existing Habitat in the CFCA	0.0	27.1	161.8
CFCA AAHUs	0.0	19.8	45.5
Total Acres of Existing Habitat	205.6	234.7	438.6
Total AAHUs	183.6	176.4	102.5

In the absence of a flood risk management project, no substantial changes to wetlands would be expected under the FWOP condition. No substantial developments or changes to general land use practices that would further alter the already degraded nature of the study area's hydrology are expected. It is also assumed that wetlands in the study area would be maintained in their current, degraded condition.

Terrestrial Habitat

Floodplain forest habitat in the study area generally corresponds with the Central Hardwood Floodplain Forest ecological system (NatureServe, 2024a). Vegetation in this kind of forest can be quite variable, but common tree species include box elder (*Acer negundo*), silver maple (*Acer saccharinum*), green ash (*Fraxinus pennsylvanica*), eastern cottonwood (*Populus deltoides*), American sycamore (*Platanus occidentalis*), and American elm (*Ulmus americana*). The trees that dominate these kinds of forest are frequently early to mid-successional species that are effective at spreading to new locations. The shrub layer can vary considerably, though oftentimes it is sparse. Shrub species commonly include pawpaw (*Asimina triloba*) and silky dogwood (*Cornus amomum*). Vines, such as poison ivy (*Toxicodendron radicans*) are frequently abundant. The understory often features abundant spring ephemerals, though a combination of ferns and forbs may be more characteristic for this layer by mid-summer.

However, the substantial amounts of human disturbance that the study area has been subjected to has resulted in the spread of invasive species. The Missouri Invasive Plant Council has identified the most harmful invasive plant species for each region of Missouri (Missouri Invasive Plant Council, 2021). Particularly noteworthy invasive plant species for the study area include reed canary grass (*Phalaris arundinacea*), Japanese hops (*Humulus japonicus*), bush honeysuckle (*Lonicera* spp.), common reed (*Phragmites australis*), and Johnson grass (*Sorghum halepense*), among others. In addition to these invasive plants, invasive insects have also reduced habitat quality in this area. The emerald ash borer (*Agilus planipennis*) has been particularly impactful by devastating ash tree populations wherever an

infestation takes hold. USDA records for the species indicate that it was first reported in Callaway County in 2018 (USDA, 2023). Thus, while the study area's terrestrial habitat has not been entirely eliminated, the current habitat is degraded when compared to its historic ecological conditions.

In the absence of a flood risk management project, no substantial changes to the terrestrial habitat of the study area would be expected under the FWOP condition. The overall quality of the habitat would continue to be degraded by a combination of invasive species and direct disturbance by human activities.

Fish and Wildlife

The Missouri River is home to a diverse array of fish species. The species that inhabit this river frequently contend with continuous high turbidity, swift currents, a scarcity of backwater habitat, and an unstable sand-silt bottom (Pflieger, 1971). Noteworthy Missouri River fish include paddlefish (*Polyodon spathula*), shovelnose sturgeon (*Scaphirhynchus platyrhynchus*), longnose gar (*Lepisosteus oculatus*), blue catfish (*Ictalurus furcatus*), and flathead catfish (*Pylodictis olivaris*; Galat et al., 2005). Additional species can be found along the border of the main Missouri River channel or in floodplain waters such as oxbows. Some such species include black bullhead (*Ameiurus melas*), tadpole madtom (*Noturus gyrinus*), green sunfish (*Lepomis cyanellus*), and bluegill (*Lepomis macrochirus*).

Due to the substantial development that has occurred in the study area, much of the fauna that inhabit this location are edge and urban-adaptive species that can tolerate these disturbances. Wildlife that can be found in this area include small mammals such as eastern cottontail rabbit (*Sylvilagus floridanus*), gray squirrel (*Sciurus carolinensis*), fox squirrel (*Sciurus niger*), Virginia opossum (*Didelphis virginiana*), and raccoon (*Procyon lotor*), among others. Larger mammals include whitetail deer (*Odocoileus virginianus*), red fox (*Vulpes vulpes*), and coyote (*Canis latrans*). Various species of birds, reptiles, amphibians, and invertebrates also inhabit this area.

In the absence of a flood risk management project, meaningful changes to the local habitat are not anticipated and therefore fish and wildlife resources within the study area would not be expected to change under the FWOP condition.

Threatened and Endangered Species

Federally Listed Species

An official list of federally protected species was generated using the US Fish and Wildlife Service (USFWS) automated Information for Planning and Consultation (IPaC) website. The list generated by the IPaC website included six federally listed species that could potentially be affected by activities near the study area. These are listed in **Table 5**. However, the presence of a species on the list does not necessarily indicate presence within the study area.

Table 5. Federally Listed Species Potentially Present in the Study Area

Taxa	Scientific Name	Common Name	Federal Status	Federal Critical Habitat w/n Study Area
Fish	<i>Scaphirhynchus albus</i>	Pallid Sturgeon	Endangered	No
Insect	<i>Argynnis idalia occidentalis</i>	Western Regal Fritillary	Proposed Threatened	No
Insect	<i>Danaus plexippus</i>	Monarch Butterfly	Candidate	No
Mammal	<i>Myotis grisescens</i>	Gray Bat	Endangered	No
Mammal	<i>Myotis septentrionalis</i>	Northern Long-eared Bat	Endangered	No

Taxa	Scientific Name	Common Name	Federal Status	Federal Critical Habitat w/n Study Area
Mammal	<i>Myotis sodalis</i>	Indiana Bat	Endangered	No
Mammal	<i>Perimyotis subflavus</i>	Tricolored Bat	Proposed Endangered	No

Pallid sturgeon are large, long-lived fish that inhabit large, deep turbid river channels, usually in strong current over firm sand or gravel (USFWS, 2023f). This species is adapted to murky waters such as the Missouri River and is known to migrate throughout the Missouri and Mississippi river systems. This species is imperiled by a variety of factors, perhaps the most notable of which are river channelization, bank stabilization, impoundment, and altered flow regimes. USFWS data indicates that pallid sturgeon may inhabit the Missouri River along the entirety of the study area and may also utilize the lower portions of local tributaries such as Turkey Creek as well (USFWS, 2023f). MDC records also indicate that the species may be present in this general area (see **Appendix F**).

Gray bats live in caves year-round. During the winter, gray bats hibernate in deep, vertical caves. In the summer, they roost in caves which are scattered along rivers. These caves are in limestone karst areas of the southeastern United States. The gray bat habit of roosting in large numbers in only a limited number of caves makes them highly vulnerable to human disturbance. Gray bats are also imperiled by habitat loss, as caves important for roosting have been flooded and submerged by reservoirs (USFWS, 2022b). Roosting caves for this species are not known within the study area, though many caves have been identified in the general region around this location (MoDNR, 2023). MDC has records of gray bats within one mile of the study area (see **Appendix F**), and some gray bats may visit the study area during their nightly foraging.

The northern long-eared bat was listed as a threatened species in 2015 and then reclassified as an endangered species in 2023 due to a further declining population. Like other listed bat species, northern long-eared bats have experienced a population decline resulting from white-nose syndrome and human disturbance (USFWS, 2023e). The bats spend winter hibernating in caves and mines. During the summer, the bats roost singly or in colonies underneath bark, in cavities, or in crevices of both live trees and snags. Males and non-reproductive females may also roost in cooler places, like caves and mines. Site visits by biologists confirmed the presence of multiple living and dead trees with the sufficient size (i.e., three inches diameter at breast height or greater) and characteristics (e.g., exfoliating bark, crevasses) to make them suitable for summer roosting by northern long-eared bat.

In the spring, Indiana bats emerge from hibernation and migrate to summer roost sites. During the summer months, female Indiana bats establish maternity colonies of up to 100 bats under the loose bark of trees and in tree cavities. Loss and fragmentation of forest habitat are among the major threats to Indiana bat populations. Other threats include white-nose syndrome, winter disturbance, and environmental contaminants (USFWS, 2022c). While there are no known Indiana bat roosts within the study area or its immediate vicinity, some trees within the study area have characteristics that make them suitable for roosting.

During the spring, summer and fall, tricolored bats are found in forested habitats where they roost in trees, primarily among leaves. During the winter, tricolored bats are found in caves and mines. White-nose syndrome has led to 90 to 100% declines in tricolored bat winter colony abundance at sites impacted by the disease (USFWS, 2022g). Other threats to this species include collisions with wind-energy turbines and habitat loss. Some trees within the study area may provide suitable roosting for this species.

The monarch butterfly is a migratory insect that depends on milkweed plants for reproduction (USFWS, 2023d). This species may use fields, roadside areas, wetlands, urban gardens, or any other areas with milkweed plants as habitat. Because the study area has ample open (i.e., not forested) land likely suitable

for milkweed, the monarch butterfly is likely present. The primary threats to this species include the loss and degradation of breeding, migratory, and overwintering habitat and exposure to insecticides.

The western regal fritillary is a large, non-migratory butterfly subspecies that specializes on grassland habitats (USFWS, 2024). Larvae overwinter in nearby grassland vegetation before emerging in early spring to search for violets (*Viola* spp.), which is their only food source at this life stage. Adults can drink nectar from a variety of sources. This insect depends on large, well-connected, and diverse grasslands, and is threatened by habitat fragmentation due to development, herbicides, and invasive species.

No federally designated critical habitat is identified within the study area.

State Listed Species

In 1972, the Missouri General Assembly passed an Act (Section 252.240 RSMo.) charging the MDC with establishing a list of endangered species and providing protection for them. Coordination has occurred with MDC through the Missouri Natural Heritage Program (MONHP) to identify species and natural communities of conservation concern near areas of interest, such as the study area. State listed species with records near these areas are listed in **Table 6** and described below. Records of state ranked species are provided in **Appendix F**.

Table 6. State-listed Species Identified within the Study Area

Taxa	Scientific Name	Common Name	State Status
Fish	<i>Acipenser fulvescens</i>	Lake sturgeon	Endangered
Fish	<i>Platygobio gracilis</i>	Flathead chub	Endangered

In the absence of a flood risk management project, the presence and condition of listed species within the study area would not be expected to change.

Migratory Birds

Certain birds are protected under the Migratory Bird Treaty Act (MBTA) and Bald and Golden Eagle Protection Act (BGEPA). The USFWS IPaC website was used to determine which species protected by these regulations may be present within the study area. These are listed in **Table 7**. The 1988 amendment to the Fish and Wildlife Conservation Act mandates the USFWS to identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the ESA. Pursuant to this effort, some migratory birds have been identified as Birds of Conservation Concern (BCC). This BCC status may be applicable across a species' entire range or only applicable in certain Bird Conservation Regions.

Table 7. Migratory Birds Potentially Present within Study Area

Common Name	Scientific Name	Birds of Conservation Concern (BCC) Status	Breeding Season within Study Area
Grasshopper Sparrow	<i>Ammodramus savannarum perpallidus</i>	BCC – Bird Conservation Region	June through August
Eastern Whip-poor-will	<i>Antrostomus vociferus</i>	BCC range-wide	May through August
Golden Eagle	<i>Aquila chrysaetos</i>	Not BCC in this area, but subject to BGEPA	Breeding not known within study area.
Semipalmated Sandpiper	<i>Calidris pusilla</i>	BCC – Bird Conservation Region	Breeding not known within study area.

Common Name	Scientific Name	Birds of Conservation Concern (BCC) Status	Breeding Season within Study Area
Henslow's Sparrow	<i>Centronyx henslowii</i>	BCC range-wide	May through August
Chimney Swift	<i>Chaetura pelagica</i>	BCC range-wide	March through August
Black-billed Cuckoo	<i>Coccyzus erythrophthalmus</i>	BCC range-wide	May through October
Bobolink	<i>Dolichonyx oryzivorus</i>	BCC range-wide	May through July
Rusty Blackbird	<i>Euphagus carolinus</i>	BCC – Bird Conservation Region	Breeding not known within study area.
Kentucky Warbler	<i>Geothlypis formosa</i>	BCC range-wide	April through August
Bald Eagle	<i>Haliaeetus leucocephalus</i>	Not BCC in this area, but subject to BGEPA	September through July
Wood Thrush	<i>Hylocichla mustelina</i>	BCC range-wide	May through August
Red-headed Woodpecker	<i>Melanerpes erythrocephalus</i>	BCC range-wide	May through September
Prothonotary Warbler	<i>Protonotaria citrea</i>	BCC range-wide	April through July
Cerulean Warbler	<i>Setophaga cerulea</i>	BCC range-wide	April through July
Prairie Warbler	<i>Setophaga discolor</i>	BCC range-wide	May through July
Field Sparrow	<i>Spizella pusilla</i>	BCC – Bird Conservation Region	March through August
Least Tern	<i>Sternula antillarum</i>	BCC range-wide	April through September
Lesser Yellowlegs	<i>Tringa flavipes</i>	BCC range-wide	Breeding not known within study area.

Bald eagles were historically in danger of extinction throughout most of their range (USFWS, 2023a). This was due to a variety of factors, such as habitat destruction or degradation, illegal shooting, and contamination of their food source by the insecticide Dichlorodiphenyltrichloroethane, commonly known as DDT. The species was listed as endangered in most states under the ESA in 1978 and, thanks to the protections afforded by this law and other environmental regulations, the bald eagle population recovered. While bald eagles were delisted under the ESA in 2007, the species is still protected by the MBTA and the BGEPA. Both laws prohibit killing, selling, or otherwise harming eagles, their nests, or their eggs. A bald eagle nest has been identified within the vicinity of the CFCA (see **Appendix F**). In the absence of a flood risk management project, the presence and condition of migratory birds within the study area would not be expected to change.

2.4 PHYSICAL ENVIRONMENT

Hydrology and Hydraulics

Flooding on the left-bank of the Missouri River through Jefferson City is driven by Missouri River events. These events originate upstream of the study site, typically with ample predicted warning of a predicted Missouri River flood condition, due to the numerous tributaries and large drainage area upstream of the site. The Missouri River floodplain through Jefferson City is uniquely situated where limestone bluffs parallel the channel overbanks, binding the floodplain to a consistent footprint for most flood conditions once overtopping low-lying levees, with depths increasing as flows increase.

Hydrologic Analysis

The drainage area of the Missouri River at Jefferson City is approximately 507,500 square miles. The immediate study area is located within the Hydrologic Unit Code 10 (HUC-10) Jefferson City - Missouri River watershed 1030010213, outlined in **Figure 7**. The Missouri River watershed above Jefferson City is

generally rural and used for agriculture. The Missouri River overbank through central Missouri is protected by locally constructed and operated agricultural levees. The Moreau River and Osage River confluences with the Missouri River are six and fourteen miles downstream of the Jefferson City United States Geological Survey (USGS) gage, respectively. The Osage River is regulated by multiple mainstem dams including Bagnell Dam, privately owned by Ameren, and the Harry S. Truman Dam, a USACE operated structure utilized for flood control.

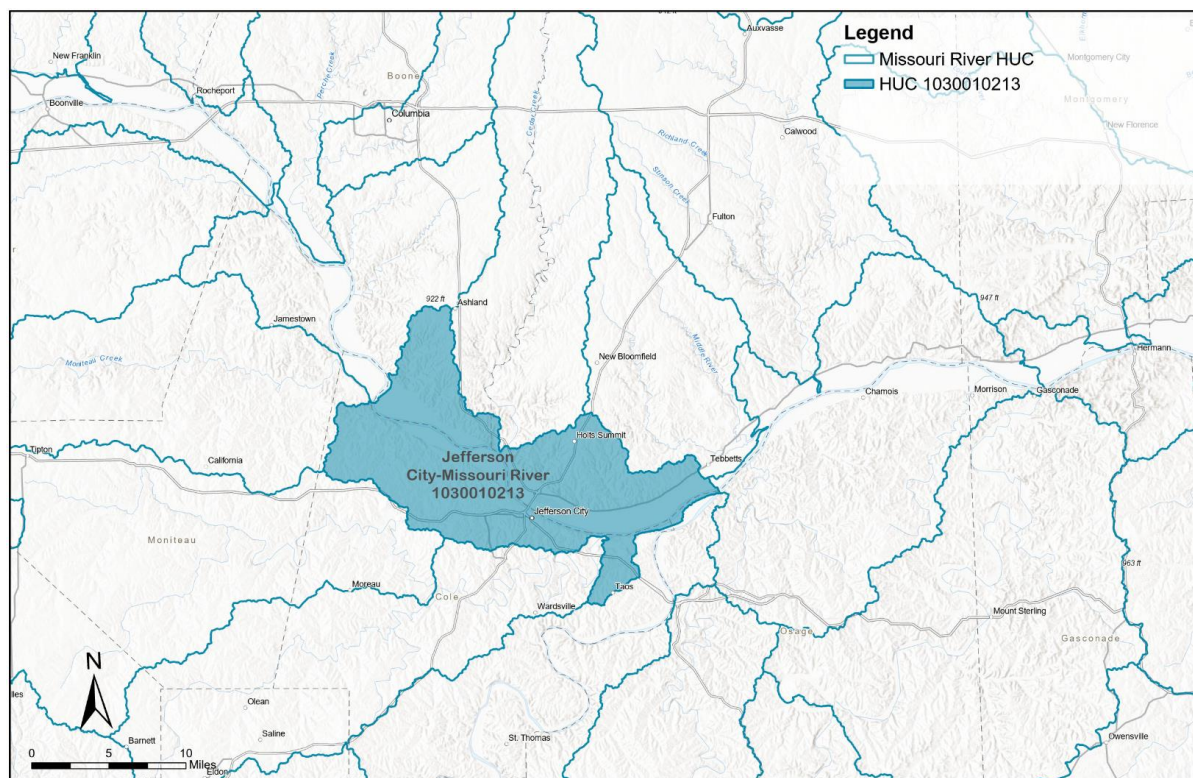


Figure 7. Jefferson City - Missouri River Watershed (HUC 1030010213)

Primary data sources for the hydrologic analysis include observed gage data and development of an expanded period of record. The hydrologic inflow data used in the hydraulic model was developed from the Missouri River Flow Frequency Study (MRFFS 2023). The Missouri River Flow Frequency Study did not include Jefferson City as a calculated gage location, however the upstream and downstream hydraulic model boundaries at Boonville and Hermann were included. Peak regulated frequency flows for events spanning from 99% to 0.2% AEP were adopted as target flows for the Boonville and Hermann gage locations. Jefferson City target flows, as summarized in **Table 8**, were developed by scaling the flows using factors informed by ratio targets of the 2003 flow frequency hydraulic routing and major tributary frequency flows. There is consistency in flow frequency data between the 2023 MRFFS and 2004 UMRSFFS flow frequency studies for the reach of river being studied between the Boonville and Hermann gages. Therefore, the 2023 flow frequencies were adopted as the FWOP flows. An ECB 2018-14 review of possible long-term hydrological changes did not result in robust trends, confirming the adoption of existing flows as the FWOP condition for this study.

Table 8. Summary of MRFFS Target Flows and Derived Jefferson City Flow Frequencies

AEP (%)	Boonville (MRFFS 2023 Flow) (cfs)	Jefferson City Feasibility Study Flow Target (cfs)	Hermann (MRFFS 2023 Flow) (cfs)
0.2	731,000	748,000	933,000

AEP (%)	Boonville (MRFFS 2023 Flow) (cfs)	Jefferson City Feasibility Study Flow Target (cfs)	Hermann (MRFFS 2023 Flow) (cfs)
0.5	672,000	689,000	722,000
1	572,000	588,000	666,000
2	531,000	546,000	571,000
4	417,000	431,000	506,000
10	334,000	346,000	416,000
20	280,000	290,000	345,000
50	204,000	212,000	262,000
99	78,000	81,000	100,000

The Missouri River is the source of flooding for the existing CV Drainage District. The targeted peak flow frequencies were utilized to create input hydrographs for the hydraulic model. Input hydrographs were developed by scaling 2018 flood hydrographs. The mainstem hydrograph included the Boonville gage, and tributary hydrographs were scaled to best meet frequency flow targets. As each storm is different, tributary scaling factors were assessed for feasibility by comparing peak flows to a range of historical storm events. A detailed summary of hydrologic considerations for this site is in **Appendix A1**.

Hydraulic Model

The modeled area for this study includes the Missouri River from Boonville to Hermann, spanning river miles 197 to 98, through central Missouri. The existing conditions and FWOP models are equivalent, with no watershed land use changes or terrain features within the area of alternative comparison anticipated to be substantially modified within the study timeframe. The hydraulic analysis was performed to estimate depth, durations, and velocities of flow frequency events routed through the study area. A total of eight recurrence intervals were modeled for the USACE Hydrologic Engineering Center-Flood Damage Reduction Analysis (HEC-FDA) of each alternative and FWOP condition.

Hydraulic modeling was performed using USACE Hydrologic Engineering Center-River Analysis System (HEC-RAS) Version 6.4.1. Two reference models, including the 2022 CWMS model and Lower Missouri River System Plan draft model, were utilized to construct the greater Missouri River routing for the Jefferson City feasibility study. Additional refinements to the Jefferson City left bank were incorporated into a 2D flow area to depict updated data for the project area and create a terrain for the existing CV Levee and adjacent left bank levees with a smaller terrain grid sample. Hydrologic inputs included an upstream boundary condition at the Boonville gage and three major tributaries (Gasconade, Moreau, and Osage Rivers) as well as lateral inflows along the Missouri River mainstem to account for watershed runoff independent of major tributaries. For the feasibility-level of study, calibration of the hydraulic model prioritized routing peak flows and resulting conservative maximum water surface elevations through Jefferson City at and above flood action stage. Additional information regarding the development of the HEC-RAS model is included in **Appendix A1**.

Geology and Soils

The study area is located within the alluvial valley of the Missouri River. The study area is relatively flat with elevations that range between 535 and 570 feet North American Vertical Datum of 1988 (NAVD88). The Missouri River Valley at the site of the study area is filled with alluvial deposits generally consisting of coarser sands and gravels overlaid by finer silts and clays. The 2001 GRR states that the finer soils, also referred to as the blanket, range in thickness between 5 and 15 feet. Below the blanket is highly permeable sand and gravel with a thickness that varies between 75 and 80 feet. Below the sand and gravel is dolomite bedrock of the Roubidoux or Gasconade Formation. Additional soil details can be found in **Appendix A3**.

The Natural Resource Conservation Service's (NRCS) Web Soil Survey website was used to help identify the presence of hydric or prime farmland soils. This NRCS soil data is summarized below in **Table 9**. The CV Area and CFCA exhibit very similar soils and share several kinds of soil series between them. Because both areas are located within the Missouri River floodplain, soils in these areas are very deep, relatively flat, and were formed in Missouri River alluvium. Many of these soils are also well suited for agriculture, though often need protection from flooding to fully achieve this use. Both areas exhibit soils that vary considerably in terms of their hydric qualities.

Table 9. Major Soil Associations within the Study Area

Soil Series	Slope	Hydric	CV Area Presence	CFCA Presence	Description
Lowmo	0–2%	No	Commonly Present	Commonly Present	Very deep, well drained soils formed in Missouri River alluvium. Occurs on floodplains. These soils are prime farmland.
SansDessein	0–2%	Yes	Commonly Present	Commonly Present	Very deep, poorly drained soils formed in alluvium. Occur on floodplains and floodplain steps of the Missouri River. These soils are prime farmland if drained, though they are not considered prime farmland when flooded frequently.
Booker	0–2%	Yes	Commonly Present	Absent	Very deep, poorly to very poorly drained, very slowly permeable soils formed in clayey alluvium on floodplains or clayey lacustrine sediments on glacial lake plains. These soils are not prime farmland.
Blencoe	0–2%	No	Commonly Present	Commonly Present	Very deep, somewhat poorly drained soils on floodplains and floodplain steps. Formed in 51 to 102 centimeters of clayey alluvium and underlying loamy alluvium. These soils are prime farmland if drained.
Peers	0-2%	No	Absent	Commonly Present	Very deep, somewhat poorly drained soils formed in Missouri River alluvium. Occur on floodplains and floodplain steps. These soils are prime farmland.
Haynie	0-2%	Yes	Absent	Commonly Present	Very deep, moderately well drained soils on floodplains. Formed in calcareous alluvium. These soils are not prime farmland.

In the absence of a flood risk management project, the geology within the study area would not change substantially. However, continued flooding of the study area would result in continued deposition and erosion of soils under the FWOP condition.

Climate

The climate of the study area is typical of Missouri: summers are generally warm and humid, and winters are relatively mild. Missouri's location in the interior of North America and the lack of mountain barriers to the north and south expose the state to incursions of cold arctic air masses in the winter and warm, moist air masses from the Gulf of America in the summer (University of Missouri, 2025). Due to the interaction of these two kinds of air masses, severe thunderstorms are common in Missouri. Precipitation in the study area is generally greatest in spring and summer.

The infrastructure and installation resilience assessment conducted for this study assessed historic hydrometeorological data and projected future hydrometeorological data to gain insight on the projection

of future risk at this site. The main climatic risk factor for the L-142 levee is increased Missouri River streamflow, especially during flood-prone seasons including spring and early summer.

Available literature suggests observed warming trends in the Lower Missouri River Basin are projected to carry into the future. Additionally, precipitation and streamflow models suggest upward trends, but with no substantial developed consensus across sources. Generally, precipitation increases are most anticipated in the spring months and late winter.

Evaluations of future extreme precipitation and streamflow generated using the Comprehensive Hydrology Assessment Tool (CHAT) suggest future increases in both 3-day maximum precipitation and annual maximum mean monthly precipitation when Representative Concentration Pathway (RCP) 8.5 is assumed, with the most robust evidence of increased monthly mean streamflow in the end-of-century (2070 – 2099) epoch. This is supported by the likely increases in spring precipitation and runoff. The Vulnerability Assessment (VA) Tool indicates that flood magnification drives the vulnerability score for the Lower Missouri River watershed (HUC 1030). Relative to the rest of the country, flood vulnerability in the Lower Missouri Basin is particularly impacted by projected change in hydrologic trends.

Table 10 indicates potential residual risks for flood risk management project features due to projected changes in hydrology. The table also includes a qualitative rating of how likely those residual risks are to materialize and undermine project features resulting in adverse effects to the study area. Examples of building resilience into flood risk management project features include designing top elevations of levees to protect against extreme events, providing designed overtopping at predetermined locations to reduce the risk of uncontrolled failures, and robust erosion protection designs.

Table 10. Residual Risk due to Projected Changes in Hydrology

Project Feature	Trigger	Hazard	Harm	Qualitative Likelihood
Levees & Berms	Increased seasonal precipitation	Future flows may be larger than present. Large flood volumes may occur more frequently.	Levees could overtop more frequently or be loaded for longer durations, resulting in increased flood-fighting and O&M costs.	Likely
Internal Drainage	Increased seasonal precipitation	Increased flows behind the leveed area. Longer drawn down times along the Missouri River.	Flow volume internal to the leveed area could increase, requiring additional pumps or an extended time to relieve. Longer river draw down times could result in longer internal drainage ponding conditions.	Likely
Riprap Bank Stabilization	Increased seasonal precipitation	Future flows may be larger than present. Large flood volumes may occur more frequently.	Higher flows and velocities would result in increased O&M costs.	Likely
Floodproofing measures	Increased seasonal precipitation	Future flows may be larger than present. Large flood volumes may occur more frequently.	Floodproofing measures could overtop during more frequent storm events, leading to additional repair costs.	Likely

Projected forecasts indicate the potential for larger and more frequent storms which would exacerbate flooding in the future. However, projected changes in flows are assumed to be gradual and to occur within the uncertainty of existing flow frequencies. As a result, flow frequencies were assumed to be stationary for the 50-year period of analysis. More frequent extremes in drought conditions are also expected for the study area. Additional information regarding climate patterns for the Lower Missouri River Basin can be found in **Appendix A2**.

Air Quality and Noise

The Clean Air Act, as amended (42 U.S.C. § 7401 *et seq.*), requires the U.S. Environmental Protection Agency (EPA) to designate National Ambient Air Quality Standards (NAAQS). The EPA has identified standards for six pollutants: lead, sulfur dioxide, carbon monoxide, nitrogen dioxide, ozone, particulate matter (less than 10 microns and less than 2.5 microns in diameter), along with some heavy metals, nitrates, sulfates, volatile organic and toxic compounds (**Table 11**). As of 30 September 2025, Callaway and Cole Counties, Missouri are currently in attainment for all EPA air quality standards (EPA, 2025).

Table 11. U.S. Environmental Protection Agency (EPA) Air Quality Standards

Pollutant	Averaging time	Criteria	Form
Carbon monoxide	8 hours	9 ppm	Not to be exceeded more than once per year
Carbon monoxide	1 hour	35 ppm	Not to be exceeded more than once per year
Lead	Rolling 3 month	0.15 µg/m ³	Not to be exceeded
Nitrogen dioxide	1 hour	100 ppb	98 th percentile of 1-hour daily maximum concentrations, averaged over 3 years
Nitrogen dioxide	1 year	53 ppb	Annual Mean
Ozone	11218 hours	0.070 ppm	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
Particle Pollution (PM _{2.5})	1 year	12.0 µg/m ³	Annual mean, averaged over 3 years
Particle Pollution (PM _{2.5})	1 year	15.0 µg/m ³	Annual mean, averaged over 3 years
Particle Pollution (PM _{2.5})	24 hours	35 µg/m ³	98 th percentile, averaged over 3 years
Sulfur dioxide	1 hour	75 ppb	99 th percentile of 1-hour daily maximum concentrations, averaged over 3 years
Sulfur dioxide	3 hours	0.5 ppm	Not to be exceeded more than once per year

The most noteworthy producer of noise within the study area is transportation. The largest source of noise within the CV Area is the Jefferson City Memorial Airport. Most of the CV Area is affected by the noise generated by this facility, typically within the range of 45 to 60 decibels though at times can reach 90 decibels or more in the immediate vicinity of the runway (DOT, 2020). This noise is generated by aircraft activity, so this facility does not produce this noise incessantly. Roadways are also a notable source of noise within the area, particularly around U.S. Highways 54 and 63. Noise can sometimes reach 80 decibels or more immediately near these highways, though these noise effects attenuate with distance. Equipment typical for agriculture or construction are also sources of substantial noise generation. Tractors and combines can generate noise greater than 90 dBA, though the use of heavy equipment such as this is often intermittent or temporary and the noise attenuates with distance. For these reasons, people in the CV Area do not generally experience hazardous noise conditions.

The CFCA is much less developed than the CV Area and is generally less noisy. No major roadways go through this area, and the Jefferson City Memorial Airport is far enough that aircraft noise is not substantial here. A railway runs along the southern edge of the floodplain here and may occasionally generate noise of 90 decibels or more. However, this noise attenuates with distance from the railway. Otherwise, noise generation at this location is generally limited to agricultural equipment.

Under the future without project condition, air quality and noise would be expected to be comparable to existing conditions. USACE is unaware of any proposals that would substantially increase the emission of

air quality pollutants in or near the study area. The Jefferson City Memorial Airport Master Plan makes a number of recommendations regarding the facility, such as the extension and widening of a runway and the expansion of the terminal area with box/corporate hangars. These modifications to the airport may be associated with a general increase in facility use and, as a result, an increase in aircraft-related noise. However, these potential modifications to the airport are relatively modest and USACE anticipates that airport-related noise under the future without project would be overall comparable to existing conditions.

Cultural Resources

The Lower Missouri River floodplain has potential to hold cultural resources dating from historic times back at least 12,000 years. Cultural resources include but are not limited to pre- and post-contact archeological sites (habitation sites, human burial sites, farmsteads, resource processing areas, and shipwrecks), buildings, bridges, landscapes, and trails. A desktop review of cultural resources was conducted for the Jefferson City L-142 Study area. This review consisted of an examination of the records in the MoDNR online archeology database, the National Register of Historic Places (NRHP) database, and USACE records.

The review of the study area, including the CFCA, found no sites listed on or determined eligible for listing on the NRHP. A patchwork of archeological surveys is recorded in the study area with most conducted within the floodplain. These surveys are of varying size and associated with actions requiring compliance with the National Historic Preservation Act (NHPA) (16 U.S.C. § 470 et seq.). The surveys need to be reviewed on a case-by-case basis to determine whether they meet modern standards to identify historic properties.

A total of 17 recorded cultural sites are mapped within or on the edge of the study area. Twelve of the sites are precontact Native American sites; two of these sites recorded in the Missouri River floodplain and the remaining 10 precontact sites are located on the bluff edge immediately adjacent to the floodplain or on terraces of tributary streams near where these streams enter the floodplain. Six of the sites were recorded in the 1960's as Native American burial mounds or cairns along the bluff edge. The records and maps of these locations are rough and can only be considered approximate locations. The two prehistoric sites in the floodplain were recorded as habitation sites. Five historic post American settlement sites are recorded in the floodplain; two are habitation sites, two are mapped shipwreck locations, and one is a cemetery. The locations of the shipwrecks are based on captains' logs and have not been field confirmed. The cemetery was damaged by 1993 flooding and human remains were exposed. The NRHP eligibility for all seventeen sites is either unreported or undetermined.

Under the future without project condition, any potential cultural resources in the study area would remain subject to the factors currently affecting them or would remain unchanged. Current conditions that have the greatest effect in the study area include continued erosion and land development.

Hazardous, Toxic, and Radioactive Waste

A Hazardous, Toxic, and Radioactive Waste (HTRW) assessment was performed to determine the environmental conditions of the study area. The assessment identifies potential hazards via soil, surface water, and groundwater contaminant pathway interactions that may occur during project implementation. This assessment identified four sites within the study area that may be contaminated with HTRW materials (see **Figure 8**).

Any proposed construction should avoid these locations if possible. The full HTRW assessment of the CV Area is available in **Appendix C2**. An initial assessment of the CFCA did not identify any sites of concern, which is expected given that location has primarily been used for agriculture. A full HTRW assessment for the CFCA borrow site would occur prior to project implementation.

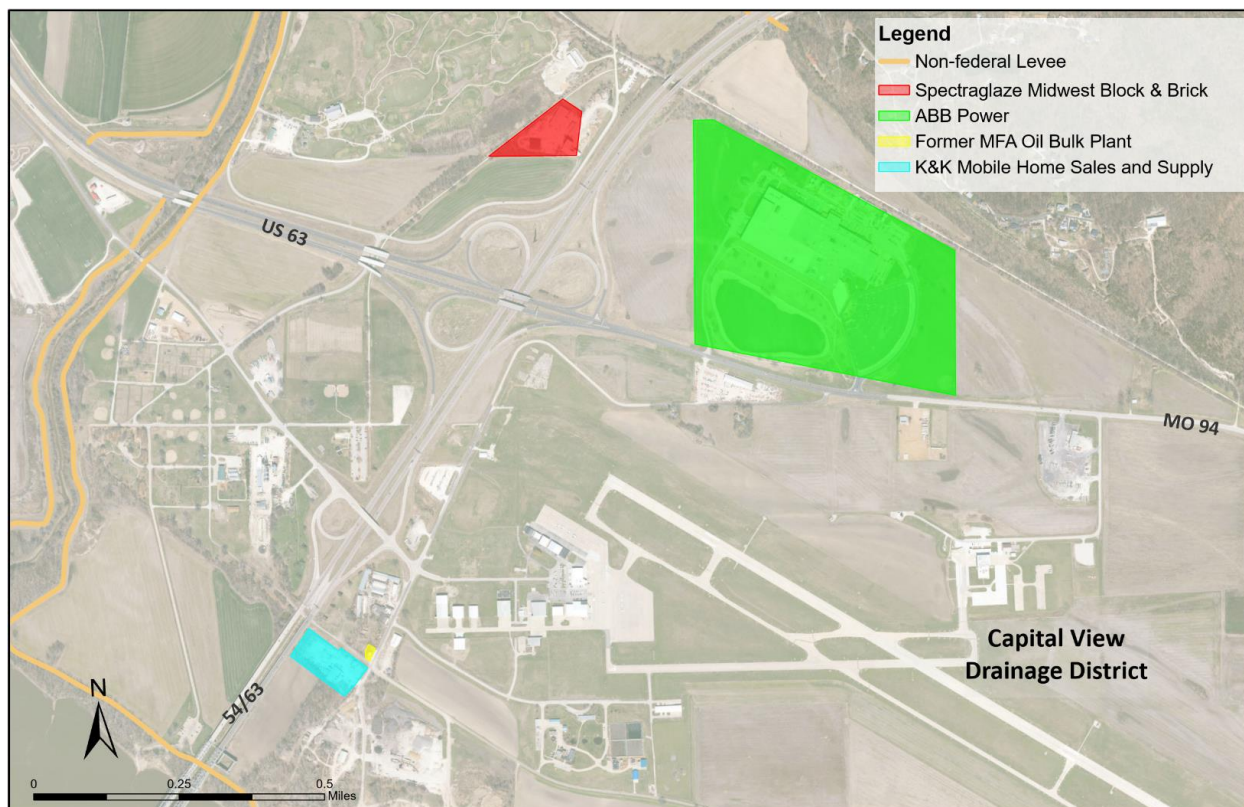


Figure 8. Locations of Potential HTRW Concern

The assessment identified eighteen contaminations or potential contaminations located at seventeen properties. Of these properties, fourteen are not expected to have resulted in potential HTRW hazards. This is due to No Further Action Letters being issued at these locations or because the nature of the potential contamination does not indicate substantial likelihood of HTRW hazards (e.g., the presence of underground storage tanks with no known releases to the environment). Potential to encounter contaminated soils at these locations is limited.

The former Spectraglaze facility was an operation where glazing was applied to concrete blocks for use in architectural landscaping applications. Heat from a fire at the plant in 1999 caused a release of trichloroethene into the soil on the south side of the plant. While remedial action was taken, the chlorinated solvents were not adequately addressed. There is currently a prohibition of the use of groundwater and drilling at the site. Potential HTRW hazards are expected at the site.

Hitachi Energy (the former ABB Power site) was found to have at least one storage tank that leaked a petroleum substance sometime around 1990. The incident had been closed by the Missouri Department of Natural Resources (MoDNR) tanks section with a No Further Action Letter, but that letter was rescinded as contamination was found in 2000 after sampling the area. Potential HTRW hazards are expected at the site.

A petroleum or hazardous substance storage tank or regulated release at the Former MFA Oil Bulk Plant was addressed under the Missouri Risk-Based Corrective Action (MRBCA) Guidance for Petroleum Storage Tanks. Evaluation of environmental media found that concentrations of any remaining contaminants, if present, do not pose an unacceptable risk to human health or the environment provided that Activity and Use Limitations applied to this property remain in place. These limitations require that this site must remain non-residential with no domestic consumption of drinking water.

A petroleum or hazardous substance release at the K & K Mobile Home Sales and Supply site is currently being addressed under the MRBCA Guidance for Petroleum Storage Tanks. While information regarding this facility was limited during the HTRW assessment's records review, there is a potential for HTRW hazards at this site.

In the absence of a flood risk management project, the presence and condition of HTRW materials within the study area would not be expected to change under the FWOP condition.

2.5 BUILT ENVIRONMENT

The built environment of the study area includes a number of noteworthy developments. This includes the CV Levee, which is an 8.8-mile-long non-federal levee that reduces flood risk to approximately 3,300 acres. This levee was overtopped by floods in 1993, 1995, and 2019. The study area also includes important transportation infrastructure. The Jefferson City Memorial Airport is one of the busiest airports in Missouri, has more than 60 based aircraft, and is home to several corporate and state government flight departments (Jefferson City, 2023). The most noteworthy roadways in the study area are U.S. Highway 63 and U.S. Highway 54, which cross the Missouri River over a bridge into the rest of Jefferson City. This bridge is highly important to local traffic, as the next closest bridges across the Missouri River are the Interstate 70 bridge approximately 32.5 miles northwest and the Missouri Route 19 bridge approximately 41 miles northeast.

Many developments in the built environment are important local employers. In addition to the airport, economic developments include the Hitachi Energy manufacturing plant, Capital Sand quarry, wastewater treatment plant, and a number of other businesses. The study area also includes some noteworthy recreational developments, though primarily on the western end. Such developments include a golf course, event center, community garden, ball fields, dog park, and a Missouri River boat ramp. There is also a trailhead for the Katy Trail on the northwest side of the CV Area.

The built environment of the CFCA is considerably less developed. The primary feature located there is the Prison Farm levee, which is a 3.8-mile-long earthen levee that reduces flood risk to approximately 998 acres. This location is primarily developed for row crop agriculture.

At the time of this study, there are no known proposals that would substantially alter the built environment of the study area. Activities in the study area that would impact the built environment generally appear to be limited to maintenance activities and modifications to already existing infrastructure. The Jefferson City Memorial Airport Master Plan makes a number of recommendations regarding the facility. These recommendations include the partial relocation of one runway; the extension and widening of another runway; the expansion of the terminal area with box/corporate hangars; improvements to perimeter fencing, the gate, and overall security; and a new location for the air traffic control tower.

The Missouri Department of Transportation (MoDOT) has several planned or ongoing projects in and around the CV Area, such as pavement resurfacing, guardrail replacement, bridge maintenance and rehabilitation, and highway widening. Such actions are typical for roadway maintenance, and it can be safely assumed that activities such as these would occur throughout the period of analysis. Overall, the FWOP conditions of the built environment are likely very similar to the existing conditions.

Additional details about the area's infrastructure are provided in **Appendix E**.

2.6 SOCIOECONOMIC ENVIRONMENT

Jefferson City is the capital of Missouri. Most of the economic and political activity that takes place in Jefferson City does so on the south side of the river, outside of the project area. That is where most businesses and homes reside as well. After the 1993 flood, most residences in the study area (over 100) were bought out by the government and today, only six functioning homes remain (with an additional dilapidated home bringing the total to seven). Most of the structures in the project area are commercial, industrial, or public. The main businesses in the study area are Capital Sand & Gravel, Jefferson City Memorial Airport, and Hitachi Energy. Major public structures include the Jefferson City Regional

Wastewater Treatment Plant and the National Guard Armory. The study area also contains vital transportation arteries that handle a combined nearly 80,000 vehicles per day, and 2,100 acres of agricultural land.

The demographics of the project area are summarized in **Table 12**. The city of Jefferson City and Callaway County have similar populations of around 44,000 people. The per capita income of both areas is notably below the national average, though it's slightly higher in Jefferson City than in Callaway County. Unemployment in Jefferson City is lower than the national average, though it is modestly higher in Callaway County compared to the nation overall.

Table 12. Demographic Data – American Community Survey Estimates

Indicator	Jefferson City (2024 Data*)	Callaway County (2024 Data*)	Missouri (2024 Data*)	U.S. (2024 Data*)
Total Population	42,564	45,126	6,245,466	340,110,988
Age				
% under 5 years	5.9	5.4	5.6	5.5
% under 18 years	19.9	20.5	22.0	21.5
% 65 and older	17.5	19.0	18.7	18.0
Sex				
% Male	51.1	51.4	49.3	49.5
% Female	48.9	48.6	50.7	50.5
Race (percentage)				
White	72.3	90.4	82.1	74.8
Black or African American	16.1	5.1	11.7	13.7
American Indian and Alaska Native	0.4	0.7	0.7	1.4
Asian	2.4	0.9	2.5	6.7
Native Hawaiian and Other Pacific Islander	0.0	0.1	0.2	0.3
Two or more races	6.8	2.8	2.8	3.1
Hispanic or Latino (of any race)	4.0	2.7	5.6	20.0
Education				
% High School or higher	92.8	91.1	91.9	89.6
% Bachelor's Degree or higher	38.7	24.6	32.4	35.7

*Most recent data available

3.0 Plan Formulation and Evaluation

3.1 PLANNING FRAMEWORK

A six-step planning process to guide federal project studies, as detailed in Engineer Regulation (ER) 1105-2-103 “Policy for Conducting Civil Works Planning Studies” was used for this feasibility study. This process is a structured approach to problem solving, which provides a rational framework for federal project decision making. The six steps are outlined in **Figure 9**:

1. Specify water and related land resource problems and opportunities (relevant to the planning setting) associated with the federal objective and specific state and local concerns.
2. Inventory, forecast, and analyze water and related land resource conditions within the planning area relevant to the identified problems and opportunities.
3. Formulate alternative plans.
4. Evaluate effects of the alternative plans.
5. Compare alternative plans.
6. Select recommended plan based upon the comparison of alternative plans.

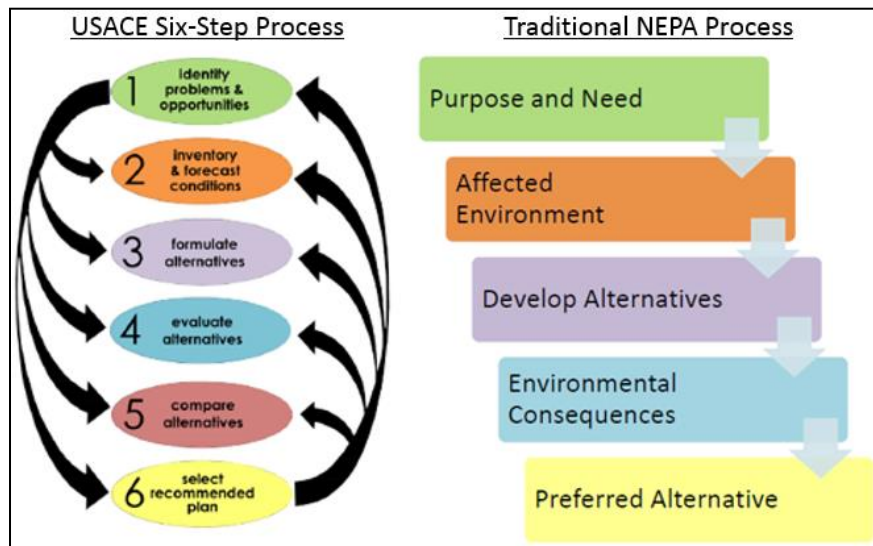


Figure 9. USACE Six-Step Process

Plan formulation is the process of evaluating existing conditions and building alternative plans that meet planning objectives and avoid planning constraints. This study examines and addresses the federal criteria of completeness, efficiency, effectiveness, and acceptability. To adequately address these criteria, the development and early screening of potential alternatives considered a number of evaluation factors. Primary among those factors are the following:

- Engineering and flood risk management adequacy (effectiveness/completeness)
- Ability to contribute to meeting the planning objectives (effectiveness/completeness)
- Consistency with planning constraints and authorities
- Acceptability (includes law and policy, sponsor, environmental, cultural and public aspects)
- Early cost indicators (early efficiency indicators for screening purposes)

- Construction site constraints and real estate requirements (topography, location conflicts, adjacent development, etc.)

The guidance for conducting civil works planning studies, ER 1105-2-103, Policy for Conducting Civil Works Planning Studies, requires the systematic formulation of alternative plans that contribute to the federal objective. To ensure sound decisions are made with respect to development of alternatives and ultimately with respect to plan selection, the plan formulation process requires a systematic and repeatable approach. This chapter presents the results of the plan formulation process for the Jefferson City Feasibility Study. Alternatives were developed in consideration of study area problems and opportunities as well as study objectives and constraints. Measures and alternatives were evaluated against the four Principles and Guidelines evaluation criteria: completeness, effectiveness, efficiency, and acceptability.

Alternative plans are a set of one or more flood risk management measures functioning together to address one or more planning objectives. A measure is a feature or activity that can be implemented at a specific geographic site to address one or more planning objectives. Throughout this study, iterations of alternative plans throughout the watershed have been performed, outlined later in **Section 3.4**.

Economic and Environmental PR&Gs for Water and Related Land Resources Implementation Studies were established pursuant to the Water Resources Planning Act of 1965 (PL 89-80), as amended (42 U.S.C. 1962a-2 and d-1) with the intent to ensure consistent planning by federal agencies for plan formulation. In accordance with the PR&Gs, four accounts were established to facilitate evaluation and display potential impacts from alternative plans. The four accounts are 1) National Economic Development (NED); 2) Environmental Quality (EQ); 3) Regional Economic Development (RED); and 4) Other Social Effects (OSE).

The NED displays changes in economic value of national output of goods and services while the EQ displays non-monetary effects on significant natural and cultural resources. The RED account notes change in distribution of regional economic activity and OSE registers plan effects from perspectives relevant to plan formulation but not reflected in the other three accounts. The four accounts were considered during alternative formulation and ultimately selection of the Recommended Plan. Together, the four accounts assess the comprehensive benefits of proposed alternatives within the study area.

3.2 ASSUMPTIONS

Key assumptions for this study include:

- The study area is expected to remain at risk of recurring and devastating flooding and subject to similar flood related effects.
- Land use within the study area is not anticipated to change substantially over the next 50 years. Even with a new federal levee, there is no local interest in gaining accreditation through FEMA.
- Other non-federal levees adjacent to the study area would remain in place at current levels of performance.
- Projected hydrologic forecasts indicate the potential for larger and more frequent storms, which would exacerbate flooding in the future. However, projected changes in flows are assumed to be gradual and to occur within the uncertainty of existing flow frequencies. As a result, flow frequencies were assumed to be stationary. More frequent extremes in drought conditions are also expected for the study area.

3.3 MANAGEMENT MEASURES

Measures are the building blocks of alternatives. Structural and nonstructural measures were considered consistent with USACE planning guidance. An initial site visit was held on 9 March 2023 with the PDT, local sponsors, and stakeholders. An initial planning charette was held with the PDT, local sponsor, and

stakeholders on 3 May 2023. During the charette, an initial list of measures was identified for consideration in development of plan alternatives. In total, the PDT and local partners developed 37 initial management measures for consideration. These measures were then organized into seven Alternative Themes (not including the No Action Alternative): Nonstructural, Natural & Nature Based, Channel Modification, Infrastructure Improvement, Improved Resilience, Existing Levee Modifications, and New Structural Measures. The alternative themes were developed to help the PDT think about various ways to combine measures to solve the identified problems in the study area.

Nonstructural measures considered included floodproofing (i.e. modifying structures), buy-outs/relocations, and a flood warning system. Structural measures considered included levee setbacks, detention basins, raising critical infrastructure, and modification to the U.S. Highway 54/63 bridge piers. Resilience improvements included levee reinforcement, managed overtopping, designated breach locations, reverse loading design, seepage berms, and stability berms. Environmental enhancements such as wetlands could be stand-alone or included with off-channel detention measures to provide nature-based solutions that reduce flood risk and restore the environment. While measures can be “stand-alone” alternatives, most plan alternatives included a combination of measures. These measures were presented at the Alternatives Milestone Meeting (AMM) held on 5 June 2023.

Measure Theme 1 – No Action

- Required plan, provides baseline FWOP conditions.

Measure Theme 2 – Nonstructural Measures

- Floodproofing: dry floodproofing by adding an exterior protective barrier around specific structures, and wet floodproofing by renovating to remove expensive utilities or equipment from flood-prone areas and allowing flood waters to pass through without causing structural damage.
- Elevating: elevating structures where they are built so they receive less damage from water inundation.
- Buyouts/Relocation: buying structures or moving structures to new locations.
- Flood Warning System: flood sensors/gages and warning devices incorporated into existing local planning framework to boost effectiveness of flood warnings and evacuations.

Measure Theme 3 – Natural & Nature Based Solutions

- Levee Setback: install setback levees and allow some areas to flood to increase floodplain capacity and connectivity.
- Detention Basins and Wetland Restoration: restoration or creation of wetlands to serve as temporary storage of excess water volume.

Measure Theme 4 – Channel Modifications

- In-stream Retention: Mainstem Missouri River reservoir, stays in channel.
- Deepening of Missouri River Channel: one-time deepening of river channel to allow for more flow.
- Widening of Missouri River Channel: cutting back riverbanks to allow for more flow.
- Dredging of Missouri River Channel and use of dredged material: ongoing dredging operation to deepen channel to allow for more flow.

Measure Theme 5 – Infrastructure Improvements

- **Raise Critical Infrastructure:** increase access to critical facilities during flood events and raise critical infrastructure including, but not limited to, public utilities and critical material suppliers.
- **Submersible Pumps:** pumps for moving interior water past a flood barrier, which operate when inundated.
- **U.S. Highway 54/63 Bridge Pier Modification:** increase conveyance of water through narrow point created by the bridge infrastructure.

Measure Theme 6 – Resiliency Improvements

- **Reinforce Levee:** provide additional reinforcement through riprap and other means in areas where erosion may be an issue.
- **Managed Overtopping:** managed overtopping for areas to fill more slowly and within predictable inundation limits in the event of a flood.
- **Designated Breach Locations:** managed breach locations to aid in predictability of inundation in the event of a flood.
- **Reverse Loading Design:** engineered levee system to withstand riverward and landward loading of flood water.
- **Add Seepage Berms:** additional reinforcement to control underseepage.
- **Add Stability Berms:** additional reinforcement to prevent stability issues such as sloughing and failure during a flood event.

Measure Theme 7 – Existing Levee Modifications

- **Raise Existing (CV) Levee:** provide a higher level of risk reduction from over-topping by increasing the height of the existing levee.
- **Setback Existing (CV) Levee:** setback existing levee to allow for additional conveyance riverward of the levee and less frequent inundation of the levee toe.

Measure Theme 8 – New Structural Measures

- **New Federal Levee Construction:** compacted earthen berm to decrease the initial overtopping frequency.
- **Floodwall:** concrete floodwall barrier.

The feasibility study process involves successive iterations of alternative solutions to the defined problems. These solutions are based upon the study objectives and constraints, and address problems and opportunities that have been previously defined. **Figure 10** shows the major steps taken in the process from the initial development of measures at a planning charrette through identification of the recommended plan for implementation. The following section describes the process and decisions to be made.



Figure 10. Alternative Development Screening Diagram

Initially, the measures were screened against the project objectives and four PR&G criteria of effectiveness, efficiency, completeness, and acceptability. Additionally, measures were evaluated against

the project constraint, or the degree to which the measure avoids or minimizes disproportionate impacts to the economically disadvantaged and socially vulnerable populations in the study area. Specific questions included:

- Does the measure meet planning objectives?
- Does the measure avoid planning constraints?
- Is the measure technically feasible?
- Does the measure meet the overall goals of the System Plan?
- Does the measure have disproportionate impacts to vulnerable communities?

Table 13 describes the measures that were eliminated during the charette screening, and the rationale for their elimination.

Table 13. Eliminated Measures

No.	Measure	Rationale for Elimination
M 3	Flood Warning System	No tributary contributing to flash flooding, Missouri River provides substantial warning prior to flooding.
M 4	Missouri River Reservoir	Not effective at meeting study objectives. High level of environmental impacts, and costs.
M 5	Channel Widening	Not effective at meeting study objectives. Impacts to existing dredging operations would be unacceptable to stakeholders.
M 6	Channel Deepening	Not effective at meeting study objectives due to ineffective hydraulic results. Impacts to existing dredging operations would be unacceptable to stakeholders. Potential for high environmental impacts.
M 7	Channel Dredging for capacity, material	Not effective at meeting study objectives due to ineffective hydraulic results. Impacts to existing dredging operations would be unacceptable to stakeholders. Potential for high environmental impacts.
M 8	Capital View Levee Setback	Does not decrease initial overtopping frequency to meet economically justified project.
M 9.2	Capital View Levee Raise to 33'	Does not decrease initial overtopping frequency to meet economically justified project.
M 9.3	Capital View Levee Raise to 32'	Does not decrease initial overtopping frequency to meet economically justified project.
M 9.4	Capital View Levee Raise to 1% AEP	Substantial hydraulic impact to Wears Creek and adjacent levee systems with low likelihood of feasible mitigation.
M 12	Managed Overtopping of Capital View Levee	Managed overtopping would not provide additional protection to property, infrastructure, etc. Terrain does not allow for keeping water away from critical infrastructure.
M 13	Designated Breach Location of Capital View Levee	Designated breaches would not eliminate additional breaching, would not provide additional protection to property, infrastructure, etc. Terrain does not allow for keeping water away from critical infrastructure.
M 14	Reverse Loading of Capital View Levee	Does not meet study objective of decreasing flood risk, does not decrease initial overtopping frequency.
M 17.4	New Levee, floodwall included	Space limitations do not exist between critical infrastructure, transportation, public goods, etc. that would require use of floodwall vs. levee.
M 18	Add additional drainage structures	Does not meet objectives, internal drainage concerns were not expressed by community

No.	Measure	Rationale for Elimination
M 20	Add pump station	Existing inundation is so low it would not be feasible on its own. Leveed area is not suitable for centralized internal drainage via pumping.
M 22	Wetlands	Violates FAA study constraint, not a viable measure to reduce flood risk.
M 23	Off-Channel Detention Basin	Violates FAA study constraint.
M 27	US Highway 54/63 Bridge Pier Modification	Initial analysis and descriptions of past floods revealed the piers do not appear to trap debris or cause conveyance restrictions at this site. Therefore, modifications to increase capacity of water under the bridge wouldn't provide benefit.

Structural and nonstructural measures retained after the initial formulation and screening are listed in Table 14 measures retained. Table 14. Measures Retained

Table 14. Measures Retained

No.	Measures (M)
M 1	Non-Structural – Floodproofing existing structures
M 2	Non-Structural – Buy-outs and/or relocation of existing structures
M 2.1	Non-Structural – Elevate in Place
M 9.1	Structural – Capital View Levee Raise 34'
M 10	Structural – Remove Capital View Levee
M 11	Structural – Slope Protection of Capital View Levee
M 15	Structural – Addition of Seepage Berms at Capital View Levee
M 16	Structural – Addition of Stability Berms at Capital View Levee
M 17.1	Structural – New Levee Historic L-142 Alignment
M 17.2	Structural – New Levee Optimization Alignment
M 17.3	Structural – New Levee Highway Alignment
M 19	Structural – Replace Existing Drainage Structures
M 21	Structural – Submersible or Portable Pumps
M 24	Structural – Remove Prison/Church Farm Levee
M 25	Structural – Raise Critical Infrastructure
M 28	Structural – North Renz Levee Modification/Incorporation into P.L. 84-99
M 29	Structural – Cedar Creek, Sec. 2 Levee Modification/Incorporation into P.L. 84-99
M 30	Structural – Renz Farm Road Crossing Closure Structure
M 31	Structural – New Levee: Turkey Creek Setback

3.4 ARRAY OF ALTERNATIVES

Carrying forward the Measures described in the above table, the PDT held an additional Charette on 14-15 March 2024 to combine the measures into alternatives. The team used existing economic and engineering data, design criteria, and feedback received during the public involvement process to create CAs. Sixteen Measures were incorporated and combined into 13 CAs. The PDT assumed nonstructural measures could be considered in all alternatives and applied where technically feasible. The 13 CAs made up the Initial Array of Alternatives for further assessment. **Table 15** lists the Initial Array of Alternatives and includes the measures in each alternative. These alternatives were presented to the Vertical Team during an In-Progress Review (IPR) on 2 May 2024 for consideration and discussion.

Through the alternative development process, it became apparent that options for flood risk reduction are really limited to two categories: remaining nonstructural measures that can be undertaken in the study area, and a structural solution of a levee. Most of the alternatives are variations of the structural solution of modifications to the existing levee or the construction of a new levee setback from the Missouri River.

Multiple iterations of structural levee alternatives were considered, which varied both levee height and levee setback alignments. Iterations of both these factors were considered early in identifying alternatives to determine the most economical alternative relative to levee overtopping frequency and reduced flood area behind the proposed levee. Iterations began along the existing CV Levee footprint as requested by public input, then iterated with setbacks to reduce induced impacts observed with levee raises within the floodplain.

Table 15. Initial Array of Measures and Combined Alternatives

Combined Alternative	Description	M 9.1 Capital View Levee Raise 34'	M 10 Remove Capital View Levee	M 11 Slope Protection of Capital View Levee	M 15 Addition of Seepage Berms at Capital View Levee	M 16 Addition of Stability Berms at Capital View Levee	M 17.1 New Levee Historic L-142 Alignment	M 17.2 New Levee Optimization Alignment	M 17.3 New Levee Highway Alignment	M 19 Replace Existing Drainage Structures	M 21 Submersible or Portable Pumps	M24 Remove Prison/Church Farm Levee	M25 Raise Critical Infrastructure	M 28 North Renz Levee Modification / Incorporation into P.L. 84-99	M 29 Cedar Creek, Sec. 2 Levee Modification / Incorporation into P.L. 84-99	M 30 Renz Farm Road Crossing Closure Structure	M 31 New Levee: Turkey Creek Setback	M 1 Floodproofing existing structures	M 2 Buy-outs and/or relocation of existing structures	M 2.1 Elevate in Place
CA0	No Action																			
CA1	Existing Capital View Alignment, 34-ft Stage	X									X							X	X	X
CA2	Turkey Creek & Riverside Setback, 34-ft Stage, Capital View Removed	X									X							X	X	X
CA3	Existing Capital View Alignment with Resiliency			X	X	X					X							X	X	X
CA4	Optimization Alignment, 37-ft Stage, Capital View Remains							X			X							X	X	X
CA5	Optimization Alignment, 37-ft Stage, Capital View Removed		X					X			X							X	X	X
CA6	Historic L-142 Alignment, 45-ft Stage, Capital View Remains						X				X							X	X	X

Combined Alternative	Description	M 9.1 Capital View Levee Raise 34'	M 10 Remove Capital View Levee	M 11 Slope Protection of Capital View Levee	M 15 Addition of Seepage Berms at Capital View Levee	M 16 Addition of Stability Berms at Capital View Levee	M 17.1 New Levee Historic L-142 Alignment	M 17.2 New Levee Optimization Alignment	M 17.3 New Levee Highway Alignment	M 19 Replace Existing Drainage Structures	M 21 Submersible or Portable Pumps	M24 Remove Prison/Church Farm Levee	M25 Raise Critical Infrastructure	M 28 North Renz Levee Modification / Incorporation into P.L. 84-99	M 29 Cedar Creek, Sec. 2 Levee Modification / Incorporation into P.L. 84-99	M 30 Renz Farm Road Crossing Closure Structure	M 31 New Levee: Turkey Creek Setback	M 1 Floodproofing existing structures	M 2 Buy-outs and/or relocation of existing structures	M 2.1 Elevate in Place
CA7	Historic L-142 Alignment, 45-ft Stage, Capital View Removed		X				X				X							X	X	X
CA8	Highway Alignment, 37-ft Stage, Capital View Remains								X		X							X	X	X
CA9	Highway Alignment, 37-ft Stage, Capital View Removed		X						X		X							X	X	X
CA10	Limited Resiliency Measures Outside of Capital View Footprint													X	X	X		X	X	X
CA11	Nonstructural																	X	X	X
CA12	Remove Church Farm Levee											X								
CA13	Hybrid Alignment, 41-ft Stage, Partial Capital View Removal										X						X	X	X	X

CA0 No Action

Under the No Action alternative, no federal action would be taken. NEPA requires Federal agencies to consider the No Action alternative. It serves as a baseline against which action alternatives are measured. The projection of the No Action alternative into the future is the FWOP Condition. This alternative is the baseline condition used to identify potential impacts and benefits of proposed Future With Project (FWP) alternatives. If a FWP alternative is not identified to have federal interest, then the No Action Alternative can be selected by default.

CA1 Existing Capital View Alignment, 34-ft Stage

CA1 evaluates increasing the height of the levee along the existing CV alignment to an overtopping stage of 34 feet on the Jefferson City gage. The existing CV Levee would be removed and rebuilt to meet current design requirements in the same location. The new levee would be 46,423 feet long and be an average of 3.1 feet above the existing CV Levee with a max height increase of 6.4 feet. This would lower the overtopping AEP from the current condition of 17% AEP to 8.0% AEP. The levee would become a federal levee system, renamed L-142.

CA2 Turkey Creek and Riverside Setback, 34-ft Stage, Capital View Removed

CA2 evaluates construction of a new levee setback approximately 1,000 feet along the Missouri River and Turkey Creek reach. The setback levee is located at the northeast side along an existing farm field and along the western edge of a golf course. The levee then crosses U.S. Highway 54 at high ground and cuts south through Old Cedar City, where there are a few residences, City owned community gardens, and practice baseball fields. The proposed alignment follows along Sandstone Drive to the south, around to the east and ties into the existing embankment of southbound U.S. Highway 54. The alignment continues from the northbound U.S. Highway 54 embankment and follows along to the east approximately 1,000 feet setback from the bank of the Missouri River. It then connects to high ground at the bluff by turning north along a tributary that feeds Niemans Creek. The 34-foot flood stage would lower the overtopping AEP to 6.5% and provide an expected levee performance of 1/15 year.

CA3 Existing Capital View Alignment with Resiliency

CA3 evaluates the existing CV alignment with added resilience measures. See the discussion in **Section 3.4.2** for the site description of the existing Capital View Levee. The levee would retain its current elevation of an overtopping stage of 30.5 feet, 17% AEP (1/6 year). The levee is rebuilt to federal standards for material composition and compaction. The alternative includes adding closure structures and resilience measures such as armament, seepage and stability berms, and managed overtopping.

CA4 Optimization Alignment, 37-ft Stage, Capital View Remains

CA4 evaluates construction of a new levee built to the elevation that correlates to a 37-foot stage, 3.5% AEP (1/28 year). A version of this alignment was brought forward and recommended for consideration by the public to minimize real estate impacts by utilizing existing property owned by Jefferson City and existing right(s)-of-way. The alignment follows along the existing CV Levee from station 0+00 to 113+00. The levee then turns and follows along the Missouri River at an offset, and then along Sandstone Drive and Mokane Road. The levee connects to high ground at the bluff by turning north along the existing CV Levee station 430+00 to 464+22.

The optimization alignment levee would be constructed from station 0+00 to 337+05 meeting federal standards for material composition and compaction. The portions of the existing CV Levee that overlap the proposed alignment for this alternative would be reduced to base elevations and reconstructed meeting federal standards to the proposed elevations. The remaining existing CV Levee would not be modified. Borrow material would be required to complete the proposed alternative.

The proposed alignment for CA4 is a levee that would reduce occurrence of flooding for approximately 2,200 acres of Missouri River floodplain in Callaway County, Missouri. The CV Levee would remain with 1,100 acres between the existing levee and the proposed federal levee footprint.

CA5 Optimization Alignment, 37-ft Stage, Capital View Removed

CA5 evaluates construction of a new levee built to the elevation that correlates to a 37-foot stage, 3.5% AEP (1/28 year). A version of this alignment was brought forward and recommended for consideration by the public to minimize real estate impacts by utilizing existing property owned by Jefferson City and existing right(s)-of-way. The alignment follows along the existing CV Levee from station 0+00 to 113+00. The levee then turns and follows along the Missouri River at an offset and then along Sandstone Drive and Mokane Road. It connects to high ground at the bluff by turning north along the existing CV Levee station 430+00 to 464+22.

The optimization alignment levee would be constructed from station 0+00 to 337+05 meeting federal standards for material composition and compaction. The portions of the existing CV Levee that overlap the proposed alignment for this alternative would be reduced to base elevations and reconstructed meeting federal standards to the proposed elevations. The remaining existing CV Levee would be fully removed and used for borrow material to construct the setback levee. Additional borrow material would be required to complete the proposed alternative.

The proposed alignment for CA5 is a levee that would reduce occurrence of flooding for approximately 2,200 acres of Missouri River floodplain in Callaway County, Missouri.

CA6 Historic L-142 Alignment, 45-ft Stage, Capital View Remains

CA6 was developed as a new levee built to the elevation that correlates to a 45-foot stage, 0.2% AEP (1/500 year). This alignment was previously developed and designed to 95% completeness and was never constructed. The proposed alignment begins at high ground along the South U.S. Highway 54 embankment and continues along the east side of the golf course and crosses U.S. Highway 63 at a high point west of the U.S. Highway 63/54 interchange. The alignment continues through Old Cedar City, tying into the bridge abutment along Sandstone Drive at U.S. Highway 54. The levee then continues to follow Mokane Road to the east then turns north just east of the airport.

The historic L-142 alignment would be constructed from station 0+00 to 247+27 meeting federal standards for material composition and compaction. The remaining existing CV Levee would not be modified or removed. Borrow material is required to complete the proposed alternative.

CA6 would reduce occurrence of flooding for approximately 1,500 acres of Missouri River floodplain in Callaway County, Missouri. The CV Levee would remain protecting 1,700 acres between the existing levee and the proposed federal levee footprint, though at a lower level of protection than the new federal levee.

CA6 and CA7 have the smallest leveed area and would conflict with the Jefferson City Memorial Airport master plan.

CA7 Historic L-142 Alignment, 45-ft Stage, Capital View Removed

CA7 was developed as a new levee built to the elevation that correlates to a 45-foot stage, 0.2% AEP (1/500 year). This alignment was previously developed and designed to 95% completeness and was never constructed. The proposed alignment begins at high ground along the South U.S. Highway 54 embankment and continues along the east side of the golf course and crosses U.S. Highway 63 at a high point west of the U.S. Highway 63/54 interchange. The alignment continues through Old Cedar City, tying into the bridge abutment along Sandstone Drive at U.S. Highway 54. The levee then continues to follow Mokane Road to the east then turns north just east of Jefferson City Memorial Airport.

The historic L-142 alignment would be constructed from station 0+00 to 247+27 meeting federal standards for material composition and compaction. The remaining existing CV Levee would be fully deconstructed and used for borrow material to construct the setback levee. Additional borrow material would be required to complete the proposed alternative.

CA7 would reduce occurrence of flooding for approximately 1,500 acres of Missouri River floodplain in Callaway County, Missouri.

CA6 and CA7 have the smallest leveed area and would conflict with the Jefferson City Airport master plan.

CA8 Highway Alignment, 37-ft Stage, Capital View Remains

CA8 was developed as a new levee built to the elevation that correlates to a 37-foot stage, 2.5% AEP (1/40 year). The alignment utilizes the existing U.S. Highway 54 embankment as the line of protection. The levee then turns and follows along the existing ROW and property owned by Jefferson City along Mokane Road. It connects to high ground at the bluff by turning north along the existing CV Levee station 430+00 to 464+22.

The highway embankment alignment levee would be constructed from station 0+00 to 272+30 meeting federal standards for material composition and compaction. The portions of the existing CV Levee that overlap the proposed alignment for this alternative would be degraded and reconstructed meeting federal standards to the proposed elevations. The remaining existing CV Levee would go on unchanged. Borrow material is required to complete the proposed alternative.

CA8 would reduce occurrence of flooding for approximately 1,700 acres of Missouri River floodplain in Callaway County, Missouri. The CV Levee would remain protecting 1,500 acres between the existing levee and the proposed federal levee footprint, though a lower level of protection than the new federal levee.

CA9 Highway Alignment, 37-ft Stage, Capital View Removed

CA9 was developed as a new levee built to the elevation that correlates to a 37-foot stage, 2.5% AEP (1/40 year). The alignment utilizes the existing U.S. Highway 54 embankment as the line of protection. The levee then turns and follows along the existing ROW and property owned by Jefferson City along Mokane Road. It connects to high ground at the bluff by turning north along the existing CV Levee station 430+00 to 464+22.

The highway embankment alignment levee would be constructed from station 0+00 to 272+30 meeting federal standards for material composition and compaction. The portions of the existing CV Levee that overlap the proposed alignment for this alternative would be degraded and reconstructed meeting federal standards to the proposed elevations. The remaining existing CV Levee would be fully deconstructed and used for borrow material to construct the setback levee. Additional borrow material would be required to complete the proposed alternative.

CA9 would reduce occurrence of flooding for approximately 1,700 acres of Missouri River floodplain in Callaway County, Missouri.

CA10 Limited Resiliency Measures Outside of Capital View Footprint

CA10 considers modification and incorporation of the North Renz levee into the P.L. 84-99 program. The North Renz levee is located along the left bank of the Missouri River between Cedar Creek (river mile 148.2) and 147.3. This alternative also considers the modification and incorporation of the Cedar Creek, Sec.2 levee into the P.L. 84-99 program. The Cedar Creek, Sec. 2 levee is located along the left bank of the Missouri River between river mile 146.8 and Turkey Creek (river mile 144.5).

CA11 Nonstructural

CA11 includes incorporation of various nonstructural measures such as floodproofing (wet or dry), elevate in place, and buyouts or relocations. These measures are considered within the area of the existing CV Levee.

CA12 Remove Church Farm Levee

CA12 considers the removal of the existing CFCA levee located along the right bank of the Missouri River upstream of the study area. The existing Church Farm levee is located between river mile 151.7 to 154.8. This alternative is evaluated to determine if there would be measurable benefit in the Missouri River water surface profile at Jefferson City by allowing floodwaters to inundate the conservation area and provide off-channel storage.

CA13 Hybrid Alignment, 41-ft Stage, Partial Capital View Removal

CA13 was developed as a new levee built to the elevation that correlates to a 41-foot stage, 1% AEP (1/100 year). This alignment is a hybrid of CA2, CA4, and CA5. The alignment follows along the embankment for U.S. Highway 54, then continues along the north and west side of the golf course. The levee connects to high ground crossing over U.S. Highway 63 and continues through Old Cedar City tying into the U.S. Highway 54 embankment near the bridge abutment. The alignment follows east along Sandstone Drive and Mokane Road before a slight turn south to follow the natural drainage path along a farm levee. The levee connects to high ground at the bluff by turning north along the existing CV Levee station 430+00 to 464+22.

The hybrid alignment levee would be constructed from station 0+00 to 313+32 meeting federal standards for material composition and compaction. The portion of the existing CV Levee that overlaps the proposed alignment for this alternative would be degraded and reconstructed meeting federal standards to the proposed elevations. The portion of existing CV Levee from station 0+00 to 160+00 would be deconstructed and used for borrow material to construct the setback levee. The remaining existing CV Levee would not be modified. Additional borrow material would be required to complete the proposed alternative.

CA13 would reduce the occurrence of flooding for approximately 2,100 acres of Missouri River floodplain in Callaway County, Missouri. The CV Levee would remain with 1,000 acres between the existing levee and the proposed federal levee footprint.

3.5 PLAN EVALUATION

Initial Array

The PDT reviewed the initial array of alternatives and conducted a new round of screening. Analysis of the alternatives and associated measures was conducted by considering qualitatively each alternative's ability to meet the project objectives and by applying criteria from USACE guidance and the P&G, as described in ER 1105-2-100.

Screening based on the P&G criteria (Effectiveness, Efficiency, Acceptance, and Completeness) eliminated CA3, CA10, and CA12. Explanation of the screening is presented in **Table 16**.

Table 16. Combined Alternatives Screened Out

Combined Alternative	Description	Screening Justification
CA3	Existing Capital View Alignment with Resiliency	All benefits are realized due to a reduction in breach potential. Does not increase flood risk benefits above the 17% AEP (1/6 year). Screened due to a lack of efficiency (P&G Criteria) associated with minimal flood risk benefits.
CA10	Limited Resiliency Measures Outside of Capital View Footprint	Does not meet project objective of reducing flooding. Does not meet effectiveness (P&G Criteria) as a standalone alternative.
CA12	Remove Church Farm Levee	Had no measurable effects of reducing water surface elevation at Capital View as a standalone measure. It is neither effective nor complete (P&G Criteria).

Additional screening of the remaining alternatives was conducted again using P&G Criteria of efficiency and effectiveness, specifically using the estimated annual costs of each alternative, the overtopping frequency the alternative would provide, and the annual benefits expected. The analysis is shown in **Table 17**.

Table 17. Alternative Cost and Benefit Analysis

Alt	Description	Annual Economic Cost	Annual Detour/Delay Benefits*	Annual Flood Damage Reduction Benefits	Mean Annual Benefits	Mean BCR	Mean Annual Net Benefits
CA0	No Action	\$0	\$0	\$0	\$0	0	\$0
CA1	Current Capital View to 34' Flood Stage	\$7,962,200	\$471,000	\$1,954,500	\$2,425,500	0.3	(\$5,536,700)
CA2	Capital View @ 34-ft stage, Turkey Creek/Riverside setbacks of 1,000 ft	\$12,844,100	\$254,000	\$500,100	\$754,100	0.1	(\$12,090,000)
CA4	Optimization Alignment 37-ft stage, Capital View Remains	\$14,220,500	\$327,000	\$6,740,300	\$7,067,300	0.5	(\$7,153,200)
CA5	Optimization Alignment 37-ft stage, Capital View Removed	\$15,034,100	\$374,000	\$6,689,200	\$7,063,200	0.5	(\$7,970,900)
CA6	L-142 historic alignment and profile, Capital View remains	\$20,290,200	(\$9,000)	\$18,813,600	\$18,804,600	0.93	(\$1,485,600)
CA7	L-142 historic alignment and profile, Capital View removed	\$21,306,100	(\$97,000)	\$18,824,700	\$18,727,700	0.88	(\$2,578,400)
CA8	Highway alignment, Capital View remains	\$11,599,100	\$334,000	\$6,974,500	\$7,308,500	0.6	(\$4,290,600)
CA9	Highway alignment, Capital View removed	\$12,725,300	\$343,000	\$6,995,100	\$7,338,100	0.6	(\$5,387,200)
CA11	Non-Structural	\$513,800	\$0	\$397,200	\$397,200	0.8	(\$116,400)
CA13	Hybrid Alignment, Profile at 1% AEP	\$11,319,500	\$337,000	\$14,721,500	\$15,058,500	1.3	\$3,739,000

*Discrepancies in totals due to rounding

**Oct 2025 Price Levels

Based on the analysis shown in **Table 17**, the PDT applied the P&G Criteria of efficiency and observed the low net benefits and high annual costs for many of the alternatives, resulting in BCRs less than one. Using this information, the PDT then considered the totality of comprehensive benefits in the four accounts as described in the *Economic and Environmental Principles for Water and Related Land Resources Implementation Studies*, established by the Water Resources Council in 1983. Further direction on the comprehensive assessment and documentation of benefits was issued in EP 1105-2-103 to clarify water resources development during project planning.

- The NED account displays changes in the economic value of the national output of goods and services.
- The Environmental Quality (EQ) account displays non-monetary effects on significant natural and cultural resources.
- The Regional Economic Development (RED) account registers changes in the distribution of regional economic activity that result from each alternative plan.
- The Other Social Effects (OSE) account registers plan effects from perspectives that are relevant to the planning process but are not reflected in the other three accounts.

The PDT determined the following criteria and characteristics to be relevant in the four accounts:

National Economic Development (NED):

- Total Investment Cost.
- BCR.
- Net Annual Benefits in flood damages reduced and detour and delay costs reduced.

Regional Economic Development (RED):

- Local Capture (RECONS), or the economic impacts to the region resulting from the proposed construction of the Recommended Plan.
- Allowing major employers to stay open and provide goods and services to the region, along with the employment benefits of those jobs.
- Agricultural Protection, specifically the average annual crop acreage inundated.

Other Social Effects (OSE):

- Life Safety.
- Adhering to Lower Missouri River System Plan goal of increased conveyance.
- Maintaining access to goods, services, and transportation networks to the community.
- Reduced damage and better access during flood events to free outdoor recreational opportunities via the Katy Trail.

EQ:

- Net AAHUs from restored acres.
- Cultural Resources.

A more detailed discussion of the four accounts and the metrics and screening criteria utilized can be found in **Appendix E**.

Using the four accounts, CA1 (Existing Capital View Alignment, 34-ft Stage) was eliminated because of a low BCR and very little opportunity for benefits in the other three accounts. With the leveed area remaining unchanged, there would be no environmental benefit, and the overtopping frequency would continue to be the most frequent of any of the structural alternatives. Additionally, the high overtopping frequency does not allow for substantial RED benefits or OSE benefits. Major employers are impacted in frequent storm events, agricultural production is inundated, and transportation networks become impassable. The alternative also does not adhere to the System Plan goal of increased conveyance, as the existing levee is immediately adjacent to the riverbank.

The Initial Array of Alternatives was presented to the sponsor and local stakeholders for consideration at a public meeting held in April 2024. Feedback was considered from the comments and questions from the public and interested stakeholders. Using this feedback, while a near positive BCR was met for CA6 (Historic L-142 Alignment, 45-ft Stage, CV Remains) and CA7 (Historic L-142 Alignment, 45-ft Stage, CV Removed), the sponsor and stakeholders found these alternatives unacceptable. With regards to screening using the four accounts criteria, this alignment eliminates businesses and community gathering centers from the leveed area, which was considered as a negative effect in the RED and OSE benefits categories. Therefore, the PDT eliminated CA6 and CA7 from further evaluation and consideration.

Additional sponsor and public feedback was received on CA8 (Highway Alignment, 37-ft Stage, CV Remains) and CA9 (Highway Alignment, 37-ft Stage, CV Removed). These alignments leave several of the benefits, especially those in the RED and OSE accounts, outside of the leveed area. The businesses and local stakeholders specifically excluded from the proposed leveed area were opposed to these alignments. The alignment also does not allow for the best utilization of the Katy Trail access, and diminishes the use of this important free outdoor recreation opportunity. Therefore, the PDT eliminated these alternatives from further evaluation.

To get to the final array, the PDT ultimately looked at the specific alignments and feasible overtopping frequencies they can achieve, while considering the potential for induced impacts to upstream and downstream levee systems. Additionally, the PDT considered impacts to the larger community of Jefferson City across the Missouri River, which includes economically vulnerable populations. Using these considerations, the PDT further screened CA2 (Turkey Creek & Riverside Setback, 34-ft Stage, CV Removed), CA4 (Optimization Alignment, 37-ft Stage, CV Remains) and CA5 (Optimization Alignment, 37-ft Stage, CV Removed). These three screened alternatives provided the lowest levels of levee performance and also fewer comprehensive benefits when compared to the remaining alternatives. Screening of the initial array of CAs is summarized in **Table 18**.

Table 18. Initial Screening of Combined Alternatives

Combined Alternative	Description	Screened Out (Y/N)	Justification
CA0	No Action	N	Retained as the baseline alternative.
CA1	Existing Capital View Alignment, 34-ft Stage	Y	Negative net benefits, little to no opportunity for total net benefits across the four accounts. Does not meet overall goal of conveyance or resilience in System Plan.
CA2	Turkey Creek & Riverside Setback, 34-ft Stage, Capital View Removed	Y	Negative net benefits, high overtopping frequency does not justify cost of federal levee segment, minimal total net benefits.
CA4	Optimization Alignment, 37-ft Stage, Capital View Remains	Y	Negative net benefits, moderate overtopping frequency does not justify cost of federal levee segment, minimal total net benefits.
CA5	Optimization Alignment, 37-ft Stage, Capital View Removed	Y	Negative net benefits, moderate overtopping frequency does not justify cost of federal levee segment, minimal total net benefits.
CA6	Historic L-142 Alignment, 45-ft Stage, Capital View Remains	Y	Negative net benefits, community and non-federal sponsor opposition.
CA7	Historic L-142 Alignment, 45-ft Stage, Capital View Removed	Y	Negative net benefits, community and non-federal sponsor opposition.
CA8	Highway Alignment, 37-ft Stage, Capital View Remains	Y	Negative net benefits, businesses and other stakeholders opposed, less RED and OSE benefits.

Combined Alternative	Description	Screened Out (Y/N)	Justification
CA9	Highway Alignment, 37-ft Stage, Capital View Removed	Y	Negative net benefits, businesses and other stakeholders opposed, less RED and OSE benefits.
CA11	Nonstructural	N	Carried forward for further evaluation as required plan.
CA13	Hybrid Alignment, 41-ft Stage, Partial Capital View Removal	N	Carried forward for further evaluation with positive NED and total net benefits, level of protection significantly higher, structural alternative.

The PDT, in cooperation with the non-federal sponsor, determined the final array to be three alternatives:

- CA0 – No Action
- CA11 – Nonstructural
- CA13 – Hybrid Alignment, 41-ft Stage, Partial Capital View Removal

The final array alternatives do not violate the constraint of the study, which is to avoid increasing bird strike risk near the regional airport.

4.0 Environmental Effects and Consequences

4.1 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter presents the environmental consequences, as required by the National Environmental Policy Act (NEPA) and NEPA Implementing Procedures. This chapter is organized by resource topic with the impacts of each alternative described within each resource section. The consequences of the No Action Alternative and the reasonably foreseeable effects of the action alternatives on the resource categories are presented. To streamline this document, where effects across alternatives are nearly the same or identical, they are described together under one combined sub-heading.

The NEPA and NEPA Implementing Procedures (dated June 30, 2025) require an analysis of the likely environmental effects of a proposed project and that USACE determine whether those impacts may be significant. Effects (or impacts) are changes to the human environment from alternatives that are reasonably foreseeable and have a reasonably close causal relationship to the proposed action or alternatives. Effects to the environment may include ecological, aesthetic, historic, cultural, economic, social, or health effects, and can be either beneficial or adverse. As per the Implementing Procedures, USACE considered connected actions including actions that automatically trigger other actions, that cannot or would not proceed unless other actions are taken previously or simultaneously or are independent parts of a larger action and depend on the larger action for their justification. The Implementing Procedures also state that USACE should generally not consider effects that are remote in time, geographically remote, that are the product of a lengthy causal chain, that are outside of USACE's authority to prevent, that would occur regardless of the proposed action, or that would be initiated by a third party, unless USACE can determine it is reasonable to consider such effects.

In considering the degree of the effects of the action, USACE considered both short-term and long-term effects, both beneficial and adverse effects, effects on public health and safety, and effects that would violate laws protecting the environment. The term "degree" is not defined in the governing regulations but generally refers to the magnitude of change that would result from the alternatives evaluated herein. In considering whether the effects of the proposed action are significant, USACE analyzed the potentially affected environment and degree of the effects of the alternatives. Consideration of significance included the severity (quality and sensitivity) of the impact on the specific resource, the location and context of the project, and the effect's duration (short- or long-term).

This analysis of reasonably foreseeable impacts only includes those effects that are sufficiently likely to occur such that a person of ordinary prudence would take it into account in reaching a decision. The potential impacts of the alternatives are described in this EA using the following terms:

- Beneficial: A positive change in the condition or appearance of the resource or a change that moves the resource toward a desired condition.
- Adverse: A change that moves the resource away from a desired condition or detracts from its appearance or condition.
- Short-term: impacts generally occur during construction or for a limited time thereafter, generally less than two years, by the end of which the resources recover their pre-construction conditions.
- Long-term: impacts last beyond the construction period, and the resources may not regain their preconstruction conditions for a longer period of time.

All potentially relevant resource areas were initially considered for analysis in this EA. Some resource topics are not discussed, or the discussion is limited in scope, due to the lack of anticipated effect from the alternatives on the resource or because that resource is not located within the affected environment. Resource topics considered but eliminated from further analysis are provided in **Table 19**.

Table 19. Resources Considered but Eliminated from Further Analysis

Resource	Rationale
Geomorphology	None of the alternatives evaluated in this analysis would alter the study area's geomorphology to a substantial degree. While this resource has been excluded from further individual analysis, it is discussed where relevant under other resource topics (e.g., hydrology and hydraulics).
Water Supply	Water supply for municipal, industrial, and commercial uses along the Missouri River can be affected by conditions such as river flows and stages, reservoir water surface elevations, river water chemistry including sediment, and channel locations. None of the alternatives evaluated in this analysis would alter the channel itself or its supply of water. Best management practices would be used to prevent substantial water quality impacts. No alternatives would meaningfully impact the Missouri River's use for water supply.
Wild and Scenic Rivers	The Missouri River is designated as a Recreational River under the Wild and Scenic Rivers Act. This designation applies to two reaches: from Fort Randall Dam downstream to the backwaters of Lewis and Clark Lake and from Gavins Point Dam downstream to Ponca State Park. Both reaches are located very far away from the study area and would not be affected by any of the alternatives. None of the other streams potentially affected by the alternatives are designated under the Wild and Scenic Rivers Act.

USACE used habitat modeling to evaluate the potential ecological impacts of the final array of alternatives (see **Appendix C1**). This modeling included Cost-Effectiveness and Incremental Cost Analysis (CE/ICA) for measures that could be added to the federal interest plan to mitigate impacts. Based on the results of this analysis, USACE added 45.4 acres of floodplain forest mitigation by adaptively managed natural regeneration to the federal interest plan. This mitigation would occur in the CV Area borrow site after the completion of borrow collection. The further analysis of the federal interest plan in this report includes this habitat mitigation. In addition, USACE assumes that borrow collection in the CFCA under the federal interest plan would not affect land management, as the hydrologic and hydraulic conditions would generally be maintained. USACE assumes that these areas would gradually recover from borrow excavation, and any habitat that has regenerated in this location under existing conditions would be allowed to continue regeneration. USACE assumes no removal or modification to the levee located at the CFCA.

Geology and Soils

This section describes the possible impacts of the alternatives on the study area's geology and soil. Potential agricultural impacts are considered as part of the overall evaluation of potential soil impacts. The physical scope of this analysis is generally restricted to the study area.

CA0 – No Action. Under CA0, no federal action would be undertaken. There would be no impacts to the study area's geology or soils.

CA11 – Nonstructural. None of the activities that would be undertaken as part of CA11 would impact the study area's geology or soils.

CA13 – Hybrid Alignment, 41-ft Stage, Partial CV Removal (federal interest plan). None of the construction activities that would occur under the federal interest plan would be anticipated to impact the study area's soils.

According to the NRCS Web Soil Survey website, the proposed levee alignment would cover 48.7 acres of prime farmland, and 35.1 acres of land that is prime farmland if drained. In addition, there is 32.2 acres of land that is prime farmland if drained, located on the riverward side of the proposed levee alignment that would experience restored floodplain hydrology. Thus, the federal interest plan could affect up to 116 acres of prime farmland. The PDT has coordinated these impacts with the NRCS, including the submission of Form AD-1006. Because these adverse effects are relatively small in scale, the implementation of the federal interest plan would have a negligible impact on soil resources.

Land Use

This section describes the possible impacts of the alternatives on land uses. The land use area of analysis is generally restricted to the study area and any easements that could be needed for alternatives.

CA0 – No Action. There would be no short-term impacts to the study area's land use. The anticipated changes to the study area's built environment that were discussed in **Section 2.5**, such as runway expansion at the airport and highway modification projects, would be expected to continue. However, because the area's flooding concerns would not be addressed, there is a long-term risk that some businesses may relocate out of the area to avoid flood damages.

CA11 – Nonstructural. CA11 would have negligible to beneficial effects on the study area's land use. Elevation and floodproofing would allow some properties to continue their current use. Buyouts would remove some properties from the floodplain, which would reduce flood damages and result in land use that is more compatible with the area's natural tendency to flood. However, some facilities may not be able to implement any of these measures. For example, facilities that are unable to implement the floodproofing or elevation measures may relocate out of the study area in the long-term to avoid flood damages, as under CA0.

CA13 – Hybrid Alignment, 41-ft Stage, Partial CV Removal (federal interest plan). The federal interest plan would largely maintain the current land use in the study area. Most locations in the study area would either experience greater protection from flooding impacts or would maintain their current level of protection. Locations along Turkey Creek in the CV Area would experience a restoration of floodplain hydrology. Approximately 45.4 acres of farmland that is owned by Jefferson City within this hydrologically restored area would be converted to native floodplain forest habitat for mitigation. Other locations within the reconnected floodplain would be expected to maintain their current land use for the foreseeable future, though the higher frequency of inundation may eventually result in some farmland being converted to other land use types (e.g., floodplain habitat). USACE would not anticipate borrow collection activities at the CFCA to alter land management practices. The large agricultural character of the CFCA would be maintained.

Hydrology and Hydraulics

This section describes the possible impacts on hydrology and hydraulics. The USACE used hydrologic and hydraulic modeling along approximately 50 Missouri River miles upstream and downstream of the study area to determine the scope of potential impacts associated with water surface elevation.

CA0 – No Action. Under CA0, the existing hydrologic and hydraulic conditions of the study area would be generally maintained. Future flood events would continue to occur, and USACE expects future patterns of inundations would be comparable to floods in the area's recent history. Future flood-related impacts would therefore be expected throughout the period of analysis.

CA11 – Nonstructural. None of the measures included in CA11 would have a substantial effect on the area's hydrology and hydraulics. The CV Levee would be unaffected by nonstructural measures. The hydrologic and hydraulic conditions of the study area would generally be the same as under CA0.

CA13 – Hybrid Alignment, 41-ft Stage, Partial CV Removal (federal interest plan). Along Turkey Creek in the western portion of the CV Area and along the Missouri River from the Turkey Creek confluence downstream to the Capital Sand quarry, the CV Levee would be removed. This would restore the natural floodplain hydrology of the Missouri River and Turkey Creek in the area between the CV area and the proposed levee alignment. Water from these streams would be allowed to spread out over a larger area during flood events, which is anticipated to be beneficial to floodplain hydrology. Thus, the long-term impact to the Missouri River and Turkey Creek would be beneficial.

Appendix A documents hydrologic and hydraulic assumptions, modeling, and anticipated changes in inundation patterns regarding the federal interest plan and is summarized here. The modeled area

extends from Boonville, Missouri near River Mile 197 to Hermann, Missouri near River Mile 98. This modeled area extends roughly 50 River Miles upstream and downstream of the study area. While the federal interest plan would set levee coverage back for part of the study area, the newly constructed levee would be taller than the existing CV Levee. This would be necessary to improve flood protection in the area behind the new levee from a 17% AEP to a 1% AEP based design. Consequently, water surface elevation around the study area would be expected to slightly increase during select flood events greater than the existing CV Levee height. The increases in inundation depth would be most applicable for storms greater than the 10% AEP. In these conditions, flows are bluff-to-bluff through the low-lying levees through the study area and increases in depth are added to areas that would be inundated under FWOP conditions regardless. With the displacement of water, duration of the Missouri River flooding would not be affected, and velocities would remain within the range of those typically experienced through the study site and not impact the existing system dynamics. Due to the bluff-to-bluff condition, increases in flow depth do not directly correlate to a drastic change in inundation footprint. Change in inundation footprint is restricted by topology and is generally limited to low-lying areas currently used for conveying water (ditches and minor tributary floodplains) or located on the face of bluff shelves.

Modeling indicates adjacent levees would not experience a detectable change in AEP of overtopping with implementation of the federal interest plan. Hydraulic modeling also indicates that any changes to river velocities in the channel and at the existing port location are within velocity parameters observed in existing flow conditions.

Impacts to Wears Creek, which is located on the right bank of the Missouri River across from the study area, are expressed as differences in maximum water surface elevation of the Missouri River at the confluence of Wears Creek. The federal interest plan would cause no meaningful change in water surface elevation at the confluence of Wears Creek during the most frequent flow events at the 50% and 20% AEP. At more infrequent flow events, starting at 10% AEP, the federal interest plan would cause a minor increase in water surface elevation. In existing conditions, road closures in the Wears Creek floodplain due to Missouri River flooding begin at the 26-foot river stage, corresponding to a storm probability frequency between 50% and 20% AEP. The U.S. Highway 63 / 50 corridor through the Wears Creek floodplain is closed at a 34-foot Missouri River stage, corresponding to a storm probability frequency of roughly 2% AEP. The current Jefferson City flood action plan would remain applicable with the federal interest plan due to the relatively small scale of the water surface elevation increases and impacts regarding Wears Creek occurring during less frequent flood events. Thus, USACE does not anticipate the federal interest plan would cause substantial adverse impacts relating to water surface elevation.

Under the System Plan, USACE anticipates that a variety of flood risk studies similar to the one documented in this report would be undertaken throughout the Missouri River floodplain between Sioux City, Iowa and St. Louis, Missouri. USACE anticipates that these future studies would formulate potential measures to address flood risk similar to measures formulated in this study. At this early stage, it cannot be fully determined how many of these studies would be undertaken, where precisely they would be located, what recommendations they would make, or how many recommendations would be carried forward for implementation. However, it can be assumed that these other studies would have the objective to reduce public safety risk and economic damage due to flooding impacts along the Missouri River.

The two other ongoing studies under the System Plan are located around Brunswick, Missouri and Holt and Doniphan Counties in Missouri and Kansas, respectively. These locations are beyond the hydraulic modeling extent of this study. Modeling for the federal interest plan indicates that this alternative would not meaningfully impact upstream hydraulics at the locations of these other studies, as the federal interest plan's hydraulic effects are negligible within the modeled extent. The federal interest plan would therefore not interfere with the successful implementation of flood risk management actions taken at these other study locations.

USACE anticipates the combined effect of System Plan spin-off projects would cumulatively increase as these projects were implemented. The recommendations made by the System Plan include a variety of measures that could either increase or decrease flood stages and flow rates at various locations, but USACE anticipates the overall effect of these projects would be a general increase in floodwater

conveyance at the system scale. The federal interest plan would contribute to this outcome by reducing the extent of Missouri River levee coverage. Modeling for the System Plan indicates that a systematic increase in conveyance would typically reduce upstream flood stages to a greater degree than increase downstream flood stages, though the latter would still likely occur in some places. Any ongoing or future studies conducted under the System Plan would be evaluated for their potential for hydraulic impacts, on both an individual scale and collectively with other actions. Regardless, both individual modeling for the federal interest plan and general modeling for the System Plan indicate that increased conveyance would have beneficial effects on hydrology and hydraulics.

Aquatic Habitat and Associated Resources

This section describes the possible impacts of the alternatives on aquatic habitat. These resources include surface waters (e.g., streams) and wetlands. Discussion of potential groundwater impacts is also included here due to the close relationship between groundwater and aquatic habitat in the context of the study area.

CA0 – No Action. Under CA0, no actions would be undertaken that would impact aquatic habitat or groundwater. Aquatic habitat in the study area would generally maintain its degraded and fragmented character. Future activities within the study area (e.g., continued agriculture, roadway projects) would likely be concentrated on already disturbed areas. Largescale reductions in aquatic habitat would not be anticipated. USACE anticipates no effects on the alluvial aquifer.

CA11 – Nonstructural. None of the measures included in CA11 would affect aquatic habitat or groundwater. The condition of these resources would be the same as under CA0.

CA13 – Hybrid Alignment, 41-ft Stage, Partial CV Removal (federal interest plan). **Appendix C1** contains the Section 404(b)(1) analysis conducted on the federal interest plan, which is summarized here. The Missouri River and its tributaries would not experience adverse impacts to any meaningful degree. The proposed levee alignment is located landward of the existing CV Levee. Thus, there would be no fill activities in these waterbodies. Best management practices such as silt fences would be used to minimize the siltation of these waterbodies via runoff. The construction contractor would be required to obtain a National Pollutant Discharge Elimination System (NPDES) stormwater runoff permit from MoDNR prior to project implementation. USACE would require the contractor to comply with all conditions of the permit.

Along Turkey Creek in the western portion of the CV area and along the Missouri River from the Turkey Creek confluence downstream to the Capital Sand quarry, the CV Levee would be removed. This would restore approximately 250 acres of the natural floodplain hydrology of the Missouri River and Turkey Creek in the area between this portion of the CV Levee and the proposed levee alignment. Water from these streams would be allowed to spread over a larger area during flood events, which would be beneficial to floodplain hydrology. In addition, the conversion of 45.4 acres to riparian floodplain habitat for on-site mitigation in the CV area borrow site (see Error! Reference source not found. or refer to **Appendix C1**) would be expected to indirectly benefit water quality in the Missouri River and Turkey Creek. While neither of these waterbodies are currently listed on the Missouri 303(d) list of impaired waters, the increase in native habitat land cover would offer additional filtration of runoff and would be beneficial for water quality. This can be especially beneficial in agricultural settings such as the study area, as fertilizers are widely in use and can easily enter streams and other waterbodies via runoff. Thus, the long-term impact to the Missouri River and Turkey Creek would be anticipated to be beneficial.

The construction of the levee under the federal interest plan would impact wetlands along the alignment by filling them in and removing vegetation, resulting in a net loss of 1.1 acres of wooded wetland habitat, 0.5 acres of non-farmed emergent wetland habitat, and 20.5 acres of farmed wetlands within the study area. Because wetland areas are located throughout the study area, it would be impractical for any proposed levee alignment to avoid them entirely. Instead, during the alternative development these areas were avoided to the extent practicable, and avoidance of higher quality areas was prioritized over lower quality areas. In the study area, the lowest quality areas are farmed wetlands, which are areas that could likely support wetland ecology but are maintained for row crop agriculture. The avoidance of wetland areas also helps to minimize the impacts by reducing the quantity of wetlands that would be filled in. Best

management practices such as silt fences would be used to minimize impacts to wetlands outside of the levee alignment to minimize sediment runoff.

The federal interest plan would result in the permanent removal of approximately 0.6 acres of forested wetland, 0.5 acres of scrub wetland, 20.5 acres of farmed wetlands, and 0.5 acres of other kinds of emergent wetland. In addition, borrow activities in the CV area would result in the permanent loss of an additional 0.2 acres of forested wetland and 0.3 acres of farmed wetland. Wetlands are not present in the areas affected by staging, site access or the removal of the existing levee. For this reason, no wetland impacts associated with these activities would be anticipated.

Wetlands are also located throughout the CFCA borrow site. Borrow excavation would clear vegetation and disturb local soil conditions, so there would be a short-term decrease in the quality of wetland habitat. Approximately 27.1 acres of wooded wetland habitat and 161.8 acres of farmed wetlands would be impacted in this way. The CFCA is sufficiently far enough away from the Jefferson City Memorial Airport that it is not subject to waterfowl attractant restrictions associated with this airport. Because of this, approximately 27.1 acres of wooded wetland habitat would be allowed to naturally regenerate after borrow collection at the CFCA. USACE anticipates that excavation of borrow material under the federal interest plan would create an opportunity to improve geomorphology in some wetland areas, which would be allowed to naturally regenerate habitat. Farmed wetland areas would not be expected to benefit in this way because USACE expects they would still be in agricultural use over the long term.

Habitat modeling provided in **Appendix C1** indicates that levee construction and borrow collection activities would result in a net loss of wetland value as represented by habitat units. Using the FACWet model, which is a general ecological model for wetlands and riparian habitat, USACE determined that the federal interest plan would result in the net loss of 1.6 average annual habitat units (AAHUs) of wooded wetland habitat and 8.9 AAHUs of emergent wetland habitat over the period of analysis. Thus, the federal interest plan would have an adverse impact on wetlands unless mitigated (see **Section 4.2** for mitigation details). **Table 20** provides a summary of the impacts to wetlands and other habitats.

Table 20. Acres of Habitat Impacts and Net Ecological Effect of CA13

Habitat Variable	Wooded Wetlands	Emergent Wetlands (including Farmed Wetlands)	Non-Hydric Habitat	Total Habitat
Acres Impacted by Construction and Utility Relocation (CV Area)	1.1 Acres	21.0 Acres	12.4 Acres	34.5 Acres
Acres Impacted by Levee Removal Activities (CV Area)	0 Acres	0 Acres	0.8 Acres	0.8 Acres
Acres Impacted by Borrow Activities (CV Area)	0.2 Acres	0.3 Acres	0.5 Acres	1.0 Acres
Acres Impacted by Borrow Activities (CFCA)	27.1 Acres	161.8 Acres	0 Acres	188.9 Acres
Net Ecological Impact (CV Area)	-0.6 AAHUs	-4.1 AAHUs	+13.5 AAHUs	+8.8 AAHUs
Net Ecological Impact (CFCA)	-1.0 AAHUs	-4.8 AAHUs	0 AAHUs	-5.8 AAHUs
Net Ecological Impact (Mitigation)	+1.6 AAHUs	+8.9 AAHUs	0 AAHUs	+10.5 AAHUs
Total Acres Impacted	28.4 Acres	183.1 Acres	13.7 Acres	225.2 Acres
Total Net Ecological Impact without Mitigation	-1.6 AAHUs	-8.9 AAHUs	+13.5 AAHUs	+3.0 AAHUs
Total Net Ecological Impact with Mitigation	0 AAHUs	0 AAHUs	+13.5 AAHUs	+13.5 AAHUs

The excavation associated with the collection of borrow material under the federal interest plan would not be anticipated to result in any alteration of the quality, character, or amount of groundwater resources within the study area. Thus, no effect on groundwater would be expected under the federal interest plan.

The topics covered in this section are discussed in greater detail in the 404(b)(1) analysis and habitat modeling analysis provided in **Appendix C1**. Based on this analysis, the federal interest plan has been identified as the Least Environmental Damaging Practicable Alternative (LEDPA). While the federal interest plan does cause short-term adverse impacts that CA0 and CA11 would not, the federal interest plan would also restore floodplain hydrology and mitigate impacts to riparian forest habitat at the CV Levee borrow area. Habitat modeling provided in **Appendix C1** indicates that the long-term benefits of habitat mitigation would ultimately exceed the short-term impacts over the course of the 50-year period of analysis for riparian habitat. However, there would still be a net impact to wetland habitat with implementation of the federal interest plan. While USACE has avoided and minimized impacts to wetlands to the extent practicable, there is no practicable alternative that would adequately meet the purpose and need of this study without some adverse effect on wetlands. Because of this and the net increase to riparian habitat, USACE has identified the federal interest plan as the LEDPA. The implementation of the federal interest plan would require the acquisition of a 401 Water Quality Certification (WQC) from the MoDNR. This 401 WQC would be obtained prior to construction, during the Pre-Construction Engineering and Design (PED) phase.

Water Quality

This section describes the possible impacts of the alternatives on water quality.

CA0 – No Action. Under CA0, no federal action would be undertaken. Flooding would continue to impact the study area, and this has the potential to impact surface waters and other aquatic resources. The floodplain contains nutrients from agricultural activities, sediments, and other pollutants that could be carried by floodwaters into the Missouri River and other nearby waterbodies. However, the study area is already characterized by a history of flood events and none of the surface water features located in or along the study area are listed as impaired waters in the 2022 Section 303(d) List for Missouri (MoDNR, 2022). USACE does not anticipate that these surface water features would become impaired because of CA0. Similarly, the Missouri River is subject to a TMDL for chlordane and PCBs in fish tissue, and USACE does not anticipate CA0 to result in elevated levels of these pollutants. USACE does not anticipate water quality conditions within the study area to change substantially because of CA0.

CA11 – Nonstructural. None of the measures included in CA11 would have a substantial possibility of water quality impacts. Soil disturbing activities would be short-term and mitigated using BMPs under this alternative. Overall, water quality conditions under CA11 would not meaningfully differ from the conditions expected under CA0.

CA13 – Hybrid Alignment, 41-ft Stage, Partial CV Removal (federal interest plan). In the short-term, BMPs such as silt fences would be used to minimize the siltation of nearby waterbodies via runoff. USACE would require the construction contractor to obtain an NPDES stormwater runoff permit from the MoDNR because the federal interest plan would disturb more than one acre of soil. USACE would require the contractor to comply with all conditions of the permit. Because of this, USACE anticipates the federal interest plan would not result in substantial short-term adverse effects on water quality.

Along Turkey Creek in the western portion of the CV area and along the Missouri River from the Turkey Creek confluence downstream to the Capital Sand quarry, the CV Levee would be removed. This would restore approximately 250 acres of natural floodplain hydrology of the Missouri River and Turkey Creek in the area between the CV area and the proposed levee alignment. Water from these streams would be allowed to spread over a larger area during flood events, which is anticipated to be beneficial to floodplain hydrology. In addition, the conversion of 45.4 acres to floodplain forest habitat in the CV Levee borrow area for on-site mitigation would be expected to indirectly benefit water quality in the Missouri River and Turkey Creek. While neither of these waterbodies are currently listed on the Missouri 303(d) list of impaired waters, the increase in native habitat land cover would offer additional filtration of runoff and would be beneficial for water quality. This can be especially beneficial in agricultural settings such as the

study area, as fertilizers are widely in use and can easily enter streams and other waterbodies via runoff. Thus, the long-term impact to the Missouri River and Turkey Creek is anticipated to be beneficial.

Floodplains

This section describes possible impacts of the alternatives on the floodplain. As part of the evaluation of potential indirect effects, this section analyzes the potential of alternatives to promote future development within the floodplain. The section summarizes the eight-step evaluation process under Executive Order 11988, the full documentation of which is provided in **Appendix C1**. The scope of this analysis is generally focused on the floodplain.

CA0 – No Action. Under CA0, no actions would be undertaken that would impact the floodplain. The current risk of life loss and economic damage due to flood events would continue.

CA11 – Nonstructural. None of the measures included in CA11 would affect the floodplain. Floodproofing and structure elevations would make some structures in the floodplain more resilient to flooding impacts. Buyouts and relocations would result in the removal of some structures from the floodplain. Because this alternative would not alter hydrology or flooding frequency of the study area, CA11 would not promote new development within the floodplain.

CA13 – Hybrid Alignment, 41-ft Stage, Partial CV Removal (federal interest plan). This alternative would construct a new levee within the Missouri River floodplain. The new levee would reduce the likelihood of flooding from levee overtopping from a 17% AEP to a 1% AEP based design. The portion of the floodplain landward of the newly constructed levee would include the Jefferson City Memorial Airport, the Hitachi Energy plant, a wastewater treatment plant, various other businesses, various residences, and some agricultural land. While this area would experience less frequent flooding, USACE does not anticipate that the federal interest plan would promote development in the floodplain for a few key reasons. The left bank of the Missouri River is specifically outlined in the Jefferson City's future land use map as a "River Transition Overlay Annexation", which is defined as "areas that need additional scrutiny in regard to development in and around the floodplain, flood prone areas, or environmentally sensitive features" by city code. The city of Jefferson City has extensive experience in floodplain management and has taken broad risk reduction acts since the 1993 flood.

In addition, the newly constructed levee would not meet FEMA accreditation standards, and flood risk would still be associated with the 1% AEP as delineated by the FEMA Flood Insurance Rate Map. Further development is limited by established infrastructure in the area including the airport and wastewater treatment facility. There is added interest by the City in maintaining the area east of the airport as undeveloped because it is their sludge disposal location for the adjacent wastewater treatment facility. During floods, there is considerable cost incurred by the City to find an alternative disposal location. Thus, the implementation of the federal interest plan would not promote development in the floodplain due to these unique site conditions. Implementation of the federal interest plan would reduce hazard and risk associated with floods for critical infrastructure and minimize impact of floods on human safety, health, and welfare beyond existing city floodplain management practices.

In addition to the newly constructed levee, the federal interest plan would also remove the existing CV levee west of U.S. Highway 54. This would restore floodplain hydrology to approximately 250 acres of land between the new and removed levees. Because the federal interest plan would partially restore the hydrological connectivity of the Missouri River and Turkey Creek without promoting the new development in the floodplain, the long-term effect of this alternative would be beneficial to floodplains. Compliance with each step of the eight-step decision-making process for Executive Order 11988 is fully documented in **Appendix C1**.

Jefferson City is an existing participant in FEMA's NFIP. The development of the federal interest plan's levee alignment and profile included incorporation of levee setbacks to optimize levee height, inclusion of critical infrastructure into the leveed area, and minimal changes to the base flood elevation (BFE). Construction of the federal interest plan's levee alignment would require a Conditional Letter of Map

Revision (CLOMR) to document changes in floodplain hydraulics and BFE through the project area and mitigation to any impacted structures.

Terrestrial Habitat

This section describes possible impacts of the alternatives on terrestrial habitat. In the context of this study, terrestrial habitat refers to land-based habitats such as riparian forests. The geographic scope of this analysis is restricted to the study area.

CA0 – No Action. Under CA0, no actions would be undertaken that would impact terrestrial habitat. USACE anticipates that terrestrial habitat within the study area would maintain its current quality and quantity.

CA11 – Nonstructural. None of the measures included in CA11 would affect terrestrial habitat.

CA13 – Hybrid Alignment, 41-ft Stage, Partial CV Removal (federal interest plan). In addition to the previously discussed wetland habitat impacts, the federal interest plan would also remove some amount of non-wetland riparian floodplain habitat. **Table 20** provides a quantified summary of the anticipated lost habitat. USACE assumes that any potential utility relocation work would be conducted within the construction footprint of the new levee. While habitat is generally sparser on the landward side of the existing CV Levee, USACE anticipates that a small quantity of floodplain forest adjacent to the existing levee would need to be cleared for levee removal activities. Habitat is not substantially present within the staging areas and so no habitat impact is anticipated at these locations. There are a variety of roadways within the CV area that have been previously cleared of habitat. Therefore, USACE does not anticipate that habitat removal or disturbance would be needed in any substantial quantity for site access.

In general, impacted habitat in the CV Area would be permanently lost. This is because habitat in this area would be primarily cleared for the construction and maintenance of the new levee alignment. In contrast, impacted habitat in the CFCA would be temporarily disturbed and then allowed to recover and regenerate over the long-term. This is because USACE would only use the CFCA for borrow collection activities under the federal interest plan, and long-term changes in land use management would not be necessary or expected. Areas currently maintained for agriculture would remain in this condition, and areas that are currently allowed to regenerate habitat by ecological succession would be allowed to continue this process.

The federal interest plan would provide habitat benefits in two ways. First, the levee setback and partial removal of the existing CV Levee would reconnect approximately 250 acres of the Missouri River and Turkey Creek floodplains. The habitat in this reconnected area would be enhanced by the restoration of floodplain hydrology, as the species native to this habitat are adapted to periodic inundation. Second, the conversion of 45.4 acres to floodplain forest habitat within this hydrologically reconnected part of the floodplain for on-site mitigation would provide further environmental benefits. The mitigation forest habitat would be larger than the total amount of lost wooded habitat in the CV Area (15.0 acres), resulting in a net expansion of 30.4 acres of wooded floodplain habitat. Habitat modeling has determined that, with these benefits, the federal interest plan would generate 3.0 Net AAHUs over the long-term (see **Table 20**). In other words, the overall habitat lift would exceed the adverse effects of habitat clearing and disturbance. However, most of this lift would be provided by the mitigation or enhancement of non-wetland habitat. In summary, the federal interest plan would incur short-term impacts to habitat due to actions associated with construction and other project implementation activities, though floodplain reconnection and habitat mitigation would provide long-term benefits to habitats. See **Section 4.2** for additional information on Mitigation, Monitoring, and Adaptive Management.

In all locations where vegetation is cleared or disturbed, invasive species would be controlled to prevent their spread. The monitoring and adaptive management plan developed for the federal interest plan includes actions for the control of invasive species (see **Appendix C1**). USACE would ensure that native species would be used to reseed these disturbed areas.

Fish and Wildlife

This section describes possible impacts of the alternatives to fish and wildlife. The analysis in this section evaluates potential effects to animal species that inhabit the area in or around the study area.

CA0 – No Action. Because no action would be undertaken with CA0, there would be no direct impact to the study area's fish and wildlife. Flood events would continue to occur in the study area, and this may have effects on the area's fish and wildlife. For example, severe floods could inundate the study area for an extended length of time and cause wildlife in the area to be displaced. However, flooding is a natural occurrence on the floodplain and so the fish and wildlife that naturally inhabit this location are adapted to tolerate this kind of disturbance. Thus, USACE does not anticipate CA0 to cause substantial impacts to the study area's fish and wildlife in the short-term or long-term.

CA11 – Nonstructural. The measures included in CA11 would have no impact on fish and wildlife.

CA13 – Hybrid Alignment, 41-ft Stage, Partial CV Removal (federal interest plan). Short-term impacts on fish and wildlife under the federal interest plan would be negligible. Most of the land impacted by construction activities would be farmland or other areas where native habitat has effectively been lost. The forests and wetlands that would be impacted are all characterized by moderate to severe disturbance by human activities. Thus, the fish and wildlife that are present are generally edge and urban adaptive species that are able to tolerate these disturbances. While construction activities would add to these disturbances in the short term, these activities would not occur around the clock and would not cause the study area to become unusable for the species that inhabit it currently. The net long-term benefits to floodplain habitat would be expected to have overall beneficial effects on wildlife. The partial removal of the existing CV Levee would enhance habitat connectivity and facilitate easier movement between the Missouri River and floodplain habitat. Aquatic organisms may benefit indirectly from the improved filtering of water over the floodplain.

USACE does not anticipate the local impact to wetlands to substantially affect fish and wildlife. The affected wetlands do not generally exhibit pools or standing water, so fish and mussels would not be present. Any aquatic organisms present would very likely be amphibious (e.g., frogs) or capable of flight (e.g., waterfowl) because the fragmented distribution of these habitats requires traversal over dryer habitats to move from one wetland to another. The wetlands are also of generally poor quality due to the area's extensive agricultural use and development. While the federal interest plan would result in a loss of wetland acreage in the CV Area, wetlands are scattered throughout this location and most wetland acreage in the CV Area would be unaffected by the federal interest plan. Wetlands in the CFCA would be disturbed by excavation activities, but the total wetland acreage would not be expected to change. These areas would gradually recover over the long term. To mitigate for federal interest plan impacts to wetland habitat, mitigation credits would be purchased from credit banks or in-lieu fee programs (see **Section 4.2**). For these reasons, USACE would not expect any extirpation of species from the study area that uses these wetland areas.

Threatened and Endangered Species

This section describes possible impacts of the alternatives to threatened and endangered species, or species that are proposed to be listed as threatened or endangered. The analysis in this section evaluates potential effects to species that inhabit the area in or around the study area.

CA0 – No Action. Because no action would be undertaken with CA0, there would be no impact on any threatened or endangered species present in the study area.

CA11 – Nonstructural. The measures included in CA11 would have no impact on threatened or endangered species.

CA13 – Hybrid Alignment, 41-ft Stage, Partial CV Removal (federal interest plan). The federal interest plan would require the clearing of approximately 42.1 acres of wooded habitat, and site investigations have indicated that much of this habitat contains trees suitable for roosting by Indiana bat, northern long-

eared bat, and tricolored bat. However, tree removal activities would be timed to occur during the winter hibernation period for these species in order to mitigate potential tree-clearing impacts. In addition, the conversion of approximately 45.4 acres to floodplain forest habitat for on-site mitigation would occur at the CV Area, and approximately 27.1 acres of wooded wetland habitat at the CFCA would be allowed to continue natural regeneration and ecological succession after borrow collection. The long-term effect, therefore, would be an expansion of wooded habitat by approximately 30.4 acres and a greater amount of potential summer roosting habitat for these listed bat species. Milkweed (*Asclepias* spp.) may be present within the project area. While construction activities may result in some incidental removal of milkweed plants, USACE does not anticipate this would occur on a large scale and disturbed areas would be reseeded with native species, including appropriate milkweed species.

For these reasons, USACE is making a “may affect, but not likely to adversely affect” determination for the northern long-eared bat and Indiana bat. USACE concurred with this determination in an email dated 4 June 2025. USACE and USFWS agree that a determination of “not likely to jeopardize the continued existence of the species” is appropriate for the proposed listed species tricolored bat and monarch butterfly. In the event that the final listing of these species happens before the completion of this project, USACE would reinitiate consultation.

Because project activities would not meaningfully impact Missouri River in-channel habitat, no impact would occur to pallid sturgeon. Because caves and prairie habitat are absent from the study area, no impacts would occur to gray bat or western regal fritillary. USACE is therefore making a “no effect” determination for these species.

Migratory Birds

This section describes possible impacts of the alternatives on migratory bird species. The analysis in this section evaluates potential effects to species that are seasonally present or present year-round in or around the study area.

CA0 – No Action. CA0 would have no effect on migratory birds, including bald eagles.

CA11 – Nonstructural. CA11 would have no effect on migratory birds, including bald eagles.

CA13 – Hybrid Alignment, 41-ft Stage, Partial CV Removal (federal interest plan). While the federal interest plan includes tree removal activities that could disturb migratory bird nests, these activities would be timed so that they would occur outside of the nesting season. The mitigation of floodplain forest at the CV borrow site would provide additional habitat to migratory birds in the long-term. This is not expected to increase the risk of bird strikes at the airport. The conversion of farmland in this borrow area to native vegetation would likely decrease the presence of geese there because agricultural land offers better foraging for this animal (Fox & Abraham, 2017). According to a Memorandum of Agreement (MOA) between the FAA, USACE, and other federal agencies, geese account for the second highest number of aircraft-wildlife strikes that result in damage or adversely affect an aircraft’s flight (see **Appendix F**). While bald eagles are known to nest in the vicinity of the CFCA, borrow activities would occur more than 660 feet from the nest location, which would make any potential impacts to bald eagles negligible.

Cultural Resources

This section describes potential impacts to cultural resources in the study area. Cultural resources are any pre-contact or historic remains or indicators of past human activities, including artifacts, sites, structures, landscapes, and objects of importance to a culture or community for scientific, traditional, religious, or other reasons. Historic properties are cultural resource sites that are listed on or eligible for listing on the NRHP.

CA0 – No Action. CA0 would have no effect on either currently known or unknown historic properties within the study area. Sites would be subject to the same adverse impacts from erosion, land development, or looting activity that they may currently be subject to.

CA11 – Nonstructural. No known historic properties would be adversely impacted by the nonstructural measures. The effects to historic properties would likely be like CA0. Any unknown cultural resources identified during the design or construction phases would be coordinated with applicable resource agencies for eligibility and any required avoidance, minimization, or mitigation actions.

CA13 – Hybrid Alignment, 41-ft Stage, Partial CV Removal (federal interest plan). The federal interest plan could have either beneficial or adverse impacts on historic properties. No known historic properties would be adversely impacted by the federal interest plan's measures. However, currently unknown, or unrecorded historic properties could be affected by the levee setback and through borrow activity. Conversely, currently unknown sites could also be protected from flood damage. Any unknown cultural resources identified during the design or construction phases would be coordinated with applicable resource agencies for eligibility and any required avoidance, minimization, or mitigation actions.

Socioeconomics and Demographics

This section describes potential impacts to socioeconomic and demographic conditions from the alternatives. This evaluation considers the communities and businesses that are potentially affected by activities within the study area.

CA0 – No Action. No federal action would be undertaken with CA0, and therefore no short-term impacts to socioeconomics or demographics would occur. However, flood damages would be expected to continue unabated. There is a long-term risk that businesses in the CV Area may eventually relocate out of the study area to avoid flood events, and this could result in the local loss of employment opportunities. Jefferson City and Callaway County may be particularly vulnerable to the effects of this risk if it is realized because these communities have per capita incomes noticeably lower than the national average (see **Table 12**). Thus, long-term adverse impacts to socioeconomics are possible under CA0.

CA11 – Nonstructural. CA11 would have beneficial effects on socioeconomics and demographics. The measures included in this alternative would reduce the damages experienced in the study area during flood events. Floodproofing would help make some local employers located within the study area more flood resilient. CA11 would therefore result in a reduced risk of lost employment opportunities compared to CA0.

CA13 – Hybrid Alignment, 41-ft Stage, Partial CV Removal (federal interest plan). The federal interest plan would have beneficial effects on socioeconomics and demographics in the short-term and long-term. Construction activities under this alternative would create job and business opportunities in the short term. In the long term, the study area's employers would be more resilient to flooding events and therefore less likely to relocate to another area. A greater number of local employers would experience reduced flood risk under the federal interest plan relative to CA11 because the nonstructural measures included in this latter alternative would not be applicable to all facilities in the study area. For that reason, the federal interest plan would provide the greatest benefits of final array alternatives.

Hazardous, Toxic, and Radioactive Wastes (HTRW)

This section describes the potential impacts of the alternatives relating to HTRW materials and contamination. This evaluation is particularly focused on areas with a known history of HTRW contamination.

CA0 – No Action. No HTRW substances would be generated under CA0, and therefore no HTRW impacts would occur.

CA11 – Nonstructural. None of the measures included in CA11 would impact properties that have a known potential for HTRW contamination.

CA13 – Hybrid Alignment, 41-ft Stage, Partial CV Removal (federal interest plan). Known contamination sources within the study area would not be anticipated to prevent the implementation of this alternative. The proposed levee alignment under the federal interest plan would intercept the Former MFA Oil Bulk

Plant and K & K Mobile Home Sales and Supply sites. The non-federal sponsor would be required to address any HTRW concerns and ensure that lands necessary for the implementation of the federal interest plan are clean. If any HTRW materials are present in the lands necessary for the federal interest plan, the implementation of the federal interest plan would include strict adherence to health and safety plans and project specifications to avoid potential HTRW impacts. HTRW substances would not be produced by this alternative, so there would be no potential for further contamination during construction.

Air Quality

This section describes the potential impacts of the alternatives on air quality. This evaluation considers the study area and other nearby locations because air quality emissions have the potential to affect areas beyond the location of their original source.

CA0 – No Action. There would be no emission of air quality pollutants under CA0, and existing air quality conditions would largely be maintained.

CA11 – Nonstructural. None of the measures included in CA11 would result in air quality emissions in any meaningful quantity. Air quality conditions under CA11 would generally be the same as under CA0.

CA13 – Hybrid Alignment, 41-ft Stage, Partial CV Removal (federal interest plan). Construction activities under the federal interest plan would require the use of heavy equipment that emit diesel fuel fumes and exhaust, and fugitive dust would be made airborne from construction activities. However, the federal interest plan would not require nonstop construction and as such, equipment downtime would allow for dispersion of any fumes or fugitive dust generated during construction. In addition, dust control BMPs would be implemented to reduce the impact of fugitive dust. An NPDES permit would need to be acquired prior to construction activities because the federal interest plan would disturb more than one acre of soil. Greenhouse gas emissions under the federal interest plan would also be temporary and would not occur on a large enough scale to degrade air quality. USACE anticipates that approximately six portable pumps may occasionally be used to facilitate interior drainage for the new levee alignment. Any emissions associated with these pumps would be temporary and only occur during high water events. The implementation of the federal interest plan would not cause criteria pollutant attainment status to be lost in either Callaway or Cole Counties.

Noise

This section describes the potential impacts of the alternatives relating to noise. This evaluation considers the study area and other nearby locations because noise-causing activities can have effects beyond the location of their original source.

CA0 – No Action. The implementation of CA0 would not result in any noise generation. Existing noise conditions would be maintained under CA0.

CA11 – Nonstructural. None of the measures included in CA11 would generate any substantial amount of noise. Noise conditions under CA11 would generally be the same as under CA0.

CA13 – Hybrid Alignment, 41-ft Stage, Partial CV Removal (federal interest plan). Noise associated with this alternative would be limited to noise generated during construction activities. Construction noise would be similar to other machinery used in the local area. Common equipment used during construction generally emit noise levels around 85 dBA at 45 feet. The noise associated with construction would only occur during daylight hours, thereby providing regular respite from noise-related impacts. USACE anticipates that approximately six portable pumps may occasionally be used to facilitate interior drainage for the new levee alignment. USACE expects that noise associated with these pumps would be temporary (i.e., only occurring during high water events) and would not notably exceed other sources of noise in the area (e.g., airport activities). The federal interest plan would be expected to result in minor noise impacts.

Aesthetics and Recreation

This section describes the possible impacts of the alternatives on aesthetics and recreational opportunities. Potential aesthetic and recreational impacts are evaluated in and around the study area.

CA0 – No Action. CA0 would not alter the study area's aesthetics or recreational opportunities in the short term. However, the area's flood risk would be maintained, and it is likely that future floods would disrupt access to recreational resources in the area.

CA11 – Nonstructural. Property buyouts would result in negligible alterations to the study area's aesthetics. Recreational opportunities would be unaffected by CA11. Consequently, aesthetic and recreation resources under CA11 would generally be the same as under CA0.

CA13 – Hybrid Alignment, 41-ft Stage, Partial CV Removal (federal interest plan). Aesthetics would experience short-term adverse impacts due to construction activities, though these impacts are not expected to substantially differ from other short-term construction-related activities that have occurred in the past. The long-term aesthetic impact may be beneficial, as habitat mitigation in the CV Area borrow site would partially restore the area's natural appearance. Adverse recreational impacts would be minor. Impacted recreational features in the CV area, which are generally concentrated in the western part of this area, would likely include the Katy Trail, the local golf course, community gardens, and practice baseball fields. The CFCA includes roughly 7 acres of sunflower fields managed for dove hunting, approximately 6 acres of which would be temporarily removed by borrow collection activities. This would result in a short-term recreational impact, though most of the CFCA would not be impacted. Sunflowers could be planted elsewhere to maintain this hunting opportunity in the long-term.

While it may be necessary to temporarily close or detour the Katy Trail during construction activities, the trail could resume normal operation after the federal interest plan was implemented. In the CFCA, ongoing land management practices could resume after borrow collection, including management of sunflower fields for dove hunting. Some features would experience long-term impacts, such as a partial reduction of the community gardens where the proposed levee alignment overlaps with their current placement. However, recreational features within the coverage of the setback levee constructed under the federal interest plan would benefit from enhanced flood risk reduction. These areas would be at less risk of damage and access to these areas would be more reliably maintained during high water events. Overall, the implementation of the federal interest plan would not be expected to substantially alter the character of the study area's recreational opportunities.

Traffic and Transportation

This section describes the possible impacts of the alternatives on traffic and transportation. This evaluation includes transportation by land, water, and air.

CA0 – No Action. CA0 would not directly impact traffic or transportation in the study area. However, the study area's flood risk would be left unaddressed. The study area would continue to experience flooding that could disrupt transportation. Roadways have been closed in response to previous floods, and the risk of future closures would continue under this alternative. Flooding also has the potential to impact Jefferson City Memorial Airport, such as by affecting the runway or by closing roads that are necessary to access the airport. Thus, CA0 has the potential to adversely impact traffic and transportation in the study area in the long-term.

CA11 – Nonstructural. None of the measures included in CA11 would impact traffic or transportation in the study area. The measures included in this alternative would not be applicable to transportation infrastructure. Traffic and transportation conditions under CA11 would generally be the same as under CA0.

CA13 – Hybrid Alignment, 41-ft Stage, Partial CV Removal (federal interest plan). Construction activities under the federal interest plan would likely result in short-term impacts on traffic. Some of the study area's roadways would need to be temporarily closed during construction of the levee to serve as access to

work areas, which would restrict the movement of traffic. However, because there are a variety of roadways present within the study area, construction would be phased so that alternative routes would be available and minimize the adverse impact to traffic. The federal interest plan would have the long-term benefit to transportation by providing an enhanced level of flood protection for the area it covers, which includes the local airport and several roadways. Water surface elevation modeling indicates that road closures in the Wears Creek floodplain would likely occur at about the same frequency under the federal interest plan. Detour routes would be comparable or improved in comparison to the FWOP conditions.

USACE does not anticipate that reconnecting part of the floodplain under the federal interest plan would result in a meaningfully increased risk of wildlife air strikes. While this reconnection would allow this part of the floodplain to be inundated more frequently, it would also drain faster because the levee would no longer be restricting the movement of water from the floodplain back into the river. While the few wetlands within the reconnected floodplain could potentially retain water relatively longer, the wetlands in this part of the floodplain are generally forested. Coordination between USACE and FAA has indicated that these forested wetlands are less attractive to particularly problematic species such as Canada geese (*Branta canadensis*), which prefer open areas like farmlands for easier foraging. Regardless, USACE would continue its coordination with FAA and MoDOT to ensure that this alternative would not decrease the safety of the airport. USACE would request a formal review for airspace considerations by FAA and MoDOT during the PED phase. Coordination between USACE and these agencies has identified no substantial concerns with the actions proposed under the federal interest plan, and any recommendations made for design changes to improve airport safety would most likely be minor (e.g., additional lighting for features near a runway). In summary, USACE does not anticipate that impacts to traffic and transportation would be substantial and the long-term effect would likely be beneficial.

4.2 MITIGATION, MONITORING, AND ADAPTIVE MANAGEMENT

The implementation of the federal interest plan would cause unavoidable impacts to approximately 28.4 acres of wooded wetland habitat and approximately 183.1 acres of primarily farmed emergent wetland habitat resulting in a combined habitat impact of 10.5 AAHUs (**Table 20**). In particular, the proposed levee alignment crosses over several likely wetland sites, which would be filled in, and additional wetland impacts would be incurred by borrow collection activities. To mitigate these impacts and maintain compliance with the Clean Water Act (CWA), USACE formulated an array of mitigation measures that would restore wetland and riparian habitat. Measures included mitigation credits purchased from credit banks or in-lieu fee programs, as well as on-site restoration of wetland habitat that the project sponsor would be responsible for managing in the long-term. USACE then combined these measures into mitigation alternatives and performed CE/ICA to compare and evaluate the cost effectiveness of these mitigation alternatives. Based on the results of this analysis, USACE concluded that the most cost-effective way of mitigating wetland impacts would be to purchase wetland mitigation credits. Credits would be purchased from a provider operating within the nearby Missouri River watershed, ensuring that the wetlands restored and managed by these mitigation services are representative of the wetlands that would be impacted by the federal interest plan. The habitat modeling and CE/ICA analysis are described in greater detail in **Appendix C1**. USACE would evaluate and identify which particular mitigation service would be most cost effective in the PED phase.

Based on the CE/ICA analysis, USACE also recommends on-site mitigation by converting 45.4 acres to natural floodplain forest habitat within the CV Area borrow site. This mitigation would be accomplished by allowing the site to naturally regenerate native tree species adapted to floodplain conditions, such as eastern cottonwood, silver maple, and American sycamore. Habitat modeling provided in **Appendix C1** has determined that while the federal interest plan would result in the net loss of 7.0 AAHUs of non-hydric riparian habitat in the absence of habitat mitigation, the regeneration of 45.4 acres of floodplain forest habitat would generate 20.5 AAHUs of non-hydric riparian habitat over the long-term. Thus, 13.5 AAHUs would contribute to the federal interest plan's EQ account (see **Section 5.2**). To facilitate the successful implementation of this recommendation, USACE drafted a monitoring and adaptive management plan for this habitat mitigation (see **Appendix C1**). This plan outlines the objectives, performance measures, success criteria, monitoring design, decision triggers, and adaptive management actions. Ecological success criteria would include tree survival and overall habitat structure. Monitoring for the excessive

establishment of invasive species would also be included. Contingency measures would include installing additional fencing to prevent herbivory, treatments for invasive species (e.g., pesticide application), and plantings of different species of native trees in the event some species fail to establish. This plan also details the duration of monitoring and adaptive management actions, data analysis and use, and the responsibilities of USACE and the project sponsor. Once all the ecological success criteria are achieved, the mitigation would be deemed successful, and the management of the site would transition to long-term management.

Any direct or indirect impacts on cultural resources would be addressed in the NHPA Programmatic Agreement now being developed between the USACE, Missouri SHPO, Tribal Nations, and the ACHP. A copy of the current draft of the Programmatic Agreement is included in **Appendix C1**.

5.0 Plan Comparison and Selection

5.1 PLAN COMPARISON

The PDT, in cooperation with the non-federal sponsor, determined the final array to be three alternatives. Descriptions of and risk and uncertainty related to the final array of alternatives is briefly described below. More information on residual risk can be found in **Appendix E**.

Combined Alternative 0 No Action

CA0 is the No Action Alternative (NAA). USACE planning policy (Engineering Regulation 1105-2-103) and NEPA require consideration of a NAA. The NAA is the basis for the FWOP Condition and assumes no measures would be implemented by the federal government to achieve the planning objectives. The NAA is the base condition to measure FWP alternatives.

The NAA would not meet the objective to reduce flood risk within the study area and economic damages caused by inundation of structures, agricultural lands, and impacts to the businesses and critical infrastructure would continue to occur. No action would result in continued, recurring flooding which causes major impacts to transportation, regional supply chains, and community cohesion. The existing non-federal levee, Capital View, would remain in its current condition performing at 17.0% AEP of overtopping. Risk from flooding remains in the area, and businesses, farmers, and residents will continue to incur damages because of recurrent flooding in the area. The NAA is shown in **Figure 11**.

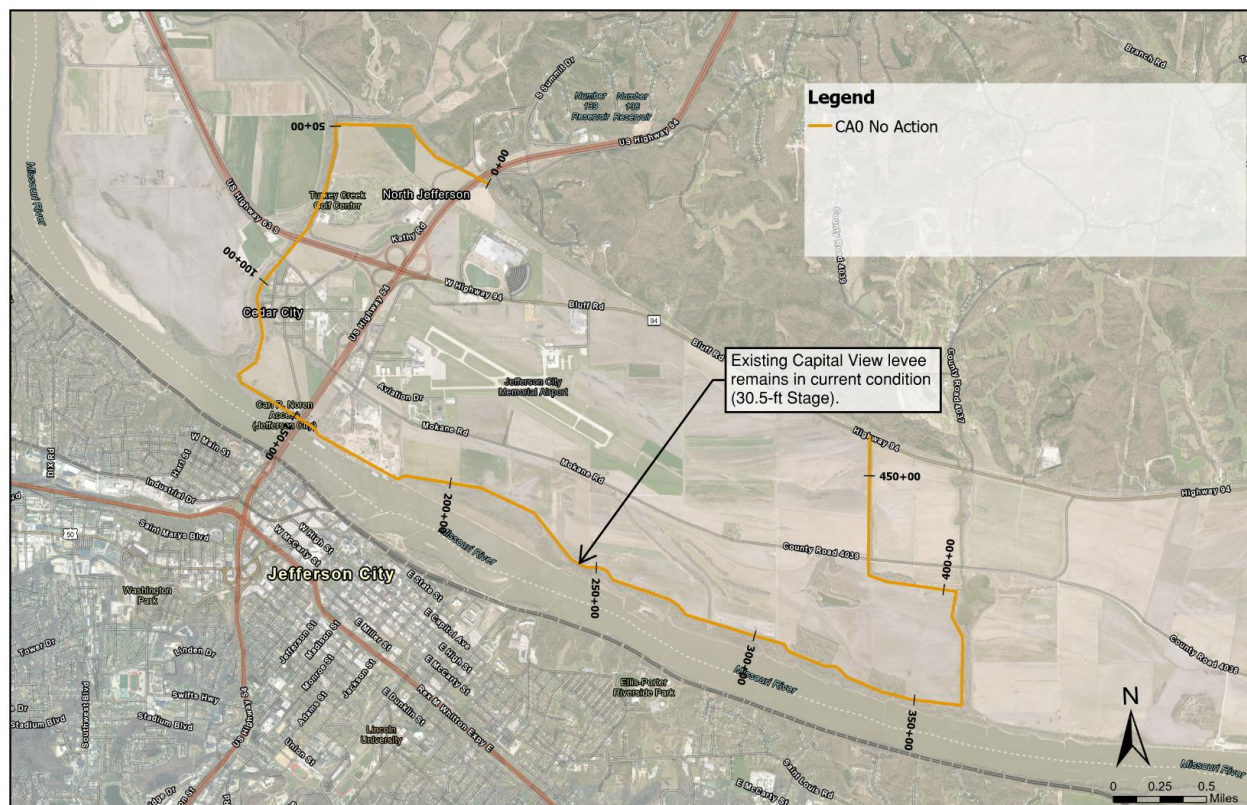


Figure 11. CA0 No Action

Combined Alternative 11 Nonstructural

CA11 is the nonstructural alternative carried forward for consideration, which includes elevating, dry floodproofing, wet floodproofing, and buyouts/relocations. Cost uncertainty exists with this alternative due

to a lack of parametric costs. The PDT aggregated the nonstructural measures by floodplain and occupancy type. Multiple iterations of a nonstructural plan were formulated but ultimately the PDT decided to formulate a nonstructural plan based on commercial and public service cohesion, identity, and resilience. This plan entails non-residential structures remaining in place and receiving elevation or floodproofing where applicable. Residential structures, along with outbuildings on the same parcel, would be elevated or bought out/relocated to reduce damages and life safety risk. It should be noted that a substantial effort was made after the historic Flood of 1993 to implement nonstructural measures within the FEMA mapped floodplain. This was undertaken by Jefferson City and resulted in hundreds of buyouts, relocations, updated zoning of the left-bank floodplain for development, and elevations of critical infrastructure. Therefore, there were limited structures remaining in the leveed area that would be eligible for nonstructural measures. Because of this effort and the limited structures, this alternative only partially met the objective of reducing flood damages and did not meet the objective of reducing flood risk. As such, remaining risks include recurring flooding and damages to property, structures, critical infrastructure, and transportation networks. **Figure 12** and **Table 21** detail the structures considered along with the measure identified for each.

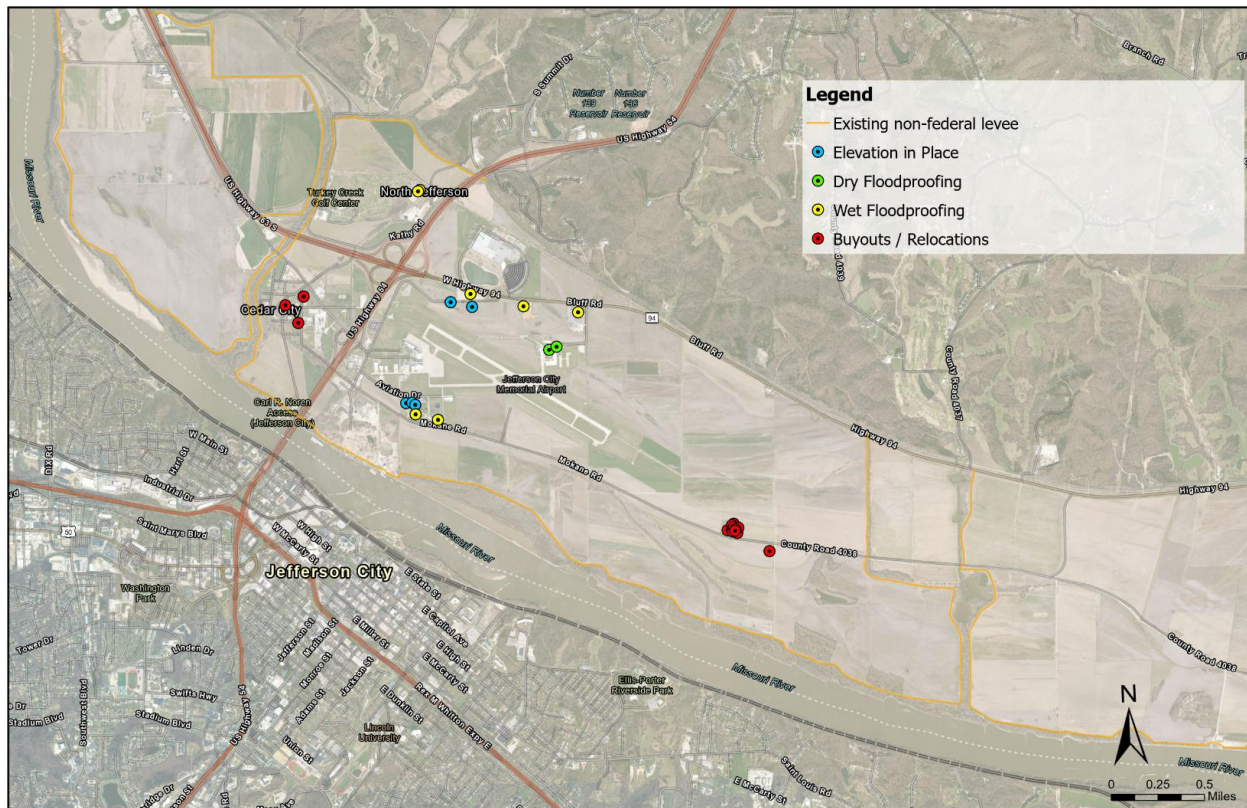


Figure 12. Nonstructural

Table 21. CA11 Nonstructural Measure Breakout

Total Structures Eligible in Plan	Structures Being Recommended for Elevation	Structures Being Recommended for Dry Floodproofing	Structures Being Recommended for Wet Floodproofing	Structures Being Recommended for Buyout/Relocation
28	5	2	7	14

Combined Alternative 13 Hybrid Alignment, 41-ft Stage, Partial Capital View Removal

The structural alternative carried forward for this project area is a federal levee system that was evaluated to have a 1% AEP of overtopping. The levee seeks to maximize public right-of-way and property for the levee footprint and protects access to critical infrastructure and the vital transportation corridor. The alignment of the levee was iterated multiple times by the PDT, local stakeholders, and the non-federal sponsor. The alignment is shown in Error! Reference source not found.. This alignment assumes the bright green segment of the existing CV Levee, west of U.S. Highway 54/U.S. Highway 63 is removed as part of the federal project. The existing levee in brown is not considered for any modification or removal as part of the federal project. Any remaining CV Levee would not be eligible for repair assistance under the P.L. 84-99 RIP. **Figure 13** shows the recommended alignment for CA13. CA13 met the study objectives of reducing flood risk and reducing flood damages, while not violating the constraint of avoiding bird strikes near the airport.

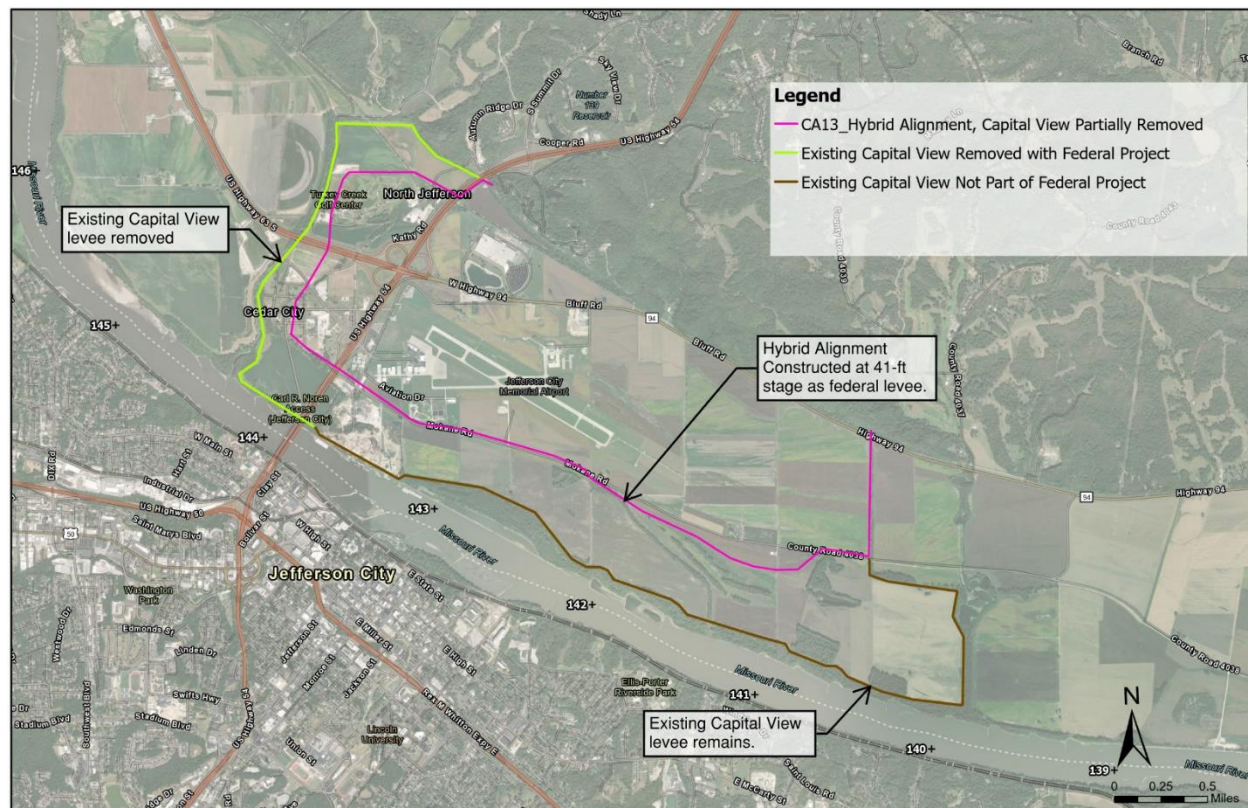


Figure 13. CA13 Hybrid Alignment, 41-ft Stage, Partial Capital View Removal

Once CA13 was identified as the most feasible structural alternative, an abbreviated flood risk assessment was performed by the PDT. Under CA13, the annual probability of failure by overtopping was lowered by 1.5 orders of magnitude compared to the existing CV Levee. The new CA13 levee would have a 1% AEP overtopping (1/100 year). The AEP for one foot of overtopping is approximately 0.2% AEP (1/500 year). That total Life-Safety Risk is driven primarily by overtopping, with all breaching prior to overtopping PFM (probable failure modes – i.e. erosion, foundation/embankment seepage and piping, slope stability, closure structure failure) plotting at least 1.5 orders of magnitude less than the overtopping PFM.

Life loss consequences are estimated to be between 0.3 and 3 under the overtopping PFM according to a LifeSim analysis. The leveed area is not densely populated, and evacuation routes are short, less than two miles. The Missouri River is a slow rising system that would allow days to weeks of advanced notice before a large-scale flood loaded the system. Based on the updated LifeSim modeling, estimated daytime

life loss is 3 and the nighttime incremental life loss is 0. The team determined the average annual life loss would be between 0.3 and 3, with an average annual life loss of 1. The risk of flooding is reduced, and residents and stakeholders would see greater certainty in levee performance and less damage within the leveed area. See **Appendix G** for more details.

The Economic and Environmental Principles and Guidelines (P&G) for Water and Related Land Resources Implementation Studies, dated 10 March 1983, established the P&G criteria used to evaluate water resources projects pursuant to the Water Resources Planning Act of 1965 (Public Law 89-8). The PDT used the P&G Criteria to evaluate the initial array of alternatives while additional engineering information was developed by various disciplines to inform decision-making. The P&G criteria are described below and summarized in Error! Reference source not found..

- **Completeness** - Completeness is the extent to which a given alternative plan provides and accounts for all necessary investments or other actions to ensure the realization of the planned effects. This may require relating the plan to other types of public or private plans if the other plans are crucial to realization of the contributions to the objective.
- **Effectiveness** - Effectiveness is the extent to which an alternative plan alleviates the specified problems and achieves the specified opportunities.
- **Efficiency** - Efficiency is the extent to which an alternative plan is the most cost-effective means of alleviating the specified problems and realizing the specified opportunities, consistent with protecting the Nation's environment.
- **Acceptability** - Acceptability is the workability and viability of the alternative plan with respect to acceptance by State and local entities and the public and compatibility with existing laws, regulations, and public policies.

Table 22. Results of P&G Criteria Assessment for the Final Alternatives Array

Alternative Plan	Completeness	Effectiveness	Efficiency	Acceptability
CA0: No Action	Yes	No	Yes	Yes
CA11: Nonstructural	Yes*	Yes (but less effective than CA13)	Partial	Yes
CA13: Hybrid Alignment	Yes	Yes	Yes	Yes

- **CA0, NAA** – CA0 is considered a complete and efficient alternative that accounts for all necessary investments for realization of the plan and would be efficient with no cost inputs. CA0 is not considered effective because the alternative would not address the FRM problems in the study area and would not provide FRM benefits beyond existing conditions. The alternative is acceptable relative to compliance with existing laws, regulations, and policies, but is not considered acceptable by the state, stakeholders, and the public due to the inability to address existing and future FRM problems in the study area. CA0 is carried forward as required to serve as a baseline for comparison with FWP alternatives to identify effects of proposed plans.
- **CA11, Nonstructural Alternative** – CA11 is considered complete without the need for additional inputs outside of the non-structural measures identified for elevations, wet/dry floodproofing, and buyouts/relocations. *However, if elevations, wet/dry floodproofing are not 100% voluntary, the plan may be considered incomplete or have less FWP FRM benefits. The plan is effective at reducing some of the FRM problems in the study area but would not address flood impacts for all of the study area as well as broader LoMo System Plan opportunities for increased conveyance and levee resilience. Relative to efficiency, CA11 has negative annual net benefits of \$-116,600 and a BCR of 0.8 (see Table 24 below), which indicates it is not as efficient compared to plans at or above normality. CA11 is considered compatible with existing laws, regulations, and public

policies. Eminent domain would be required for sponsor acquisition of buyouts/relocations that are not voluntary.

- CA13, Hybrid Alignment – CA13 is considered a complete plan without the need for additional outside investment. CA13 is the most effective and efficient relative to addressing the FRM problems within the study area with annual net benefits of \$3,739,000 and a BCR of 1.3 (see Table 24 below). This plan is also considered acceptable based on existing laws, regulations, and policies as well as with the non-federal sponsor, stakeholders, and the public.

Additionally, the PDT did one final comparison of the Final Array against the study's Objectives and Constraint. These are previously described in detail in Section 1.6. Results of this comparison are presented in Error! Reference source not found..

- As the NAA, CA0 would not meet any of the study objectives for improvements to existing flood and life safety risks associated with flooding as well as no improvements to LoMo System Plan flood conveyance and resilience objectives. This plan would not violate the study constraint or considerations. This plan would not achieve any of the FRM or LoMo System Plan objectives.
- With nonstructural measures, CA11 does reduce some flood risk within the study area but only for identified structures that have voluntary participation for elevations and wet/dry flood proofing. Identified buyouts/relocations would require voluntary participation and/or eminent domain to achieve flood and life safety risk benefits. CA11 would not meet LoMo System Plan objectives to increase Missouri River flood conveyance or increase system resilience for existing levee systems since it does not include any levee setbacks or changes to existing hydrology/hydraulics in the study area. This plan would not violate the study constraint or considerations. This plan would only partially achieve the FRM objectives of the study.
- Only CA13, Hybrid Alignment achieves all three study objectives to reduce flood and life safety risk as well as alignment with LoMo System Plan conveyance and resilience objectives. Setting-back a portion of the existing Capital View Levee would achieve system flood conveyance benefits while reducing flood risk in the study area. CA13 would not violate the constraint associated with increased bird strikes for the Jefferson City Memorial Airport by restoring proposed borrow sies to regenerated riparian corridor habitat. Also, CA13 would not violate the consideration for induced flooding with acquisition of 90% of the average fair market value for newly inundated areas and 5% of the average fair market value for areas that currently experience flooding. This is the only plan that achieves all the FRM and LoMo System Plan objectives.

Table 23. Results of Study Objectives for the Final Alternatives Array

Alternative Plan	Objective 1: Reduce Flood Risk	Objective 2: Reduce Life Safety Risk	Objective 3: System Plan	Constraint / Consideration Violation (Y/N)
CA0: No Action	No	No	No	No
CA11: Nonstructural	Yes	No	No, does not increase conveyance	No
CA13: Hybrid Alignment, 41-ft Stage, Partial Capital View Removal	Yes	Yes	Yes	No, with mitigation

The following describes the way the final array criteria were evaluated:

NED:

- Total Investment Cost.
- BCR.
- Net Annual Benefits in flood damages reduced and detour and delay costs reduced.

RED:

- Local Capture Regional Economic System (RECONS), or the economic impacts to the region resulting from the proposed construction of the federal interest plan.
- Allowing major employers to stay open and provide goods and services to the region, along with the employment benefits of those jobs.
- Agricultural Protection, specifically the average annual crop acreage inundated.

OSE:

- Life Safety.
- Adhering to Lower Missouri River System Plan goal of increased conveyance.
- Maintaining access to goods, services, and transportation networks for surrounding low-income communities.
- Reduced damage and better access during flood events to free outdoor recreational opportunities via the Katy Trail.

EQ:

- Net AAHUs from restored acres.
- Cultural Resources.

A more detailed discussion of the four accounts and the metrics and screening criteria utilized can be found in **Appendix E**.

Initially, the PDT conducted an economic comparison of the final array shown in Error! Reference source not found..

Table 24. Final Array Plan Economic Comparison

Alt	Total Project First Cost	Annual Economic Cost**	Annual Detour/Delay Benefits	Annual Flood Damage Reduction Benefits	Total Annual Benefits	Annual Net Benefits	BCR
CA0	\$0	\$0	\$0	\$0	\$0	0	0
CA11	\$12,335,900	\$513,800	\$0	\$397,200	\$397,200	\$-116,600	0.8
CA13	\$237,957,000	\$11,319,500	\$337,000	\$14,721,500	\$15,058,500	\$3,739,000	1.3

*All dollar amounts in Oct 2025 \$

**Economic Cost includes Interest During Construction and Annual OMRR&R

USACE feasibility planning is guided by the PR&G for Water and Land Related Resources Implementation Studies. The PR&G defines the Federal Objective of USACE project planning, which is to contribute to national economic development consistent with protecting the nation's environment,

pursuant to national environmental statutes, applicable executive orders, and other federal planning requirements. A wide range of alternatives were investigated and the alternative with the greatest net economic benefit was identified as the NED Plan. The alternative plan that reasonably maximizes net economic benefits consistent with protecting the nation's environment is defined as the NED plan, and in this study, CA13 is the NED Plan.

5.2 TOTAL NET BENEFITS EVALUATION

The final array was then considered across the four accounts (NED, RED, EQ, and OSE). The NED account displays changes in the economic value of the national output of goods and services. The EQ account displays non-monetary effects on significant natural and cultural resources. The RED account registers changes in the distribution of regional economic activity that result from each alternative plan. The OSE account registers plan effects from perspectives that are relevant to the planning process but are not reflected in the other three accounts.

National Economic Development

The intent of comparing alternative plans in terms of NED is to evaluate 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 are expressed as the plan's economic benefits, and the adverse NED effects are the investment opportunities lost by committing funds to the implementation of a plan. In this case, NED benefits are the reduction in flood risk achieved by expending NED costs to implement a project, and net benefits are the difference between these NED benefits and NED costs. The HEC-FDA model and the detour/delay spreadsheet model were utilized to estimate FWOP and FWP NED benefits for each alternative. These benefits were then compared to cost. Analysis included flood damages to buildings and contents, road damage, traffic detours and delays, vehicle damage, displacement, and cleanup. A breakdown of expected annual damages is shown in Error! Reference source not found., and additional details of the NED Account analysis can be found in **Appendix E**.

Table 25. Annual Damages in NED Account for FWOP Condition

	Detour/Delay Annual Damages	FDA Damages (structures, roads, vehicles, displacement, cleanup)	Total Annual Damages
Future Without Project	\$887	\$19,121	\$20,008

**Numbers in \$000s, Oct 2025 Price Level*

The NAA would not reduce these total annual damages. The Nonstructural Plan, CA11, would only reduce these damages to the 28 structures in the floodplain that would include a nonstructural measure. CA13 would benefit transportation systems, which are vulnerable to flooding, resulting in fewer delays and detours. These delays and detours are substantial, as there are not many places to cross the Missouri River, so it is not uncommon for detours to be 10-100 miles. It would also benefit the area with reductions in damage to structures, roads, vehicles, displacement of businesses and people, and the cleanup which must occur after a flood event. Therefore, CA13 has the greatest annual net benefits.

Environmental Quality

The EQ account is intended to indicate the long-term effects that the alternative plans may have on significant environmental resources. Significant environmental resources are defined by the Water Resources Council as those components of the ecological, cultural, and aesthetic environments which, if affected by the alternative plans, could have a material bearing on the decision-making process. Significance is derived from institutional, public, or technical recognition that a resource or an effect is significant. All alternatives were formulated to first avoid impacts on significant resources, particularly species and critical habitat protected by the ESA. If avoidance was not possible then minimization was

utilized to have the least impacts on regulated resources occurring in the system. Impacts on resources would continue to be considered, evaluated, and avoided or minimized to the extent possible.

In this study, the EQ benefits are greatly impacted by the land use that falls outside of the new leveed area. Much of this land is in private ownership and is currently in agricultural production. The conversion of private land into EQ lands would be a substantial issue for landowners, local stakeholders, and general public project support as well. Therefore, the PDT sought to maximize the EQ benefits that could be gained through publicly owned lands outside of the new leveed area. When looking at the final array of alternatives, the PDT determined that benefits to the environment are only gained through the federal interest plan. CA0 (No Action) and CA11 (Nonstructural) result in zero restored acres. The federal interest plan would restore approximately 250 acres of floodplain hydrology by removing part of the CV Levee, and approximately 45.4 acres of publicly owned land in this restored area would regenerate native floodplain forest habitat for mitigation. This area also has benefits of flood risk reduction, as it allows for conveyance of the Turkey Creek Tributary which is an issue during high water on the Missouri River. The total acreage of publicly owned land that could be used for mitigation within the CV Area exceeds the estimated acreage necessary for mitigating impacts to habitat overall. However, while the federal interest plan avoids and minimizes impacts to wetlands to the extent practicable, there would still be a net impact to 211.5 acres of wetland habitat resulting in the loss of 10.5 AAHUs. The FACWet model, which is a general ecological model for wetlands and riparian habitat, was used to determine the benefits and impacts in the EQ account (see **Appendix C1**). CE/ICA was performed to evaluate alternative actions to mitigate the net impacts to wetlands. The federal interest plan would include the purchase of wetland mitigation credits from a mitigation service operating within the study area's watershed (see **Section 4.2**). With these mitigation credits and the conversion of approximately 45.4 acres to floodplain habitat within the CV Area, the federal interest plan would generate a net lift of 13.5 AAHUs. This approach is detailed in **Appendix C1**. A map of the areas contributing to the EQ benefits is in **Figure 14**.

Cultural resources were also considered as part of the EQ account. As discussed in **Chapter 4**, the federal interest plan could have either positive or negative impacts on cultural resources. No known historic properties would be adversely impacted by the federal interest plan's measures. However, currently unknown or unrecorded historic properties could be affected by the levee setback and through borrow activity. Conversely, currently unknown sites could also be protected from flood damage. Cultural resource investigations would need to be conducted to determine whether unknown sites would be impacted or protected. Potential adverse impacts to cultural resources caused by the federal interest plan would be addressed in the NHPA Programmatic Agreement now being developed between USACE, Missouri SHPO, Tribal Nations, and the ACHP. Because adverse impacts would be addressed by this programmatic agreement and because USACE does not have the data to quantify any potential benefits, effects to cultural resources are considered negligible for the purposes of comprehensive benefits evaluation. Any unknown cultural resources identified during the design or construction phases would be coordinated with applicable resource agencies for eligibility and any required avoidance, minimization, or mitigation actions.

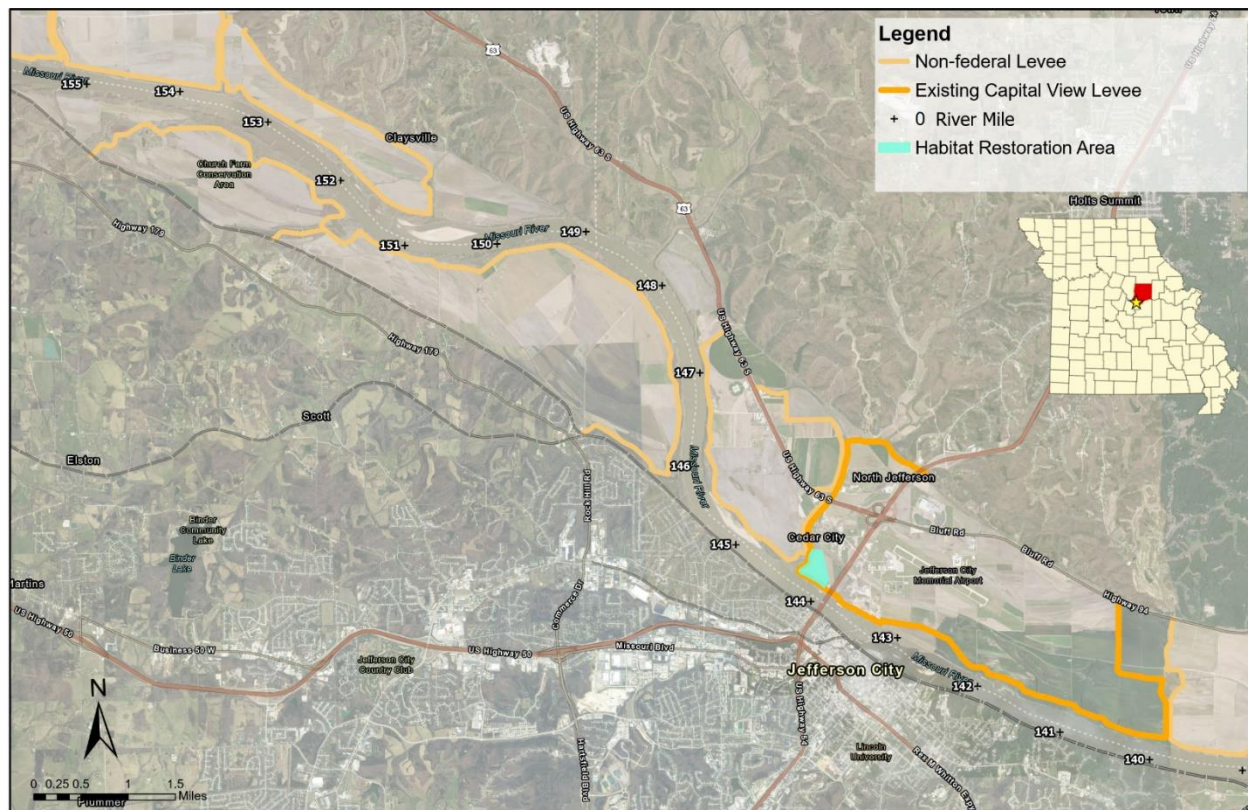


Figure 14. Potential Habitat Mitigation Areas

Regional Economic Development

The Regional Economic Development (RED) account is intended to illustrate the effects that proposed plans would have on regional economic activity, specifically regional income and regional employment. As described in **Appendix E**, the RED analysis considered three main components: allowing major regional employers to stay open and provide goods and services to the region, along with the employment benefits, agricultural protection (average annual crop acreage inundated), and potential beneficial effects of plan implementation as a function of construction and OMRR&R expenditures, which would accrue to businesses within the regional economy.

The CA0 No Action alternative would not reduce the risk of regional economic impacts from business disruption. CA11 (Nonstructural) would have minor beneficial effects for allowing major regional employers to stay open and provide goods and services to the region.

Regional income and employment are commonly applied measures of regional economic activity. The positive effects of a plan on regional employment are directly parallel to the positive effects on regional income. The primary types of positive regional impacts associated with the final alternatives involve short term employment and income gains associated with project construction. The RECONS model is utilized to analyze the economic impacts of project construction and OMRR&R expenditures. RECONS is a USACE-certified regional economic impact modeling tool that was developed to provide estimates of regional economic impacts associated with USACE spending. The model presents results at the regional level (typically a county or metropolitan statistical area), the state level (may include multiple states), and the national level.

Depending on the alternative, construction expenditures would support between 749 and 1,358 local jobs, provide between \$44,858,157 to \$81,276,424 in local labor income, and provide between \$53,482,981 to \$96,903,344 in local capture for the regional impact area. Model results are found in **Appendix E**. With

the largest construction cost, CA13 provides the greatest increase in RED benefits, including jobs and labor income.

Business interruption losses from flooding are substantial in the study area. CA13 is the alternative that provides the most benefits in these criteria. Hitachi Energy, an important employer of more than 1,200 employees, has gone to great lengths in previous flood events to continue operations. As a manufacturer of components of electric transmission systems, they were considered an essential business during COVID-19 pandemic lockdown restrictions. Their products and continued production are essential not only in the U.S., but in the global energy market. During the 2019 flood event, Hitachi Energy bused and then boated employees to work, requiring a substantial number of resources, additional costs, workplace stress, and adding to the commuting times of many employees. Additionally, their hourly employees are not paid when they cannot work, causing substantial strain to the surrounding community. A one-day closure costs at least \$192,000 per day in lost wages¹.

Other employers, such as the Jefferson City Memorial Airport and Capital Sand and Gravel also see substantial losses as businesses, and to the community during flood events. The airport was responsible for 250 direct and indirect jobs and \$21,849,000 (FY13 dollars) in economic output according to a study conducted by the MoDOT. In 2023, approximately 44,000 flights utilized the airport, including corporate flying, flight training, military exercises, air cargo, recreational flying, law enforcement operations, prisoner transports, government flights, and aerial inspections. The airport also provides critical emergency medical evacuation such as Angel Flight and Life Flight, as many in this community must utilize lifesaving medical care outside of Jefferson City.

Capital Sand is the largest producer of sand and gravel on the Missouri River, serving communities as far south as Springfield, Missouri, which is 140 miles away. Springfield is a substantial area of growth in Missouri, with an 11 percent population growth over the past 10 years². Its area of economic influence reaches 27 counties in Missouri and Arkansas and totals 1.1 million people. This growth requires the materials provided by Capital Sand. They provide nearly 1.2 million tons of production annually to the region. They also employ 34 people, with 32 of those being hourly employees. Like the Hitachi Energy employees, the inability to get to work means they are not paid, further burdening families in this community. Most employees live in the Jefferson City area, but some commute up to 1-hour in normal times, so flooding detours and delays cause even more stress and hardship on employees. Depending on the severity of future flooding, under FWOP conditions, some businesses may be forced to reduce employment, reduce (or not expand) operations, or even close permanently due to recurring losses and damages. CA13 substantially reduces flood risk and associated impacts for businesses in the study area under the FWP condition. Additional information on the RED account and comparison can be found in **Appendix E**.

Other Social Effects

The purpose of the OSE analysis is to show the beneficial and adverse effects of a flood-risk management alternative on the social wellbeing of the study area. The OSE account typically includes long-term community impacts in the areas of public facilities and services, recreational opportunities, transportation and traffic, and manmade and natural resources. The OSE account also integrates information into the planning process that is not reflected in the other three accounts used by USACE to evaluate projects and alternative plans.

Evaluation and comparison of alternatives in terms of OSE requires a qualitative and relative scoring of outputs by social factor and metric. There are a variety of potential social effects from flooding that if present in the study area under a given alternative, should be considered for assessment. Based on the measures included in each alternative and the PDT's assessment of the expected effects of the measures to OSE resources, the PDT assigned a score for each metric and alternative. Scoring used a 7-point scale from -3 to +3. Negative scores indicated adverse OSE impacts relative to the FWOP

¹ According to starting wage posted inside Hitachi Energy at \$20 per hour, 1,200 people, 8-hour shift.

² Springfield Demographic Profile, springfieldregion.com, updated 2023.

condition, and positive scores indicated beneficial OSE impacts relative to the FWOP condition. **Figure 15** below includes the scoring rubric.

Score	In Relation to the Without Project Alternative, the With Project Alternative Has ...
-3	Significant negative effects (showstopper)
-2	Moderate negative effects
-1	Minor negative effects
0	Negligible effects (no impact)
1	Minor beneficial effects
2	Moderate beneficial effects
3	Significant beneficial effects

Figure 15. Scoring Rubric (Source: USACE 201 3a)

The first OSE criteria considered life safety implications for all the alternatives in the final array. Non-breach LifeSim results were completed and assumed USACE design criteria to the future top of levee with negligible probability of a breach. LifeSim results for all alternatives were within the same order of magnitude. They all have maximum life loss results between 1 and 4. There are only four remaining homes in the Old Cedar City area that did not choose the buy-out option after the 1993 flood. The incremental risk of breach and non-breach analysis was run for CA13 as part of a risk assessment. Implementing CA13 (the only structural option in the final array) introduces no substantial incremental risk to life loss. The screening level risk assessment (SLRA) resulted in a Levee Safety Action Classification (LSAC) of 4/Low. Because the AEP of overtopping is at 1%, overtopping is the primary risk driver. The prior to overtopping average life loss is 0.1 and the overtopping average life loss is 0.08, resulting in an incremental life loss of less than one.

The other three OSE comparison criteria deal with connectivity, community cohesion, and System Plan adherence. One area of community connectivity and cohesion that is greatly impacted by flood events is the traffic network in the area. Major highways (U.S. Highway 54 and U.S. Highway 63/Missouri Route 94) in the area have very large detours when they are inundated. Traffic counts on these roadways are estimated at ~82,000 total vehicles per day. Failure of these systems, the inability to use them during the flood event, and the recovery and repair lengthening the time these roadways are closed causes additional, non-monetary impacts in the day-to-day lives of citizens not captured in the NED account. The community south of the river is not in the project area but also uses this critical infrastructure daily. The primary source of commuting and accessing public services such as healthcare, groceries, and other essential services in this area is by private vehicle. Employers in the area report that most of their employees utilize these transportation corridors to commute to work daily. A loss of these corridors would greatly diminish economic activity in the area. Flood damages to the transportation network alone in the area is estimated to be \$847,000 annually under the FWOP condition. CA13 reduces this damage to an estimated \$321,000 annually.

This community has also found a sense of identity in some of the businesses and services that are offered in the study area. The golf course and event center and the airport restaurant are locations that add to the quality of life in the broader community. They serve as gathering places, contribute to the local economy, provide recreational opportunities, and serve two economically disadvantaged communities. The Katy Trail is a nationally known outdoor recreation opportunity. All these benefits are severely damaged during flood events.

The System Plan study scope includes work with basin states, Tribes, stakeholders, other agencies, and the public to create a vision for a more flood risk resilient future for the Lower Missouri River. Resilience is being defined in the study as the ability to recover more quickly from flood events. This recovery includes increasing conveyance on the riverside of the levees, increasing level of performance of the levees, or providing features like riprap and designed overtopping to cause less catastrophic damage to the leveed area. As part of the study, Jefferson City L-142 was looked at under the Spin-off authority and considers localized solutions to the flooding problem. However, any local solution should fit within the conveyance goals and other measures considered for future system resilience. CA13 provides conveyance not only on the Missouri River but also provides the conveyance on the Turkey Creek tributary. The final array comparison using the four accounts is detailed in **Table 26** below.

Table 26. Final Array Comparison, Four Accounts

Combined Alternative	NED			RED			OSE			EQ	
	Total Project First Cost	Mean Annual BCR	Mean Net Annual Benefits (flood damages reduced + detour/delay costs reduced)	RED 1: Local Capture (RECONS)	RED 2: Allows major regional employers to stay open and provide goods and services to the region, along w/ employment	RED3: Agricultural Protection (average annual crop acreage inundated)	OSE 1: Life Safety (0.002 AEP Event Median Life Loss)	OSE 2: Adhering to LoMo System Plan Goals	OSE 3: Providing FRM benefits to communities by maintaining access to goods, services, transportation networks	EQ 1: Net AAHUs from restored acres	EQ 2: Cultural Resources
CA0	\$0	0	-	\$0	Businesses will still be prone to closures during flood events	287 acres inundated	0.3 – 3 life loss	No Change	0	0	No Impact
CA11	\$12.3 mil	0.8	-\$116,600	\$5.0 mil	Businesses will still be prone to closures during flood events	287 acres inundated	0.3 – 3 life loss	May alleviate some damage to structures, but not cost effective	No improvements to transportation arteries	0	No Impact
CA13	\$238.0 mil	1.3	\$3.7 mil	\$120.6 mil	Allows business to remain open during more frequent events	359 acres inundated (due to levee setback)	0.3 – 3 life loss	Implements one recommendation: Increases conveyance	Allows all residents, including two economically disadvantaged communities, access to major transportation arteries	13.5 net AAHUs	No Impact

*Oct 2025 Price Level.

The PDT determined that CA13 provides the most benefits and is therefore the Total Net Benefits Plan. Specifically,

- CA13 would result in \$15.1M damages reduced per year, substantially reducing community impacts.
- Two low-income communities (both within the study area and across the river in Jefferson City) would gain income stability when access to places of employment and goods and services are protected to a higher level.
- Access to jobs, transportation, and emergency care during flood events remains for a much longer period than previous levee performance.
- Community businesses, which employ thousands, are all currently at risk of becoming inoperable for extended periods of time due to flooding, putting employees at risk of losing jobs and/or income. These businesses and/or their access are included within the new federal leveed area:
 - Hitachi Energy employs over 1,200 people. Important regional manufacturer in energy sector.
 - Capital Sand & Gravel is largest producer of sand and gravel on the Missouri River, serving communities as far south as Springfield, Missouri.
 - 44,000 flights (takeoffs and landings) annually at the Jefferson City Memorial Airport with 250 jobs either directly or indirectly supported.
- Other vital services including Missouri National Guard Army Aviation Support Facility, which contributes to the military and national defense, and Jefferson City MFA AgriServices, an important resource for getting critical agricultural products to market, would gain substantial benefits in flood risk reduction.
- CA13 would contribute to community identity and cohesion by ensuring vital economic and communal centers remain accessible, including a restaurant, golf course and events center, and access to the nationally known Katy Trail. These are all important community gathering locations.
- The plan provides better opportunities to maintain infrastructure and quality of life during flood events and in the aftermath.
- CA13 would provide an increased level of performance for critical infrastructure such as the wastewater treatment plant, resulting in less clean-up costs for local governments.
- A higher level of levee performance would produce positive impacts to a strong regional economy as concerns of flooding is lessened.
- CA13 would improve the quality and quantity of natural habitat in the study area and is the only alternative to enhance hydrologic connectivity with the Missouri River.

5.3 IDENTIFICATION OF THE NATIONAL ECONOMIC DEVELOPMENT (NED) PLAN

NED Plan: Reasonably maximizes NED benefits.

CA13 is the NED Plan.

Nonstructural Plan: A primarily nonstructural alternative considered for FRM projects.

CA11 is the nonstructural plan.

Life Safety/Tolerable Risk Guidelines (TRG) Plan: An alternative that addresses life safety concerns and TRG1 and TRG4 (from PB 2019-04) for studies that involve existing or proposed dams and levees.

CA13 is the Life Safety Plan. See **Appendix G** for more detail.

Maximum Total Net Benefits Plan: The plan that maximizes total net benefits across all benefit categories.

CA13 is the Maximum Total Net Benefits Plan. It provides the most net benefits to the NED, RED, OSE, and EQ accounts. The net benefits in the NED account are positive, and the benefits realized in the other three accounts are gained at no additional cost, giving much more than any other plan.

Least Damaging Environmentally Practicable Alternative (LEDPA): Consistent with Section 404 of the CWA.

CA13 is the LEDPA Plan. USACE makes this determination based on the 404(b)(1) analysis provided in **Appendix C1**. CA0 would not be practicable because taking no action would fail to address the purpose and need of reducing life loss potential and economic damages from flooding. CA11 would not be practicable because it would fail to meet the purpose of reducing life loss potential and only partially meet the purpose of reducing flood damages because there are limited structures within the study area that would be eligible for the nonstructural measures. While CA13 would cause short-term adverse impacts that CA0 and CA11 do not, CA13 would also restore floodplain hydrology to some areas and regenerate floodplain habitat in part of the borrow area for mitigation. Habitat modeling indicates that this habitat regeneration would ultimately exceed the short-term impacts for overall habitat (i.e., riparian and wetland habitat) over the course of the 50-year period of analysis. The remaining net impacts to wetland habitat specifically have been avoided and minimized to the extent practicable but would require mitigation that would be achieved by the purchase of wetland mitigation credits from a mitigation service within the study area's watershed. With these impacts mitigated, CA13 would therefore be the LEDPA because it is the only alternative to cause beneficial effects in the long-term.

Locally Preferred Plan: If requested by the NFS, and not in one of the other listen plans in the guidance.

The NFS has not indicated support for a Locally Preferred Plan.

5.4 PLAN SELECTION

Support for CA13 as the TSP was confirmed by the city of Jefferson City, Missouri as the currently identified implementation sponsor after the draft report was reviewed and submitted.

After the TSP milestone, CA13 was refined and optimized as the federal interest plan for potential follow-on design and construction phases.

The city of Jefferson City, Missouri is currently identified as the non-federal sponsor for design, construction, and OMRR&R.

5.5 DEVIATIONS FROM THE NED PLAN

CA13 is identified as both the NED and federal interest plan. No USACE policy deviations or waiver submissions would be required for implementation of CA13 as the federal interest plan.

6.0 Recommended Plan

6.1 NO ACTION ALTERNATIVE

Coordination with the City of Jefferson City, Missouri as the implementation NFS has indicated that the City can acquire and hold title to land outside City jurisdictional boundaries, but the City lacks the power of eminent domain beyond its city limits. Therefore, the City is not capable of performing all NFS project implementation responsibilities. An additional NFS with authority to acquire all necessary interests in land beyond the City limits has not been identified. Due to the inability to provide necessary lands, easements, right of ways, and relocations (LERR) for the project, the Final Report and Integrated EA identify the No Action Alternative (CA0) as the Recommended Plan, despite federal interest in completing the project.

The remainder of this chapter discusses the federal interest plan (CA13) components, accomplishments, costs, requirements, and risks assuming a capable NFS is identified in the future for project implementation.

6.2 PLAN ACCOMPLISHMENTS

The federal interest plan is the structural alternative, CA13 (Hybrid Alignment, 41-ft Stage, Partial Capital View Removal), see **Figure 16**. This plan provides not only NED benefits, but also the most comprehensive benefits across all four accounts. The earthen levee embankment would encompass 2,100 acres of area including critical infrastructure, transportation networks, and existing leveed area as feasible for the engineered design. With an initial overtopping AEP of 1%, facilities located behind the federal levee would be able to withstand and recover from a much wider range of flood events than the existing CV Levee, which is currently at a 17% AEP of overtopping. The combination of a levee top elevation at the 1% AEP water surface elevation and the proposed setback, generally following the limits of the mapped floodway, minimizes overtopping of the proposed levee system for most historically frequent storms, while also minimizing impacts to water surface elevation for adjacent lands and the southern bank. A federal levee system would have the added benefit to stakeholders of being a predictable, engineered system designed and constructed to current design standards. The additional reliability would aid not only in flood preparation and ability to access the Capital Sand supplier during a flood event, but also resilience for major facilities including the airport, Missouri National Guard Army Aviation Support Facility, and wastewater treatment plant. The setback of the levee would not only improve conveyance for the Missouri River and Turkey Creek tributary but would also provide the potential for ecosystem habitat in areas where the existing levee is removed.

As part of the greater Lower Missouri River System, this alternative meets the consideration to plan for system conveyance and flood risk planning in the future by providing an offset from the bank of the Missouri River channel. This increased conveyance for the most frequently occurring overbank flows is needed system-wide, including the area around L-142 and Jefferson City.

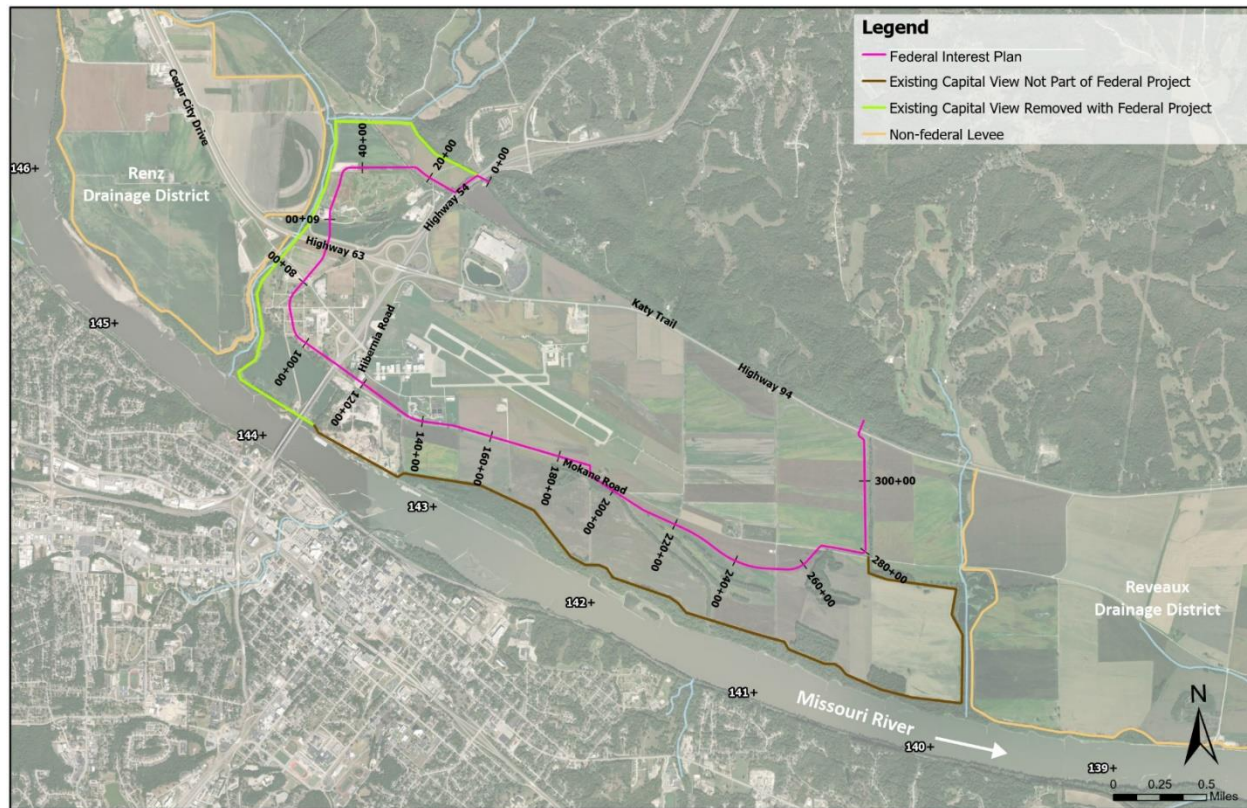


Figure 16. Federal Interest Plan – CA13

This federal interest plan provides benefits directly to vulnerable communities through flood risk reduction of critical infrastructure, transportation routes, employment opportunities, open space, and recreational benefits (notably the Katy Trail), and the protection of critical goods and services. These areas are all identified as 'low income' and would immediately benefit from the implementation of the federal interest plan.

6.3 PLAN STRUCTURAL COMPONENTS

The federal interest plan is comprised of a newly constructed levee from station 0+00 to 318+73 with a length of 30,723 feet (5.82 miles) of new earthen embankment. The average height of the embankment is 14.0 feet above ground surface. The embankment is zoned with impervious and random fill materials. The embankment would be a minimum of 10 feet wide surfaced with aggregate to allow for operation and maintenance of the project. Seepage analysis was performed, requiring the project to include approximately 18,500 linear feet of landside underseepage berms extending 150 feet from the landside levee toe with an average height of 3 feet. Underseepage berms are comprised of random material. Stability analysis was performed and would require construction of approximately 11,600 linear feet of landside stability berms, which extend 20 feet from the landside toe of the levee and have a minimum height of 3 feet. Stability berms are comprised of random material and are constructed to the same level of compaction as the levee embankment. The embankment and stability berms would be capped with 4 inches of topsoil and vegetated. The underseepage berms, where farmed, would be capped with 12 inches of topsoil and temporarily vegetated. Riverside armoring with riprap slope protection is required where high velocities pose a risk to embankment erosion. The riprap and bedding would be constructed along approximately 3,120 linear feet on part of the western reach facing the Missouri River. The existing CV Levee embankment and drainage pipes would be removed between Station 0+00 and 160+00. Approximately 11 new drainage structures would be constructed to maintain proper drainage within the protected area. Eight gateway structures will be constructed. It is estimated that three portable pumps are

necessary for interior drainage. Drainage features would be evaluated and potentially combined to efficiently drain the interior.

Borrow material to construct the features would be hauled in from Church Farm levee upstream and from adjacent properties. Borrow sources are not finalized but identified sources will provide enough material.

Up and over ramps would be installed to maintain access to properties and businesses along the project. Five closure structures would be necessary at the Katy Trail, Cedar City Drive, Hibernia Road, Highway 94 and Katy Trail.

A substantial number of utilities would be required to be relocated with the federal interest plan. The alignment would extend through well-developed areas and impact on a variety of utility services. Relocations would include waterlines, overhead electric lines and power poles, sanitary sewer force mains, sanitary sewer gravity mains, gas lines, telephone lines, fiber lines, storm drainage utilities, and communication lines.

The elements and features comprising the federal interest plan would be constructed together and are not considered separate elements.

6.4 COST ESTIMATE AND ECONOMICS

A detailed cost estimate for each site was developed using the USACE Micro-Computer Aided Cost Estimating System MII (MCACES 2nd generation) in accordance with guidance contained in ER 1110-2-1302, Civil Works Costs Engineering. In compliance with ER 1110-2-1302, a cost and schedule risk analysis (CSRA) was conducted on the initial array of alternatives.

The PDT, in collaboration with MoDNR, conducted a CSRA for the project to identify construction risk for project features. The purpose of this assessment was to establish a risk-based contingency for each alternative. Risks identified have an expected likelihood of occurrence and consequence (cost) should the risk come to fruition. Both cost increases and cost decreases are considered when evaluating the consequence. The risks are modeled using a Monte Carlo Simulation with likelihood and consequence taken into consideration. The result is a risk-based contingency at various confidence levels. The FY26 Project First Cost of \$291,000,000 includes a contingency of \$75,600,000 (26 percent) at an 80 percent confidence level for CA13. An 80 percent confidence level indicates the total project cost has an 80 percent chance the actual cost would be at or below the total cost-plus contingency.

The Fully Funded Total Project Cost is \$359,622,000. The Effective Price Level is FY33 Q2. The Fully Funded Cost is the estimate at the effective price level escalated to the midpoint of construction and/or design. The Fully Funded Cost is the estimate at the effective price level escalated to the midpoint of construction and/or design. The fully funded estimate includes construction costs (including costs associated with purchasing mitigation credits); Planning Engineering and Design (PED; including costs associated with adaptive management and monitoring), Construction Management (CM), (including Engineering During Construction (EDC) and Supervision and Administration (S&A) during construction); Land, Easements, Rights-of-Way, Relocations, and Disposal Areas (LERRDs); a risk derived contingency; and escalation from the price level date to the midpoints of design and construction.”.

The cost estimate for the federal interest plan is shown in **Table 27** and presents a breakdown of the estimated Project First Cost.

Table 27. Project First Costs for Federal Interest Plan, CA13

Cost Item	Cost (FY 2026) in \$1,000s
Construction Costs	\$178,500
Fish & Wildlife	\$1,100
Relocations	\$32,400

Cost Item	Cost (FY 2026) in \$1,000s
Planning, Engineering, and Design (PED)	\$27,700
Engineering During Construction, Supervision & Administration (EDC, S&A)	\$11,400
Real Estate (LERDs)	\$39,900
Total Project First Cost*	\$291,000

*Rounded FY26 Price Level

Additionally, after the federal interest plan was selected, slight changes were made to move the project toward 35 percent design maturity. The changes are related to engineering by nature but have a slight effect on the economics of the project. The changes are not substantial enough to change the federal interest plan, and any other alternative selected would go through a similar process.

The hydraulic model was refined based on information gained from further surveying. These refinements include earthwork estimates, utility impacts, closure structure development, interior drainage, and more. See **Appendix A1** for more detail on how the hydraulic model was refined.

The changes to the hydraulic model changed the hydraulic files that are imported into FDA, as well as the flow-frequency functions and stage-discharge functions. The changes are minimal, but do slightly change the economic benefits, which, with combined with changes to the project first cost estimate, change the federal interest plan annual net benefits and BCR. These changes are shown below in **Table 28**, expanding on **Table 27** above.

Table 28. Federal Interest Plan Economic Summary

Costs	CA13
Total Project First (Capital) Costs	\$290,935
IDC	\$46,297
Total Investment Costs	\$337,232
I&A Factor	0.040730275
Annualized Costs	\$13,736
Annual AM&M Costs	\$36
Annual OMRR&R Costs	\$156
Total Annual Costs	\$13,928
Mean Expected Annual Damages	\$4,872
Mean Expected Annual Damages Reduced	\$15,136
Mean BCR	1.09
Mean Annual Net Benefits	\$1,208

Oct 2025 Price Level; \$000s; Discrepancies in totals due to rounding.

6.5 LANDS, EASEMENTS, RIGHTS-OF-WAY, RELOCATIONS, AND DISPOSAL AREAS (LERRDS)

For the Federal Interest Plan, the non-federal sponsor is required to provide any LERRDs necessary for project construction and OMRR&R. A Real Estate Cost Estimate has been completed by a Certified General Review Appraiser. It includes the real estate acquisition values for the affected lands in Fee for mitigation, Fee for billboard sites, permanent easements for levee and roads, temporary work area easements for construction staging, and one business relocation under PL 91-646. Administrative costs associated with the land acquisition have been included in the overall LERRD cost. The total LERRD value and acreage amounts are detailed in **Appendix D – Real Estate Plan**.

A preliminary cost estimate for the real estate necessary to mitigate the induced flooding is \$15,199,900 this includes 90 percent of the average fair market value for newly inundated areas and 5 percent of the average fair market value for areas that currently experience flooding. The total real estate, including the

project footprint, is \$72,213,876, which includes land costs, NFS incidentals, and utility relocations. Additional funds to acquire the necessary real estate are estimated at \$3,937,500 for Federal real estate administrative oversight. Because the damages extend beyond the jurisdictional extent of the non-Federal sponsor, agreements with nearby municipalities and county jurisdictions would be required to implement the project. Further refinement of real estate requirements will be continued in the PED phase, as plans are refined and advanced further.

6.6 OPERATIONS, MAINTENANCE, REPAIR, REPLACEMENT, AND REHABILITATION (OMRR&R)

An Operation and Maintenance Manual would be developed by USACE at the completion of construction and all operation and maintenance responsibilities would be transferred to the non-federal sponsor in perpetuity after completion of construction. Once the project is turned over, the non-federal sponsor is fully responsible for all OMRR&R costs of the project in accordance with the OMRR&R Manual and 33 C.F.R. § 208.10 and ER 1110-2-401. Some repairs may be eligible for federal assistance under the USACE Rehabilitation and Inspection Program. The non-federal sponsor should reserve enough funding to complete routine operations and maintenance activities as well as plan for long term rehabilitation and replacement. Routine O&M activities the sponsor would need to perform on this project include, but are not limited to mowing, removal of unwanted vegetation, animal control, minor slope repair, crown repair, gate maintenance and operation, pipe inspections and cleaning, relief well testing and cleaning, and emergency planning. Non-routine O&M items, also referred to as RR&R, would include major slide or slope repairs, lining or replacement of drainage pipes and relief wells, gatewell repairs, gate replacements, and riprap replacement. Flood fight activities would include levee patrols, sandbagging, and ringing of sand boils.

The USACE Levee Cost Estimating Tool was used to estimate the OMRR&R cost for each alternative. This tool gives a broad range of costs to help sponsors estimate costs needed for common levee related activities. The tool gives a high and low range for Average Yearly Costs that includes routine O&M, non-routine RR&R, and flood fight activities. For all alternatives the lowest number was used as it was the most appropriate based on knowledge of what local levee districts typically spend each year on maintenance. The Average Yearly Cost for OMRR&R of the federal interest plan was estimated to be \$195,160. Of this number, \$97,730 was estimated for routine O&M, \$29,430 is estimate for non-routine RR&R and \$29,010 for flood fighting.

6.7 PROJECT RISKS

Risk and uncertainty are inherent in water resources planning and design. These factors arise due to errors in measurement and from the innate variability of complex physical, social, and economic situations. The measured or estimated values of key planning and design variables are rarely known with certainty and can take on a range of possible values. Risks identified during the planning process are documented and managed through a project risk register that is used by the PDT throughout the project life. Risk-based analysis allows the issues of risk and uncertainty to be included in project formulation.

All risks are recorded in the Risk Register. Those identified as High risk are detailed below:

1. **Public Input and Consensus:** The study area contains vocal stakeholders, large private landownership, and varying stakeholder expectations associated with past project, right bank, and prior litigation.

Description and Potential Impacts: The study NFS, MoDNR, has indicated that they will only support a plan with full consensus from all affected landowners. Outreach has continued with the selection of the federal interest plan. Additional coordination relative to NFS sponsorship and land acquisition will be required to get to the next stage of implementation. The City of Jefferson City has agreed to be the NFS for project implementation including design, construction and OMRR&R cost-sharing requirements. However, coordination with the City has indicated that they

do not have imminent domain and condemnation authority outside of their jurisdictional boundaries to acquire necessary project lands if necessary. Therefore, the City is not capable of performing all NFS project implementation responsibilities. An additional NFS with authority to acquire necessary project lands has not been identified. Any future changes to the federal interest plan or the inability to identify a capable implementation sponsor could result in potential project schedule delays, increased project costs, delayed completion of project phases, and/or project termination.

Risk Management Recommendation: Conduct initial sponsor and outreach events, clear communication of project location and scope, tie modeling back into the system plan model, increase the real estate effort due to large private land ownership and continue to work with study partners and stakeholders for identification of a capable implementation NFS.

2. **Borrow Locations:** Local landowners struggled to identify local borrow sources within close proximity of the project. Borrow locations must also limit air strikes at the airport and need to be coordinated.

Description and Potential Impacts: The study area is a frequent site for borrow due to levee repairs and flood fight efforts over the past 30 years. Local landowners have indicated they do not believe there is enough borrow material available within the leveed area to build a new levee system. Additionally, borrow locations must be constructed in a way that do not allow water to pond, attracting birds near the airport runway. One of the currently assumed borrow locations (CFCA) is approximately sixteen miles from the project, which increases haul costs.

Risk Management Recommendation: Continue to encourage sponsor to coordinate with local landowners for borrow, and coordinate with FAA on borrow location designs within the airport radius. Look for borrow sources on publicly owned lands. Account for current borrow location haul distance and potential for project schedule and cost impacts.

3. **Real Estate Uncertainty Regarding Induced Flooding Impacts:**

Description and Potential Impacts: Impacts to schedule could lower the ability of the Chiefs Report to be authorized in the Water Resources Development Act expected in 2026. Considering induced flooding impacts, analyses, and results could result in changes to required real estate, federal interest plan costs, and delays to the project schedule.

Risk Management Recommendation: The PDT has prepared a non-standard estate for specific impacts on property and remains engaged with the vertical team as policy changes are implemented at an enterprise level. The PDT will continue to coordinate with the USACE vertical team, USACE HQ, the non-federal sponsor, and required PDT disciplines related to induced flooding. The PDT will proactively respond to any future policy changes and direction at the enterprise level.

6.7.1 RESIDUAL RISK

Although it might be desirable if a flood-risk management project could eliminate the consequences of flooding to property and people, the simple fact is that no project that conceivably could be constructed would successfully contain every possible flood. Significant flood risk will continue if the Jefferson City project is implemented. Most importantly, implementing CA13 (the only structural option in the final array) introduces no significant incremental risk to life loss. The screening level risk assessment (SLRA) resulted

in a Levee Safety Action Classification (LSAC) of 4/Low. Because the AEP of overtopping is based on the 0.01 AEP event, overtopping is the primary risk driver. The average life loss prior to over topping is 0.1 and the overtopping average life loss is 0.08, resulting in an incremental life loss of less than one. Additionally, CA13 meets the Tolerable Risk Guidelines per Planning Bulletin 2019-04. Please see Section 7 of Appendix A1.4 and Section 7.2 of **Appendix E** for additional details on residual risk, and **Appendix G** for more detail on the levee Risk Assessment.

6.7.2 CLIMATE ADAPTION

The federal interest plan is adaptable to residual risk due to projected changes in hydrology due to design elements incorporated into the overall preliminary design. As described in the Existing and FWOP condition discussion, flow frequencies are assumed to be stationary for the 50-year period of analysis. The federal interest plan reduces the likelihood of levee breach for the leveed area due to the addition of a federal levee system designed to EM 1110-2-1913, replacing the current non-federal levee unit for much of the study area. Additionally, managed overtopping is incorporated into the design per ECB 2019-8 to ensure a predictable location of overtopping, even as overtopping frequencies could vary in the future. The top of levee design is based on a design flow, not a frequency target, and incorporated 1-foot on average of additional height to account for uncertainty. Finally, riprap was incorporated at the upstream tieback of the levee to protect the embankment from varying velocities due to the hydraulic constriction of the Missouri River bridge as a precautionary measure developed from past performance of similar river constrictions. All of these design decisions create an effective, efficient system that is adaptable for future hydrometeorological changes. The local sponsor is aware of climatic risks along the Missouri River through the study area. The proposed federal interest plan would be part of the federal levee program and eligible for P.L. 84-99, which ensures periodic evaluation of levee conditions and performance.

6.8 COST SHARING

The cost of the feasibility phase is shared (50/50) with the NFS pursuant to the terms of the FCSA executed by the USACE Kansas City District Commander and MoDNR on 28 November 2022. The cost share for the PED phase and the construction phase would be included in the Project Partnership Agreement (PPA) and is expected to be 65/35 federal/non-federal. The city of Jefferson City, Missouri is currently identified as the cost share sponsor for project implementation but a new or additional NFS would likely be required due to current issues with land acquisition capabilities of the City of Jefferson City, Missouri. Estimated cost shares based on project first costs are included in **Table 29** below.

Table 29. Breakout of Study Cost Sharing & CA13 Implementation

WBS Cost Item	Federal Share	Non-Federal Share	Total
01 Lands & Damages	\$0 (0%)	\$39,900,000 (100%)	\$39,900,000
02 Relocations	\$0 (0%)	\$32,400,000 (100%)	\$32,400,000
06 Fish & Wildlife Facilities	\$715,000 (65%)	\$385,000 (35%)	\$1,100,000
11 Levees & Floodwalls	\$164,220,000 (92%)	\$14,280,000 (8%)	\$178,500,000
30 PED	\$18,005,000 (65%)	\$9,695,000 (35%)	\$27,700,000
31 S&A	\$7,410,000 (65%)	\$3,990,000 (35%)	\$11,400,000
Total First Cost Shares*	\$189,150,000 (65%)	\$101,850,000 (35%)	\$291,000,000
Total Cost Share Percentages	65%	35%	100%

6.9 DESIGN AND CONSTRUCTION

The federal interest plan is not comprised of separable elements and therefore it is assumed that the project will be completed as a whole, assuring temporary flood protection as necessary. Following authorization of the Chief's Report in WRDA 2026, the Design Phase is anticipated to commence in Q2 of FY27 and be completed within two years. Duration of construction is expected to be six years, beginning in FY30, assuming a typical construction crew works 8 hours per day 5 days per week. Additional details on design and implementation are discussed in **Appendix B**.

6.10 ENVIRONMENTAL COMMITMENTS

The implementation of the federal interest plan would result in a variety of environmental commitments. To comply with the Clean Water Act, a Section 401 Water Quality Certification and NPDES permit would need to be acquired prior to project implementation. These permits would outline further commitments such as BMPs that would need to be used. Such practices would likely include silt fencing around construction activities to minimize siltation.

Mitigation would be needed for unavoidable impacts to wetlands within the study area. CE/ICA determined the most cost-effective way to mitigate these impacts would be to purchase wetland mitigation credits from a mitigation service, such as a credit bank or an in-lieu fee program (see **Appendix C1**). Credits would be purchased from a provider operating within the nearby Missouri River watershed, ensuring that the wetlands restored and managed by these mitigation services are representative of the wetlands that would be impacted by the federal interest plan. USACE would evaluate and identify which mitigation service would be most cost effective in PED phase.

Based on the CE/ICA results, USACE also recommends on-site conversion of 45.4 acres to natural floodplain forest habitat within the CV Area borrow site for mitigation. This mitigation would be accomplished by allowing the site to naturally regenerate native tree species adapted to floodplain conditions, such as eastern cottonwood, silver maple, and American sycamore. To facilitate the successful implementation of this recommendation, USACE drafted a monitoring and adaptive management plan for this habitat mitigation (see **Appendix C1**). Monitoring for the excessive establishment of invasive species would also be included. Contingency measures would include installing additional fencing to prevent herbivory, treatments for invasive species (e.g., pesticide application), and plantings of different species of native trees in the event some species fail to establish. This plan also details the duration of monitoring and adaptive management actions, data analysis and use, and the responsibilities of USACE and the project sponsor. Once all the ecological success criteria are achieved, the mitigation would be deemed successful, and the management of the site would transition to long-term management.

To avoid impacts to federally listed tree roosting bats or federally protected migratory bird species, tree removal activities would need to abide by seasonal restrictions to avoid incidental take. The planning aid letters developed by USFWS make a number of recommendations that USACE would follow to the extent practicable. Design implementation would require coordination with MoDOT to ensure that construction activities were scheduled so that alternative routes would be available for any potential road closures that would need to occur.

6.11 PROJECT-SPECIFIC CONSIDERATIONS

No project-specific considerations are known at this time.

6.12 ENVIRONMENTAL OPERATING PRINCIPLES (EOP)

The implementation of the federal interest plan would meet the USACE Environmental Operating Principles. Achievement of these principles is described in **Table 30**.

Table 30. Environmental Operating Principles

Environmental Operating Principle	Achievement of Principle
Foster sustainability as a way of life throughout the organization.	The federal interest plan would represent a more sustainable future for the study area by using a levee setback design that is more compatible with natural floodplain functioning.
Proactively consider environmental consequences of all USACE activities and act accordingly.	USACE has analyzed the federal interest plan for the potential environmental consequences of its implementation and acted accordingly. USACE has coordinated with agencies such as USFWS and FAA to ensure that potential environmental impacts are identified.
Create mutually supporting economic and environmentally sustainable solutions.	The federal interest plan is economically sustainable by reducing the cost of flood damages. The federal interest plan is environmentally sustainable because it would restore some of the lost hydrological functioning to the floodplain.
Continue to meet our corporate responsibility and accountability under the law for activities undertaken by USACE, which may impact human and natural environments.	USACE has endeavored to meet our corporate responsibility and accountability by remaining in compliance with the law and USACE policy.
Consider the environment in employing risk management and systems approach throughout the life cycles of projects and programs.	USACE has used a risk management and systems approach throughout the feasibility study. This has included environmental considerations, such as potential backwater effects associated with the federal interest plan and other structural measures.
Leverage scientific, economic, and social knowledge to understand the environmental context and effects of USACE actions in a collaborative manner.	USACE has leverage scientific, economic, and social knowledge in the formulation of the federal interest plan. USACE has worked with agencies, local organizations, and knowledgeable individuals to collaboratively understand the environmental context and effects that the federal interest plan would be expected to have.
Employ an open, transparent process that respects views of individuals and groups interested in USACE activities.	USACE has employed an open and transparent process throughout the feasibility study by offering numerous opportunities to learn about the study and comment on it. Four public scoping meetings were held, and all individuals and groups interested in the study were invited to ask questions and provide comments.

6.13 VIEWS OF THE NON-FEDERAL SPONSOR

The feasibility study NFS, MoDNR, and the implementation sponsor, City of Jefferson City, Missouri both support the federal interest plan but as previously identified, the City cannot utilize eminent domain and condemnation for the acquisition of project lands if necessary. A letter of intent to participate in and in support of the federal interest plan has been received from Jefferson City.

6.14 FEMA FLOODPLAIN CONSIDERATIONS

Jefferson City is an existing participant in FEMA's NFIP and actively manages the floodplain. The development of the CA13 alignment and profile included incorporating levee setbacks to optimize levee height, incorporate critical infrastructure into the leveed area, and minimize changes to the BFE. Construction of the CA13 alignment would require a Conditional Letter of Map Revision (CLOMR) to document changes in floodplain hydraulics and BFE through the project area. Mitigation to any impacted structures due to changes in BFE will also be incorporated with selected plan design. The CA13 levee would not meet FEMA accreditation standards, due to height, and the leveed area would not be removed from the FEMA mapped floodplain. The floodplain management plan currently adopted by the city is likely sufficient for continued implementation if CA13 were to be constructed. In coordination with further design of the federal interest plan, the existing floodplain management plan would be reviewed by the non-federal partner to ensure compatibility.

7.0 Environmental Compliance

7.1 ENVIRONMENTAL COMPLIANCE

The below environmental compliance **Table 31** provides the status of federal laws or EOs relative to compliance with NEPA.

Table 31. Environmental Compliance Status

Federal Law or Executive Order	Compliance*
Archeological Resources Protection Act, 16 U.S.C. 470aa, et seq.	Full Compliance
Bald and Golden Eagle Protection Act, 16 U.S.C. 668-668d	Full Compliance
Clean Air Act, as amended, 42 U.S. C. 7401 et seq.	Full Compliance
Clean Water Act (Federal Water Pollution Control Act), 33 U.S.C. 1251, et seq.	Full Compliance
Coastal Zone Management Act, 16 U.S.C. 1451, et seq.	Not Applicable
Endangered Species Act, 16 U.S.C. 1531, et seq.	Full Compliance
Estuary Protection Act, 16 U.S.C. 1221, et seq.	Not Applicable
Farmland Protection Policy Act, 7 U.S.C. 4201, et. seq.	Full Compliance
Federal Water Project Recreation Act, 16 U.S.C. 460/-12, et seq.	Full Compliance
Fish and Wildlife Coordination Act, 16 U.S.C. 661, et seq.	Full Compliance
Floodplain Management (Executive Order 11988)	Full Compliance
Invasive Species (Executive Order 13122)	Full Compliance
Land and Water Conservation Fund Act, 54 200302, et seq.	Not Applicable
Marine Protection Research and Sanctuary Act, 33 U.S.C. 1401, et seq.	Not Applicable
Migratory Bird Treaty Act, as amended, 16 U.S.C. 703-712	Full Compliance
National Environmental Policy Act, 42 U.S.C. 4321, et seq.	Full Compliance
National Historic Preservation Act, as amended, 54 U.S.C. 300101, et seq.	Full Compliance
Protection & Enhancement of the Cultural Environment (Executive Order 11593)	Full Compliance
Protection of Wetlands (Executive Order 11990)	Full Compliance
Section 10 of the Rivers and Harbors Act of 1899, 33 U.S.C. 403	Full Compliance
Watershed Protection and Flood Prevention Act, 16 U.S.C. 1001, et seq.	Full Compliance
Wild and Scenic River Act, 16 U.S.C. 1271, et seq.	Not Applicable

***NOTES:**

Not applicable. No requirements for the statute required: compliance with the current stage of planning.

Full compliance. Having met all requirements of the statute for the current stage of planning (either preauthorization or post authorization).

In-Progress. Not having met some of the requirements to be in full compliance but anticipated to be in full compliance upon final state of planning.

Noncompliance. Violation of a requirement of the statute.

CLEAN WATER ACT (CWA)

The federal interest plan would cause unavoidable impacts to wetlands that would need to be mitigated to comply with the CWA. USACE formulated an array of mitigation alternatives that could mitigate these impacts and CE/ICA determined that the purchase of wetland credits from a mitigation service operating within the local Missouri River watershed would be the most cost-effective way of mitigating these impacts. USACE would evaluate and identify which specific kind of mitigation service (e.g., credit bank, in-lieu fee program) would be most cost-effective in PED phase. In addition, USACE would need to acquire a water quality certification and NPDES permit issued by MoDNR. USACE would acquire these permits prior to start of construction activities. In a letter dated 15 September 2025, MoDNR concurred with USACE that there are no foreseen water quality issues that would arise from this project (see **Appendix F**).

NATIONAL HISTORIC PRESERVATION ACT (NHPA)

The federal interest plan would need to be evaluated using the process laid out in the NHPA programmatic agreement being developed for the Study. The programmatic agreement process would be followed to determine if there are historic properties within the areas of potential effect for these alternatives, the determination of effects to these properties, and treatment or avoidance measures as appropriate.

ENDANGERED SPECIES ACT (ESA)

The federal interest plan would remove habitat suitable for federally listed bats and protected migratory bird species. There would be season restrictions on the timing of these activities and coordination of the anticipated effects on these species with USFWS. Because of these restrictions, USFWS concurred with USACE's determination of a "may affect, but not likely to adversely affect" determination for Indiana bat and northern long-eared bat in an email dated 4 June 2025. USFWS stated a "not likely to jeopardize the continued existence of the species" determination is appropriate at this time for the tricolored bat and monarch butterfly, which are currently proposed for listing. USFWS recommends that USACE reinstate consultation if the final listing for these species happens before the completion of the project. No impacts to pallid sturgeon, gray bat, or western regal fritillary are anticipated because there would not be meaningful impacts to the habitat for these species.

FISH AND WILDLIFE COORDINATION ACT (FWCA)

Pursuant to the Fish and Wildlife Coordination Act, USFWS has produced two planning aid letters for the Lower Missouri River System Plan study that are also applicable to the Jefferson City study. These letters are provided in **Appendix F**. In summary, these letters encourage the use of nature-based features and the expansion of the riparian corridor by creating terrestrial habitat. The federal interest plan would use recommendations made in these planning aid letters to the extent feasible, such as by hydrologically restoring part of the floodplain. USFWS is also producing a coordination act report for the Lower Missouri River System Plan study.

USFWS also provided comments specific to the Jefferson City study. These recommendations are provided in full in **Appendix F** and are summarized here. Regarding borrow sites, USFWS recommends taking fill from existing decommissioned levees where possible and otherwise borrowing dirt from areas close to the river to facilitate better aquatic connectivity for the Missouri River. USFWS recommends to gently slope the sides of borrow pits to reduce erosion and support a wider diversity of plant species. USFWS recommends positioning borrow areas to expand habitat to areas currently lacking in diverse structure and distributing borrow locations to allow for habitat mosaics. Regarding riparian forests, USFWS recommends leaving existing habitat intact, expanding it with plantings, and planting native species suitable for site soils. USFWS recommends planting native milkweed species. Regarding vegetation management, USFWS recommends avoiding overuse of herbicides and insecticides, avoiding mowing and herbicide use during time periods when monarch eggs and caterpillars are present, and

adopting burning practices that promote beneficial plants. USACE would implement these recommendations and the recommendations made at the level of the Lower Missouri River System Plan study where feasible and appropriate.

7.2 PUBLIC INVOLVEMENT

Six public scoping meetings were held during the development of this feasibility report in May 2023, November 2023, February 2024, April 2024, September 2024, and January 2025. These public meetings were all held in MoDNR offices located within Jefferson City, Missouri. These meetings were attended by representatives of USACE, the CV Drainage District, Jefferson City, resource agencies, and businesses. Local landowners and other interested members of the public also attended these meetings.

AGENCY COORDINATION

Coordination with the USFWS, EPA, FEMA, FAA, Missouri NRCS, MoDNR, MDC, and MoDOT occurred throughout this phase of the project. Agency coordination was initiated with these organizations with scoping letters. Two interagency meetings on 22 March 2023 and 23 March 2023 were held to brief these agencies on the study setting, key considerations, and its place within the broader Lower Missouri River System Plan. Agency representatives have also participated in the public scoping meetings.

One-on-one coordination with agencies also occurred to discuss particular topics. Meetings occurred with FAA, MoDOT, and representatives of the airport to discuss potential air hazard risks associated with project activities (e.g., wildlife strikes), which could result from changes to the local land use. Discussions with FAA occurred regarding how habitat regeneration could be done in the vicinity of the airport without causing a substantial change in wildlife strike risk. Coordination with FAA determined that the federal interest plan would require formal notice and review for airspace consideration under 14 CFR Part 77, Safe, Efficient Use, and Preservation of the Navigable Airspace. FAA recommends a 120-day notification for this review. This notification and review would occur during PED phase, prior to any project implementation activities.

USACE coordinated with USFWS and MDC pursuant to Fish and Wildlife Coordination Act (FWCA). USFWS has produced two planning aid letters for the Lower Missouri River System Plan study that are also applicable to the Jefferson City study. USFWS provided comments specific to the Jefferson City study during the public review period of the draft report. These FWCA materials are provided in **Appendix F**. In addition, coordination with USFWS has occurred to discuss potential impacts to bald eagles to avoid the need for an incidental take permit. The Osage Nation is a cooperating agency in this study and assisted the PDT during alternative development by providing comments on the initial array. The Osage Nation also reviewed and commented on a draft of this feasibility report prior to the public comment period.

TRIBAL CONSULTATION

Consultation was initiated with 42 federally recognized Native American tribes (Tribes) by letter in March 2023. An Initial Tribal Nations briefing and listening session was held in August 2023. During the session The Osage Nation requested cooperating agency status for the Study. USACE agreed to this request and an MOA for this status was executed in December 2023. Since that time, The Osage Nation was briefed on project developments in May 2024 per terms of the MOA. Tribal Consultation on the development of a programmatic agreement for compliance with the NHPA has been ongoing with all consulting Tribes since 2023. A list of consulting Tribal Nations is included in **Appendix F** along with a list of agencies, organizations, and persons to whom copies of the draft report were sent to for review.

PUBLIC COMMENTS AND RESPONSES

Study stakeholders have shown a keen interest in the study and have provided feedback on a variety of subjects, such as suggestions for alternatives, the placement of proposed levee alignments, and requests for information regarding activities in the study area and the history of flood impacts. Stakeholders

commonly voiced concerns about potential backwater effects across the river resulting from changes to levee coverage and for the potential future and status of the CV Levee in the event that a structural alternative would move forward for implementation. Numerous engagements outside of public meetings were also held to help explain alternatives, get feedback, and gain the consensus desired by the NFS. This outreach is detailed in **Appendix F. Table 32** summarizes the feedback received during the public comment periods and USACE responses.

Table 32. Public Comment and USACE Response Summary

General Nature of Comment	Number of Comments	Summary of USACE Responses
Some comments voiced support for CA13 as the proposed action. Reasons given for this support include improved flood resilience for a variety of area interests and infrastructure.	8	USACE acknowledges this support for CA13 as the federal interest plan. USACE carefully considered all comments received on this study, both those in favor of project implementation and those opposed, prior to selecting CA13 as the federal interest plan.
Some comments state that the existing Capital View Levee is inadequate for reducing flood risk to major developments within the study area, which poses an ongoing threat to the region's economic vitality and infrastructure reliability.	7	USACE acknowledges the importance of the critical infrastructure within the study area and its current vulnerability to flood risk.
Some comments voiced concerns about CA13 exacerbating flooding and raising flood management costs for other nearby areas and levee districts. Some comments noted the presence of agricultural, commercial, and recreational development in areas with potentially affected flood conditions. Some comments suggested potential actions, such as raising other nearby levees.	6	The hydrologic and hydraulic modeling USACE has conducted for this study indicates that nearby levees would not experience a detectable change in annual exceedance probability of overtopping with implementation of the federal interest plan. Similar Missouri River flows would result in similar flow patterns and adjacent inundation probabilities in the existing and proposed conditions due to the federal interest plan's levee setback. Water surface elevation around the study area would be expected to slightly increase during select flood events, generally for storms greater than 10% AEP, which is comparable to a 2019-level-impact event under these conditions, increases in depth would be located over areas that would be inundated under FWOP conditions regardless (post levee overtopping). USACE does not anticipate the federal interest plan would result in any substantial increase in flood-related costs (e.g., levee maintenance, flood fighting, etc.) for other levee districts.
Some comments note concern, hesitancy, or opposition to CA13 from some local levee district board members, landowners, and other stakeholders. Reasons given for this include increased flood-related impacts to the area.	6	USACE acknowledges this opposition to project implementation. USACE carefully considered this perspective prior to identifying CA13 as the federal interest plan. Chapter 4 details the consequences that would be anticipated from the implementation of any alternatives in the final array, including the federal interest plan. This evaluation includes consideration for the potential impacts experienced by these stakeholders. It is the determination of USACE that these impacts would not be significant.

General Nature of Comment	Number of Comments	Summary of USACE Responses
Some comments stated that the implementation of CA13 would reduce flood-related impacts and provide environmental benefits.	4	USACE acknowledges this feedback on the primary benefits of implementing the federal interest plan. The list of benefits provided in these letters is similar to the list of the federal interest plan's benefits provided in Section 5.2 .
The Iowa Tribe of Kansas and Nebraska notes no concerns of potential significant impacts.	3	USACE acknowledges this feedback.
MDC comments were generally supportive of Church Farm Conservation Area contributing borrow material for project implementation. MDC requests that coordination regarding this area and its levee continue and occur well in advance of decisions on borrow location and extents, borrow area recovery, and logistics of access to and transport of borrow material.	2	USACE would continue coordination with MDC, including discussions regarding the Church Farm Conservation Area. This coordination would include discussing borrow location and extents, borrow area recovery, and logistics of access to and transport of borrow material prior to any commitments concerning these details, as appropriate. USACE does not anticipate affecting the levee at this location.
Some comments submitted information pertaining to historic floods and levee performance.	2	USACE greatly appreciates information that helps us to better understand the historic and existing conditions of the study area.
Some comments questioned why a wastewater treatment plant was constructed within the floodplain.	2	Floodplain construction ordinances are implemented at the local and county level.
FAA comments that this project would require formal notice and review for airspace considerations under 14 CFR Part 77, Safe, Efficient Use, and Preservation of the Navigable Airspace. FAA recommends a 120-day notification. FAA notes that additional coordination with MoDOT would also be required.	1	USACE would continue its coordination with FAA and MoDOT regarding potential impacts to the Jefferson City Memorial Airport. Formal notice and review for airspace considerations would occur during PED.
One comment requested a detailed hydrological study to determine the potential impact of CA13 on nearby areas. The commenter objects to the proposed action unless USACE publishes a study showing no impact on the Reveaux levee.	1	A detailed hydrology and hydraulic analysis is provided in Appendix A1 of the report. Special attention was taken during the development of alternatives to avoid impacts on adjacent properties both upstream and downstream of the proposed project. Any alternative with a substantial effect on adjacent properties was removed from consideration. USACE does not anticipate the federal interest plan to result in any substantial flood-related impacts to the Reveaux levee.
One comment noted that a public meeting was held during weather conditions that impeded participation.	1	USACE held public scoping meetings in May 2023, November 2023, February 2024, and April 2024. USACE has endeavored to provide multiple opportunities for in-person participation.
One comment noted issues with invasive plants and mowing at locations within the study area.	1	USACE would implement measures to prevent the spread of invasive species during construction. The non-federal sponsor would be responsible for long-term OMRR&R of project lands, including invasive species management.

General Nature of Comment	Number of Comments	Summary of USACE Responses
One comment voiced support for the city of Jefferson City, Missouri becoming the implementation partner for this study.	1	USACE acknowledges this perspective.
One comment noted that CA13 would open up currently productive farmland to increased flooding by removing a portion of the Capital View Levee, while other levee alternatives considered would not do so. The comment states it would be helpful to stakeholders to understand beyond high level descriptions how USACE concluded some levee alternatives would not result in positive flood risk management benefits.	1	To evaluate the net benefits, USACE compares the annualized cost of implementing an alternative to the annualized benefits expected from it. This evaluation is summarized in Section 3.5 of the main report and provided in full in Appendix E .
One comment stated that it would be helpful for stakeholders to have a good understanding of which aspects of the proposed action have yet to be fully determined and which aspects are unlikely to change as the design process continues.	1	Project designs recommended in this study are in a relatively early conceptual stage that would be refined during the PED phase. At this time, USACE anticipates the basic details provided about the federal interest plan in Section 3.4.14 would generally remain true regardless of refinements. USACE does not expect the levee stage (i.e., 41 feet), partial removal of Capital View Levee, or the critical infrastructure contained within the levee to change. Various disciplines identify opportunities for refinement in their appendix documents. Specific levee alignment, utilities, recreational considerations, current land use, interior drainage, and roadway infrastructure are some areas of potential refinement.
One commenter noted that they followed a permitting process for construction in the floodplain and questions whether the implementation of CA13 would undergo the same process.	1	If the proposed action progresses towards implementation, this action, like others undertaken by private entities, would be subject to floodplain and other design / permitting requirements. Construction of the federal interest plan's alignment would require a Conditional Letter of Map Revision (CLOMR) to document changes in floodplain hydraulics and BFE through the project area.
One commenter read the Review Plan and requested to be informed if there is additional information regarding the project.	1	The publicly released draft report and appendices were released along with the review plan and summarize the full study process and contain the information detailing the formulation of alternatives, the evaluation of anticipated impacts, and the selection of the federal interest plan.
One commenter stated that creating more room for the Missouri River to inundate is a necessary approach and appreciates the associated creation of environmental benefits.	1	USACE acknowledges this perspective.
One comment stated that businesses in the area feel like any comments they make will not be given consideration.	1	USACE is keenly interested in the thoughts and views of all stakeholders in this study. USACE carefully considered all comments received on this study, both those in favor of project implementation and those opposed, prior to making any decisions or commitments regarding the federal interest plan.

General Nature of Comment	Number of Comments	Summary of USACE Responses
One comment stated the costs associated with CA13 should be proof its implementation is not a favorable conclusion.	1	USACE has conducted an economic analysis that considers the cost of project implementation, the anticipated costs of future project maintenance, and the anticipated economic effects on local agriculture and business, among other considerations. Chapter 5.0 details the comparison of plans, the evaluation of their total net benefits, and the plan selection. Based on this analysis, USACE has determined that CA13 would address the study's purpose and need in a cost-effective manner by reducing the costs associated with flooding over the long-term. Note that this report uses feasibility level cost estimates that are expected to change and will continue to be refined throughout the feasibility study, PED, and construction phases.
One comment stated that CA13 would provide a great deal of protection and ensure proper functioning of the WWTP.	1	USACE has identified the increased flood resilience that the WWTP and other critical infrastructure would receive as part of the federal interest plan's accomplishments (see Section 6.2).
USFWS concurs with a "may affect, but not likely to adversely affect" determination for Indiana bat and northern long-eared bat due to seasonal restrictions on tree clearing. The tricolored bat and the monarch butterfly are proposed for listing and therefore a "Not likely to jeopardize the continued existence of the species" is an appropriate determination at this time. In the event that the final listing of these species happens before the completion of this project, it is recommended to reinitiate consultation.	1	USACE acknowledges and concurs with this feedback. In the event that the status of the potentially listed species changes prior to completion of the project, USACE would reinitiate consultation.
USFWS provides a series of fish and wildlife related recommendations for the project in lieu of a project-specific planning aid letter, pursuant to the Fish and Wildlife Coordination Act and NEPA. These recommendations primarily concern borrow areas, riparian forests, and vegetation management with the purpose of minimizing impacts and fostering enhanced environmental conditions.	1	USACE acknowledges these recommendations regarding borrow pits, riparian forests, and vegetation management. USACE concurs these recommendations would be beneficial for fish and wildlife resources. USACE would implement these recommendations to the extent practicable.
MoDNR foresees no water quality issues that would arise from the implementation of CA13. In the event of project approval, MoDNR and USACE would coordinate on the requirements for a complete request for a Section 401 Water Quality Certification.	1	USACE acknowledges and concurs with this feedback. USACE would continue its coordination with MoDNR and would acquire a water quality certification for the federal interest plan prior to project implementation. USACE anticipates acquiring this certification in the project's PED phase.

8.0 Recommended Plan Considerations

8.1 NO ACTION ALTERNATIVE

Coordination with the City of Jefferson City, Missouri as the implementation NFS has indicated that they can acquire and hold title to land outside City jurisdictional boundaries, but the City lacks the power of eminent domain beyond its city limits. Consequently, the City cannot fully execute all NFS implementation responsibilities. An additional NFS with authority to acquire all necessary interests in land beyond the City limits has not been identified. Due to the inability to provide necessary LERRs for the project, this Final Report and Integrated EA identify the No Action Alternative (CA0) as the Recommended Plan despite federal interest in completing the project.

The remainder of this chapter discusses the federal interest plan (CA13) components, accomplishments, costs, requirements, and risks assuming a capable NFS is identified in the future for project implementation.

The final alignment of the federal interest plan was developed by incorporating minor shifts from the CA13 alignment to accommodate road alignments, minimize impact to utilities, optimize closure structure locations, and efficiently incorporate the proposed levee into the existing site terrain (**Figure 17**).

The federal interest plan includes removal of the existing CV Levee west of the U.S. Highway 54/63 overpass to allow additional conveyance and storage volume along Turkey Creek. The existing, non-federal CV Levee east of the U.S. Highway 54/63 overpass is assumed to remain and is not part of the federal project footprint.

The minimum top of levee elevation is set at the profile produced by the 590,000 cfs (based on the 1% AEP event as identified at the time of this study), plus one foot of additional height for uncertainty. Upstream of the Missouri River bridge abutment, an extra foot of levee height was added to ensure initial overtopping downstream, consistent with ECB 2019-8 Managed Overtopping of Levee Systems. This design is expected to flood at less than 1% AEP with a 54% assurance of passing the 1% AEP event. The Sponsor does not desire the option to accredit the levee through FEMA.

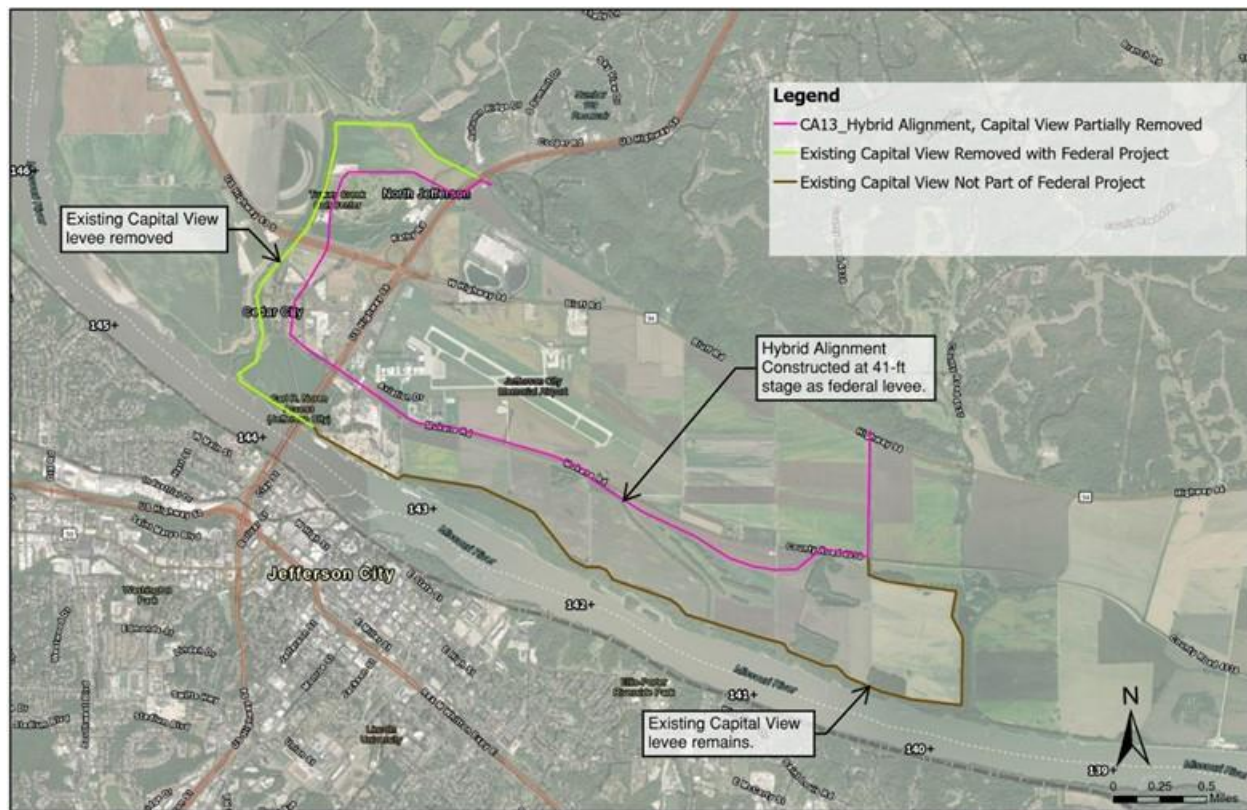


Figure 17. Federal Interest Plan (CA13) Alignment

8.2 REAL ESTATE ASSUMPTIONS BEYOND PROJECT AREA

Real estate needs beyond the project area were determined by a preliminary takings analysis. This analysis considers the hydraulic impacts of the federal interest plan, which displaces floodwater volume from the area bound by the proposed levee. Impacts were defined as any change from the FWOP condition. The data tolerance for reporting is set to report values in tenths of feet (0.0-ft). Impact areas were totaled from the 1% AEP federal interest plan inundation to the bank-line with a flowage easement non-standard estate valuation at 5 percent of the average fair market value for areas that currently experience flooding. The approach is subject to refinement as the non-standard estate is finalized.

A comparison of the hydraulic profiles during flood events from the with and without project models showed changes in the inundated area and increases in water surface elevations (WSE) for events between 20% and 0.2% AEPs. The project would result in an additional 776 acres being newly inundated at the floodplain margins. Additionally, during flood events that exceed the approximate 10% AEP, additional depths of 0.2-1.5 ft of water are added on top of significant amounts of flood waters already present. Because these changes in inundation area and depth cannot be mitigated through adjustment of project features or alternative selection, the mitigation is just compensation for approximately 27,013 impacted acres (1671 parcels across 5 counties). A preliminary cost estimate for the real estate to mitigate the induced flooding is \$15,199,900, which includes 90 percent of the average fair market value for newly inundated areas and 5 percent of the average fair market value for areas that currently experience flooding. The total real estate, including the project footprint, is \$72,276,376, which includes land costs, NFS incidentals, and utility relocations. Additional funds to acquire the necessary real estate are estimated at \$3,937,500 for Federal real estate administrative oversight.

8.3 DESIGN MATURITY

The design maturity determination for the Lower Missouri Jefferson City L-142 Flood Risk management Study has been evaluated for hydrology and hydraulics modeling, geotechnical data and subsurface

investigations, and survey data. The aggregate for all features achieves 35% design maturity per ECB 2023-9 Rev 1. This level of design maturity meets the expected level to generate the cost products for this project. See **Appendix B** for additional cost information.

HYDROLOGY AND HYDRAULICS

The hydrology and hydraulics modeling is currently at a 65% design maturity.

1. Hydrology (95% maturity)
 - a. Adopted the most recent Missouri River Flow Frequency Study (2023) flows.
 - b. In PED, there will be refinement to this flow to match the Missouri River Stage-Frequency study, which is not yet available. For this study, we interpolated the Jefferson City gage flow based on the bounding Boonville and Hermann gage flows published with the 2023 MRFFS flows and using ratios between gages from the 2004 study to triangulate flows at Jefferson City. (For scale, 588,000 cfs and 689,000 cfs are the 1% and 0.5% AEP Missouri River flows at Jeff City. The difference in WSE routing through Jefferson City between these flows is 1.8-ft.)
2. 1D/2D hydraulic model (75% maturity)
 - a. Calibrated to 2019 flood, validated to 2018 in-bank highwater
 - b. Approximately 100 miles modeled (to see full resolution of any impacts between FWOP and federal interest plan)
 - c. 2D area includes the left bank through the project area (CV and adjacent levees). Within the 2D area, an effort was made to update all geometry input data to reflect current conditions – 2021 USACE low water corridor light detection and ranging (LiDAR), surveyed levee top elevations for CV, adjacent private levee, and updates to the downstream Reveaux Levee. The highway bridge was also included with the updated model.
 - d. The 1D model utilized upstream and downstream of the project site is a fully calibrated, stress tested, and reviewed CWMS model.
 - e. Channel bathymetry was compared to 2021 bathymetry through the project corridor to ensure bathymetry is consistent with current conditions
3. Federal Interest Plan Development 35% maturity, major features identified
 - a. Top elevation – based on 590,000 cfs (1% AEP) routed with managed overtopping enforced at downstream end. Superiority on levee tiebacks.
 - b. Interior drainage calculations conducted to size gate wells. Gate well locations identified and confirmed grading is feasible.
 - c. Major study components have been identified and collaborated with geology, civil, and structural PDT members.

The major H&H items that are anticipated in PED include:

- Update hydrologic analysis to include adopted stage-frequency flow values at the Jefferson City gage. (Not completed in feasibility because report is not yet available.)
- Import Jefferson City project features in HEC-RAS to the adopted stage-frequency model for final design. (Not completed in feasibility because the reviewed/tested/adopted model is not yet available.)
- Due to length in time from Feasibility to PED, these updates are anticipated and would apply to most projects as new data continues to be available.
- Further define minor project features, such as interior drainage and closure structures, to detail-level design.

A) GEOTECHNICAL DATA AND SUBSURFACE INVESTIGATIONS

The geotechnical data and subsurface investigations is currently at a 35% design maturity.

1. Geotechnical Investigations (90% Maturity)
 - a. Historical borings – a previous design in the vicinity was developed to 95% design, which provided the PDT with numerous historical investigations to be used during the development of the subsurface data for this analysis.
 - b. New borings – 8 new borings were completed in 2025 to validate analysis assumptions that were made based on the previous borings.
 - c. Additional borings – During the next phase of the project, PED, additional investigations will occur to refine the design of the embankment geometry, stability, and underseepage berms.
2. Underseepage Analysis (35% Maturity)
3. Stability Analysis (35% Maturity)
4. Levee Cross Sections
 - a. The currently recommended embankment geometry (typical section -1:3 side slopes with a 10-foot crest) is similar to the geometry of federal levees across the NWK AOR. These levees have a long history of satisfactory performance across the full range of loading. Future studies and analysis will seek to optimize the embankment and berm geometry but are unlikely to result in major changes to the typical sections currently recommended.

B) SURVEY DATA

The survey data is at a 35% design maturity.

1. Topographic Survey (100% Maturity)
 - a. Terrain within the project area and modeled 2D storage area is sourced from 2021 Kansas City USACE Missouri River Corridor LiDAR. The 1-m terrain mesh was developed by Stantec, a FEMA contractor. The mosaic compiles the 2021 USACE low water corridor LiDAR (2-ft ERDAS Imagine hydro-flattened DEM) with 2020 USGS LiDAR (1-meter 3DEP hydro-flattened DEM).
 - b. Risks with using the LiDAR were identified and added in the CSRA process for contingency. During future phases field topography will be acquired for design development.
 - c. Field topography was collected for the centerline of the existing CV levee to validate the LiDAR. When compared with the LiDAR, it was within the +/- 6-inch tolerance.
2. Existing Utilities (65%)
 - a. Historically utility relocations have resulted in significant cost and schedule growth on similar projects. To reduce this risk the team has devoted significant effort to document utilities in the project area.
 - b. Historical Information:
 - i. Compiled utility information from the previous L-142 levee design, 2010 MRAPPS river survey, provided utility as-builts.
 - c. Utility Communications: We have received information from all providers except for electric and gas who will not provide their utility information.
 - i. Water – received GIS shapefiles including type, size, and location of mains, laterals, valves, valve pits, structures and hydrants.
 - ii. Sanitary Sewer – received shapefiles and as-built plans from Jefferson City.
 - iii. Storm Sewer – GIS shapefiles including pipe type, size and location of culverts, ditches, and channels.
 - iv. Gas – No Information provide from Ameren. Historical data and field survey was used to identify.
 - v. Electric – No information provided from Ameren; however, site visits and imagery was used to identify overhead electric line locations.
 - vi. Communications – received varied information from providers including shapefiles, scanned maps, and sketches.

- d. Utility Survey: Utility locates were called and a field survey of the marked lines were collected for the major utility corridor along Mokane Road. This information was used to verify utilities in the area with what the team had been provided by the utility providers.
 - i. Areas where utility locates weren't field surveyed include areas showing very minor utilities as received from the owners.
 - e. A subsurface utility engineering (SUE) table has been developed to compile all the information gathered about the utilities in the area.
- 3. 3D Design Modeling (35% Maturity)
 - a. Using the LiDAR and geotechnical design of the embankment, stability and underseepage berms, the lead Civil Engineer has developed a 3D model of the embankment/berm geometry to more accurately estimate the necessary quantities of fill.
 - b. Developing a 3D model of the project site also assists in identifying real estate limits for a more accurate appraisal process.
- 4. Real Estate (50% Maturity)
 - a. Utilized 2023 parcel data and advanced 3D grading model to determine project footprint.
 - b. Various easement types were identified including permanent, temporary and permanent-farmable.

9.0 District Engineer Recommendation

Based on the conclusions of this study, after having considered all significant aspects in the overall public interest, including environmental, social, and economic effects; and engineering feasibility; I recommend the Federal Interest Plan for flood risk management on the Lower Missouri River, as fully detailed in this Feasibility Report and Integrated Environmental Assessment. The USACE Kansas City District recommends a structural measure of a new levee that includes removal of the existing Capital View Levee west of the U.S. Highway 54/63 overpass to allow additional conveyance and storage volume along Turkey Creek. The existing, non-federal Capital View Levee east of the U.S. Highway 54/63 overpass is assumed to remain and is not part of the federal project footprint. The top of levee elevation is based on an overtopping flow of 590,000 cfs (1% AEP as identified at the time of this study). The Sponsor does not desire the option to accredit the levee through FEMA. The Kansas City District recommends that the FRM measures in Jefferson City, Missouri be constructed generally in accordance with the Federal Interest Plan herein, and with such modifications thereof, as per the discretion of the Director of Civil Works, it may be advisable at an estimated project first cost of approximately \$291,000,000 (Effective Price Level FY26Q2).

Recommendations for provision of Federal participation in the plan described in this report would require the non-federal sponsor(s) to enter into a written Project Partnership Agreement (PPA), as required by Section 221 of Public Law 91-611, as amended, to provide local cooperation satisfactory to the Secretary of the Army. Such local cooperation shall provide, in part, the following draft items of local cooperation:

- a. Provide a minimum of 35 percent, up to a maximum of 50 percent, of construction costs, as specified below:
 1. Provide, during design, 35 percent of design costs in accordance with the terms of a design agreement entered into prior to commencement of design work for the project;
 2. Pay, during construction, a contribution of funds equal to 5 percent of construction costs;
 3. Provide all lands, easements, rights-of-way, and placement areas and perform all relocations determined by the Federal government to be required for the project;
 4. Provide, during construction, any additional contribution necessary to make its total contribution equal to at least 35 percent of construction costs;
- b. Prevent obstructions or encroachments on the project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) that might reduce the level of flood risk reduction the project affords, hinder operation and maintenance of the project, or interfere with the project's proper function;
- c. Inform affected interests, at least yearly, of the extent of risk reduction afforded by the flood risk management features; participate in and comply with applicable Federal floodplain management and flood insurance programs; prepare a floodplain management plan for the project to be implemented not later than one year after completion of construction of the project; and publicize floodplain information in the area concerned and provide this information to zoning and other regulatory agencies for their use in adopting regulations, or taking other actions, to prevent unwise future development and to ensure compatibility with the project;
- d. Operate, maintain, repair, rehabilitate, and replace the project or functional portion thereof at no cost to the Federal government, in a manner compatible with the project's authorized purposes and in accordance with applicable Federal laws and regulations and any specific directions prescribed by the Federal government;
- e. Give the Federal government a right to enter, at reasonable times and in a reasonable manner, upon property that the non-Federal sponsor owns or controls for access to the project to inspect the project, and, if necessary, to undertake work necessary to the proper functioning of the project for its authorized purpose;

- f. Hold and save the Federal government free from all damages arising from design, construction, operation, maintenance, repair, rehabilitation, and replacement of the project, except for damages due to the fault or negligence of the Federal government or its contractors;
- g. Perform, or ensure performance of, any investigations for hazardous, toxic, and radioactive wastes (HTRW) that are determined necessary to identify the existence and extent of any HTRW regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. 9601-9675, and any other applicable law, that may exist in, on, or under real property interests that the Federal government determines to be necessary for construction, operation, and maintenance of the project;
- h. Agree, as between the Federal government and the non-Federal sponsor, to be solely responsible for the performance and costs of cleanup and response of any HTRW regulated under applicable law that are located in, on, or under real property interests required for construction, operation, and maintenance of the project, including the costs of any studies and investigations necessary to determine an appropriate response to the contamination, without reimbursement or credit by the Federal government;
- i. Agree, as between the Federal government and the non-Federal sponsor, that the non-Federal sponsor shall be considered the owner and operator of the project for the purpose of CERCLA liability or other applicable law, and to the maximum extent practicable shall carry out its responsibilities in a manner that will not cause HTRW liability to arise under applicable law; and
- j. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended, (42 U.S.C. 4630 and 4655) and the Uniform Regulations contained in 49 C.F.R Part 24, in acquiring real property interests necessary for construction, operation, and maintenance of the project including those necessary for relocations, and placement area improvements; and inform all affected persons of applicable benefits, policies, and procedures in connection with said act.

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

Date

Andrew T. Niewohner
Colonel, Corps of Engineers
District Commander

10.0 List of Preparers

Name	Role	Qualifications (Licensing and Years of Experience)
Baker, George	Cost Engineer	Certified Cost Consultant 8 years of experience
George, Noah	Economist	6 years of experience
Edkin, Rachel	Realty Specialist	Realty Specialist with 7 years of experience, serving as Team Lead for 3 years
Fernandez, Eduardo	Structural Engineer	Registered EIT, 22+ years of experience with structural engineering flood control design, inspection, and technical leadership
Headlee, Max	Environmental Resources Specialist	5 years of experience
Meade, Timothy	Archeologist and Tribal Liaison	20+ years of experience
Mehnert, James	Geotechnical Engineer	Professional Engineer 30+ years of experience
Niemann-Harper, Ginger	Plan Formulator and Project Manager	Community Planner 7 years water resources experience
Sciarra, Jennifer	Technical Lead and Civil Engineer	Professional Engineer 17 years of experience
Spangler, Natalie	Civil Engineer, Environmental	Professional Engineer 11 years of experience
Swacker, Shelbi	Hydraulic Engineer	Professional Engineer 10 years of experience
Wood, Jennifer	Geologist	Registered Geologist 22 years of experience