2023

CAP Section 205 Flood Risk Management Study

City of Fenton, Missouri

DRAFT Feasibility Study Report with Integrated Environmental Assessment

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US Army Corps of Engineers ®
St. Louis District

U.S. Army Corps of Engineers, St. Louis District

Non-Federal Sponsor: City of Fenton, Missouri

12/6/2023

Cover Sheet

Project Title: CAP Section 205 Flood Risk Management Study
City of Fenton, Missouri
Feasibility Study Report with Integrated Environmental Assessment

Proposed Action: The St. Louis District of the U.S. Army Corps of Engineers is investigating alternatives to reduce the risk of economic damages due to flooding in Fenton, Missouri.

Location: City of Fenton, St. Louis County, Missouri

Type of Statement: Draft Feasibility Report with integrated Environmental Assessment

Lead Agency: U.S. Army Corps of Engineers – St. Louis District (MVS)

Cooperating Agencies: N/A

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Date by which comments must be received: 20 January 2024

Abstract:

CAP SECTION 205 FLOOD RISK MANAGEMENT STUDY
CITY OF FENTON, MISSOURI
FEASIBILITY STUDY REPORT WITH INTEGRATED ENVIRONMENTAL ASSESSMENT

EXECUTIVE SUMMARY

This Draft Feasibility Study Report with Integrated Environmental Assessment investigates the viability of alternative measures to address problems and opportunities associated with flood risks in the City of Fenton.

The City of Fenton has recently experienced several large flood events which have resulted in substantial economic damages and social disruption. Most recently, the City was inundated by two floods of record within a 16-month timeframe (December 2015 and May 2017), and was included in the area declared for federal disaster assistance (DR-4250-MO in 2015, DR-4317-MO in 2017). These floods damaged homes and critical infrastructure in the study area. The flood in December 2015 impacted approximately 11% of homes located in the city, resulting in more than $3M in documented damages. It also caused $1.2M in estimated infrastructure damage, disruption of the sewage treatment plant, closure of the major transportation link, Interstate 44, and closure of multiple major connecting routes. Sixteen months later in May 2017, new record and near-record water levels occurred on all Meramec Basin gaging stations, including near record levels recorded on the Fenton gage.

Study objectives included reduction in life safety risk due to flooding, including inundation of emergency corridors and critical infrastructure; reduction in economic damage due to flooding; and potential for increased recreation opportunities related to flood risk reduction measures.

The Project Delivery Team identified a broad range of potential structural and nonstructural measures that could be undertaken to achieve project objectives. Potentially viable measures were identified and combined into alternative plans. Initially, five alternatives were developed for evaluation and comparison: No Action, Levees and Floodwalls, Nonstructural, Levees and Nonstructural, and a possible Local Plan. Through initial analyses, these five alternatives were reduced to two alternatives in the final array: No Action and Nonstructural.

Based on the evaluation and comparison of the final array of alternatives, the Nonstructural alternative has been identified as the Tentatively Selected Plan (TSP). This plan calls for floodproofing 13 commercial structures using wet floodproofing techniques and elevating one residential structure. The Preliminary Total Project First Cost is estimated to be $3,349,000 (Fiscal Year 2023 price level) and the benefit-to-cost ratio is 2.6. The TSP reduces estimated average annual damages by $332,000 and produces $205,000 in annual net benefits (50-year period of analysis, 2.75% Federal discount rate).

During the next phase of the study, additional information will be gathered and additional analyses will be performed to refine the TSP. This phase is referred to as Feasibility Level Design and may result in changes to the number of structures included in the plan, the level of flood event to be addressed, the project costs and the project benefits. However, it is not anticipated to result in a change from the Nonstructural alternative to a structural plan or to the No Action plan.

TABLE OF CONTENTS

**Chapters and Sections marked with an asterisk are required content for compliance with the National Environmental Policy Act*

APPENDICES

LIST OF FIGURES

LIST OF TABLES

ACROYNYMS AND ABBREVIATIONS

AAHU: Average Annual Habitat Units
AALL: Average Annualized Life Loss
ACE: Annual Chance of Exceedance
ACS: American Community Survey
ADCIRC: Advanced Circulation
AEP: Annual Exceedance Probability
APE: Area of Potential Effects
APF: Annual Probability of Failure
ASTM: American Society for Testing and Materials
ATR: Agency Technical Review
BCR: Benefit-to-Cost Ratio
BGEPA: Bald and Golden Eagle Protection Act
BLH-Wet: Bottomland Hardwood-Wet habitat
BMP: Best Management Practice
CAP: Continuing Authorities Program
CDP: Census Designated Place
CED: Comprehensive Environmental Document
CEQ: Council of Environmental Quality
CERCLA: Comprehensive Environmental Response, Compensation and Liability Act
cfs: cubic feet per second
CFR: Code of Federal Regulations
CO: Carbon Monoxide
COTP: Captain of the Port
CSVR: Content-to-Structure Value Ratio
CWA: Clean Water Act
dB: decibel
dBA: A-Weighted Decibel
DNL: Day-Night Average Sound Level
DO: Dissolved Oxygen
DoD: Department of Defense
DQC: District Quality Control
DWS: Drinking Water Supply
ead: equivalent annual damage
ECB: Engineering and Construction Bulletin
EFH: Essential Fish Habitat
EIS: Environmental Impact Statement
EJ: Environmental Justice
EO: Executive Order
EOP: Environmental Operating Principles
EPA: Environmental Protection Agency
EQ: Environmental Quality
ER: Engineer Regulation
ERDC: Engineer Research and Development Center
ESA: Environmental Site Assessment
FEMA: Federal Emergency Management Agency
FMP: Fishery Management Plan
FPPA: Farmland Protection Policy Act
FID: Federal Interest Determination
FONSI: Finding of No Significant Impact
FWAC: Future Without Action Condition
FWOP: Future Without Project
FWP: Fish and Wildlife Propagation
FY: Fiscal Year
HEC: Hydrologic Engineering Center
HEC-FDA: Hydrologic Engineering Center Flood Damage Analysis
HEC-HMS: Hydrologic Engineering Center Hydrologic Modeling System
HEC-RAS: Hydrologic Engineering Center River Analysis System
H&H: Hydrology and Hydraulics
HTRW: Hazardous, Toxic, and Radioactive Waste
HUD: Housing and Urban Development
IER: Individual Environmental Report
IPET: Interagency Performance Evaluation Task Force
JPM-OS: Joint Probability Method-Optimal Sampling
LERRD: Lands, Easements, Rights-of-way, Relocations, and Disposal
LORR: Level of Risk Reduction
LSRI: Life-Safety Risk Indicator
MM: Mile Marker
MDNR: Missouri Department of Natural Resources
MDC: Missouri Department of Conservation

NAAQS: National Ambient Air Quality Standards
NAVD88: North American Vertical Datum of 1988
NED: National Economic Development
NEPA: National Environmental Policy Act
NMFS: National Marines Fisheries Service
NOAA: National Oceanic and Atmospheric Administration
NO_x: Nitrogen Oxides
NRCS: National Resources Conservation Service
NRHP: National Register of Historic Places
NSI: National Structure Inventory
O_3: Ozone
O&M: Operations and Maintenance
OMRR&R: Operations, Maintenance, Repair, Replacement, and Rehabilitation
OSE: Other Social Effects
PCR: Primary Contact Recreation
PED: Preconstruction Engineering and Design
PFM: Probable Failure Mode
PM: Particulate Matter
PPA: Project Partnership Agreement
RAS: River Analysis System
REC: Recognized Environmental Conditions
RED: Regional Economic Development
RM: River Mile
RNA: Regulated Navigation Areas
ROW: Right-of-Way
SAV: Submerged Aquatic Vegetation
SCR: Secondary Contact Recreation
SHPO: State Historic Preservation Office
SEMA: (Missouri) State Emergency Management Agency
SO_x: Sulfur Oxides
SQRA: Semi-Quantitative Risk Assessment
SWPPP: Stormwater Pollution Prevention Plan
TDS: Total Dissolved Solids
THPO: Tribal Historic Preservation Officer
TRG: Tolerable Risk Guidelines
TSP: Tentatively Selected Plan
USACE: U.S. Army Corps of Engineers
USCG: U.S. Coast Guard
USDA: U.S. Department of Agriculture
USEPA: U.S. Environmental Protection Agency
USFWS: U.S. Fish and Wildlife Service
USGS: U.S. Geological Survey
VOC: Volatile Organic Compound
VRAP: Visual Resources Assessment Procedure
WRDA: Water Resources Development Act
WRRDA: Water Resources Reform and Development Act

CAP SECTION 205 FLOOD RISK MANAGEMENT STUDY
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1. INTRODUCTION

1.1 STUDY SCOPE

This City of Fenton, Missouri Flood Risk Management Feasibility Study Report with Integrated Environmental Assessment (EA) presents the results of a U.S. Army Corps of Engineers – St. Louis District (USACE) flood risk management study for the City of Fenton in St. Louis County, Missouri.

In accordance with Continuing Authorities Program procedures, a Federal Interest Determination (FID) was conducted by the USACE and approved in June 2022. The FID found a potential federal interest in a flood risk management project in Fenton and recommended further study.

1.2 STUDY AUTHORITY

This study is authorized by Section 205 of the 1948 Flood Control Act, as amended, which provides a continuing authority for the Corps of Engineers to develop and construct small flood control projects without additional congressional authorization.

1.3 STUDY AREA AND MAPS

The City of Fenton is located in St. Louis County, Missouri

Figure 1-1 shows the general study area location. Figures 1-2 and 1-3 show key study area features.

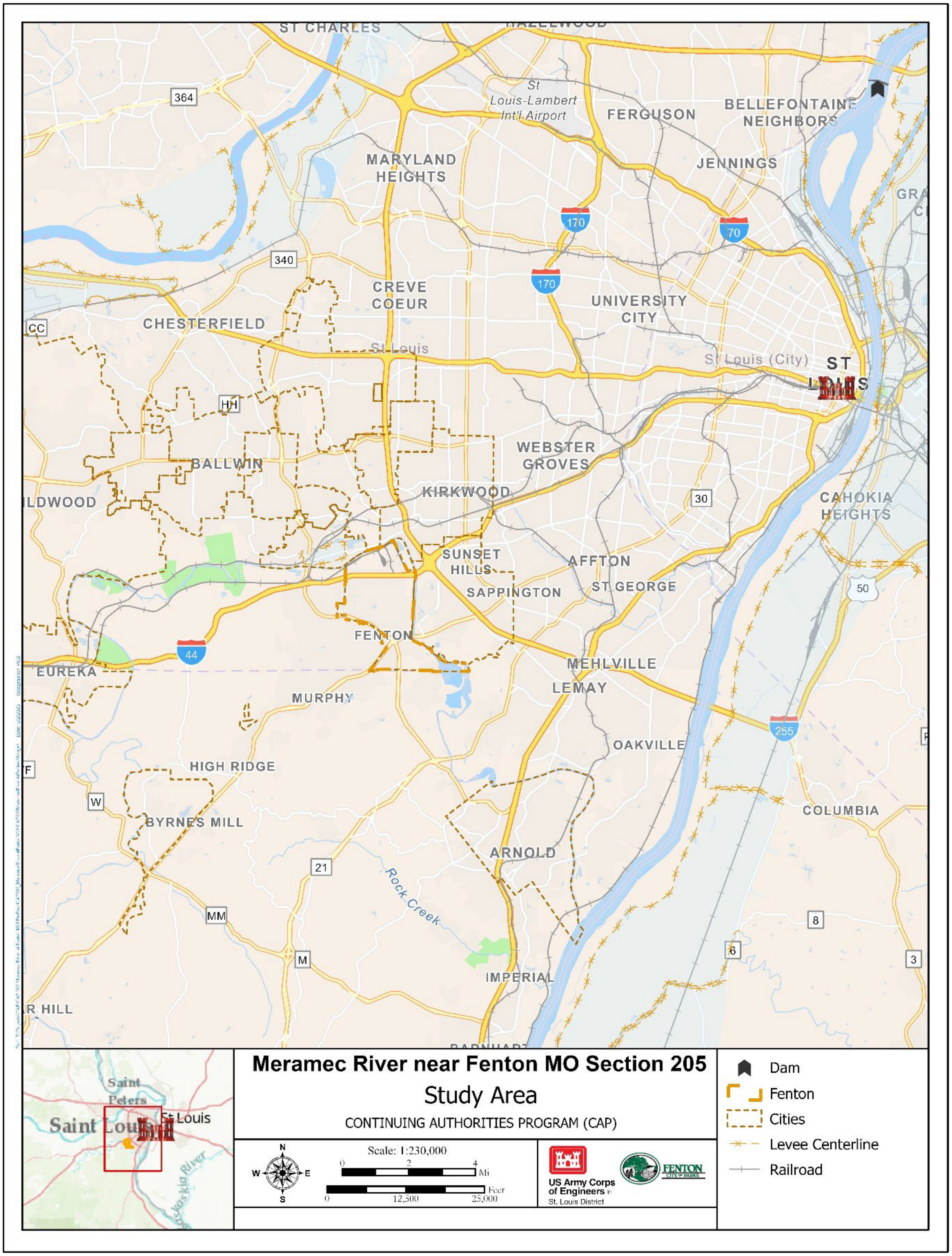

Figure 1-1. Study Area Location

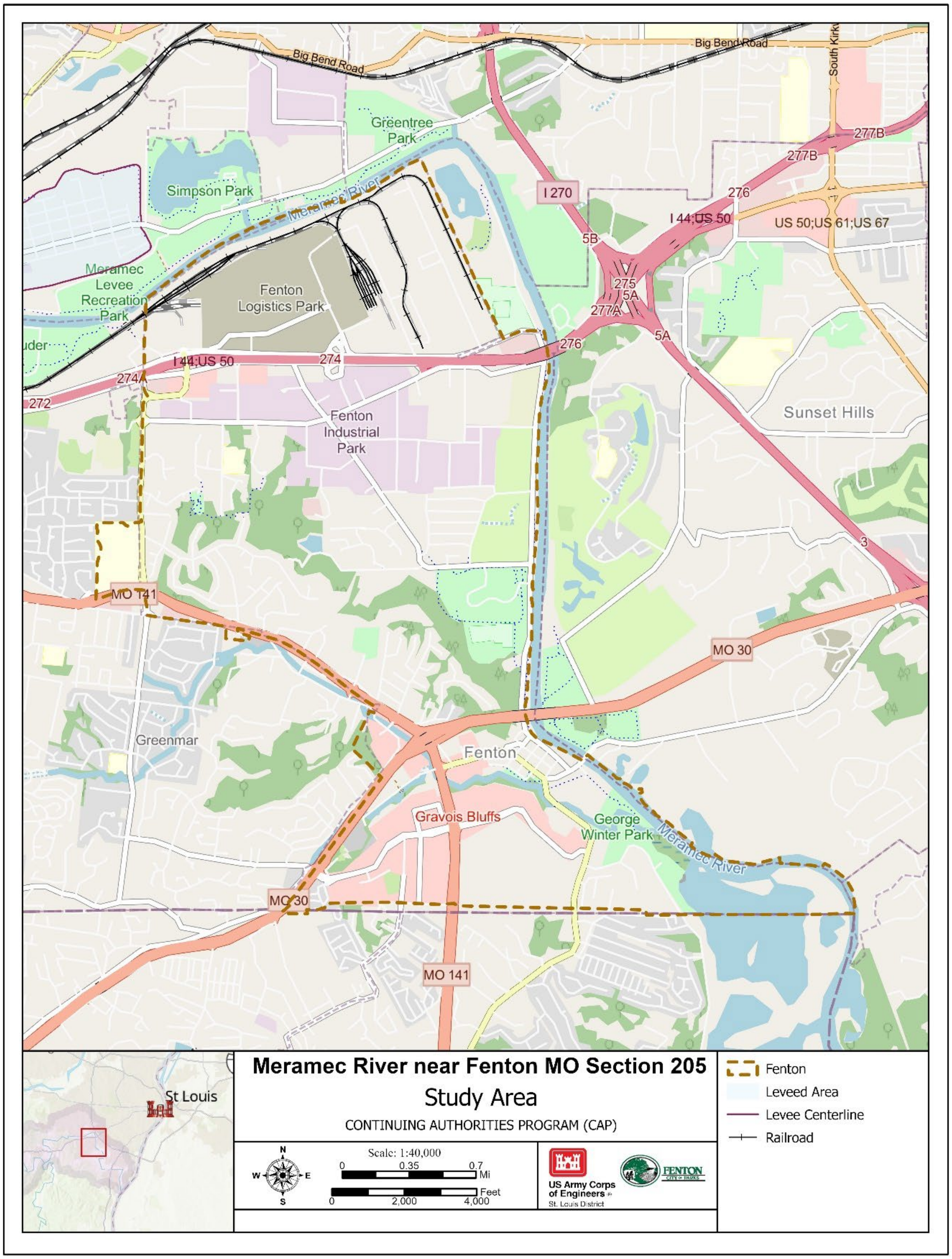

Figure 1-2. Study Area Features

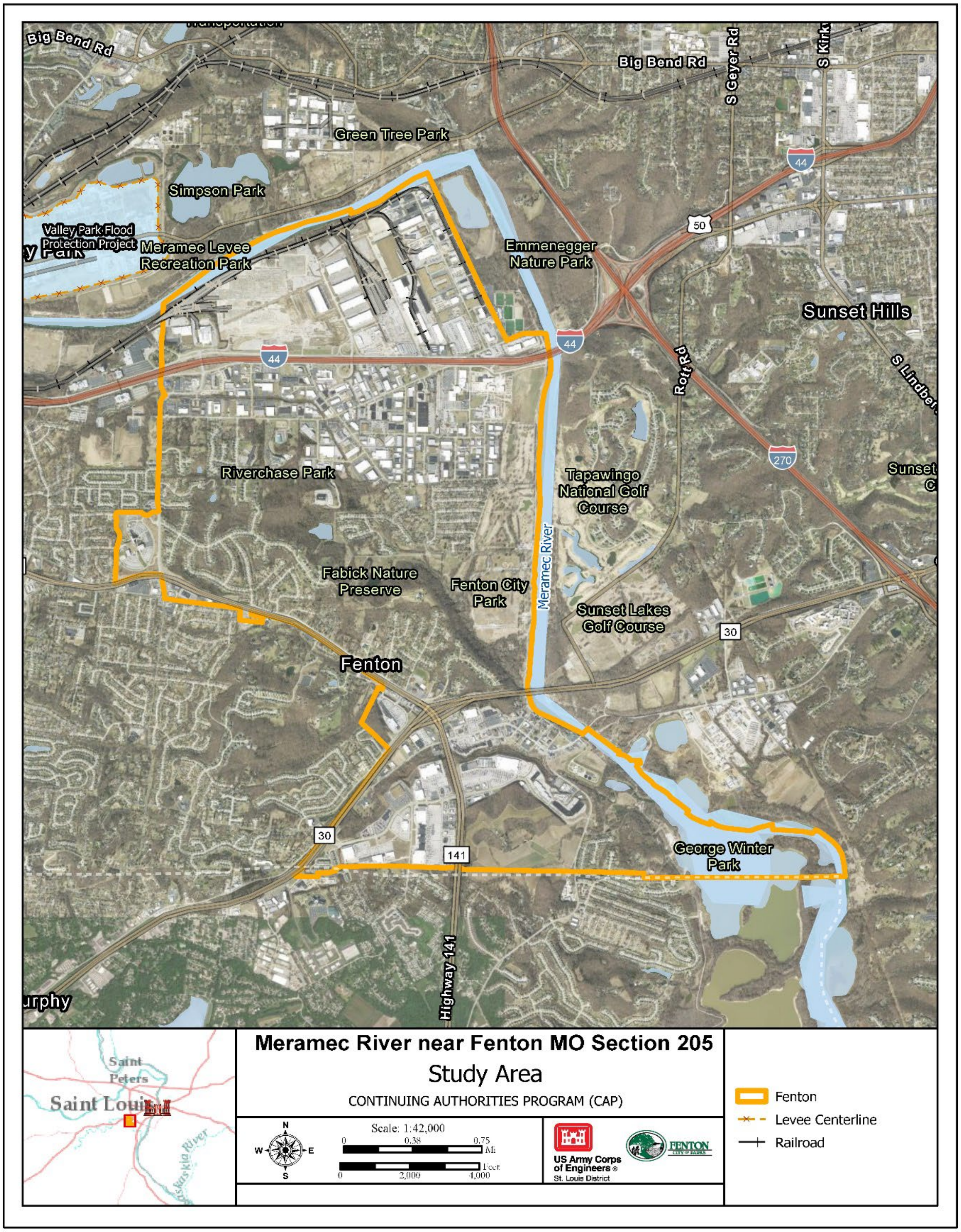

Figure 1-3. Study Area Features on Aerial Imagery

1.4 PURPOSE & NEED*

The City of Fenton has recently experienced several large flood events which have resulted in substantial economic damages and social disruption. The goal is that any potential project recommended by this study would reduce the flood risk in the city. The purpose of this study is to analyze alternatives to reduce the flood risk from the Meramec River and tributaries. The study evaluates and compares the benefits, costs, and impacts (positive or negative) of alternatives including the No Action Alternative and identify whether an economically justified plan exists to reduce flood risk. This report also satisfies the requirement of the National Environmental Policy Act (NEPA) to evaluate the potential environmental impacts of the proposed federal action.

1.5 NON-FEDERAL SPONSOR

The non-federal sponsor for this study is the City of Fenton, Missouri, and the feasibility cost-share agreement was executed on 29 November 2022.

1.6 SCOPING AND COORDINATION*

Scoping is an early and open process for determining the range of issues to be addressed and for identifying the important issues related to a proposed action. Scoping is conducted early in the planning process using a variety of communication methods with the affected public, agencies, organizations, and tribes. The input received during scoping will assist USACE in making holistic, informed decisions throughout the study process. Please see Appendix G - Environmental Compliance and Coordination, for related documents.

1.6.1 COORDINATION MEETINGS

Study collaborators discussed problems, opportunities, and potential measures through coordination meetings. While not comprehensive, the following meetings are examples of coordination to-date:

- USACE plan formulation meeting (sponsor briefed after): November 30, 2022
- Public scoping meeting: March 28, 2023
- Alternatives briefing with sponsor: July 6, 2023
- Data support meeting with sponsor: August 14, 2023

1.6.2 TRIBAL COORDINATION

Tribal coordination was initiated on August 23rd, 2023 with a letter seeking input from the local Tribes on the Tentatively Selected Plan. The response period ended on September 22nd, 2023. Comments were received from the Forest County Potawatomi Community, Caddo Nation, and Quapaw Nation. Comments from the Tribes will be considered and incorporated, as appropriate, into the alternatives formulation, evaluation, and comparison, as well as the recommendation in the final report.

1.6.3 PUBLIC AND PARTNER INVOLVEMENT AND REVIEW

Public and partner agency scoping will occur throughout the duration of the planning study. A public scoping meeting was held in March 2023 in the City of Fenton. The general public can learn more about the study through the USACE public website:

https://www.mvs.usace.army.mil/missions/programs-project-management/fenton-mo-frm/

In accordance with NEPA, the draft report with integrated environmental assessment and unsigned Finding of No Significant Impact (FONSI) (if it is determined that an EIS is not warranted) will be made available to interested members of the public and partner agencies during a 30-day public review period.

1.7 PRIOR REPORTS, EXISTING WATER PROJECTS, & ONGOING PROGRAMS

The following is a list of recent or ongoing programs and studies in the study area relevant to the City of Fenton, Missouri Flood Risk Management Feasibility Study:

- Lower Meramec River Flood Damage Reduction Project (USACE - 1987)
  - This study examined flooding problems along the lower 51 miles of the Meramec River. The study authorization stipulated that it should not examine reservoirs as a potential flood risk reduction measure. This language was likely a response to public opposition to a prior authorized project to construct a system of reservoirs on the Meramec River. This study's outcome was a single economically justified recommendation for a levee system to be constructed at Valley Park, MO. The Valley Park levee construction was completed in August of 2006.

- The Nature Conservancy (TNC) - The Meramec River Conservation Action Plan (2014)
  - The plan was a collaborative effort to develop a unified blueprint for ensuring the sustainability of aquatic resources in the Meramec River Basin. This plan comprehensively identifies and prioritizes target resources for conservation, the current health and problems affecting those resources, the source of the problems, and the best actions maximizing the benefit and long-term protection, restoration, and conservation of the Meramec River and its aquatic resources.
- St. Louis Riverfront – Meramec Ecosystem Restoration Feasibility Study (USACE - 2018)
  - This study examined opportunities for ecosystem restoration on the Meramec River. The recommended plan includes various measures such as longitudinal peak stone toe protection, root wad revetment, weirs, barbs, reforestation, sediment basins, bed sediment collectors, grade control structures, and in-stream excavation to restore and improve the aquatic ecosystem structure and function of approximately 1,600 acres of riverine and floodplain habitats leading to improved habitat for a variety of native animals, including freshwater mussels. All recommended features are located on the Big River, which is upstream of the study area. The report indicates no long-term impacts to the hydrology and

hydraulics of study area. The Chief's Report was signed in November 2019 and the project was authorized by the Water Resources Development Act of 2020 (Public Law 116-260).

- Lower Meramec Multi-Jurisdictional Floodplain Management Plan (USACE - 2020)
    - This study examined flooding problems in the Lower Meramec and developed recommendations for risk reduction and floodplain management for the communities of Arnold, Eureka, Fenton, Pacific, Sunset Hills, Union, Valley Park, Wildwood, Franklin County, Jefferson County, and St. Louis County.
- Yarnell Creek Flood Risk Evaluation, Planning Assistance to States (USACE – 2022)
    - This study evaluated opportunities to manage flood risk to structures located within Fenton along Yarnell Creek, which is a tributary to the Meramec River. The scope of the report included an analysis of structural and non-structural alternatives, including a structure inventory, to assist the city with reducing long-term flood risk. The study only evaluated flood risk associated with rainfall within the Yarnell Creek watershed and did not evaluate backwater flooding from the Meramec River.

2. PROBLEMS & OPPORTUNITIES

This section focuses on the problems to be addressed by the study, potential opportunities to be considered, study goals and objectives, as well as study constraints.

Throughout this section and all subsequent sections, flood and storm events will be referred to by their Annual Exceedance Probability (AEP), which is the probability that this level of flooding may be realized or exceeded in any given year. For example, a flood event with a 1% AEP would have a 1% probability of occurring every year. In the past, this has often been referred to as a 100-year event (an event with a return period of 100 years) or having a 1% annual chance of exceedance (ACE). Table 2-1 provides a list of AEP events that were considered during the study, with their equivalent "return period."

Table 2-1. Comparison of AEP and Return Period Terminology

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

2.1 PROBLEM IDENTIFICATION

The flood of record for the Meramec River basin occurred in May 2017. Major floods were also documented in 1915, 1916, 1942, 1945, 1950, 1957, 1961, 1969, 1979, 1982, 1993, 1994, 2008, 2015, and 2019.

Meramec River flooding in the City of Fenton causes economic damages to residences, businesses, and public structures. Additionally, there is life risk associated with flooding of transportation and emergency corridors.

More recently, the City of Fenton, Missouri (population of approximately 4,000) has experienced several major flood events, including two floods of record within a 16-month timeframe (December 2015 and May 2017). Recent flood events involved both inundation from the Meramec River as well as tributary flash flooding events, including flooding in August 2019 and June 2020 when the Yarnell Creek and Fenton Creek both exceeded 1% AEP flood events. The current (May 2017) and previous (December 2015) floods damaged homes and critical infrastructure in the study area and were included in the area declared for federal disaster assistance (DR-4250-MO in 2015, DR-4317-MO in 2017). The flood in December 2015 impacted approximately 11% of homes located in the city, resulting in more than $3M in documented damages. It exceeded the previous 1982 flood of record by 4 feet. The city also experienced $1.2M in estimated infrastructure damage, loss of the sewage treatment plant, closure of the major transportation link, Interstate 44, and closure of multiple major connecting routes. Sixteen months later in May 2017, new record and near record water levels occurred on all Meramec Basin gaging stations, including near record levels recorded on the Fenton gage.

Figure 2-1 illustrates the Federal Emergency Management Agency (FEMA) 1% and 0.2% AEP floodplains, as well as the floodway.

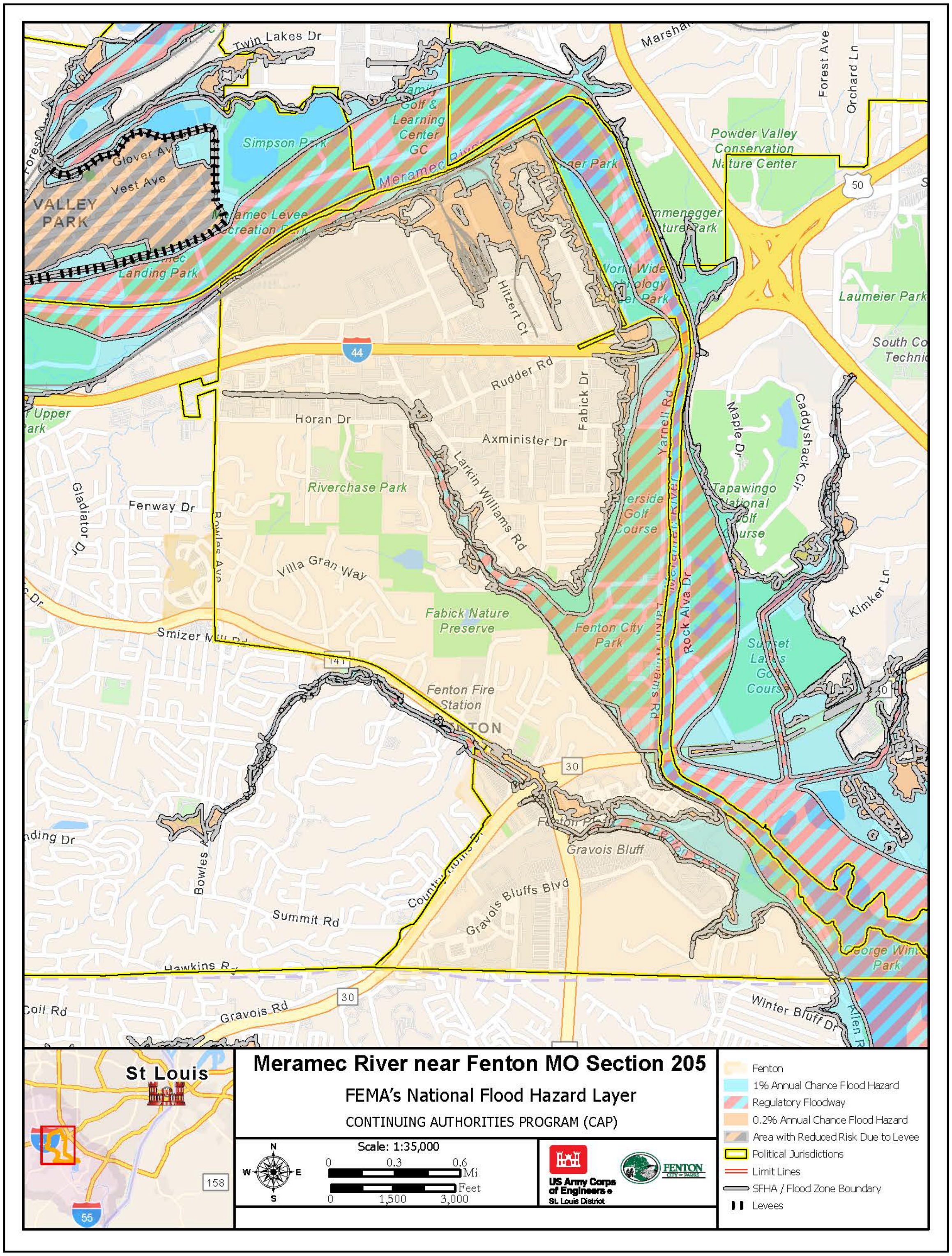

Figure 2-1. Fenton Area – Meramec 1% and 0.2% AEP Floodplains and Floodway

Figure 2-2. Flooding in the Winter of 2015 - 2016

Figure 2-3. Flooding in the Spring of 2017

2.1.1 STRUCTURE INUNDATION

There are 92 flood-prone structures located in the 1% AEP floodplain. The primary source for severe flooding for the City of Fenton is the Meramec River. Backwater flooding on the Meramec River in Fenton can occur when there is flooding on the Meramec River along with high water levels on the Mississippi River, therefore impeding the high water on the Meramec to subside. Backwater flooding on tributaries to the Meramec is also possible. Major tributaries of the Meramec River and lakes around the City of Fenton include: Fishpot Creek upstream of the study area, Grand Glaize Creek and Simpson Park Lake adjacent to the study area, Fenton Creek and Yarnell Creek within the study area, and Saline Creek and Butler Lakes downstream of the study area.

Figure 2-4 shows the locations of all structures within the 1% AEP floodplain included in the analysis of the study area, which includes 761 residential and 375 nonresidential structures.

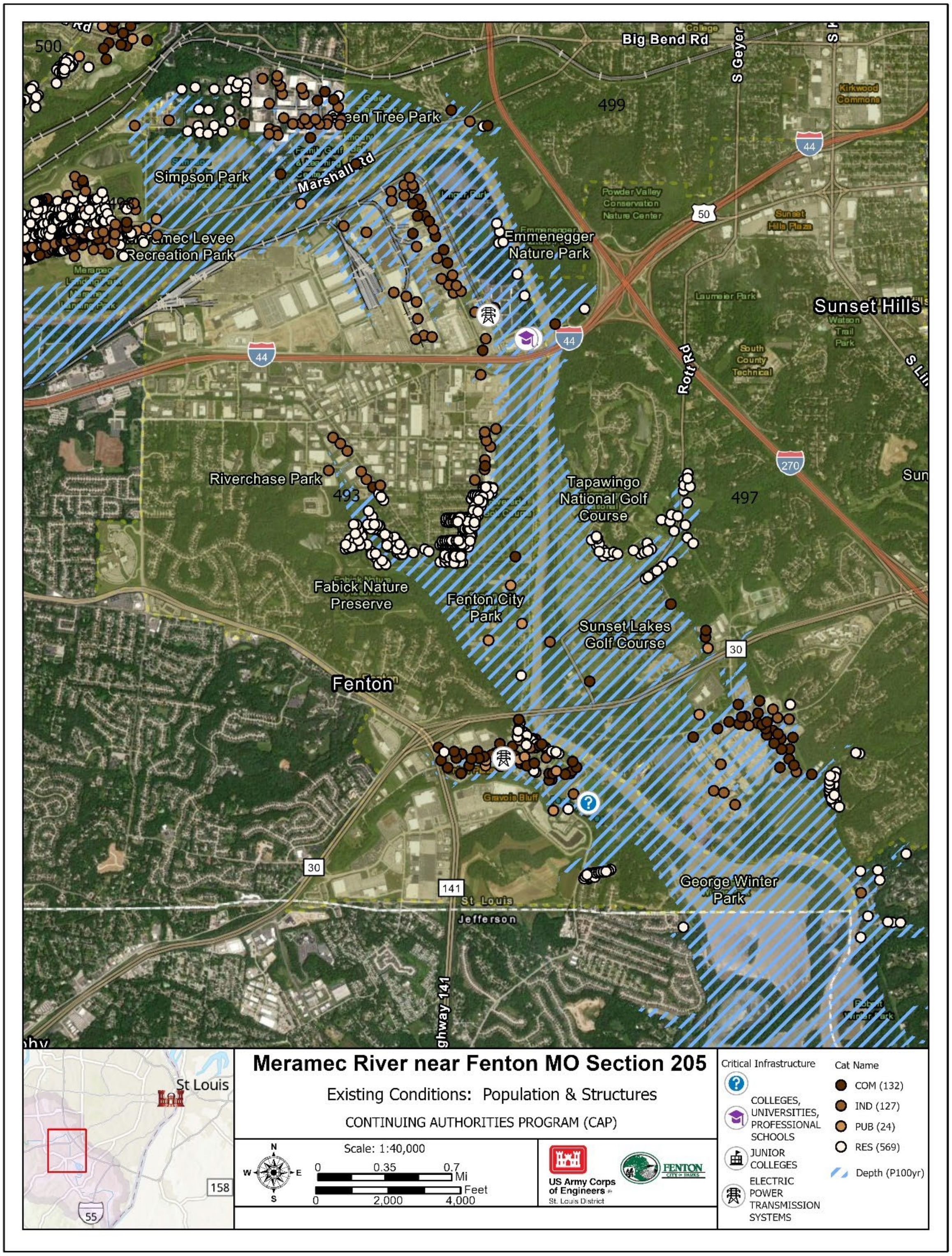

Figure 2-4. Structures Located Within the 1% AEP Floodplain

2.1.2 EMERGENCY EVACUATION ROUTES

In addition to the flooding of structures, the closure of Gravois Road, a major route in Fenton, causes a hazard to people and emergency responders by reducing access to the city's primary emergency exit routes. In combination with the closure of local highways and Interstate 44 during the 2015 and 2017 flood events, the only detour route available to the public and emergency responders was State Route 100 (also known as Manchester Road).

2.1.3 PROBLEM SUMMARY

In summary, the flooding problems in the City of Fenton include the following:

- Flooding of residences and businesses, resulting in structural damages as well as social and business disruption.
- Flooding of public structures and critical infrastructure, resulting in reduction in services; and
- Flooding of transportation and emergency corridors, resulting in life safety risk.

The flood risk management measures discussed in this report are focused on Meramec River flooding only, which produced the current flood of record in May 2017 and the near-record flood in the winter of 2015/2016.

2.2 OPPORTUNITIES

Opportunities are conditions in the study area that may be improved with implementation of a federal project. Opportunities may or may not be directly related to the problems but could be positively affected by a project incidental to solving the problems. For this study, the following opportunities were identified:

- Increase flood risk awareness in the City of Fenton.
- Increase recreation and educational opportunities associated with flood risk reduction features.
- Increase environmental improvement opportunities associated with flood risk reduction features.

2.3 GOALS & OBJECTIVES

The overarching goal of this study is to formulate an alternative for flood risk reduction and determine if Federal participation within the study area is justified. The Federal Objective, as set forth in the Water Resources Development Act of 2007, specifies that Federal water resources investments shall reflect national priorities, encourage economic development, and protect the environment by:

(1) seeking to maximize sustainable economic development.

(2) seeking to avoid the unwise use of floodplains and flood-prone areas and minimizing adverse impacts and vulnerabilities in any case in which a floodplain or flood-prone area must be used; and

(3) protecting and restoring the functions of natural systems and mitigating any unavoidable damage to natural systems.

The study evaluates and compare the benefits, costs, and impacts (positive or negative) of alternatives to reduce flood risk in the City, including the No Action Alternative.

Specific study objectives were developed to identify measures and alternatives which can address the study area's problems while taking advantage of the identified opportunities and avoiding the constraints. The following study objectives were developed based on the study area problems, opportunities, and goals, as well as the federal objective and regulations.

Objectives:

- Reduce life safety risk due to flooding, including inundation of emergency corridors and critical infrastructure, in the City of Fenton over the period of analysis.
- Reduce economic damage due to flooding in the City of Fenton over the period of analysis.
- Increase recreation opportunities in the City of Fenton related to flood risk reduction measures (if applicable).

2.4 CONSTRAINTS

A planning constraint limits the extent of the plan formulation process. Plans are formulated to meet study objectives and avoid violating the constraints. All USACE studies have a set of "universal" constraints and also study-specific constraints. These are listed below, along with a list of additional considerations that, while not constraints, may influence the study process.

Universal Study Constraints Applicable to this Study

- Avoid and/or minimize environmental and cultural resources impacts, including but not limited to endangered species and federally listed critical habitat.
- Avoid and/or minimize locating project features on lands known to have Hazardous, Toxic and Radioactive Waste (HTRW) concerns.
- Resource constraints such as time, money, and knowledge.
- Constraints associated with adherence to applicable laws and policies.

Study-Specific Constraints

- If FEMA Hazard Mitigation Grant Program funds have been previously used for buyouts in the study area, those properties will be unavailable for use by structural measures.
- If adding recreation, recreation features can only be added to lands required for FRM features.

Additional Study Considerations

- The focus of the study will be solely on direct or indirect flooding caused by the Meramec River. Yarnell Creek is a tributary to the Meramec River. Its watershed overlaps with the study area and it can cause flood damages independent of flooding on the Meramec River. Effects of flooding from the Yarnell Creek watershed and potential actions to be considered by the City can be found in the Yarnell Creek Flood Risk Evaluation report (USACE 2022) conducted under the Planning Assistance to States Program.

3. EXISTING CONDITIONS

3.1 HYDROLOGIC AND HYDRAULIC CONDITIONS

3.1.1 MODELING

Flood risks for the Meramec River for existing conditions were modeled using existing hydrologic and hydraulic models that were produced by a contractor for the FEMA Flood Insurance Study update for St. Louis County. The Hydrologic Engineering Center's (HEC) Hydrologic Modeling System (HMS) version 4.10 and River Analysis System (RAS) version 6.3.1 are the two software products that were utilized. The existing models were updated using currentl rainfall data from NOAA Atlas 14 to evaluate a suite of eight rainfall frequencies. Data output was analyzed and compiled into depth grids and inundation maps for economic evaluation.

3.1.2 INUNDATION MODELING

To model flooding extent and depths, an existing 1-dimensional RAS model was utilized. The 50, 20, 10, 4, 2, 1, 0.5, and 0.2% Annual Exceedance Probability events were evaluated for the Meramec River. The City of Fenton primarily experiences flood damages from inundation from the Meramec River. The river discharge and water surface elevation (WSE) for each AEP event at the USGS Fenton River Gage (XS 83411.2) can be seen below in Table 3-1.

Table 3-1. RAS Results at Fenton Gage

AEP Event	Discharge (CFS)	WSE (Feet-NAVD 88)
50%	40,400	407.43
20%	67,600	413.48
10%	87,900	416.20
4%	116,600	420.21
2%	140,000	423.04
1%	164,700	425.67
0.5%	192,000	428.28
0.2%	226,600	431.15

Upon completion of the RAS modeling, two main outputs were created: depth grids and inundation area. The depth grids are a grid-based (raster) format using the same grid cell size as the terrain data used for the project, in this case a Light Detection and Ranging (LiDAR) data set. A depth grid for a particular frequency event is computed by subtracting the terrain elevation from the water surface elevation. Negative values are discarded, leaving a final product that indicates the depth of flooding for a given frequency.

By creating a polygon shapefile around the area where the flooding depth is greater than zero, an inundation boundary is created for each flood event. The inundation boundary and depth grids are valuable tools for determining the location of structures that are at risk for flood damages. These tools are also used for economic evaluation. Figure 3-1 shows the extents of the RAS model and the cross sections included in the model at the City of Fenton.

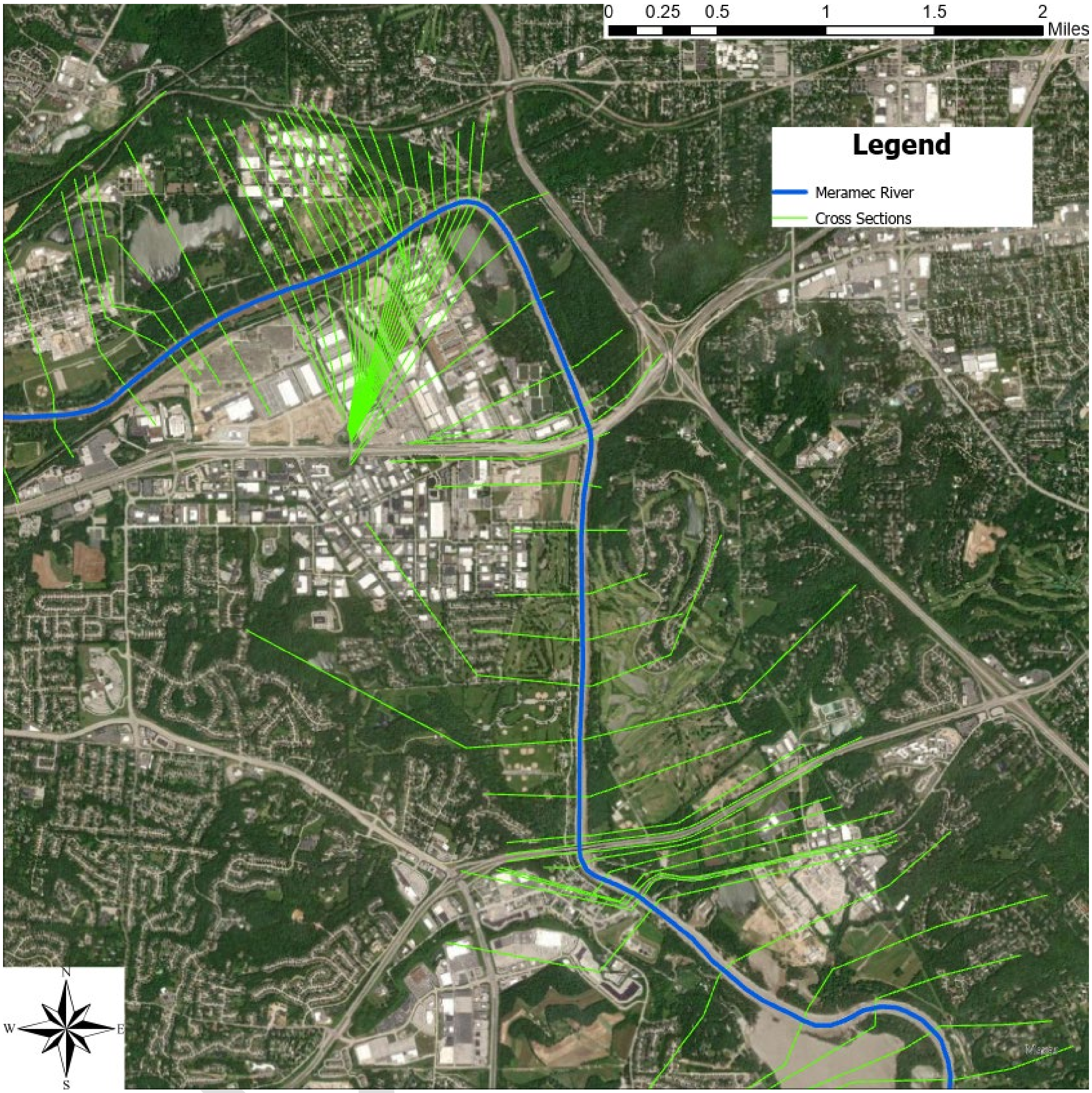

Figure 3-1. Meramec River at Fenton Hydraulic Model

The Meramec River RAS model extents approximately 50 miles, but only an 8-mile reach near the project area in the City of Fenton is shown in Figure 3-1. There are 15 miles of the river downstream towards the Mississippi River, and 27 miles of the river modeled upstream. For the evaluation of existing conditions, Future Without Project (FWOP), and all alternatives, any flood impacts or project limitations have been evaluated for the full extent of the RAS model and not just within the area shown above.

Figure 3-2 and Figure 3-3 show examples of the peak flood depths for two flood events that were evaluated with the RAS models, the 1% and 0.2% AEP floods, respectively.

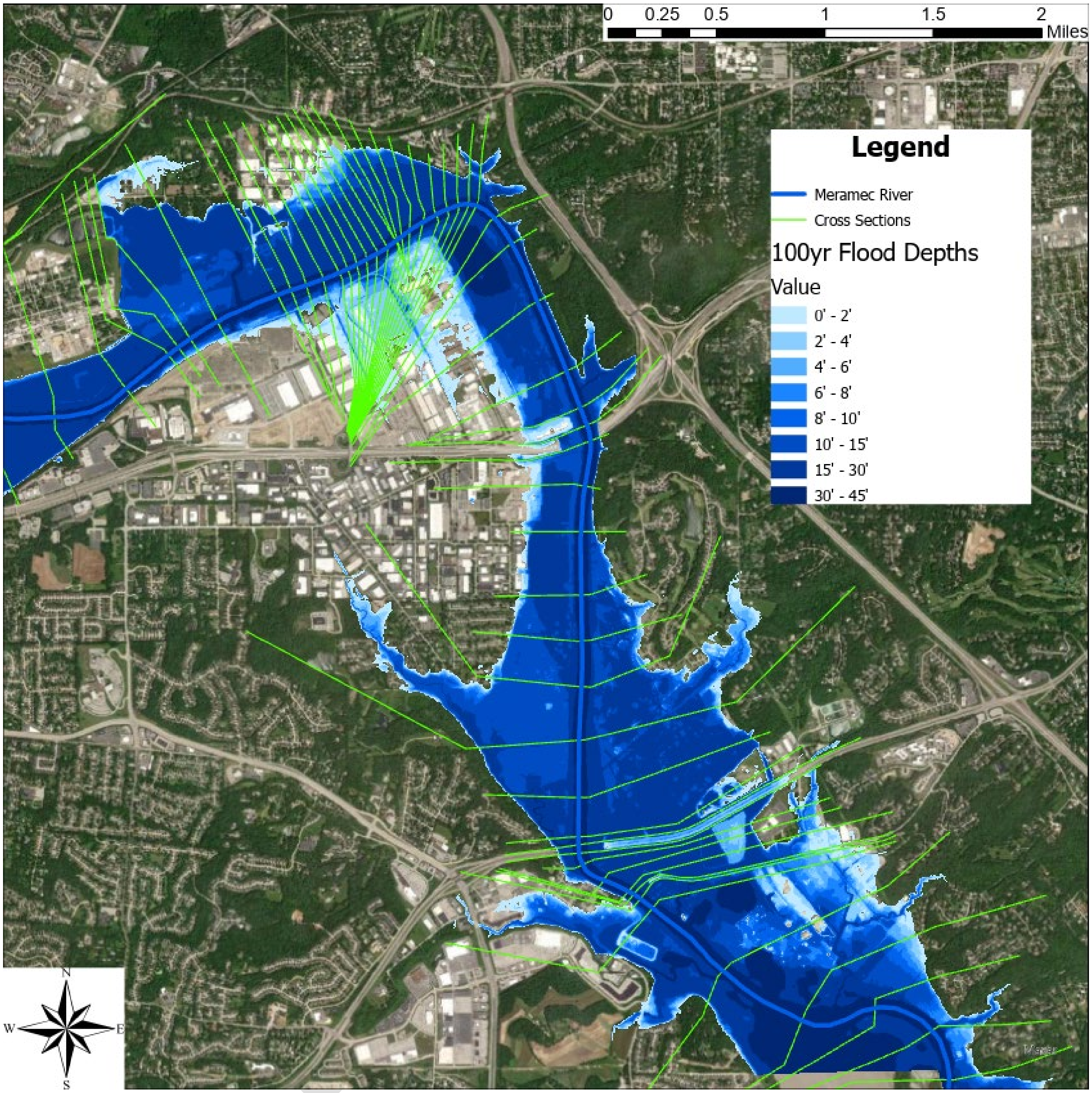

Figure 3-2. 1% AEP Peak Depths (ft.) for Existing Conditions

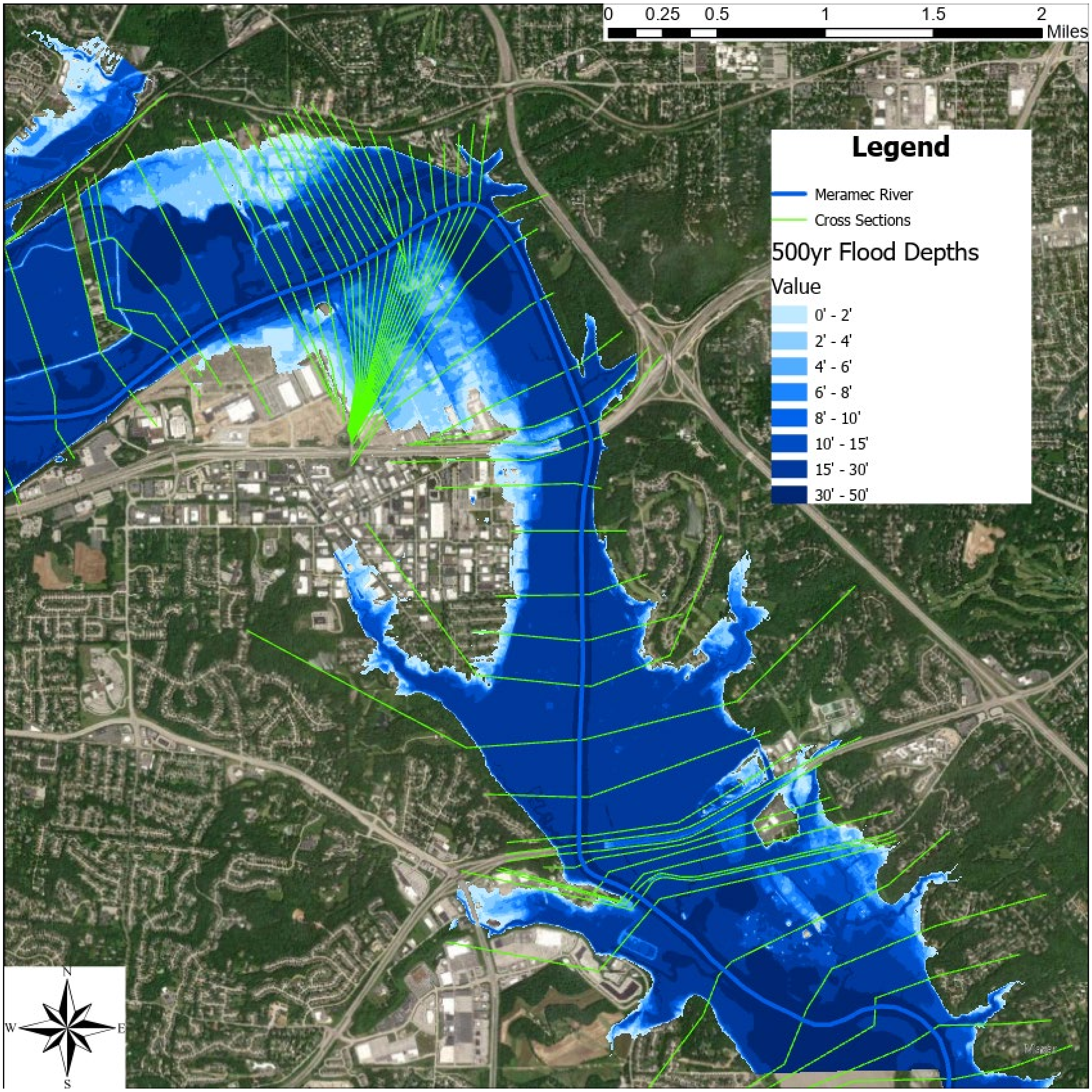

Figure 3-3. 0.2% AEP Peak Depths (ft.) for Existing Conditions

3.2 ECONOMIC DAMAGES

The HEC Flood Damage Analysis (FDA) program version 1.4.3 was utilized to evaluate flood damages using risk-based methods. The key economic inputs for the analysis are the structure inventory, depth-damage functions, content-to-structure value ratios, and the associated quantified risk and uncertainty parameters associated with these inputs.

Figure 3-4 below is the elevation map.

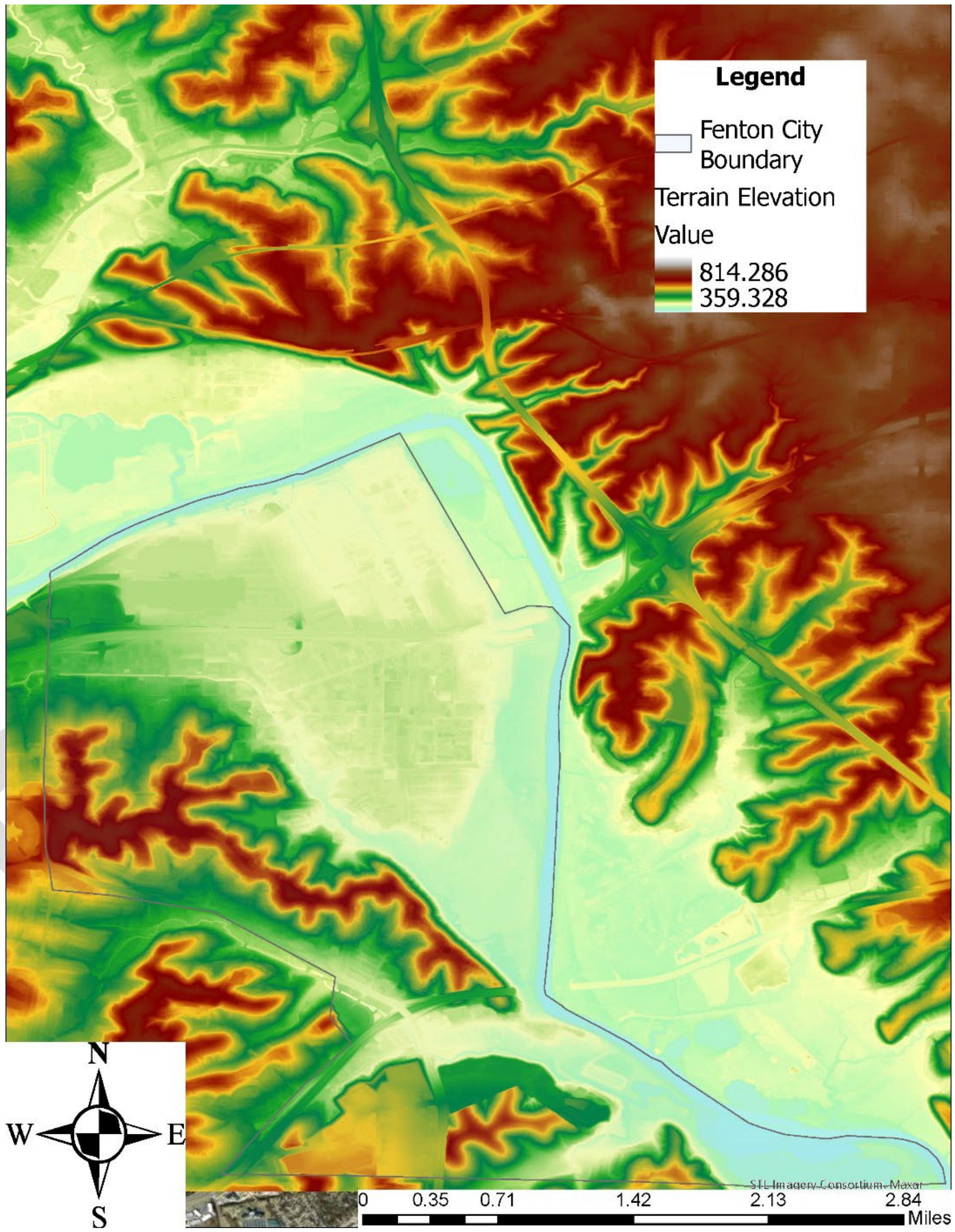

Figure 3-4. LiDAR Ground Surface Elevation Map – Fenton

There are three primary ways to measure flood susceptibility in structures:

1) First Floor Elevation
2) Beginning Damage Elevation
3) Depth of Flooding Relative to First Floor

For this study, structures' first floor elevations were not surveyed using traditional survey crews. Instead, first floor elevation was defined as the ground surface elevation plus the foundation height, which was estimated by utilizing a Google Street View windshield survey for each structure. For structures with partial or blocked views, a subsequent survey was conducted in-person to determine the foundation of a structure.

First floor elevation can be used to quickly identify structures that are more likely to be flood-prone, relative to neighboring structures. Additionally, the first-floor elevation signifies where most damages to contents and the building envelope, or the outer shell of a structure (walls, roof, etc.), begin. While first floor elevation measurements provide an assessment of the elevation at which significant damages will begin, they do not properly illustrate where water enters the building, or the depths of flooding given a particular flood event.

Beginning damage elevation is defined as the lowest point at which water begins to enter the building and is dependent on the building's foundation type. Beginning damage elevation is measured as ground surface elevation plus any distance up to a basement window, crawl-space vent, or door or window leading into the structure. Beginning damage elevation improves on the first-floor elevation statistic because it considers each of the different kinds of foundations that a structure could have.

Depth of flooding relative to the first floor is the most precise indicator of flood susceptibility and goes beyond the normal measure of first floor elevation by indicating how high flood depths are expected to rise on a structure for a given flood event. A depth of flooding measurement of two feet would indicate that a given flood event would be expected to flood the structure two feet above the first floor. A depth of flooding measurement of negative two feet would indicate that flooding is not anticipated to reach the first floor but instead could cause damage in a subfloor space such as the basement or crawlspace. Since the ground surface elevation changes spatially, the depth of flooding estimate provides the best overall characterization of flood susceptibility by being able to compare flood-prone structures across multiple floodplains, such as across the Lower Meramec Basin. Flood velocities for each structure were generated but, given the dissipating effects of vegetation covering most banks in combination with slow rising rivers, concerns about structural integrity due to water velocity was not an issue for the average structure in the City of Fenton.

For illustrative purposes, the 1% AEP event was chosen to display the way that the study evaluated damages to structures due to flooding. Once each structure in the floodplain was assigned a flood elevation for the 1% AEP frequency, it was related to the first-floor elevation to determine the depth of flooding relative to the first floor. Depths of floodwaters are the primary driver of risk in the basin over velocity.

A table of summary statistics for each of the elevation categories is shown in Table 3-2.

Table 3-2. Fenton, MO Structure Elevation Statistics – 1% AEP Floodplain

Fenton	
Structure Count (within 1% AEP floodplain)	87
Average Ground Surface Elevation (ft NAVD 88)	423.6
Average Foundation Height (ft)	0.6
Average First Floor Elevation (ft NAVD 88)	424.2
Average Beginning Damage Elevation (ft NAVD 88)	424.2

3.2.1 STRUCTURE EVALUATION

Structure square footage, building type, address, and assessed structure and land values were gathered using a combination of the National Structure Inventory, a Google StreetView windshield survey, ArcGIS Pro, and RSmeans. The National Structure Inventory database was used to determine building type. Google StreetView, in tandem with ArcGIS Pro, was used to determine square footage and addresses. RSmeans, an industry standard valuation reference, was used to determine depreciated replacement value for the structures identified. The values calculated were adjusted based on RSmean's location factor for St. Louis.

Table 3-3 shows the distribution of structures by occupancy type, as well as the average depth of flooding on the first floor, which reveals that the community experiences different issues as it relates to the type of structures within the 1% AEP floodplain boundaries. The community of Fenton is highly mixed between residential, commercial, and industrial.

Table 3-3 First Floor Flood Depth Statistics by NSI Damage Category

Fenton	Inundation Depth for 1% AEP Event
Residential 1-2 Story Homes	12 structures, average depth of 1.6 feet
Commercial	58 structures, average depth of 3.6 feet
Industrial	16 structures, average depth of 2.3 feet
Public	1 structure, average depth of 1.1 feet

Depth-Damage Relationships and Content-to-Structure Value Ratio (CSVR)

Depth-damage relationships define the relationship between the depth of flooding and the percent of damage at varying depths that occurs to structures and contents. These mathematical functions are used to quantify the flood damages to a given structure. The content-to-structure value ratio (CSVR) is expressed as a ratio of two values: the depreciated replacement cost of contents and the depreciated replacement cost of the structure. Table 3-4 shows the CSVRs and standard deviations used in the economic modeling.

Table 3-4. Content-to-Structure Ratios (CSVRs) and Standard Deviations

Content-to-Structure Value Ratios (CSVRs) and Standard Deviations (SDs)		
Structure Category		**(CSVR,SD)**
Residential	One-story no basement	(1.0, 0.3)
	One-story with Basement	(1.0, 0.27)
	Two-story with Basement	(1.0, 0.25)
Non-Residential	Eating – Fast Food, Restaurants	(0.31, 0.52)
	Groceries and Gas Stations	(0.82, 0.68)
	Light Industrial	(0.47, 0.89)
	Public and Semi-Public Buildings	(0.26, 0.0)
	Multi-Family Buildings	(0.12, 0.53)
	Repair and Home Use	(0.82, 0.68)
	Retail and Personal Services	(0.31, 0.52)
	Warehouses and Contractor Services	(0.46, 0.59)

3.2.2 MODERATE FLOOD RISK (0 TO 3 FEET INUNDATION)

The City of Fenton has a high percentage of structures within the moderate flood risk category.

Figure 3-5 shows the 1% AEP depth of flooding in the City of Fenton by structure. In the figure, structures not colored are either not estimated to be flood-prone, flood at less frequent events (0.2% or 0.5% AEP), or may be vacant land.

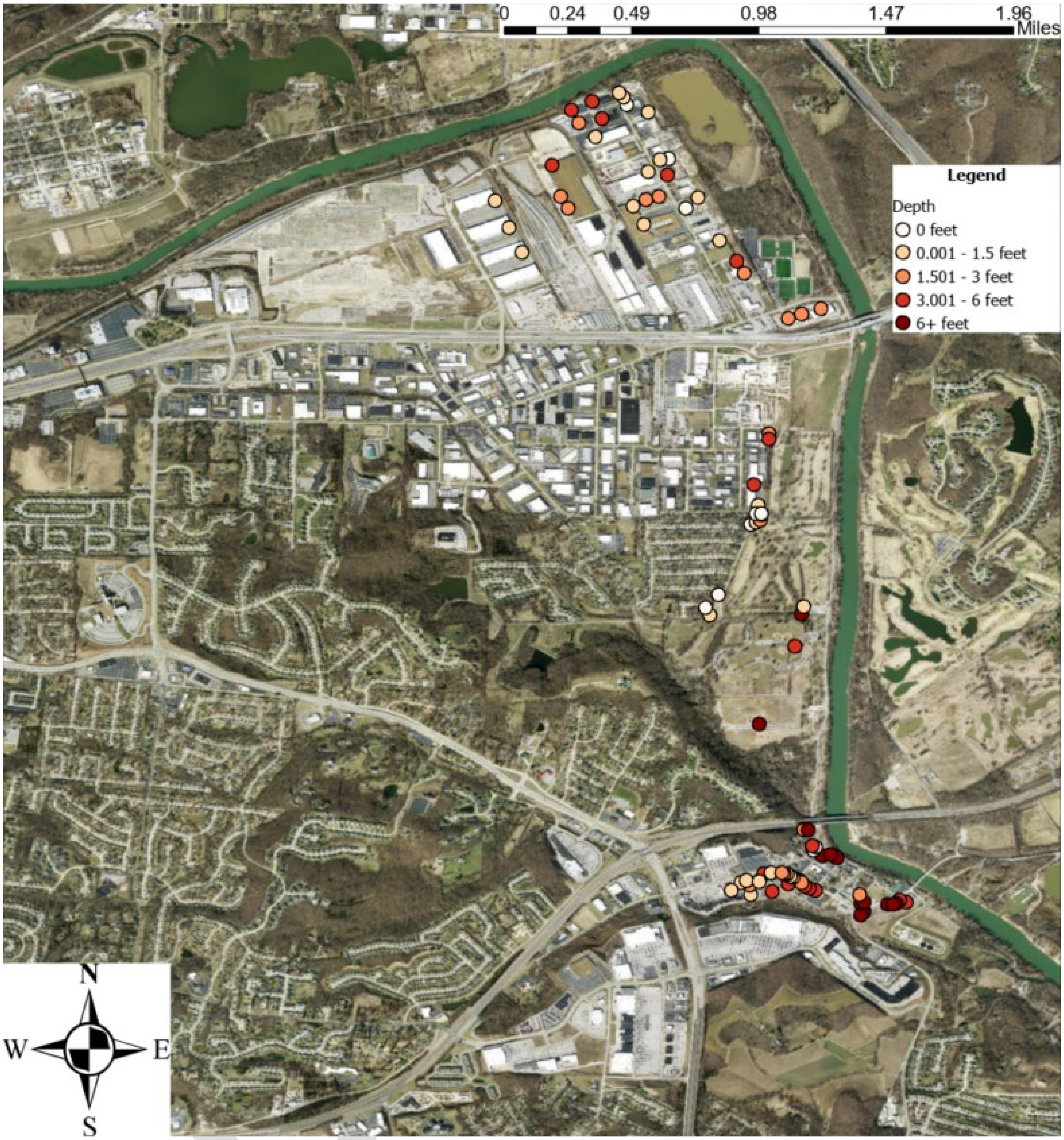

Figure 3-5. 1% AEP Structural Flood Depths – City of Fenton

3.2.3 EXISTING CONDITIONS DAMAGES

The above analytical process was performed for flood events ranging from 50% to 0.2% AEP. Table 3-5 displays the number and type of structures damaged in each floodplain. The existing conditions damages by probability event are displayed in Table 3-6 and Table 3-7 presents the total expected annual damages, which incorporates the damages from the full range of probability events.

Table 3-5. Existing Conditions Structures Damaged, by Floodplain

	Annual Exceedance Probability (AEP) Floodplain							
Structure Type	**50%**	**20%**	**10%**	**4%**	**2%**	**1%**	**0.5%**	**0.2%**
Residential	0	0	1	3	4	12	32	73
Commercial	0	0	3	8	16	24	32	43
Industrial	0	1	5	7	17	45	53	71
Public	0	0	0	0	0	1	2	3
Total	**0**	**1**	**9**	**18**	**37**	**82**	**119**	**190**

Table 3-6. Existing Conditions Damages by Probability Event

Fenton, Missouri Damages by Probability Event	
Probability Event	**Damages under existing conditions ($)**
50%	0
20%	158,190
10%	793,850
4%	3,219,350
2%	19,623,930
1%	80,774,780
0.5%	166,230,900
0.2%	262,393,730

Table 3-7. Existing Conditions Annualized Economic Damages (50-year period of analysis, 2.75% interest rate)

Fenton, Missouri Expected Annual Damages	
Location	**Expected Annual Damages ($)**
City of Fenton	2,414,700

3.3 LIFE RISK

There is a risk to human health, safety, and property associated with flood events in the Lower Meramec basin, specifically in the City of Fenton. This has been demonstrated by documented impacts as early as the 1920s. During many of these flood events, residents are evacuated from their homes, structures experience major damage, and many evacuation routes are shut down by floodwaters. In addition, access to critical infrastructure such as hospitals, fire departments, police departments, and schools are limited or cut off.

To model life safety risk for the City of Fenton, Life-Safety Risk Indicator (LSRI) version 2.0.126 modelling was used. Using hydraulic inputs for the 1% and 0.2% AEP events, the LSRI models did not show any areas of potential life-risk concern within the City of Fenton for the 1% AEP and 0.2% AEP events, respectively. Figure 3-6 shows the results of the LSRI model for the City of Fenton. In the figure, depth of flooding in the river's floodplain for the 0.2% AEP event are overlaid on the aerial photography. The hexagons represent areas analyzed for potential life risk. The green hexagon areas do not have life-risk concerns in the LSRI 0.2% AEP model. If the model identified potential life risk for the 0.2% AEP event, it would be indicated by a red hexagon. There are no red hexagons in the figure.

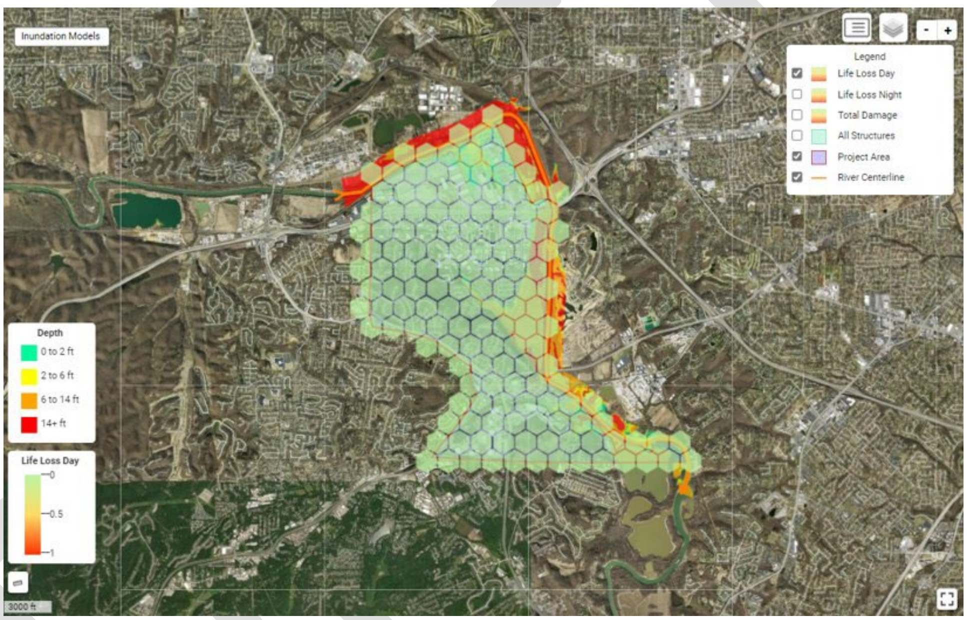

Figure 3-6. SRI Life-Risk Analysis – 0.2% AEP event

4. AFFECTED ENVIRONMENT (EXISTING CONDITIONS)*

This section describes existing conditions in the project area, which are referred to under the NEPA process as the Affected Environment. It is used as a baseline again which the alternatives (including no action) are compared. The resources described in this section are those recognized as significant by laws, executive orders, regulations, and other standards of national, state, or regional agencies and organizations; technical or scientific agencies, groups, or individuals; and the general public.

4.1 TOPOGRAPHY, GEOLOGY, AND SOILS

The City of Fenton, MO is in St. Louis County, Missouri, to the southwest of the Greater St. Louis metropolitan area. St. Louis County contains parts of two physiographic provinces: the west county area, in the Salem plateau of the Ozarks, and the remainder within the Dissected Till Plains (Missouri Geological Survey, 1967). Fenton is located within a physiographic area that is considered rolling with anywhere from 5 – 9% slopes. The physiography further east and south towards the Meramec River is more gently rolling and level with slopes rarely exceeding 2%. Generally, the southwestern region of St. Louis County has shallow unconsolidated deposits (i.e., soil), with common areas of bedrock exposure. The bedrock geology in the county consists of essentially flat (i.e., level) sedimentary formations of mostly limestone and dolomites. A slight dip (i.e., inclination from horizontal) in the regional northeast has been modified by several minor folds in the northern part of the county (Engineering Geology of St. Louis County, Missouri, 1971).

Primary soil types and depositional environments in the study area fall into three primary categories: alluvial soils, colluvial soils, and residual soils. Alluvial soils are those transported and deposited by streams; these will generally follow near surface topography and stratigraphy along Fenton Creek and further east towards the Meramec River floodplain. Colluvial soils are generally found in the near surface and subsurface topography along the edges of the alluvial floodplain. Those soils are types that are generally deposited at the base of hills and bluffs and accumulated by slow mass movement (i.e., creep) downslope. Residual soils are those primarily formed or left in place by the decomposition or disintegration of the parent rock. Figure 4-1 below is a generalization of engineering geologic units that are prevalent along the Meramec River and the study area. The Meramec River alluvial valley is composed of those units identified as Ia, Ib, and Id. While this area influences, the engineering considerations for the study area to some degree, any alternatives will likely be located along the uplands within units Ic, IIa, IIb, and/or Xa.

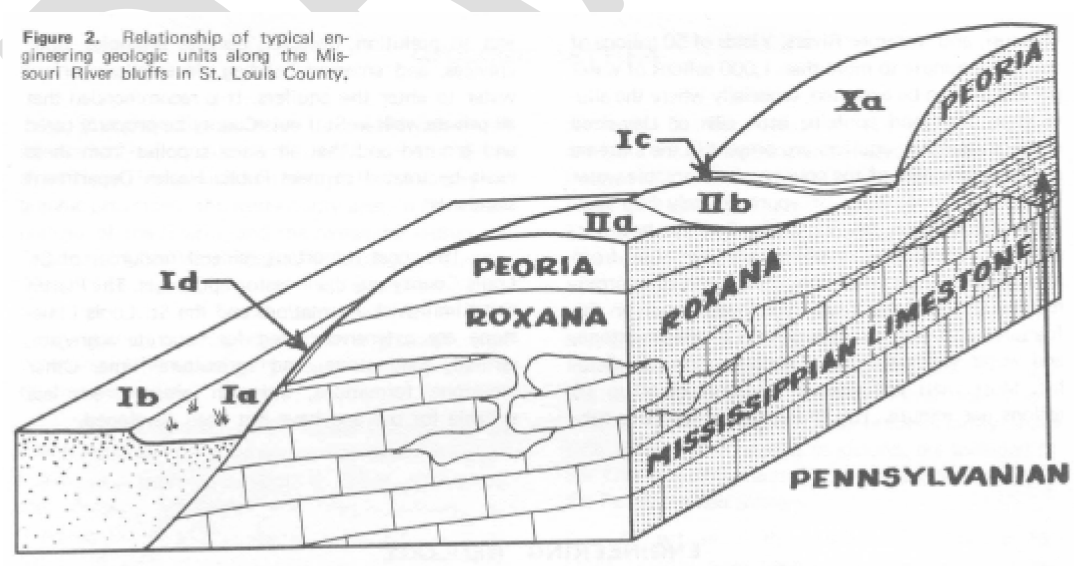

Figure 4-1. Generalization of Engineering Geologic units in St. Louis County

4.2 LAND USE / LAND COVER

The land cover in and around Fenton is primarily influenced by human development such as industrial and residential areas and major highways, including Highway 30, Highway 141, and I-44 (Figure 4-2). Approximately 66% of the land within the city limit is considered developed, with most of the development surrounding major roadways or as part of the industrial complex between I-44 and the Meramec River. Approximately 5% is open water, 25% is forested or wetlands, and 4% is cultivated crop or hay/pasture.

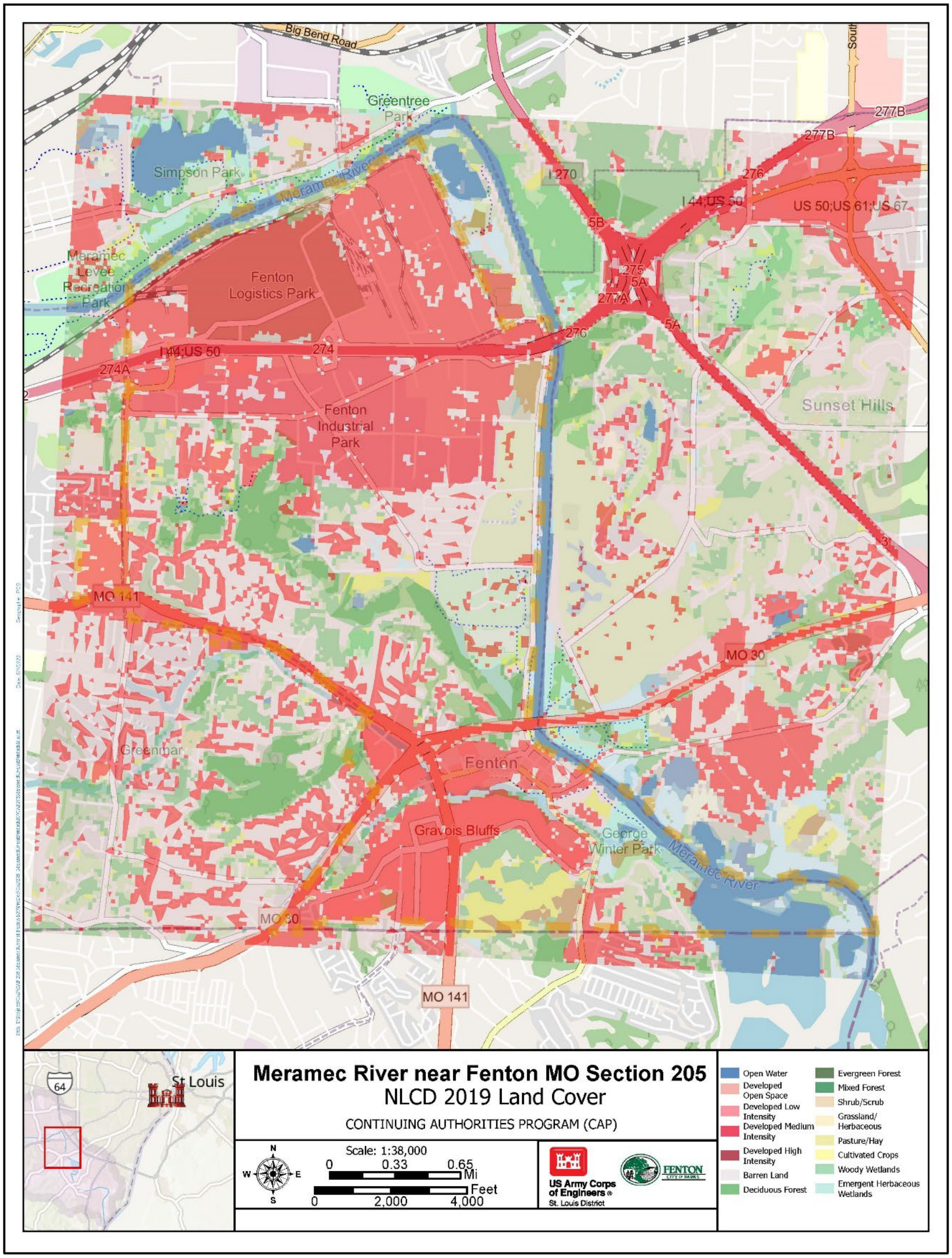

Figure 4-2. Land cover in the City of Fenton, Missouri (NLCD 2019)

4.3 WETLANDS AND VEGETATION

The study area is bordered on the north and east side by 8.5 river miles of the Meramec River, but little associated riparian habitat remains. Fenton has been historically disturbed by natural and industrial practices, which limits the establishment and sustainability of wetlands and other forested or vegetated areas. Historically, oaks (*Quercus spp.*) were significant components of native floodplain forests in the watershed, however, species such as cottonwood (*Populus spp.*), silver maple (*Acer saccharinum*), and willow (*Salix spp.*) now dominate flood-prone areas. A review of the National Wetlands Inventory Database identified relatively few, segmented forested wetlands adjacent to project area waterways and managed recreation areas (Figure 4-3; USFWS 2022).

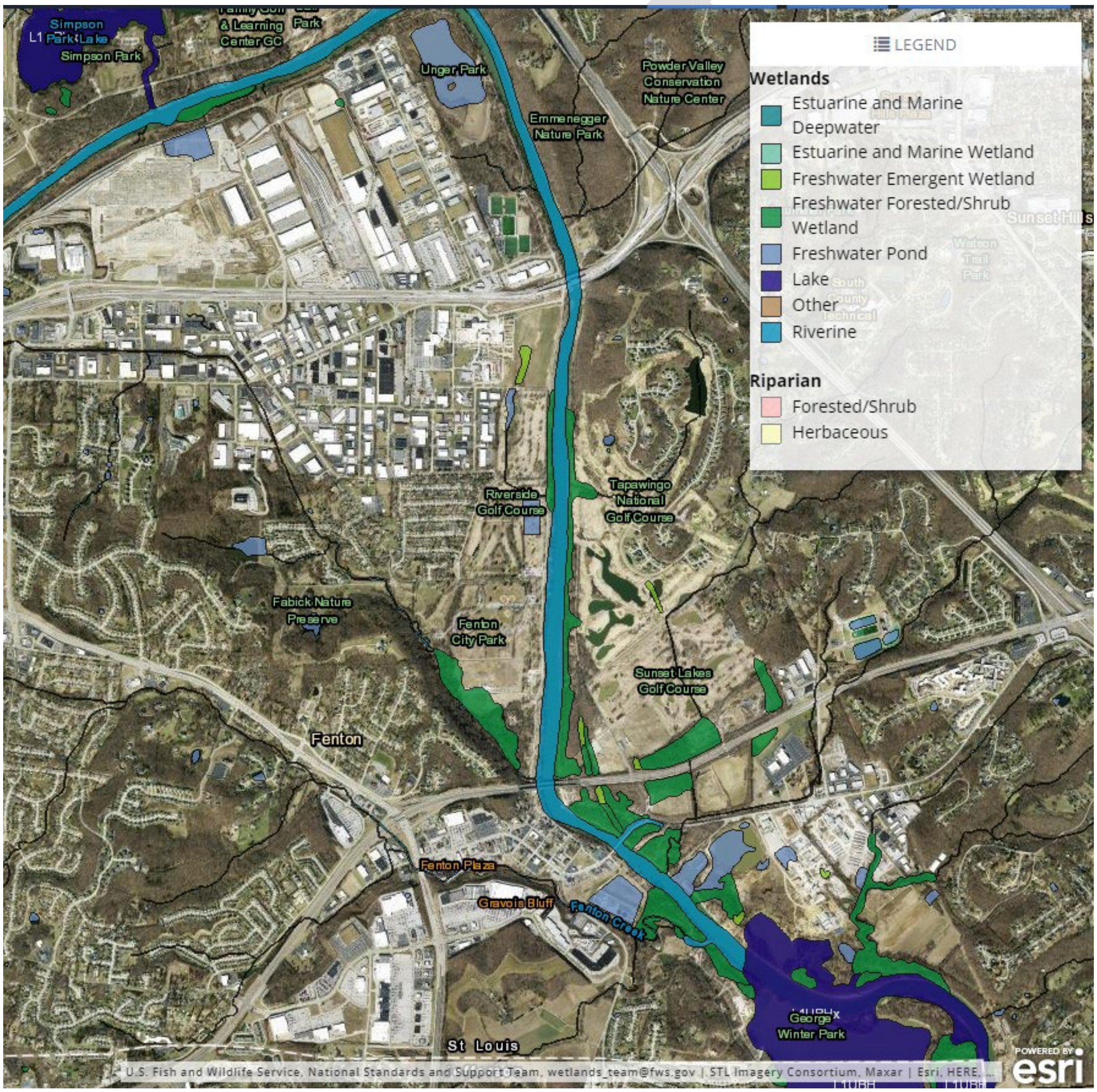

Figure 4-3. National Wetland Inventory Database wetland map for the study area in Fenton, MO

4.4 WATER QUALITY

Under Clean Water Act Section 303(d), states, territories, and authorized tribes are required to develop a list of water quality-impaired areas. The law requires that these jurisdictions establish priority rankings for water on the lists and develop action plans named Total Maximum Daily Loads (TMDL) to guide water quality improvement. The Missouri Department of Conservation's (MDC) 2020 Missouri Integrated Water Quality Report, Section 303(d): Listed Waters lists the Meramec River as impaired due to lead pollution from old lead belt tailings, and Fenton Creek as impaired due to chloride and *E. coli* pollution from urban runoff and storm sewers. Addtionally, there is known ground water contamination in the area from the former Chrysler Automobile Assembly Plant as well as the Valley Park TCE (trichloroethene) Superfund Site. See Section 4.5 Hazardous, Toxic, and Radioactive Waste for more information.

4.5 HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE (HTRW)

USACE regulations (ER-1165-2-132, ER 200-2-3) and District policy requires procedures be established to facilitate early identification and appropriate consideration of potential HTRW in feasibility, preconstruction engineering and design, land acquisition, construction, operations and maintenance, repairs, replacement, and rehabilitation phases of water resources studies or projects by conducting a Phase I Environmental Site Assessment (ESA). USACE specifies that these assessments follow the process/standard practices for conducting Phase I ESAs published by the American Society for Testing and Materials (ASTM).

The purpose of a Phase I ESA is to identify, to the extent feasible in the absence of sampling and analysis, the range of contaminants (i.e. Recognized Environmental Conditions, RECs) within the scope of the U.S. Environmental Protection Agency's (EPA) Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and petroleum products. Current policy is to avoid known HTRW to the extent practicable or until hazard risks and potential liability are mitigated.

For the purpose of assessing environmental risk in the early stages of CAP Section 205 for the City of Fenton, MO, an environmental records search was conducted on several environmental databases including:

1. U.S. Environmental Protection Agency's Enforcement and Compliance History Online (ECHO)
2. Missouri Department of Natural Resources's Environmental Site Tracking and Research Tool (E-Start)
3. Pipeline and Hazardous Materials Safety Administration's National Pipeline Mapping System (NPMS)

The environmental records search identified the following known/remediated environmental conditions within the immediate area of the proposed action:

1. Chrysler Dump - 478 S Highway 141. The Chrysler Dump previously contained hardened paint waste adjacent to Fenton creek on the south side of proposed levee 2. The site was placed on the U.S. EPA's Comprehensive Environmental Response, Compensation, and Liability information system (Superfund) in 1993 due to soil and

groundwater contamination. Cleanup began in early 1997, which consisted of excavating and disposing of the solid waste and drums, placement of eighteen inches of a clean, compacted clay soil liner over the affected area, and placement of six inches of vegetated topsoil over the clay liner.

2. Mikes Auto Repair - 64 Gravois Rd. A petroleum storage tank closure or regulated release was addressed under the Missouri Risk-Based Corrective Action 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 & Use Limitations (AUL) applied to this property remain in place (non-residential use).
3. Southwest Bell - 211 Gravois Rd. A petroleum or hazardous substance storage tank closure or regulated release was addressed prior to the adoption of the 2004 Missouri Risk-Based Corrective Action Guidance for Petroleum Storage Tanks. An evaluation found that no further action was warranted.

A review of available satellite imagery from 2005 to the present was conducted to assess any significant land use changes. The project area has remained mostly unchanged from 2005.

All findings in this report shall be further evaluated during the Phase 1 ESA per ASTM E1527-21 guidelines.

4.6 INVASIVE SPECIES (EXECUTIVE ORDER 13112)

Presidential Executive Order 13112 requires federal agencies to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts caused by invasive species.

St. Louis County has the highest number of invasive species in the state (EDDMapS 2020). Invasive species identified in the vicinity of the proposed project include common mullein (*Verbascum Thapsus*), Deptford pink (*Dianthus armeria*), eastern poison-ivy (*Toxicodendron radicans*), Japanese stiltgrass (*Microstegium vimineum*), kudzu (*Pueraria montana* var. *lobata*), osage-orange (*Maclura pomifera*) (EDDMapS 2020), and common water-plantain (*Alisma plantago-aquatica*). Another top state invasive species is the Asian clam (*Corbicula fluminea*) (USGS NAS 2020). MDC current and potential invasive species of concern include silver carp (*Hypophthalmichthys molitrix*), bighead carp (*Hypophthalmichthys nobilis)*, Asian long-horned beetle (*Anoplophora glabripennis*), emerald ash borer (*Agrilus planipennis*), European wood wasp (*Sirex noctilio*), gypsy moth (*Lymantria dispar*), rock dove (*Columba livia*), European starlings (*Sturnus vulgaris*), and zebra mussels (*Dreissena polymorpha*). Silver carp and Bighead carp have been observed in the Meramec River. These invasive fishes are planktivores, which means they compete with native freshwater mussels for food. Zebra mussels, which are known to attach themselves to native mussels, have also been confirmed in the Lower Meramec River.

4.7 AQUATIC RESOURCES

Primary aquatic resources within the City of Fenton are the Meramec River and Fenton Creek. The Meramec River Basin is home to a variety of game fish including smallmouth bass (*Micropterus dolomieu*), rock bass (*Ambloplites rupestris*), channel catfish (*Ictalurus punctatus*), flathead catfish (*Pylodictis olivrais*), sunfish (*Lepomis* spp.), crappie (*Pomoxis* spp.) and suckers (*Catostomidae*) (Meneau, 1997).

The Meramec River basin has one of the most diverse freshwater mussel faunas in the central United States, with >40 species identified (Hinck et al. 2012). However, according to historical surveys, species richness and diversity has decreased significantly in the Meramec River (Hinck et al. 2012). In general, freshwater mussels are sensitive to changes related to altered flow, substrate stability, sedimentation, and water quality, and are highly sensitive to heavy metal toxicity. See Sections 4.9 - State Threatened and Endangered Species, and 4.10 - Federal Threatened and Endangered Species, for additional information on protected mussel species within the study area.

The Meramec River Basin has an aquatic invertebrate fauna similar to what is found in other Ozark streams. Many of the fauna are typical to riffle-pool streams and have a wide geographical distribution (Ryckman, Edgerley, & Tomlinson, 1972).

4.8 WILDLIFE RESOURCES

The Lower Meramec River Basin provides suitable wildlife habitat, however, wildlife habitat within Fenton is limited due to human development. The available habitat such as city parks, residential backyards, vegetated areas, and remnant riparian areas primarily support species adapted to human disturbance. Common mammals found within the study area include white-tailed deer (O*docoileus virginianus*), gray squirrel (*Sciurus carolinensis*), coyote (*Canis latrans*), striped skunk (*Mephitis mephitis*), rabbit (*Oryctolagus cuniculus*), raccoon (*Procyon lotor*), beaver (*Castor canadensis*), river otter (*Lontra canadensis*), muskrat (*Onadtra zibethicus*), opossum (*Didelphis virginiana*), bobcat (*Lynx rufus)*, red bat (*Lasiurus borealis*) and big brown bat (*Eptesicus fuscus*). Common amphibians and reptiles utilize the Meramec River Basin in the vicinity of Fenton including turtles, frogs, toads, salamanders, skinks, lizards, and snakes.

The Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) protect certain species of migratory birds. Twelve species of migratory birds of conservation concern may be found within the study area (USFWS 2023; Table 4-1).

Table 4-1. List of migratory birds of conservation concern from the USFWS Information Planning and Consultation tool

Common Name (Scientific Name)	Habitat	Breeding
America Golden-Plover (*Pluvialis dominica*)	Northward migration in spring mostly through Great Plains and Mississippi Valley. Often forage in open fields and prairies, far from water.	Breeds in Arctic
Bald Eagle (*Haliaeetus leucocephalus*)	Nests in large, mature, accessible trees within 2.5 miles of a body of water	1 September to 31 July
Black-billed Cuckoo (*Coccyzus erythropthalmus*)	Dense wooded habitats, young deciduous and mixed woods, edges of bogs and marshes, rivers and lake-shores, or abandoned farmlands or brushy hillsides and pastures	May – October
Cerulean Warbler (*Dendroica cerulea*)	Deciduous forests, especially in river valleys. Breeds in mature hardwoods with clear understory	21 April to 2 July
Chimney Swift (*Chaetura pelagica*)	Nests in caves, hollow trees, chimneys, and other artificial sites with vertical surfaces and low light	15 March to 25 August
Eastern Whip-poor-will (*Antrostomus vociferus*)	Nest sites often on ground in shady woods near the edge of a clearing on open soil with dead leaves	1 May to 2 August
Kentucky Warbler (*Oporornis formosus*)	Prefers deep shaded woods with dense, humid thickets, bottomlands near creeks and rivers, ravines in upland deciduous woods, and edges of swamps	20 April to 20 August
Lesser Yellowlegs (*Tringa flavipes*)	Forages in very shallow water in marshes, mudflats, and edges of lake and ponds	Breeds everywhere
Prothonotary Warbler (*Protonotaria citrea*)	Breeds in flooded river bottom hardwoods or wetlands with bay trees surrounded by cypress swamp. Nests near borders of lakes, rivers and ponds, normally only in areas with slow moving or standing water	1 April to 31 July
Red-headed Woodpecker (*Melanerpes erythrocephalus*)	Cavity nesting species found in clearings in woods, forest edges, orchards, oak savannahs	10 May to 10 September

Rusty Blackbird (*Euphagus carolinus*)	Overwintering habitat may include river bottoms and wooded swamps. Forages by wading in shallow water	Breeds elsewhere; Overwinters in MO
Wood Thrush (*Hylocichla mstelina*)	Breeds in the understory of woodlands, mostly deciduous but sometimes mixed, in areas with tall trees. More numerous in damp forest and near streams	10 May to 31 August

The species listed above are protected by the Migratory Bird Treaty Act, which prohibits the take (including killing, capturing, selling, trading, and transport) of protected migratory bird species without prior authorization by the Department of Interior U.S. Fish and Wildlife Service.

Bald eagles (*Haliaeetus leucocephalus*) winter along the major rivers in Missouri, and at scattered locations, some remain throughout the year to breed. Perching and feeding occurs along the edge of open water, from which eagles obtain fish. Winter use is highest where the river is ice-free and adequate perch sites are available. The bald eagle was removed from the List of Endangered and Threatened Species in August 2007, but it continues to be protected under the Bald and Golden Eagle Protection Act (BGEPA) and the Migratory Bird Treaty Act. The BGEPA prohibits unregulated take of bald eagles, including disturbance. The National Bald Eagle Management Guidelines (USFWS, 2007) provide landowners, land managers and others with information and recommendations regarding how to minimize potential project impacts to bald eagles, particularly where such impacts may constitute disturbance. Currently, there are no records of bald eagle nests within Fenton per the USACE Bald Eagle Database.

4.9 STATE THREATENED AND ENDANGERED SPECIES

A list of state listed threatened or endangered species known to occur in Fenton, Missouri was obtained from the Missouri Natural Heritage Program (Project ID: 11905) on 20 April 2023. The Missouri Department of Conservation provided a list of 15 state listed species which may occur in the vicinity of the proposed project. (Table 4-2).

Table 4-2. State listed threatened and endangered species list according to Missouri Natural Heritage Review Database

Scientific Name	Common Name	State Rank	State Status	Federal Status
Alasmidonta marginata	Elktoe	S2		
Alosa alabamae	Alabama Shad	S2		
Arcidens confragosus	Rock Pocketbook	S3		
Cambarus maculatus	Freckled Crayfish	S3		
Crystallaria asprella	Crystal Darter	S1	Endangered	
Cumberlandia monodonta	Spectaclecase	S3	Endangered	Endangered

Scientific Name	Common Name	State Rank	State Status	Federal Status
Elliptio crassidens	Elephantear	S1	Endangered	
Epioblasma triquetra	Snuffbox	S1	Endangered	Endangered
Faxonius harrisonii	Belted Crayfish	S3		
Haliaeetus leucocephalus	Bald Eagle	S3		
Lampsilis abrupta	Pink Mucket	S2	Endangered	Endangered
Ligumia recta	Black Sandshell	S2		
Percina shumardi	River Darter	S3		
Plethobasus cyphyus	Sheepnose	S2	Endangered	Endangered
Potamilus leptodon	Scaleshell	S1	Endangered	Endangered

4.10 FEDERAL THREATENED AND ENDANGERED SPECIES

In accordance with Section 7(a)(2) of the Endangered Species Act (ESA) of 1973 (as amended), federally funded, constructed, permitted, or licensed projects must take into consideration impacts to federally listed and proposed threatened or endangered species.

The U.S. Fish and Wildlife Service (USFWS) was contacted via the USFWS Information for Planning and Consultation (IPaC) website on 20 September 2023, and a list of Federal threatened, endangered, and candidate species (Appendix G) that could potentially be located in the proposed project area was obtained. There is no critical habitat within the proposed project vicinity (Project Code: 2023-0021887; Table 4-3).

Table 4-3. Federally listed threatened and endangered species potentially occurring within the City of Fenton.

Common Name / *Scientific Name*	Status	Habitat
Gray Bat (*Myotis grisescens*)	Endangered	Caves and mines; rivers and reservoirs adjacent to forests
Indiana Bat (*Myotis sodalis*)	Endangered	Caves and mines; roosts under loose tree bark on dead or dying trees; forages near sources of water
Northern long-eared bat (*Myotis septentrionalis*)	Threatened	Caves and mines; roosts under loose tree bark on dead or dying trees; Forages near sources of water
Tricolored Bat (*Perimyotis subflavus*)	Proposed Endangered	Caves and mines; small stream corridors with well-developed riparian woods, upland forests

Common Name / *Scientific Name*	Status	Habitat
Eastern Hellbender (*Cryptobranchus alleganiensis alleganiensis*)	Endangered	Perennial streams and rivers with large, flat rock structures
Pink Mucket (*Lampsilis abrupta*)	Endangered	Mud, sand, and shallow riffles and shoals swept free of silt in major rivers and tributaries
Salamander Mussel (*Simpsonaias ambigua*)	Proposed Endangered	Rivers, streams, creeks, or lakes, under flat rocks in areas of moderate flow, with varying substrate including bedrock, sand, gravel, or mud.
Scaleshell Mussel (*Leptodea leptodon*)	Endangered	Medium-sized and large rivers with stable channel sand good water quality
Snuffbox Mussel (*Epioblasma triquetra*)	Endangered	Small- to medium-sized creeks with swift currents, Lake Erie, and some larger rivers
Spectalecase (mussel) (*Cumberlandia monodonta*)	Endangered	Large rivers in areas sheltered from the main force of the river current
Decurrent False Aster (*Boltonia decurrens*)	Threatened	Moist, sandy floodplains and prairie wetlands
Monarch Butterfly (*Danaus plexippus*)	Candidate	North America

Gray Bat. The gray bat (*Myotis grisescens*) is listed as endangered and occurs in several Missouri counties. Typically, gray bats roost in caves year-round, with most wintering caves being vertical and deep. During the spring and fall transient periods, a much wider variety of cave types are used. During the summer, maternity colonies prefer caves that provide restricted rooms or domed ceilings that act as warm air traps. This species forages in riparian forest canopy and over rivers and reservoirs adjacent to forests. Population decline has been attributed primarily to human disturbance of bats and alteration of their habitat, as well as white-nose syndrome, caused by the fungus *Pseudogymnoascus destructans*. The fungus grows best in cold, humid conditions that are typical of many bat hibernacula. Suitable foraging habitat may occur in and adjacent to the forested areas near the project area, and a known hibernacula.

Indiana Bat. Indiana bats hibernate in caves or mines during the winter months. Hibernation season is from 1 October to 31 March. During the active season (1 April to 30 September), they roost in a wide variety of suitable habitats, such as forested/wooded areas, emergent wetlands, adjacent edges of agricultural fields, old fields, and pastures. Roosting habitats for this species include live trees and/or snags with at least 5 inches diameter at breast height (dbh) that have exfoliating bark, cracks, crevices, and/or hollows. Tree species used as roosts often include, but are not limited to, shagbark hickory (*Carya ovata*), white oak (*Quercus alba*), cottonwood (*Populus spp.*), and maple trees (*Acer spp.*). Suitable foraging habitat may occur in and adjacent to the forested areas near the project area, and a known hibernacula exists within 10 miles of the study site.

Northern Long-eared Bat. Northern long-eared bats hibernate in caves or mines during the winter months. During the active season (mid-March to 31 October), they roost in a wide variety of suitable habitats, such as forested/wooded areas, emergent wetlands, adjacent edges of agricultural fields, old fields, and pastures. Roosting habitats for this species include live trees and/or snags at least 3 inches dbh and have exfoliating bark, cracks, crevices, and/or hollows. Tree species used as roosts often include, but are not limited to, shagbark hickory (*Carya ovata*), white oak (*Quercus alba*), cottonwood (*Populus spp*.), and maple trees (*Acer spp*.). Northern long-eared bats have also been observed roosting in human-made structures such as buildings, barns, bridges, and bat houses. Suitable foraging habitat may occur in and adjacent to the forested areas near the project area, and a known hibernacula exists within 10 miles of the study site.

Tricolored Bat. Tricolored bats are wide ranging across the eastern and central United States and portions of southern Canada, Mexico and Central America. During the winter, tricolored bats are often found in caves, abandoned mines, and road-associated culverts. During the spring, summer, and fall, tricolored bats are found in forested habitats where they roost in trees, primarily among leaves of live or recently dead deciduous hardwood trees, but may also be found in Spanish moss, pine trees, and occasionally human structures. Tricolored bats face extinction due primarily to the rangewide impacts of white-nose syndrome, which has caused estimated declines of more than 90 percent in affected tricolored bat colonies across the majority of the species range. Suitable foraging habitat may occur in and adjacent to the forested areas near the project area, and a known hibernacula exists within 10 miles of the study site.

Eastern Hellbender. The eastern hellbender is the America's largest aquatic salamander. They occur in cool, permanent streams across 15 states. Eastern hellbenders prefer clear, fast-flowing, well-oxygenated streams and rivers with stream bottoms comprised of gravel and sand with an abundance of large flat rocks. Though the species' current range is largely the same as its historical range, abundance, or the number of individuals, in each of these rivers had dropped more than 70% since the 1970s.

Pink Mucket. The Pink Mucket is a freshwater mussel that is a suspension feeder on plankton and deposit feeder on bacteria and organic matter in the substrate. The Pink Mucket can be found in a variety of substrates, including mud, sand, and shallow riffles and shoals swept free of silt in major rivers and tributaries. Freshwater mussels generally require free-flowing, clean, well-oxygenated water. The Pink Mucket is presently known to occur in 16 rivers, with one of the four largest populations occurring in the Meramec River. (USFWS 1985)

Salamander Mussel. The Salamander Mussel is a small, thin-shelled, mussel, with a life span of approximately 10 years. It is the only unionid with a non-fish host, the mudpuppy (*Necturus maculosus*) for reproduction. The mussel is found in rivers, streams, creeks, or lakes, under flat rocks in areas of moderate flow, with varying substrate including bedrock, sand, gravel, or mud. Primary threats include habitat alteration or destruction, contaminants, sedimentation, climate change, altered hydrologic regime, invasive species, disease, and host species vulnerability.

Scaleshell Mussel. Scaleshell adults are suspension feeders, using their gills to remove suspended particles in the water column. They occur in medium to large rivers with low to medium gradients. It inhabits a variety of substrate types but is primarily found in stable riffles and runs with slow to moderate current velocity. The scaleshell is also usually found in stable channels where a diversity of other mussel species is concentrated (i.e., mussel bed). The scaleshell appears to be dependent solely upon freshwater drum to complete its life cycle. Drum are common in larger streams throughout the range of the scaleshell. Currently, the scaleshell can only be consistently found in three Missouri streams, the Meramec, Bourbeuse, and Gasconade rivers. While these rivers support the largest known scaleshell populations, these populations are extremely small and restricted to isolated patches of suitable habitat. Based on living and dead specimens collected during a 1997 survey in the Meramec Basin, the scaleshell occurs at isolated sites between river mile 18.5 and 60.2 of the Meramec. (USFWS 2010)

Snuffbox Mussel. The snuffbox is a small- to medium-sized mussel with a life span of approximately 20 years. Currently the snuffbox occurs in 14 states, as well as the Canadian province of Ontario. The mussel is found in rivers, streams, creeks, or lakes, in areas of moderate flow, in sand and gravel substrate. Snuffbox habitat must have adequate flow to deliver oxygen, enable passive reproduction, and deliver food to filter-feeding mussels. Snuffbox habitat is in rivers and streams with natural flow regimes. (USFWS 2022)

Spectalecase. The spectaclecase (*Cumberlandia monodonta*) is a freshwater mussel that is found in the Mississippi, Missouri and Ohio River basins. Spectaclecase mussels are found in large rivers where they live in areas sheltered from the main force of the river current. This species often clusters in firm mud and in sheltered areas, like beneath rock slabs, between boulders and even under tree roots. The spectaclecase is considered a specialist species that requires very specific habitat conditions, which limit its current range and distribution to certain sites within large rivers. Generally, mussels are long-lived, with individuals surviving up to several decades, sometimes up to 100 to 200 years. Major threats to the spectaclecase mussel include dams, small population size and fragmentation, sedimentation and pollution. Population losses due to dams have contributed more to the decline and potential extinction of the spectaclecase than any other factor.

Decurrent False Aster. The decurrent false aster is a perennial floodplain plant of open, wetland habitats, and its distribution includes Madison and St. Clair counties, Illinois, as well as St. Charles County, Missouri. Historically it occurred in wet prairies, shallow marshes, and shores of rivers, creeks, and lakes on the floodplain of the Illinois and Mississippi rivers. Currently it is found most often in old agricultural fields and along roadsides and lake shores where alluvial soils have been disturbed. This plant is an early successional species that requires either natural or human disturbance to create and maintain suitable habitat. In the past, the annual flood/drought cycle of the Illinois and Mississippi rivers provided the natural disturbance required by this species. Annual spring flooding created open, high-light habitat and reduced competition by killing other less flood-tolerant, early successional species. Field observations indicate that in “weedy” areas without disturbance, the species is eliminated by competition within 3 to 5 years (USFWS 2001). Decurrent false aster has high light requirements for growth and seed germination and shading from other vegetation is thought to contribute to its decline in undisturbed areas. Seeds of this plant can be dispersed by flooding or carried by wind and animals.

Monarch Butterfly. Much of the monarch butterfly population's life is spent migrating between Canada, Mexico, and the United States. Grasslands of central North America and areas vegetated by milkweed (*Asclepias syriaca L.*) comprise the majority of summer breeding areas. During the breeding season, monarchs require milkweed to rear larvae and provide nectar sources to sustain adults during reproduction. Nectar sources are also required by the butterflies to fuel fall migration and spring flights northward. Monarch populations of eastern North America have declined 90%. Causes of decline include deforestation, illegal logging, increased development, agricultural expansion, livestock raising, forest fires, and other threats to their migratory paths and summer and overwintering habitats. Chemical-intensive agriculture, increasing acreage converted to row crops, and mowing/herbicide treatment of roadsides have contributed to a decline of milkweed, the only plant eaten by monarch caterpillars.

4.11 AIR QUALITY

The Clean Air Act of 1963 requires the EPA to designate National Ambient Air Quality Standards (NAAQS). The EPA has identified standards for six primary pollutants: lead, sulfur dioxide, carbon monoxide, nitrogen dioxide, ozone, and particulate matter (PM_{10} – particles less than 10 microns; and $PM_{2.5}$ – particles less than 2.5 microns in diameter) (Table 4-4). St. Louis County, Missouri, is in attainment for all criteria pollutants except ozone 8-hr (2015 standard) (USEPA Greenbook, April 2023).

Table 4-4. Six pollutants and their standard criteria designated by the U.S. EPA

Pollutant	Averaging time	Criteria	Form
Carbon monoxide	8 hours	9 ppm	Not to be exceeded more than once per year
	1 hour	35 ppm	
Lead	Rolling 3 month	0.15 µg/m^3	Not to be exceeded
Nitrogen dioxide	1 hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	1 year	53 ppb	Annual Mean
Ozone	8 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	Primary; Annual mean, averaged over 3 years
	1 year	15.0 µg/m^3	Secondary; Annual mean, averaged over 3 years
	24 hours	35 µg/m^3	Primary and Secondary; 98th percentile, averaged over 3 years
Particle Pollution (PM_{10})	24 hours	150 µg/m^3	Primary and Secondary; Not to be exceeded more than once per year on average over 3 years
Sulfur dioxide	1 hour	75 ppb	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years

4.12 NOISE

The Fenton area includes industrial, transportation, recreational, residential, retail, and agricultural zones. These areas are dispersed in pockets of varying sizes and density, and each makes its own contribution to the noise characteristics of the region. Agricultural and open space areas typically have noise levels in the range of 34-70 decibels (dB) depending on their proximity to transportation arteries. Noise associated with transportation arteries such as highways, railroads, etc., would be greater than those in rural areas. Other sources of noise include operations of commercial and industrial facilities, and operation of construction and landscaping equipment. In general, urban noise emissions do not typically exceed about 60 dB but may reach 90 dB or greater in busier urban areas or near high volume transportation arteries.

4.13 AESTHETICS AND RECREATION

Resources considered aesthetically pleasing to most individuals include the Meramec River, located adjacent to the study area (approximately River Miles 21.5-14), Fenton Creek, and open spaces which include city parks, golf clubs, forested habitat, and agricultural lands.

The project area encompasses a multitude of recreational resources including city and neighborhood parks and lakes, recreational centers and sports facilities, golf courses, and the Meramec River.

4.14 TRANSPORTATION

The St. Louis region has a well-defined roadway system including a number of interstate highways which are supplemented by other federal, state and county arterial roads. Interstate highways include I-44, I-55, I-64, I-70, I-170, I-255, and I-270. Other transportation resources in the metro area include railroads, mass transit busses and light rail transit, Lambert-St. Louis International Airport, the Spirit of St. Louis Airport in Chesterfield, and regional inland waterway ports (Richard Shearer & Associates 2003). Much of Fenton's history and development is directly related to the availability of these various transportation systems. This includes the City's location on the Meramec River, the two major railroad lines that traverse the city, and I-44, Highway 30, and Highway 141.

4.15 CULTURAL AND HISTORICAL RESOURCES

This project is considered a federal undertaking and is subject to compliance with Section 106 of the National Historic Preservation Act. The St. Louis District Archaeologist performed a records review for the study area to determine if cultural resource studies have been performed in the study area and if historic properties are located in the study area. This review found that 26 cultural resource studies have been previously conducted and 28 archaeological sites have been previously recorded within the city limits of Fenton.

One historic property is within Fenton, the Swanter House, which was built in 1906 and now serves as the Fenton History Museum. A cultural resource investigation may be needed in the study area to determine if the selected alternative overlaps any archaeological sites or if any of the structures that are 50 years of age or older represent historic properties.

4.16 TRIBAL RESOURCES

An archival review revealed that there is a previously identified archaeological site within the study area. This site was identified in 1985 by the University of Missouri-St. Louis as an Emergent Mississippian village site. At the time of its identification, it was not evaluated for the National Register of Historic Places.

4.17 ENVIRONMENTAL JUSTICE

Executive Order 12898 directs federal agencies to take the appropriate steps to identify and address any disproportionately high and adverse human health or environmental effects of federal programs, policies, and activities on minority and low-income populations. Minority populations are those persons who identify themselves as Black, Hispanic, Asian American, American Indian/Alaskan Native, and Pacific Islander. A minority population exists where the percentage of minorities in an affected area either exceeds 50 percent or is meaningfully greater than in the general population.

The population of Fenton is approximately 0.6% African American, 0.0% American Indian or Alaskan Native, 2.4% Asian, 0.0% Native Hawaiian or Pacific Islander, and 5.2% more than one race (US Census 2020; Table 4-5). The population is 2.6% Hispanic or Latino (US Census 2020). There are approximately 6.6% of households in the Fenton area whose income in the past 12 months falls below the national poverty level (US Census 2021).

In addition to E.O. 12898, E.O. 14008 established the Justice40 Initiative which aims to provide 40% of the overall benefits of certain Federal investments to disadvantaged communities who are marginalized, underserved, and overburdened. Fenton is not considered a disadvantaged community based on climate change, energy, housing, pollution, transportation, water, or wastewater criteria (Climate and Economic Justice Screening Tool, 2023).

Table 4-5. Total population, racial and ethnic compositions, and socioeconomic data for the City of Fenton and St. Louis County, Missouri (US Census 2020)

Socioeconomic Indicator	City of Fenton, MO		St. Louis County, MO	
	Population	%	Population	%
White	3,645	91.4	632,283	63.0
Black or African American	24	0.6	246,642	24.6
American Indian / Alaska Native	0	0.0	2,376	0.2
Asian	94	2.4	48,784	4.9
Native Hawaiian/ Pacific Islander	1	0.0	295	0.0
Other	17	0.4	16,162	1.6
Multiple	208	5.2	57,583	5.7
Total Population	3,989	100.0	1,004,125	100.0
Hispanic	102	2.6	37,178	3.7
% Persons in Poverty		2.6		10.3
Median Household Income	97,356		72,378	

5. ASSUMPTIONS REGARDING FUTURE WITHOUT PROJECT CONDITIONS

The following assumptions regarding the Future Without Project (FWOP) Conditions is developed to describe the most likely future conditions in the project area if this federal action is not taken to address the identified problems. This section provides a detailed discussion on future conditions related to flood risk. It forms the baseline for identifying the effects of the alternatives on the flood risk and forms the basis for the No Action alternative. The future is inherently uncertain, and conditions change over time. For example, the flood risk may change if there are changes to land use in the Meramec River watershed or if there is a change in the climate that affect storm frequency and intensity.

In order to identify the assumptions to be used for this study, the study team began with the existing conditions information and considered where potential changes could occur in the future. This section provides a detailed discussion on future conditions related to flood risk. Forecasted changes to the affected environment are fully described alongside the corresponding with-project conditions in Section 7.

A forecast period of 50 years was selected as a reasonable time frame for analyzing potential changes in the project area. USACE policy requires a 50-year period of analysis except for major multipurpose reservoir projects (which can be evaluated for up to 100 years) or projects for which the beneficial or adverse effects will occur over less than 50 years. For this project, the effects are expected to extend beyond 50 years, but it is not a reservoir project; therefore a 50-year period of analysis was chosen.

This section discusses five areas of potential changes during the forecast period which the team felt could result in a future condition that differs from the existing conditions and, where needed, documents the differences.

5.1 FUTURE FLOOD CONDITIONS

The recent flooding history in the Meramec River watershed includes two extreme events (2015-16 and 2017) that are at or near all-time record levels, depending on the location in the basin. Significant development has occurred in St. Louis County and surrounding counties in the Meramec River basin in the past 40 years. As a result, it has been observed that there has been an increased frequency of flooding in the recent past that may be expected to continue.

For example, the FEMA flood insurance study performed around 1980 determined a peak flood discharge of 139,000 cubic feet per second (cfs) for the 1% AEP flood. The updated, preliminary FEMA peak flood discharge was determined in 2017 to be about 165,000 cfs for the 1% AEP flood. There are two possible reasons there has been an increase in flow for the same frequency events. The first is that there have been more moderate/large flood events, and this has caused the flow-frequency relationship to shift so that moderate/high flows have a higher frequency. The second is that more very large (possibly outlier) events have happened, and this expands the flow-frequency relationship, increasing the frequency that larger events happen at.

The Meramec River has a large watershed upstream of the City. It is unlikely that there would be development in the watershed that would be on a scale large enough to significantly impact the flows at Fenton. There are also no known planned changes to any of the bridges, culverts or crossings in the vicinity which would significantly impact the flows at Fenton.

Based on a qualitative analysis of potential climate change impacts, the Fenton study will not use a forecasted increase to flood discharges for the future flood conditions. All flood inundation maps, depth grids, and water surface elevations presented in this report represent both the existing and future flood conditions for the purposes of the study. The decision to not model increased flood frequency in the future and its potential effects on the project is summarized in Section 5.2 and discussed in more depth inAppendix B – Climate Change.

5.2 CLIMATE

USACE has an overarching climate preparedness and resilience policy and specific policies and guidance related to assessment of potential climate change impacts to inland hydrology. This overarching policy requires consideration of climate change in all current and future studies to reduce vulnerabilities and enhance the resilience of communities. In support of its policies and guidance, USACE relies on climate change science performed and published by agencies and entities external to USACE. The elucidation of science regarding the causes, predicted scenarios, and consequences of climate change is not within the USACE mission as a water resources management agency.

Engineer and Construction Bulletin (ECB) 2016-25 (Guidance for Incorporating Climate Change Impacts to Inland Hydrology in Civil Works Studies, Designs, and Projects) applies to inland hydrology. Due to observations of more extreme seasonal conditions of rainfall and runoff (flooding or drought) and altered snow volume and melt in some regions, assumptions of past trends continuing into the future are no longer appropriate in some locations. This ECB helps support a qualitative assessment of potential climate change threats and impacts that may be relevant to the particular USACE hydrologic analysis being performed.

In general terms, the focus of the climate assessment for this flood damage risk reduction study is to evaluate the likelihood of climate trends impacting the effectiveness of any risk reduction measures. Also, if climate change is expected to increase the project's overall residual risk, that will be addressed during alternative formulation and evaluation.

The primary sources of climate information were the data stations at the following locations:

- Meramec River at Eureka, Missouri
- Big River at Byrnesville, Missouri
- Big River at Richwoods, Missouri
- Farmington, Missouri

Data for annual peak streamflow shows an increasing trend of borderline statistical significance on Meramec River at Eureka, and a statistically significant increasing trend on Big River at Byrnesville (105 cfs per year). Meanwhile, data for both annual mean and annual median flows on Big River at Byrnesville show no statistically significant increasing or decreasing trends. The only strong nonstationarity among the analyses was relating to an increasing trend for annual mean flow on the Meramec River at Eureka. This nonstationarity had consensus, robustness, and non-trivial magnitude.

A literature review reveals a general consensus that there has been a moderate increase in temperature, precipitation, and streamflow in the Meramec River Valley over the past century.

Some evidence also points towards an increased frequency of extreme storm events. However, a clear consensus is lacking in the hydrologic projection literature. Projections generated by coupling Global Climate Models with macro scale hydrologic models in some cases indicate a reduction in future streamflow but in other cases indicate a potential increase in streamflow. Of the limited number of studies reviewed here, more results point toward reduction than increase, particularly during the summer months. Due to the lack of consensus, this study will assume that future hydrologic and hydraulic conditions will be the same as existing conditions.

5.3 ECONOMIC DAMAGES

The City of Fenton is largely developed and has restrictions on floodplain development. Additionally, while structures have been removed from the floodplain in the past, there are no known plans for additional removal of structures from the floodplain. The wastewater treatment plant is planned to go off-line in the near future and is not included in the economic damage calculations. Other than the wastewater treatment plant, no significant changes to the structure inventory are anticipated and future damages are expected to be similar to existing conditions (see Section 3.2).

5.4 LIFE RISK

The City of Fenton is largely developed and there is unlikely to be any significant change to the population, critical infrastructure, and evacuation routes in the future. The study assumes that future life risk conditions will be the same as existing conditions (see Section 3.3).

5.5 ENVIRONMENTAL RESOURCES

The FWOP conditions for all environmental resources are described as part of the "No Action" Alternative discussion in Chapter 7.

6. PLAN FORMULATION

The guidance for conducting civil works planning studies, ER 1105-2-100, Planning Guidance Notebook, requires the systematic formulation of alternative plans that contribute to the federal objective. This section presents the results of the plan formulation process. Alternatives were developed in consideration of study area problems and opportunities as well as study objectives and constraints with respect to the four evaluation criteria described in the Principles and Guidelines (completeness, effectiveness, efficiency, and acceptability).

6.1 ASSUMPTIONS

In the formulation of measures and alternatives, the study team utilized the following overarching scope assumptions:

- FEMA's Hydrologic and Hydraulic modeling for the upcoming Flood Insurance Rate Map (FIRM) revisions is complete and will be used for this analysis.
- Model-identified inundation areas in the nearby areas of Crestwood and unincorporated St. Louis County will not be addressed in this study.
- There would not be simultaneous flooding on both the Meramec River and Yarnell Creek.
- Potential actions to address Yarnell Creek flooding had been identified in a previous study and would not be further considered in this study.

6.2 MEASURE DEVELOPMENT

Flood risk is composed of two primary factors: the flood hazard (the frequency, depth, and velocity of flooding) and the consequences of flooding (the structures, people, services, and natural environment negatively impacted). To reduce flood risk, one or both factors must be changed from the current or projected future conditions. During plan formulation, the study team identifies potential actions that will change the flood risk.

A management measure is a feature or activity that can be implemented at a specific geographic site to address one or more planning objectives. The study team developed and screened the following measures utilizing information on existing infrastructure, existing reports, and subject matter expertise. Flood risk reduction can be achieved through a variety of approaches, including natural or nature-based features, structural features, and nonstructural interventions. Risk reduction measures can be combined to form alternative plans.

6.2.1 STRUCTURAL MEASURES

Structural measures can be designed to act as a physical barrier between floodwaters and structures at risk of being damaged by those floodwaters. Traditional structures include levees, berms, floodwalls, and road elevations.

Channel Modifications – Modifications to river channels can include many types of structural features that modify the flow characteristics of the river. For this study, the channel modification features considered included widening or deepening the Meramec River in the vicinity of the City of Fenton.

Detention Structures – A detention basin is a storage area designed to mitigate adverse impacts of excess water by temporarily holding that water and gradually releasing it downstream. For detention to be effective for this area, water would need to be detained upstream of the City.

Diversion Structure – Excess flood water may be diverted from the main river channel by a permanent diversion or bypass structure to reduce flood flows and river levels. These permanent structures are usually located in floodplains, where river slopes are relatively flat, and adjacent to the main river channel to divert water into the auxiliary channels.

Levees and Floodwalls – Levees and floodwalls reduce flood risk by acting as physical barriers against floodwaters. Levees are permanent structures, but floodwalls can be permanent or temporary.

Interior Drainage Improvements – Interior drainage systems are often needed when levees or floodwalls are constructed. These systems can store interior water during times of high exterior water via channels, pump stations, culverts, drains, and inlets to remove water from a site quickly and send it to larger streams.

6.2.2 NON-STRUCTURAL MEASURES

Nonstructural measures essentially reduce the consequences of flooding. Nonstructural measures addressed by the USACE National Nonstructural Floodproofing Committee include structure acquisitions or relocations, floodproofing of structures, implementing flood warning systems, flood preparedness planning, establishment of land use regulations, development restrictions within the greatest flood hazard areas, and elevated development.

6.2.2.1 MEASURES

Buyouts/Acquisition – Property acquisition and structure removal are usually associated with frequently damaged structures. Implementation of other measures may be effective, but if a structure is subject to repeated storm damage, this measure may represent the best alternative to eliminating risks to the property and residents. Acquisition or relocation would not be voluntary.

Floodproofing (wet and dry) – A non-elevated structure in the flood zone is prone to flooding. Dry floodproofing involves sealing the structure to make it watertight below the level that needs protection to prevent floodwaters from entering. Making the structure watertight requires sealing the walls with waterproof coatings, impermeable membranes, or a supplemental layer of masonry or concrete. Doors, vents, windows, and other openings must be retro-fitted with watertight seals to prevent flood water from entering the openings. Generally, dry floodproofing is used when the expected flood depths are low, such as a few inches of water. Wet floodproofing is a design method that allows water to move in the enclosed parts of a structure (e.g., crawlspace or unoccupied area) and then out when water recedes.

Elevation – An elevated building is a structure that has no basement and that has its lowest elevated floor raised above flood level by foundation walls, shear walls, posts, piers, pilings, or columns. Elevation of a structure is usually limited to smaller residential and commercial buildings. Whether a structure may be elevated depends on a number of factors including the foundation type, wall type, size of structure, condition, etc.

Flood Warning and Risk Communication – Flood warning systems and evacuation planning are applicable to vulnerable areas. Despite improved tracking and forecasting techniques, the uncertainty associated with the size of a storm, the path, or its duration necessitate that warnings be issued as early as possible. Evacuation planning is imperative for high density housing areas, elderly population centers, and areas with limited transportation options.

6.2.2.2 CONSIDERATIONS

Flood depths relative to the first-floor elevation are a key metric when determining a feasible nonstructural action recommendation in terms of engineering soundness. The USACE National Nonstructural Committee (NNC) publishes generic engineering-based criteria for mitigating structures based on flood depth. The committee sets a break point at flood depths less than or equal to 3 feet, which determines the extent that dry floodproofing is effective given concerns about hydrostatic pressure. There is no similar limitation related to wet floodproofing. Table 6-1 shows the statistical distribution of structures by flood depth for the City of Fenton. Since flood waters can enter basements and crawlspaces, flooding below the first floor is still a significant consideration during the analysis to determine flood mitigation approaches.

For structures with flooding that exceeds three feet, the nonstructural approaches are limited to wet floodproofing, elevation, relocation, or acquisition due to hydrostatic pressures. With that said, it is often not feasible or practical to elevate, relocate, or acquire many commercial and industrial structures. In these cases, dry floodproofing is effective up to three feet of flood depth and then damages are assumed to occur when that depth is exceeded. For areas where flood depths are expected to exceed the limits of dry floodproofing effectiveness, inventory, electrical, and other utilities can be elevated to limit the damage to contents and the building. Wet floodproofing can be applied for flood depths exceeding 3 feet and can reduce damages to the structure itself but does not provide any damage reduction for structure contents.

Table 6-1. City of Fenton, Missouri - Flood Depth Categorization for the 1% AEP Event

Depth Category	Number of Structures
Flood Depths Exceeding 3 Ft	32
Flood Depths Between 0 and 3 Ft	44
Flood Depths Below 0 FT	11
Total	87

6.2.3 NATURE BASED / NATURAL MEASURES

The team also considered potential application of natural and nature-based measures. Natural measures are created through the action of biochemical and physical processes operating in nature. Nature-based measures are products of planning, engineering design, and construction incorporating natural processes that contribute to flood risk management and resilience. Natural and nature-based measures assessed for this study included floodplain storage and constructed wetlands.

Floodplain Storage – Storage within the floodplain can attenuate the flood hydrograph and, to some extent, delay the flood wave. The design can be cross-sectional storage (similar to a “floodplain bench”), overbank storage, or off-line storage.

Constructed wetlands – Constructed wetlands are human-made treatment systems that use the natural processes that take place in wetland vegetation and soils to slow flood velocities, improve water quality, create wildlife habitat, and in some cases provide recreation opportunities.

6.3 SCREENING OF MEASURES

Screening is the process of eliminating, based on planning criteria, those measures that will not be carried forward for consideration. Criteria are derived for the specific planning study based on the planning objectives, constraints, and the opportunities and problems of the study/project area.

6.3.1 SCREENING CRITERIA

Evaluation of measures is based on the four Principles and Guidelines (P&G) criteria: completeness, acceptability, efficiency, and effectiveness. While the definitions of these criteria refer to alternatives, the USACE planning process first uses them to help in screening measures.

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 planning objectives, including actions by other federal and non-federal entities. Part of the evaluation of completeness will include the contribution of the plan towards the resilience in the engineered infrastructure, as well as in the community, economy, and environment.

Resilience is generally defined as the ability to avoid, minimize, withstand, and recover from the effects of adversity, whether natural or anthropogenic, under all circumstances of use. Completeness also considers sustainability, which is an evaluation of whether the plans include the features and resources to meet the study objectives in the study area beyond the period of analysis and the impact of the proposed project.

Effectiveness is the extent to which an alternative plan alleviates the specified problems and achieves the specified opportunities. Effectiveness will also consider the resiliency of the plan, the contribution of redundant features to overall plan effectiveness, and the robustness of the plan.

Redundancy is the duplication of critical components of a system with the intention of increasing reliability of the system, usually in the case of a backup or fail-safe. Robustness is the ability of a system to continue to operate as intended across a wide range of foreseeable operational conditions with minimal damage, alteration, or loss of functionality and to fail in a predictable way outside of that range.

Efficiency is the extent to which an alternative plan is a cost-effective means of alleviating the specified problems and realizing the specified opportunities, consistent with protecting the nation's environment. Efficiency will also consider redundancy and robustness in the alternatives and should describe any potential trade-offs with economic efficiency.

Acceptability is the workability and viability of an alternative plan with respect to acceptance by state and local entities, tribes, and the public and compatibility with existing laws, regulations, and public policies.

Screening criteria for measures included whether the measure contributes to meeting planning objectives (described in Section 2.3) and avoids constraints (described in Section 2.4) as well as qualitative assessments of effectiveness, efficiency, and acceptability.

More detail on rationale for elimination of specific measures is described in Section 6.3.2, below.

6.3.2 SCREENING RESULTS

The study team developed and screened the measures as seen in Table 6-2. Rationale for screening out measures follows the table.

Table 6-2. Measures and Screening Results

Measure	Structural, Non-Structural, Nature/Natural	Retained for Further Evaluation
Detention Structure	Structural	No
Diversion	Structural	No
Levees/Floodwalls	Structural	Yes
Channel Modifications	Structural	No
Buyouts	Non-Structural	Yes
Floodproofing (Wet and Dry)	Non-structural	Yes
Elevation	Non-Structural	Yes
Flood Forecasting/Warning System	Non-Structural	Yes
Floodplain Storage	Natural/Nature-Based	No
Constructed Wetlands	Natural/Nature-Based	No

All of the measures were determined to be acceptable and avoided the identified constraints. Additionally, all of them potentially met the objectives and were considered to be effective to some degree. Therefore, the screening criteria that became the most relevant was each measure's cost efficiency (cost of the measure relative to the reduction in flood risk).

Detention Structure – To effectively reduce risk to Fenton due to Meramec River flooding, this measure would need to be an in-stream structure located within the Meramec River upstream of the City. Construction costs would greatly exceed the level of flood damages occurring in the city (see Section 3.2.3 for a summary of damages) and this measure was removed from further consideration.

Diversion Structure – The City of Fenton and the surrounding area is highly urbanized. Diversion through, under, or around this area would be very costly and would greatly exceed the level of flood damages occurring in the City. This measure was removed from further consideration.

Levees/Floodwalls – Analyses occurring during the Federal Interest Determination focused on design of levee and floodwall systems to reduce risk for the 1% AEP and lesser (more frequent) flood events. The costs of those systems were not supported by the level of flood damages, but this measure was retained in order to explore the possibility that less costly systems (addressing lesser but more frequent flood events) may be supported.

Channel Modifications – The amount of Meramec River channel modifications required to reduce flood risk in the City would be very costly and would also have significant environmental impacts. This measure was screened from further consideration because the construction and mitigation costs would greatly exceed the level of flood damages experienced by the City.

Buyouts/Floodproofing/Elevation – While the costs of these nonstructural actions can vary greatly, they are generally less expensive than structural measures and were retained for further consideration.

Flood Forecasting/Warning System – Flood forecasting and flood warning systems are relatively inexpensive ways to alert the public to an imminent flood event, providing time to evacuate or move valuables to higher elevations. The area currently receives flood warning from the National Weather Service and may not need additional systems. This measure was retained until such time as the need for additional systems could be determined.

Floodplain Storage – To be effective, this measure would need to be constructed on a large scale. Construction costs would likely greatly exceed the level of flood damages occurring in the city and this measure was removed from further consideration.

Constructed Wetlands – Similar to Floodplain Storage, this measure would need to be constructed on a large scale to be effective. Construction costs would likely greatly exceed the level of flood damages occurring in the city and this measure was removed from further consideration.

6.4 FORMULATION STRATEGIES

As described above, a management measure is a feature or activity that can be implemented at a specific geographic site to address one or more planning objectives. The management measures carried forward are all intended to be potentially implemented alone or in combination with one another (i.e., not standalone). It is anticipated that a combination of measures can function as viable components of an integrated system to address flood risk in the study area.

The study team identified several strategies that could be used to logically combine measures into alternatives. These included:

- Maximize economic flood risk reduction
- Primarily nonstructural plan (required by USACE policy)
- Maximize benefits across benefit categories
- Stakeholder plan (if one is identified)

6.5 DESCRIPTION OF INITIAL ARRAY OF ALTERNATIVES

This section describes the initial array of structural and non-structural alternative plans based on the above strategies, preliminary data collection, and professional judgment.

The initial array of alternatives includes:

- Alternative 1: No Action Alternative
- Alternative 2: Levees and Floodwalls
- Alternative 3: Nonstructural
- Alternative 4: Combination of Levees/Floodwalls and Nonstructural
- Alternative 5. Local Plan

6.5.1 ALTERNATIVE 1. NO ACTION

For a federal project, the No Action Alternative is equivalent to the Future Without Project conditions described in Chapter 7. Chapter 5 concludes that the future flood risk will be very similar to the existing conditions that are described in Chapter 3.

6.5.2 ALTERNATIVE 2. LEVEES AND FLOODWALLS

This alternative includes one or more levee alignments within the City of Fenton. The locations of the levees target areas of concentrated structure damages where natural topography allows for the levees to tie into high ground at the target design elevation. Two potential levee alignments were considered and can be seen in Figure 6.1.

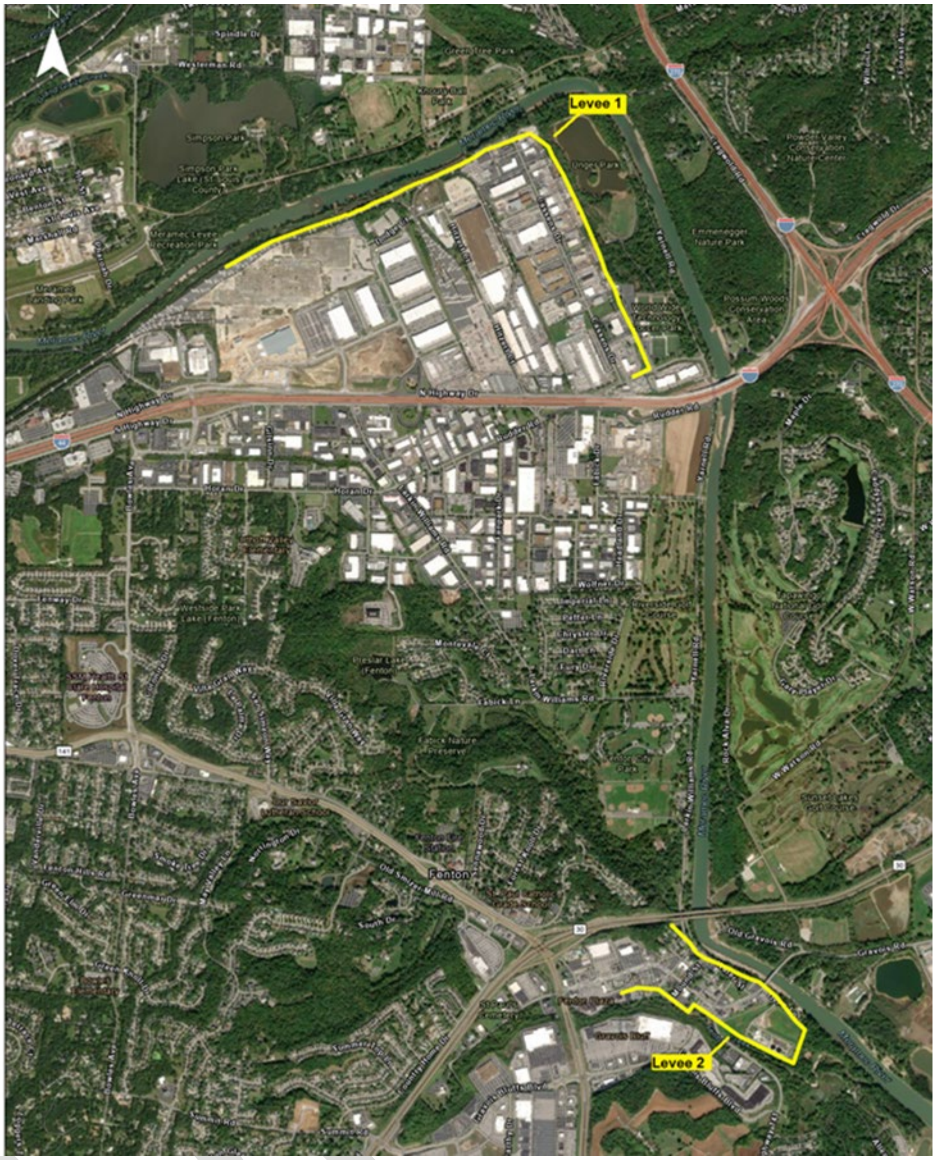

Figure 6.1. Levee Alignments Considered for Alternative 2

For these alignments, levees would be constructed where sufficient space is available. In areas where space is limited, floodwalls may be considered. Road closure structures and interior drainage facilities may also be included, as necessary. Any increases to Meramec River water levels caused by these levees would be considered and addressed, as required.

6.5.3 ALTERNATIVE 3. NONSTRUCTURAL

This alternative considers a plan to use nonstructural measures to address the flood risk in the City. To develop this alternative, structures at risk of flood damage were grouped in order to facilitate identification of applicable measures and to directly compare this plan with the levees in Alternative 2. These groups were developed using several criteria, including the following:

- Structure type (commercial, residential, industrial)
- Flood risk (depth and frequency)

- Physical separation (such as major roads)
- Overlap with levee alignments in Alternative 2.

This resulted in eight structure groups, which will be referred to as reaches. The eight reaches can be seen in Figure 6.2. Reaches 1 and 5 correspond to the potential leveed areas identified in Alternative 2.

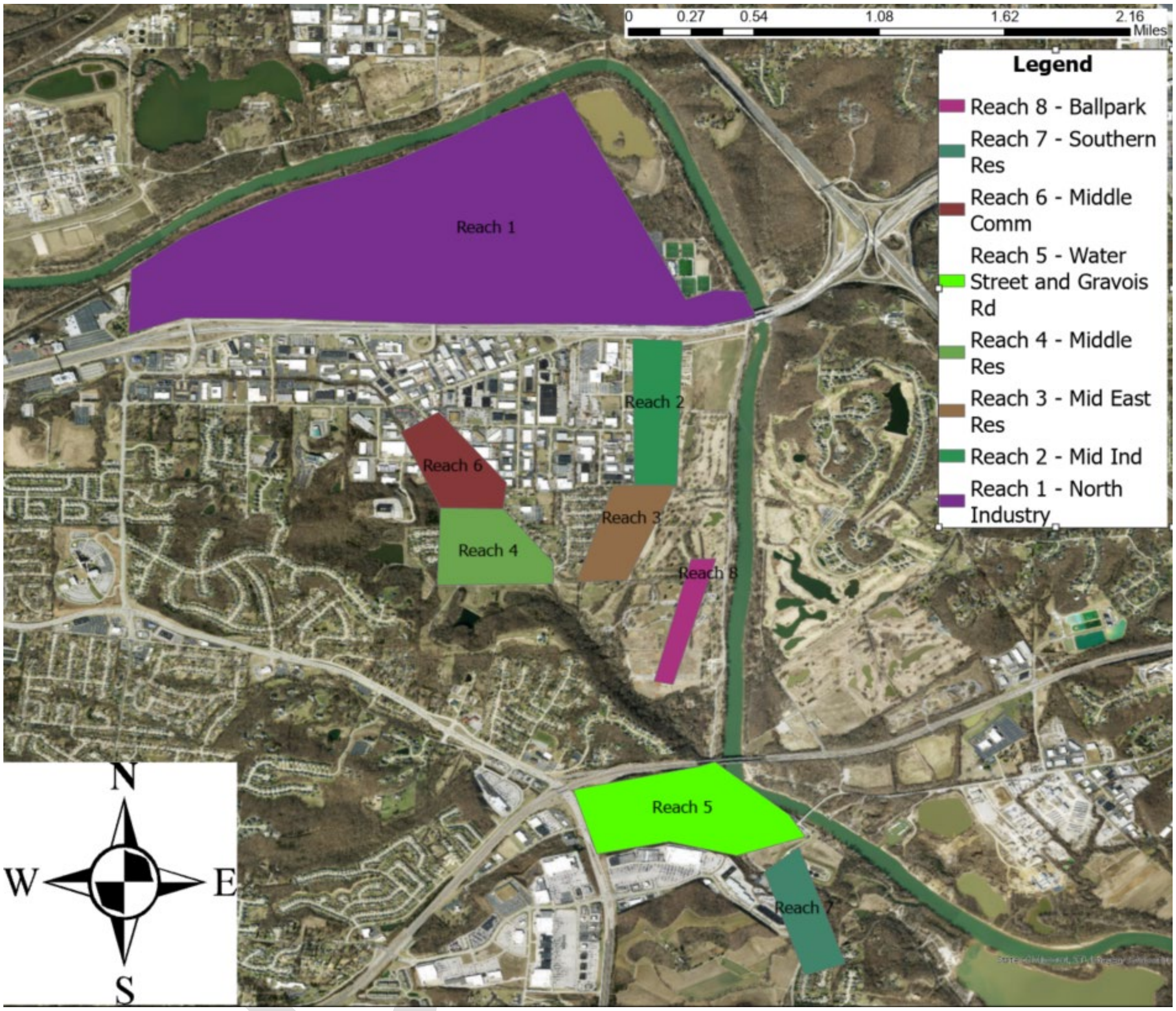

Figure 6.2. Reaches Developed for Alternative 3

Once the reaches were identified, flood risk was characterized for each reach. Reaches receiving minimal annualized damages (generally, those where structure damages were limited to less frequent events like the 1% and 0.2% AEP events) were determined to have insufficient economic damages to support construction of nonstructural measures. This removed Reaches 4, 6, and 7 from further analysis. In the remaining reaches, structure types and flood depths were used to select the nonstructural action that would be applied to each structure.

6.5.4 ALTERNATIVE 4. LEVEES AND NONSTRUCTURAL

This alternative would include one or both levees included in Alternative 2, as well as nonstructural measures applied to structures located outside of the leveed area(s).

6.5.5 ALTERNATIVE 5. LOCAL PLAN

While the public scoping meeting and early conversations with the City of Fenton did not identify a local plan that was different from the other alternatives, this potential alternative was identified as a placeholder for any concept that might be identified by the city following their review of the results of the initial evaluation of alternatives.

6.6 SCREENING OF INITIAL ARRAY OF ALTERNATIVES

Alternatives are screened through a similar process as measure screening. The purpose of screening alternatives is to determine if any of them are highly unlikely to be selected for recommendation and, therefore, do not warrant full development for the comparison of plans in the final array. The No Action plan (Alternative 1) is always carried forward into the final array and, therefore, is not included here for screening.

6.6.1 SCREENING CRITERIA

The initial array of alternatives was qualitatively and quantitatively evaluated and screened using the Principles and Guidelines evaluation criteria of effectiveness and efficiency. This was based on hydraulic modeling information (flood depth and frequency), preliminary design and costs, and preliminary economic damages information.

6.6.2 ALTERNATIVE 2. LEVEES

During the study's Federal Interest Determination phase, the two identified potential levee alignments were evaluated for the 1% AEP event. Preliminary design, costs, and economic information was developed, resulting in benefit-to-cost ratios (BCRs) of 0.03 and 0.23 for Levee 1 and Levee 2, respectively. For this screening effort, the study team chose the one with the highest BCR from that previous analysis (Levee 2) to evaluate potential for greater cost efficiency at more frequent events. The 4% AEP event was selected for analysis because there were many structures flooded at that level and the required levee height would be reduced significantly (more than 5 feet). However, given the urban environment, the need for closure structures and floodwalls (or buyouts required in the levee alignment) could not be eliminated. These features contribute significantly to the estimated total cost and the cost savings incurred by reducing the height of the system were therefore limited. The study considered the maximum allowable cost of a levee system supported by the estimated damages reduced through the 4% AEP event and concluded that the system would need to be constructed for less than $4 million. It was determined that Levee 2 could not be constructed for that amount and that Levee 1 would face similar cost and benefit challenges. Given this information and the strong opposition to levees in this area (both by the public and the City), this alternative was screened from further consideration.

6.6.3 ALTERNATIVE 3. NONSTRUCTURAL

Screening for this alternative involved applying the initially identified nonstructural actions to each of the remaining five reaches to develop preliminary costs and benefits information. For this initial analysis, commercial and industrial structures were assumed to be wet floodproofed for flood depths up to 8 feet and residential structures were assumed to be elevated. These actions were selected primarily based on depth of flooding and relatively low cost with respect to other potential actions. While dry floodproofing is also generally less costly than other actions such as relocation or buyouts, preliminary estimates indicated that dry floodproofing was unlikely to be economically justified for the commercial and industrial structures. These initial assumptions will be reconsidered during refinement of the TSP and the final recommendation may include different nonstructural actions. Costs were developed by reach, and for the screening action, benefits were estimated by flood event and included all remaining reaches. The results of this analysis are presented in Table 6-3.

Table 6-3. Initial Evaluation of Nonstructural Alternative – Net Benefits Delineated by AEP Event and Reach (2023 price level, 50-year period of analysis, 2.75% discount rate)

	Net Benefits $ (in thousands)					
AEP Event	Reach 1	Reach 2	Reach 5	Reach 6	Reach 8	Total
10%	0	0	85.92	0	33.55	119.47
4%	0	0	175.73	0	32.76	208.49
2%	-401.87	-13.03	152.99	0	32.76	-229.15
1%	-2308.7	-22.82	141.86	0	32.76	-2156.89
0.5%	-3457.8	-65.71	57.18	0	32.76	-3433.52
0.2%	-4349.8	-302.33	-63.49	-227.09	32.76	-4909.9

As seen in Table 6-3, three reaches (1, 2, and 6) did not yield positive net economic benefits for any AEP event. Reaches 5 and 8 produced positive net economic benefits in one or more AEP events and the highest net benefits in each of those reaches are shaded green. Therefore, the nonstructural plan was carried forward into the final array and includes actions in Reaches 5 and 8.

6.6.4 ALTERNATIVE 4. LEVEES AND NONSTRUCTURAL

Due to the determination that there would not be an economically supportable levee alignment, there is no opportunity to develop a plan that combines levees and nonstructural measures. Therefore, this alternative was removed from further consideration.

6.6.5 ALTERNATIVE 5. LOCAL PLAN

The screening results for Alternative 2 (levees) and Alternative 3 (nonstructural) were presented to the City in July 2023. At that time, the City did not identify any other plan for consideration. Therefore, this alternative was removed from further consideration at this time but could be reconsidered following feedback received during the public review period.

6.6.6 SCREENING RESULTS SUMMARY

Table 6-4 displays the results of the alternative screening. Only the No Action and Nonstructural alternatives are carried forward into the final analysis.

Table 6-4. Evaluation of Initial Array

	Screening Summary	Result
Alt 1. No Action	No Action	Final Array
Alt 2. Levees	No economically supportable design	Removed
Alt 3. Nonstructural	Likely economically supported plan	Final Array
Alt 4. Levees and Nonstructural	Not viable after screening of Alterative 2	Removed
Alt 5. Local Plan	None initially identified	Removed

6.7 FINAL ARRAY OF ALTERNATIVES*

Following alternative screening, the remaining alternatives are developed in more detail to refine the costs, identify the benefits, and present a tentatively selected plan (TSP). For decision making, features are generally presented at a 35% design level, utilizing existing data (such as topography and subsurface conditions) as much as possible. Design is completed during the Preconstruction Engineering and Design (PED) phase, when detailed data is acquired, and final design calculations are performed.

Based on the evaluation of the initial array as described above, the following alternatives were carried forward into the final array for further development and evaluation.

- Alternative 1: No Action
- Alternative 3: Nonstructural

7. ENVIRONMENTAL CONSEQUENCES*

In accordance with NEPA, this Chapter includes the scientific and analytic basis for comparison of the considered alternatives identified in Chapter 6, including the No Action Alternative, which is used as a baseline. The important environmental resources located in the study area are described in Chapter 4. This Chapter evaluates direct, indirect, and cumulative impacts to each resources for all retained alternatives.

7.1 TOPOGRAPHY, GEOLOGY, AND SOILS

7.1.1 NO ACTION ALTERNATIVE

Under the No Action Alternative, flooding would be expected to continue.   Some erosion and sedimentation would likely occur. No significant adverse effects are anticipated.

7.1.2 ALTERNATIVE 3

Under Alternative 3, no significant adverse effects on topography, geology, or soils in the project area are anticipated. Minimal changes would occur due to nonstructural measure construction activities.

7.2 LAND USE / LAND COVER

7.2.1 NO ACTION ALTERNATIVE

Under the No Action Alternative, flooding would be expected to continue to impact highly developed and undeveloped areas of Fenton. Potential abandonment of industrial complexes due to recurring flood damage may result. Flood damage may also impact the quality of existing natural land cover types such as forested, wetland, cultivated crop, and hay/pasture cover as a result of increased tree and crop stress and death. Increased invasion by exotic species is also a concern.

7.2.2 ALTERNATIVE 3

Depending on the location of Alternative 3 measures, beneficial effects on developed land is anticipated due to the reduced risk of flooding and flood damage. Impacts to undeveloped areas are dependent on the location of activities. Removal or alteration of forested, wetland, cropland, or other undeveloped areas would result in a moderate long term adverse impact.

7.3 WETLANDS AND VEGETATION

7.3.1 NO ACTION ALTERNATIVE

Under the No Action Alternative, wetlands and vegetated areas such as forested riparian areas, although sparse, may be negatively impacted by continued flooding due to increased tree stress and death. Increased invasion by exotic species is also a concern. Meramec River or Fenton Creek flood water carrying pollutants from adjacent residential and industrial areas have the potential to decrease habitat quality.

7.3.2 ALTERNATIVE 3

The Alternative 3 would result in some impact to the wetland and vegetation areas adjacent to the project area. Impacts would be the result of removal of vegetation to allow for construction. Overall, the Tentative Selected Plan would have a minor and/or temporary effect on wetland and vegetation.

7.4 WATER QUALITY

7.4.1 NO ACTION ALTERNATIVE

Under the No Action Alternative, flooding would be expected to continue, carrying waters from the Meramec River and surrounding waterways through residential, industrial, and undeveloped areas of Fenton. Flood waters carrying concentrations of contaminants from industrial areas and the Fenton Wastewater Treatment Plant to already impaired waterways have the potential to cause additional negative impacts to water quality.

7.4.2 ALTERNATIVE 3

Alternative 3 may result in minor and/or temporary water quality impacts due to the construction of the project; however use of best management practices (BMPs) should limit this almost entirely. Once complete, the nonstructural measures would be beneficial in reducing flooding of protected structures. This would be especially beneficial in preventing the spread of chemicals or toxic substances by flood waters.

7.5 HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE

7.5.1 NO ACTION ALTERNATIVE

Under the No Action Alternative, HTRW concerns in the project area are expected to remain similar to the existing condition unless additional cleanup or contamination occurs.

7.5.2 ALTERNATIVE 3

Alternative 3 could be beneficial in reducing the spread of HTRW materials if they reduce flooding risk to industrial properties that utilize chemicals or HTRW related substances. While there are HTRW concerns in the area, a Phase 1 ESA would be conducted to identify risks in order to avoid and/or mitigate those issues.

7.6 INVASIVE SPECIES (EXECUTIVE ORDER 13112)

7.6.1 NO ACTION ALTERNATIVE

Under the No Action Alternative, the spread of invasive species by flood waters is expected to continue. However, due to the level of development in the project area, the No Action Alternative is not anticipated to alter the overall issue of exotic species. However, frequent habitat disruption presents opportunities for colonization of disturbed sites.

7.6.2 ALTERNATIVE 3

Under Alternative 3, the spread of invasive species by flood waters is expected to continue as well. Additionally, BMPs should be required to avoid the spread of invasives by construction equipment. The nonstructural measure proposed would have a minor temporary effect on invasive species.

7.7 AQUATIC RESOURCES

7.7.1 NO ACTION ALTERNATIVE

Under the No Action Alternative, flooding would be expected to continue. Receding flood waters transporting pollutants from adjacent residential and industrial areas into the Meramec River or Fenton Creek have the potential to decrease habitat quality for aquatic species over a 50-year period. Additionally, increased sediment runoff into waterways may detrimentally impact mussels, fishes, invertebrates, and other aquatic organisms and their habitat. This may affect their population growth over the long term. This is especially true for mussel species since they are particularly sensitive to pollutants.

7.7.2 ALTERNATIVE 3

Alternative 3 could be beneficial in reducing the spread of contaminants if they reduce flooding risk to properties that utilize chemicals or other harmful substances. BMPs are anticipated to prevent contamination of aquatic resources due to construction related activities.

7.8 WILDLIFE RESOURCES

7.8.1 NO ACTION ALTERNATIVE

Under the No Action Alternative, flooding would be expected to continue, potentially damaging available wildlife and migratory bird habitat bordering the Meramec River and Fenton Creek, as well as elsewhere. Wildlife in the area may be temporarily displaced during floods, but are expected to return once flood waters recede. Although there are currently no known bald eagle nests in Fenton, Bald Eagles foraging in the area may encounter pollutants in prey or carried by flood waters.

7.8.2 ALTERNATIVE 3

No long term adverse impact on wildlife or wildlife resources are anticipated as a result of Alternative 3. Minor short term disturbances to wildlife may occur during construction activities. However, due to the level of development in Fenton, wildlife may have adjusted to such activities. If a bald eagle nest(s) was encountered during construction, USACE would rapidly investigate the location and coordinate with the U.S. Fish and Wildlife Service regarding the need for a permit.

7.9 STATE THREATENED AND ENDANGERED

7.9.1 NO ACTION ALTERNATIVE

Under the No Action Alternative, flooding is expected to continue, potentially damaging or polluting available habitat for state listed threatened and endangered species. During flood events, increased sediment runoff into waterways may impact mussels, fishes, invertebrates, and other aquatic organisms and their habitat. This may affect their population growth and continue the decline of Missouri threatened and endangered species habitat. This is especially true for mussel species since they are particularly sensitive to pollutants.

7.9.2 ALTERNATIVE 3

No long term adverse impact on state listed species are anticipated as a result of Alternative 3. Minor short term disturbances may occur during construction activities. However, due to the level of development in Fenton, any individuals in the action area may have adjusted to such activities.

7.10 FEDERAL THREATENED AND ENDANGERED

This section, along with Chapter 4, represents the St. Louis District's Biological Assessment of the project's effects on federally-listed species that may occur within the vicinity of the project area. This Biological Assessment is prepared in accordance with section 7(c) of the endangered species act of 1973, as amended.

7.10.1 NO ACTION ALTERNATIVE

Under the No Action Alternative, flooding is expected to continue, potentially damaging or polluting available habitat for federally listed species. During flood events, increased sediment runoff into waterways may impact mussels, fishes, invertebrates, and other aquatic organisms and their habitat. This may affect their population growth and continue the decline of habitat required by federal threatened and endangered species. This is especially true for mussel species since they are particularly sensitive to pollutants.

7.10.2 ALTERNATIVE 3

Gray Bat, *Indiana Bat*, *Northern Long-eared Bat*, and *Tricolored Bat* - Tree clearing activity may take place during the construction of nonstructural measures; erosion in riparian areas could eventually cause a loss of trees and potential bat habitat; and foraging within forested areas and over waterways may be impacted by construction activities; and human-made structure inhabited by bats may be disturbed or removed. Additionally, a known hibernacula exists within 10 miles of the study site. Therefore, the St. Louis District has determined that the proposed actions "*may affect, but is not likely to adversely affect*" the Gray Bat, Indiana Bat, Northern Long-eared Bat, and Tricolored Bat.

Eastern Hellbender, Pink Mucket, *Salamander Mussel*, *Scaleshell Mussel*, *Snuffbox Mussel*, *Spectalecase Mussel* – No direct in-water work is anticipated. However, runoff containing sediment from construction activities may inadvertently reach nearby waterways. Such runoff may be contaminated with chemicals and other pollutants accumulated as the runoff flows to the waterways. Therefore, the St. Louis District has determined that the proposed actions "*may affect, but is not likely to adversely affect*" the Eastern Hellbender, Pink Mucket, Salamander Mussel, Scaleshell Mussel, Snuffbox Mussel, and Spectalecase Mussel.

Monarch Butterfly – No large populations of milkweed are known to occur in the vicinity; however, extensive surveys for the species have not been conducted in proposed action areas. Since milkweeds upon which monarch butterflies depend are commonly found along roadways or are cultivated in yards, there is the potential to encounter them along with monarch butterflies. Based on the potential for presence, the St. Louis District has determined that the proposed action "*is not likely to jeopardize the continued existence*" of the Monarch Butterfly.

Decurrent False Aster - This species is known to occur in areas surrounding Fenton; however, extensive surveys for the species have not been conducted in proposed action areas. Because the site contains disturbed alluvial habitat along riverbanks and in riparian areas, the species may be present in the seedbank. Therefore, the St. Louis District has determined that the proposed action "*may affect, but is not likely to adversely affect*" on Decurrent False Aster.

7.11 AIR QUALITY

7.11.1 NO ACTION ALTERNATIVE

There would be no change in air quality under this alternative. Thus, no adverse impacts to air quality are anticipated to occur under the No Action Alternative.

7.11.2 ALTERNATIVE 3

Under Alternative 3, the operation of heavy equipment during construction would temporarily increase vehicle emissions and slightly degrade air quality in the immediate vicinity of the project area. Overall, impacts would be short-term and negligible.

7.12 NOISE

7.12.1 NO ACTION ALTERNATIVE

Under the No Action Alternative, noise levels within the project area would be expected to remain similar to the existing condition.

7.12.2 ALTERNATIVE 3

Alternative 3 would result in a temporary increase in noise levels associated with heavy equipment and construction. This may lead to the temporary displacement of some wildlife species and cause a short term disturbance to residents and businesses in the area. Noise levels would return to pre-construction levels at the completion of the project.

7.13 AESTHETICS AND RECREATION

7.13.1 NO ACTION ALTERNATIVE

Under the No Action Alternative, flooding would be expected to continue, potentially damaging aesthetically pleasing recreational and natural areas. Recreational and natural areas would potentially become covered with debris and sediment, which is generally considered unpleasant.

Recreational resources such as city and neighborhood parks, outdoor sports facilities, and golf courses, may experience additional damage. Flood waters may transfer trash or other unwanted debris across Fenton recreational areas, or make them unusable until cleaned up and repaired.

7.13.2 ALTERNATIVE 3

Some individuals may find nonstructural measures to be aesthetically unpleasing, although this opinion may change over time.

Impacts to recreation under Alternative 3 would be similar to those under the No Action Alternative, unless such areas were protected by the proposed non-structural measures.

7.14 TRANSPORTATION

7.14.1 NO ACTION ALTERNATIVE

Under the No Action Alternative, flooding would be expected to continue, creating traffic hazards, shutting down transportation systems during active flooding, and accruing additional damages to existing infrastructure.

7.14.2 ALTERNATIVE 3

Alternative 3 does not address the issues of traffic hazards, closure of transportation systems during active flooding, or accrual of damages to infrastructure. Alternative 3 may result in a minor temporary impacts to local transportation within the project area during construction. No long term or significant impacts to transportation are anticipated as a result of Alternative 3.

7.15 CULTURAL AND HISTORICAL RESOURCES

7.15.1 NO ACTION ALTERNATIVE

Under the No Action Alternative, flooding would be expected to continue, potentially damaging existing archaeological sites or historic properties. Flood damages could compromise the integrity of historic properties and adversely affect the cultural resources.

7.15.2 ALTERNATIVE 3

Alternative 3 could prevent further damage from flooding to the identified structures. Nonstructural improvements such as elevating structures or wet floodproofing structures that are historic properties could preserve the integrity of the historic property by preventing flood damage; however, such measures may change the character of the historic property and possibly compromise its integrity.

Missouri SHPO consultation will be required for all properties included in the project. Ten structures included in Alternative 3 are over 50-years old; however, three of them have been altered and do not retain sufficient integrity for listing in the National Register of Historic Places (NRHP). The remaining either have known historic properties present or require research and consultation with consulting parties to determine NRHP eligibility of the properties. Of these, one structure appears to be NRHP-eligible. Any proposed structural improvements that may change the character of the buildings or substantially alter the architecture, could be an adverse effect to the historic properties.

One structure is located with a previously recorded archaeological site, which has not been evaluated for the NRHP. Ground disturbance to the previously recorded archaeological site would be an adverse effect to the potential historic property. However, this structure has been identified for wet floodproofing, which is unlikely to involve any ground disturbance.

If the nonstructural alternative methods would not compromise the integrity of the NRHP-eligible historic property, or the unevaluated structures, and if there is no ground disturbance to the archaeological site, then a finding of “No Adverse Effect” would be determined for the project. If this is not possible, an architectural survey would be conducted to determine if the unevaluated structures are NRHP eligible historic properties. If Alternative 3 will have adverse effects to historic properties, then the District would consult with the Missouri SHPO, the Advisory Council of Historic Preservation, Tribes, and the Public to determine resolution of any adverse effects.

7.16 TRIBAL RESOURCES

7.16.1 NO ACTION ALTERNATIVE

The No Action alternative would have no effect on Tribal resources.

7.16.2 ALTERNATIVE 3

The potential impacts of Alternative 3 on Tribal resources have not yet been determined. During refinement of the Alternative 3, USACE would continue coordination and will avoid, minimize, or mitigate impacts.

7.17 ENVIRONMENTAL JUSTICE

Due to no minority, low-income, nor disadvantaged communities being identified within the study area, no disproportionate adverse impacts to those communities would occur.

7.18 CUMULATIVE IMPACTS ANALYSIS

NEPA requires a federal agency to consider not only the direct and indirect impacts of a proposed action but also the cumulative impacts of the action. Cumulative impacts are defined as those impacts that result from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or non-federal) or person undertakes the actions.

Cumulative impacts analysis requires expanding the geographic boundaries and extending the time frame to include additional effects on the resources, ecosystems, and human communities of concern.

7.18.1 GEOGRAPHIC SCOPE & TIMEFRAME

The timeframe for the cumulative impacts analysis for each considered resource begins when past actions began to change the status of the resource from its original condition, setting the long-term trend currently evident and likely to continue into the reasonably foreseeable future. For this analysis, historic or past actions are those occurring before November 2022 when the study was initiated. The present includes actions from November 2022 to the present date of the study report. The reasonably foreseeable future includes the 50-year period of analysis which extends from the present through 2076. The year 2026 was selected as the base year for the analysis because it is the earliest year that any potential project benefits are likely to be realized. A forecast period of 50 years from the year 2026 was selected as a reasonable time frame for analyzing potential changes in the project area and is in line with USACE policy. .

7.18.2 IDENTIFYING PAST, PRESENT, AND REASONABLY FORESEEABLE FUTURE ACTIONS

Details on past and existing projects are provided in Section 1.7 of this report.

Chapter 4 discusses the existing condition of each resource by describing the present condition and providing historical context for how the resource was altered to the current conditions. The study team used information from field surveys, discussions with the project sponsor and subject matter experts, scoping comments, and literature searches to assess the past and existing conditions of the resource and to identify present and reasonably foreseeable future actions.

This project in the City of Fenton is intended to reduce the risks of loss of life and property damage attributable to flooding. Effects of the proposed project would be minimal and generally positive in maintaining the quality of the human environment. The proposed actions would not affect the biodiversity of the area or permanently fragment the habitat above existing conditions. The nonstructural alternative would result a minor temporary effect on wetlands as well as fish and wildlife habitat. It would not contribute to adverse social or economic effects. No other reasonably foreseeable future actions by USACE and others in the area are anticipated.

8. EVALUATE & COMPARE ALTERNATIVE PLANS

This Chapter evaluates and compares the final array of alternatives.

Four accounts have been established to facilitate evaluation and display of effects of alternative plans:

a) The National Economic Development (NED) account displays changes in the economic value of the national output of goods and services.
b) The Regional Economic Development (RED) account registers changes in the distribution of regional economic activity that result from each alternative plan. Evaluations of regional effects are to be carried out using nationally consistent projections of income, employment, output, and population.
c) The Environmental Quality (EQ) account displays non-monetary effects on significant natural and cultural resources.
d) The Other Social Effect (OSE) account registers plan effects from perspectives that are relevant to the planning process but are not reflected in the other three accounts. In flood risk reduction studies, this commonly includes life risk and environmental justice considerations, but may include other effects important to the community.

Evaluation and comparison of alternatives is based on the four Principles and Guidelines criteria: completeness, acceptability, efficiency, and effectiveness. Resilience, redundancy, robustness, and sustainability contribute to completeness, efficiency, and effectiveness of plans and are also accounted for in the evaluation of alternatives. In some cases, the evaluation may be qualitative.

Based on the determination that environmental justice and life risk are not key considerations for this study (see Sections 4.17 and 5.4, respectively), the alternatives are evaluated primarily based on the following decision criteria:

- **Economic costs and benefits –** quantitative estimates of the total costs of each alternative and the NED and RED benefits.
- **Environmental effects –** qualitative (and quantitative, if applicable) estimates of environmental and/or cultural effects, any mitigation requirements and associated costs.

This evaluation and comparison step was based on a conceptual level of design and associated cost estimates. A summary of the evaluation and comparison of the final array of alternatives is presented below.

8.1 ALTERNATIVES DESIGN

The No Action alternative does not include construction of any features as part of a Federal project, nor does it assume any significant actions on the part of the city. Therefore, there is no design information for the No Action alternative.

8.1.1 NONSTRUCTURAL MEASURES

As previously discussed, the two nonstructural measures considered for implementation prior to the draft report included wet floodproofing for commercial and industrial structures, as well as elevation for residential structures.

Wet floodproofing is a design method that allows water to move in the enclosed parts of a structure (e.g., crawlspace or unoccupied area) and then out when water recedes. For industrial and commercial structures, this often involves installing flood vents to allow water to enter and exit, epoxying flooring/walls to reduce water damage, relocating electrical outlets, and filling or relocating utilities when applicable.

When elevating, the entire foundation of the residential structure would be lifted and placed on a new foundation (i.e., columns, piers, posted or raised foundation walls) so that the lowest habitable finished floor is above the design water surface elevation. All utilities and mechanical equipment, such as air conditioners and hot water heaters, would also be raised to this elevation. This measure is applicable to permanent residential structures only.

8.2 ECONOMIC COSTS AND BENEFITS OF ALTERNATIVES

The National Economic Development (NED) Plan is the plan that reasonably maximizes net economic development benefits, consistent with the Federal Objective.

8.2.1 FIRST COSTS OF ALTERNATIVES

For Alternative 3, the total project first cost includes the construction cost of applying the appropriate nonstructural measure to the identified structures, as well as any costs associated with acquisition of temporary construction easements. It also includes contingencies which were determined by performing an abbreviated cost risk assessment for each action alternative. These risk assessments considered uncertainties related to each input to the cost estimate.

Wet floodproofing was assumed for 13 commercial or industrial structures and elevation for one residential structure.

The No Action alternative does not include construction of any features as part of a Federal project. Therefore, there is no economic cost identified for the No Action alternative.

Table 8-1. First Cost of Alternatives

	Project First Cost (Oct 2023 Price Level)
Alternative 1 – No Action	$0
Alternative 3 – Nonstructural	$3,349,000

8.2.2 ECONOMIC BENEFITS

The benefits and costs of the alternatives were annualized over the 50-year period of analysis using the current Federal discount rate of 2.75%. The expected annual benefits (damages reduced) were determined by subtracting the total equivalent annual damages for each alternative from the total equivalent annual damages without project conditions. The net benefits for the alternatives were calculated by subtracting the annual costs from the equivalent annual benefits.

The No Action alternative does not include construction of any features to reduce flood risk in the future. Therefore, there are no economic benefits identified for the No Action alternative.

Table 8-2. Economic Benefits of Alternatives (50-year period of analysis, 2.75% discount rate)

	Annual Costs	Damages Reduced (Annual Benefits)	Net Annual Benefits
Alternative 1 – No Action	$0	$0	$0
Alternative 3 – Nonstructural	$127,000	$332,000	$205,000

8.3 COMPLETENESS, EFFECTIVENESS, EFFICIENCY & ACCEPTABILITY

Completeness, effectiveness, efficiency, and acceptability are four basic criteria used in the evaluation and screening of alternative plans (see definitions in Section 6.3.1). Alternatives considered in any planning study should meet minimum subjective standards of these criteria to qualify for further consideration and comparison with other plans.

Table 8-3 compares the final array of alternatives against these criteria. The acceptability rating indicates first if it meets the USACE acceptability requirements (yes/no) and second if it is likely to be acceptable to the public and/or City (likely/unlikely).

Table 8-3. Evaluation of Alternatives using Principles and Guidelines Criteria

Alternative	Complete	Effective	Efficient	Acceptable
No Action Alternative	Yes	No	Yes	Yes/Unlikely
Alternative 3 - Nonstructural	Yes	Yes	Yes	Yes/Likely

Completeness – Alternative 3 is complete because it includes all the necessary investments to achieve the estimated benefits. The No Action plan is also complete because it also includes everything needed to achieve its estimated benefits (none).

Effectiveness – Alternative 3 is effective in achieving the flood risk reduction objectives. The No Action Plan is not effective because it does not achieve any of the objectives.

Efficiency – Alternative 3 is efficient in reducing flood risk, as demonstrated by the positive net economic benefits. The No Action plan also efficient because it achieves zero benefits for zero cost.

Acceptability – Alternative 3 has been designed to be acceptable in terms of laws, regulations, and public policies. It may have varying levels of public acceptance, but the concept was well received at the public scoping meeting. The No Action plan does not violate any laws, regulations or policies but is unlikely to be acceptable to the public.

8.4 COMPREHENSIVE BENEFITS EVALUATION

In addition to identifying the economic costs and benefits, other positive and negative benefits of each alternative were considered in each of the four Principles and Guidelines accounts: National Economic Development (NED), Regional Economic Development (RED), Environmental Quality (EQ) and Other Social Effects (OSE). The study considers benefits in all four accounts before selecting a plan for recommendation and is required by policy to identify the plan which maximizes net total benefits across all benefit categories. Table 8-4 summarizes the full benefits analysis and allows comparison between the plans.

NED benefits are typically reported as net benefits, which are the economic benefits that are in excess of the economic costs. Alternative 3 has positive annual net benefits of approximately $209,000. It has a benefit-to-cost ratio of 2.7.

RED benefits have not yet been calculated but are primarily related to regional jobs associated with project construction. There may also be RED benefits associated with the reduction in post-flood recovery time for the commercial or industrial facilities.

Environmental Quality benefits are positive or negative benefits associated with the natural environment or cultural resources. Alternative 3 is not expected to have significant adverse impacts to the natural environment. Depending on the outcome of Tribal coordination and a cultural resources assessment of potential National Register eligible structures, there may be impacts to cultural resources that would need to be avoided or mitigated.

Other Social Effects benefits will be considered further but, at this time, there is no direct life risk identified in the study area and Alternative 3 will not change those conditions. With one residential structure included in the plan, the study will consider if elevation may reduce the owner's motivation to evacuate in advance of a flood event (indirect life risk). As discussed in Section 7.17, there are no minority, low-income, nor disadvantaged communities identified within the study area, therefore no disproportionate adverse impacts to those communities would occur.

In summary, Alternative 3 is the only plan that produces positive net economic benefits. It has no significant negative environmental benefits, and any potential cultural resources impacts would be avoided or minimized if possible during the Feasibility Level Design effort. Alternative 3 is not anticipated to significantly change any of the OSE factors in the study area.

Table 8-4. Comparison of Benefits

	Comprehensive Benefits*			
	NED	**RED**	**EQ**	**OSE**
Alternative 1 No Action	• Cost: $0 • Net Benefits: $0 • Residual EAD: $2,414,000	NA		• No Environmental Justice • Minimal life risk.
Alternative 3 Nonstructural (10%AEP)	• Cost: $3,349,000 • Net Benefits: $205,000 • Residual EAD: $2,082,000	• TBD economic benefits • Potential faster recovery, less disruption of business.	• No environmental mitigation. • Possible cultural impacts/mitigation if NR eligible structures are identified.	• No Environmental Justice concerns. • Minimal life risk. • Residential NS might discourage evacuation.

*NED costs are FY2023 price level; damages and benefits utilized 2.75% Federal discount rate.

8.5 COMPARISON SUMMARY

Table 8-5. Comparison of Final Array (FY 2023 Price Level, 50-year Period of Analysis, 2.75% Discount Rate)

Comparison Factor	Alternative 1 No Action	Alternative 3 Nonstructural
Costs		
Total Project First Cost	$0	$3,349,000
Annual O&M Costs[3]	$0	$0
Average Annual Costs	$0	$127,000
Economic Benefits - NED		
Average Annual Damages Reduced (Benefits)	$0	$332,000
Average Annual Net Benefits	$0	$205,000
Benefit-to-Cost Ratio (BCR)	N/A	2.6
Environmental Impacts – EQ		
Environmental Mitigation	N/A	N/A
Cultural	N/A	TBD
Real Estate		
Restrictive Easements	N/A	14 properties, $438,000
Residual Risk		
Life Safety	NA	NA
Average Annual Economic Damages	$2,414,000	$2,082,000

9. TENTATIVELY SELECTED PLAN (TSP)

Based on the evaluation and comparison of the final array of alternatives presented in Chapter 8, Alternative 3 (Nonstructural) designed to address flood risk for the 10% AEP event has been identified as the Tentatively Selected Plan (TSP). This Chapter describes the TSP in detail.

The next phase of the study will gather additional information and perform additional analyses to refine the TSP. This phase is referred to as Feasibility Level Design and may result in changes to the number of structures included in the plan, the types of nonstructural measures applied to each structure, the level of flood event to be addressed in each reach, the project costs and the project benefits. However, it is not anticipated to result in a change from the nonstructural alternative to a structural plan.

9.1 DESCRIPTION

The TSP includes wet floodproofing for 13 commercial structures located in Reaches 5 and 8 and elevation for one residential structure located in Reach 5. The measures taken in Reach 5 will address the 4% AEP event and will address the 10% AEP event in Reach 8. The approximate locations of these structures are shown in Figure 9.1.

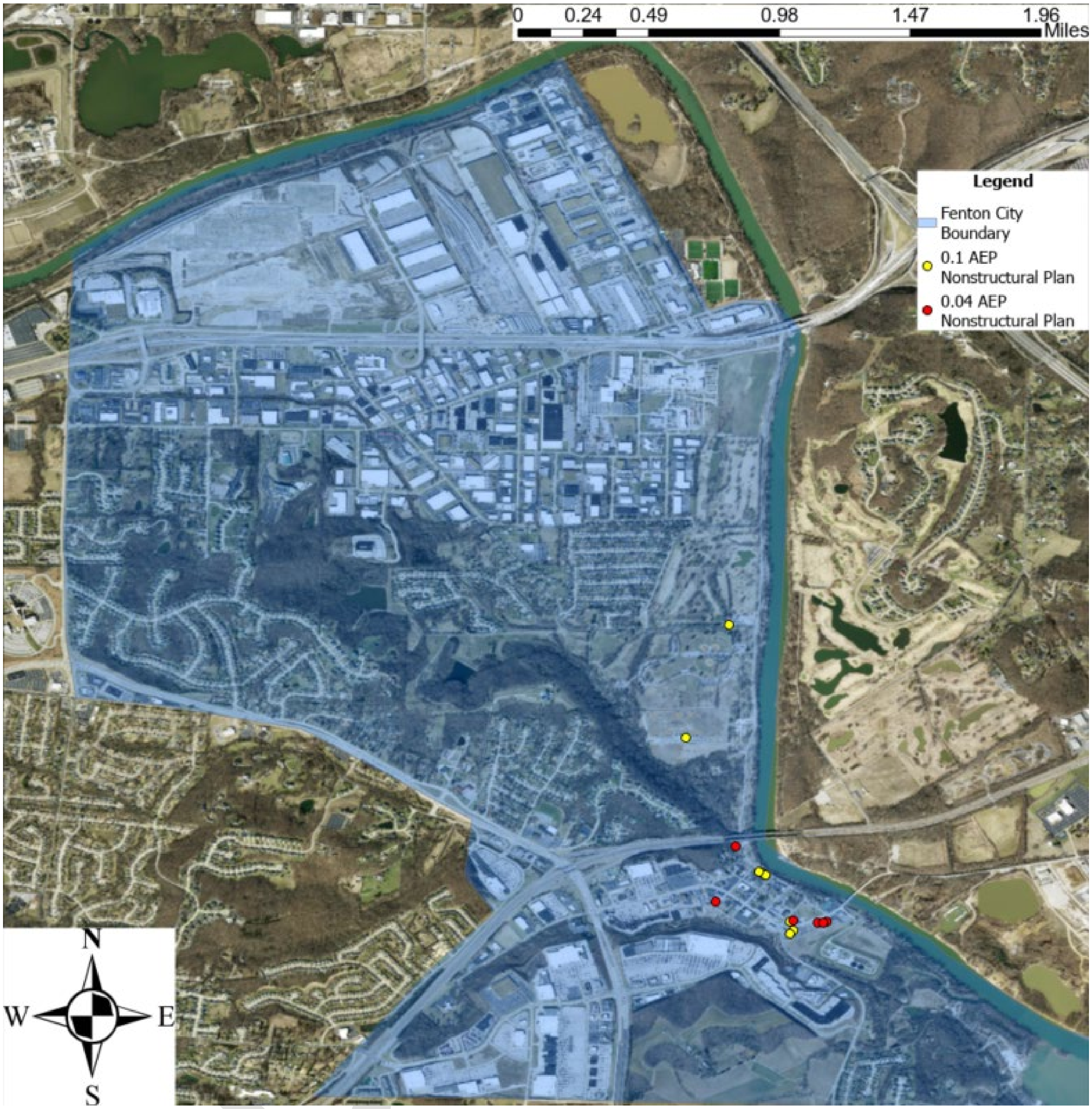

Figure 9.1. Structures Included in the Tentatively Selected Plan

9.2 COSTS

The cost estimates displayed in Table 9-1 and 9-2 were developed for nonstructural mitigation measures for each structure in the TSP. The cost estimates were developed based on the original square footage and layout of each structure, including number of floors. These costs were analyzed based on flood depths and include structure characteristics, such as foundation heights, structure type, etc.

The cost estimates include nonstructural mitigation construction costs (including mobilization/demobilization (10% for Reach 5 (4% AEP) and 15% for Reach 8 (10% AEP) of overall nonstructural mitigation costs)), contingency costs (73% of construction costs), Planning Engineering and Design (15% of overall nonstructural mitigation costs including contingency), construction management (10% of overall nonstructural mitigation costs including contingency), and Real Estate costs.

The wet floodproofing cost estimates include the installation of flood vents for each structure to allow water to enter, epoxying flooring/walls, relocating electrical outlets, filling/relocating utilities when applicable, and elevating residential structures when applicable. Real Estate lands, damages and incidental cost are also included in the estimated total cost.

Table 9-1. Total Project First Cost Summary by Feature (FY 2023 Price Level)

Feature Code	Feature Name	First Cost ($)
19	Buildings, Grounds and Utilities	$1,350,000
	Contingencies (73%)	$985,000
01	Lands and Damages	$438,000
30	Planning, Engineering and Design	$356,000
31	Construction Management	$220,000
	Total	**$3,349,0000**

9.3 ECONOMIC BENEFITS

Table 9-2. Equivalent Annual Costs and Benefits of the TSP (2023 Price Level, 50-year period of analysis, 2.75% discount rate)

Item Description	Alternative 3
Total Alternative Cost	$3,349,000
Interest During Construction	$12,000
Total Investment Cost	$3,361,000
Annualized Investment Cost	$127,000
Annual O&M	$0
Total Annualized Investment Cost	**$127,000**
Annual Benefits	$332,000
Annual Net Benefits	**$205,000**
Benefit-Cost Ratio	2.6

9.4 ENVIRONMENTAL AND CULTURAL EFFECTS

At the time of the draft report, no significant adverse environmental or cultural impacts are anticipated due to implementation of the TSP. Nonstructural actions rarely have any direct detrimental impact on the environment but potential for impacts will continue to be monitored during design refinement. As described in Section 7.15.2, it is not anticipated that the TSP will have adverse impacts to cultural resources. However, cultural resources surveys will be conducted prior to completion of the study and any potential impacts will be avoided, minimized, or mitigated.

Environmental Impacts - EQ	Minor
Cultural Impacts - EQ	Likely none

9.5 REAL ESTATE REQUIREMENTS

Real estate requirements include restrictive covenants included in floodproofing agreements to be executed with the structure owners. A restrictive covenant is a condition that restricts, limits, prohibits or prevents actions of someone named in the agreement. This is required for the wet floodproofing actions to ensure that the actions are not removed or compromised by the current or future structure owners.

Real Estate	14 properties - $463,000

9.6 RESIDUAL FLOOD RISK

Implementation of flood risk reduction measures does not remove all risks due to flooding. The risks that remain are referred to as residual risks. There is always a residual risk of economic damages or life safety consequences associated with any project. For the TSP, only 14% of the existing expected annual economic damages are reduced. This residual risk primarily stems from economic damage to structures that are not proposed to receive nonstructural actions.

While the risk to life was determined to not be a critical factor in plan development and evaluation, it must be acknowledged that the TSP does nothing to reduce the possibility of life loss (either directly from flooding or indirectly by inundation of transportation routes that may limit evacuation and access to critical services).

Residual Risk	
Life Safety - OSE	Unchanged - minimal
Economic Damages - NED	$2,082,000
Critical Infrastructure - OSE	Unchanged - minimal

9.7 RISK & UNCERTAINTY

At the planning level, there is always uncertainty about the extent to which the Tentatively Selected Plan will meet the planning objectives. This section addresses analytical risks associated with the study which are important to understand when considering the recommendation. These include remaining study risks (uncertainty related to the study's conclusions), implementation risks (uncertainty related to design and construction activities), and outcome risks (uncertainty related to the ability to achieve the plan's estimated benefits).

9.7.1 STUDY RISKS

Over the course of the study, the study team makes many assumptions and scoping choices and, with each one, there is a risk that it could affect the conclusions. If the study team assessed that an incorrect assumption or choice could result in a poor study decision, it sought to either confirm the reasonableness of the assumption or took actions (usually additional analyses) to reduce the risk of a poor decision. Through this activity, most study assumptions were eventually confirmed as reasonable and/or the remaining risk was assessed to be low. This section summarizes the study risks that remain and are relevant to the recommendations of this study.

- A Phase I ESA was not completed prior to identification of the TSP. The ESA will be completed during Feasibility Level Design. If the ESA identifies potential concerns, project costs and sponsor requirements could be impacted.
- Real Estate acquisition requirements for nonstructural actions could change during the study. USACE guidance regarding acquisition requirements for nonstructural features has been updated in the recent past. If additional updates occur, project costs could be impacted.
- Cultural resources investigations and coordination were not completed prior to identification of the TSP. If either of these activities identifies a significant concern, the measures, costs, or structures included in the plan could change.
- Costs were developed using incomplete information about each of the structures in the TSP. Costs were also prepared based off generalized designs, not a specific design for each building. More information will be obtained for each structure during Feasibility Level Design. This information could increase or decrease project costs, which could impact the TSP.

9.7.2 IMPLEMENTATION RISKS

The study lacks detailed information for the 14 structures included in the TSP. When detailed information is obtained, it is possible that some of the structures may not be able to be modified as indicated. This could result in less than 14 structures being modified or in the actual cost of the project being different than anticipated.

9.7.3 OUTCOME RISKS

All the selected nonstructural actions are voluntary measures. If some structure owners choose not to participate in the project, the indicated benefits will not be achieved. A sensitivity analysis will be conducted during Feasibility Level Design to determine the level of reduced participation that would be of concern for project success.

Similar to the identified implementation risk, the current lack of detailed information for the 14 structures included in the TSP includes a risk that fewer than 14 structures will be modified or that they will be modified differently than currently planned. This may result in the actual benefits of the project being different than anticipated.

9.8 FLOODPLAIN MANAGEMENT (EXECUTIVE ORDER 11988)

EO 11988 requires federal agencies to recognize the significant values of floodplains and to consider the public benefits that would be realized from restoring and preserving floodplains. It is the general policy of USACE to formulate projects that, to the extent possible, avoid or minimize adverse impacts associated with use of the base floodplain and avoid inducing development in the base floodplain unless there is no practicable alternative that meets the project purpose. Screening of measures and alternatives for this study considered impacts to the floodplain and minimizing induced development. Per the procedures outlined in ER 1165-2-26 (Implementation of EO 11988 on Flood Plain Management), the study team has analyzed the potential effects of the NED plan on the overall floodplain management of the study area. USACE implementation guidance in ER 1165-2-26 states the following in Paragraph 6:

EO 11988 has as an objective the avoidance, to the extent possible, of long- and short-term adverse impacts associated with the occupancy and modification of the base floodplain and the avoidance of direct and indirect support of development in the base flood plain wherever there is a practicable alternative. Under the Order, USACE is required to provide leadership and take action to:

- Avoid development in the base flood plain unless it is the only practicable alternative.
- Reduce the hazard and risk associated with floods.
- Minimize the impact of floods on human safety, health, and welfare; and
- Restore and preserve the natural and beneficial values of the base floodplain.

There are eight steps reflecting the decision-making process required in this EO. The eight steps and responses to them are summarized below.

Step 1. Determine if the proposed action is in the base floodplain.

The proposed actions are located within the base floodplain of the Meramec River.

Step 2. If the action is in the floodplain, identify and evaluate practicable alternatives to locating in the base floodplain.

As the flood risk problem is located in the base floodplain, there is no practicable alternative to taking action within the base floodplain. However, through the alternative screening process, the levee alternative (which would have the greatest impact on the floodplain) was eliminated from consideration.

Step 3. Provide public review.

The public had the opportunity to provide input to the study scoping and potential measures during the public scoping meeting in March 2023. They also have the opportunity to review and comment on the draft report during the 30-day public review period which begins in December 2023.

Step 4. Identify the impacts of the proposed action and any expected losses of natural and beneficial floodplain values.

Chapters 6, 7, and 8 of this document present an analysis of alternatives. Practicable measures and alternatives were formulated, and potential impacts and benefits were evaluated both qualitatively and quantitatively. The anticipated impacts associated with the Tentatively Selected Plan are summarized in Chapters 7, 8 and 9 of this report. The TSP does not include any expected losses of natural and beneficial floodplain values.

Step 5. Minimize threats to life and property and to natural and beneficial floodplain values. Restore and preserve natural and beneficial floodplain values.

Implementing the Tentatively Selected Plan is not anticipated to induce development in the floodplain above and beyond development that is expected to occur in the FWOP condition as described in Chapter 4. It is further assumed that new development will be built above the base 1% AEP floodplain to comply with building codes of local municipalities and to maintain participation in the NFIP, even if not able to participate in the NFIP for the Without Project condition. Flood insurance is recommended for both Without Project and with the Tentatively Selected Plan as insurance provides greater resiliency by providing financial risk management for residual risks. The TSP does not provide any opportunity to restore or preserve natural and beneficial floodplain values.

Step 6. Re-evaluate alternatives.

Chapters 6, 7, and 8 of this document present an analysis of alternatives. There are no practicable alternatives completely outside of the base floodplain for the features included in the Tentatively Selected Plan that would achieve study objectives of reducing flood risks.

Step 7. Issue findings and a public explanation.

The public has the opportunity to review and comment on the draft report during the 30-day public review period which begins in December 2023. The final feasibility report and EA will present the findings and explanation.

Step 8. Implement the action.

The proposed project on its own does not contribute to increased development in the floodplain and does not increase flood risk. The Tentatively Selected Plan is consistent with the requirements of this EO.

9.9 MEETING ENVIRONMENTAL OPERATING PRINCIPLES

USACE has reaffirmed its long-standing commitment to environmental conservation by formalizing a set of Environmental Operating Principles (EOPs) applicable to decision-making in all programs. The EOPs outline the USACE role and responsibility to sustainably use and restore natural resources in a world that is complex and changing. The recommended plan meets the intent of the EOPs.

The TSP supports each of the seven USACE EOPs. 1) The recommended plan strives to achieve environmental sustainability by implementing a project to provide flood risk management while minimizing negative changes to the natural environment. 2) The study included early engagement and considered potential environmental consequences during formulation and evaluation. 3) The TSP selection accounts for effects on natural systems and achieves flood risk reduction in an environmentally sustainable manner. 4) Thorough coordination is occurring within and outside of USACE during the entire study process. 5) In assessing flood risk, the study considered both the human and natural environment and the report explicitly discusses risks. 6) Best available science, practices, analyses and tools, commensurate with the scope and scale of the study, are being utilized. 7) The study has utilized an open and transparent process to gather input from stakeholders and interested parties.

While recognizing the economic benefits to be gained from flood risk reduction, the recommended plan has been developed to be sustainable but sensitive to the balance and synergy between development and nature.

9.10 SPONSOR SUPPORT

The City of Fenton supports the Tentatively Selected Plan and wishes to continue the study to refine the appropriate actions and scale. The city understands the cost-sharing requirements for the implementation of the TSP.

9.11 USACE CAMPAIGN PLAN

The USACE Campaign Plan provides goals, objectives, and actions for improving the USACE contribution to the nation in the areas of warfighting; civil works processes and delivery systems; risk reduction from natural events; and preparation for the future. The four primary goals are to 1) Support National Security, 2) Deliver Integrated Water Resources Solutions, 3) Reduce Disaster Risks, and 4) Prepare for Tomorrow. The Fenton TSP supports the Campaign Plan with contributions to Goals 2 and 3. The project does not make significant contributions to the other two goals.

Goal 2 (Deliver Integrated Water Resource Solutions) includes the following objectives: 2a - Deliver quality water resource solutions and services; 2b - Deliver the civil works program and innovative solutions; 2c - Develop the civil works program to meet the future needs of the nation; and 2d - Manage the life cycle of water resources infrastructure systems to consistently deliver reliable and sustainable performance. The Fenton TSP supports Goal 2 by:

- identifying a plan to reduce existing and future economic risk within the City of Fenton,
- coordinating with significant stakeholder groups throughout the study process, and
- recommending a sustainable and resilient flood risk management plan.

Goal 3 (Reduce Disaster Risks) includes the following objectives: 3a – Enhance interagency disaster response and risk reductions capabilities; 3b – Enhance interagency disaster recovery capabilities; 3c – Enhance interagency disaster mitigation capabilities; and 3d – Deliver and advance Army Geospatial Engineering. The Fenton TSP supports Goal 3 by:

- contributing significantly to interagency efforts to reduce flood risks in the study area before, during, and after plan implementation, and
- increasing awareness of the potential flood risks among the project stakeholders through coordination and increased communication with other relevant agencies, thus enhancing interagency disaster capabilities and coordination relative to disaster preparation and response.

9.12 SUMMARY OF COSTS AND BENEFITS

Key Factor	Alternative 3 Nonstructural Plan
Costs	
Total Project First Cost	$3,349,000
Average Annual O&M Costs	$0
Average Annual Costs	$127,000
Economic Benefits - NED	
Average Annual Damages Reduced (Benefits)	$332,000
Average Annual Net Benefits	$205,000
Benefit-to-Cost Ratio (BCR)	2.6
Residual Risk	
Life Safety	Unchanged - minimal
Residual Economic Damages	$2,082,000
Note: Project costs are in 2023 price level; 2.75% discount rate and 50-year period of analysis used to calculate annualized costs and damages.	

10. PROJECT IMPLEMENTATION

Implementation of the project depends on approval of this report, Congressional authorization, appropriation of sufficient federal design and construction funding, and matching sponsor contributions in the form of cash, land acquisition credit, or work-in-kind credit. A Project Partnership Agreement (PPA) will also need to be executed with the City of Fenton.

10.1 REAL ESTATE CONSIDERATIONS

This section will be fully developed following feasibility level design efforts which will further reduce uncertainties in the real estate requirements.

10.2 DESIGN CONSIDERATIONS

This section will be fully developed following feasibility level design efforts which will further reduce uncertainties in the TSP design. Feasibility level design will also include considerations for additional project resiliency and robustness. This section will document remaining uncertainties and design requirements that need to be considered and addressed during the PED phase.

10.3 CONSTRUCTION CONSIDERATIONS

This section will be fully developed following feasibility level design efforts which will further reduce uncertainties in the TSP design. This section will document construction considerations related to the feasibility level design that need to be considered and addressed during the PED and construction phases.

10.4 OMRR&R REQUIREMENTS

Operation, Maintenance, Repair, Replacement and Rehabilitation (OMRR&R) requirements will be a non-Federal responsibility and will be fully documented following feasibility level design. In general, it is expected that maintenance of nonstructural actions would fall to the structure owner as part of normal structure maintenance.

10.5 MITIGATION REQUIREMENTS

At this time, no mitigation requirements have been identified. See section 9.4 for a discussion of the evaluation of environmental and cultural effects.

10.6 IMPLEMENTATION SCHEDULE

A preliminary schedule has been developed and includes approval of this report in September of 2024 and completion of design efforts in 2025. Construction could begin in 2026 but completion is highly dependent on participation by structure owners.

A more detailed project schedule will be developed following additional design refinements. The schedule will assume Federal funding is available in the years required, sponsor matching funds are also available, structure owners are willing to participate in a timely fashion, and that the real estate actions are completed on schedule.

The schedule will reflect the information currently available and the current departmental policies governing execution of projects. It will not reflect program and budgeting priorities inherent in either the formulation of a national civil works construction program or the perspective of higher review levels within the Executive Branch. Consequently, the schedule may be modified before it is transmitted to higher authority for implementation funding.

10.7 SPONSOR REQUIREMENTS

Federal implementation of the recommended project would be subject to the non-Federal sponsor agreeing to comply with applicable Federal laws and policies, including but not limited to:

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

   a. Provide, during design, 35 percent of design costs in accordance with the terms of a project partnership agreement entered into prior to commencement of design work for the project;

   b. 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;

   c. Provide, during construction, any additional contribution necessary to make its total contribution equal to at least 35 percent of construction costs;

2. Prevent obstructions or encroachments on the project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) that might reduce the level of flood risk reduction the project affords, hinder operation and maintenance of the project, or interfere with the project's proper function.

3. Inform affected interests, at least yearly, of the extent of risk reduction afforded by the flood risk management features; participate in and comply with applicable Federal floodplain management and flood insurance programs; prepare a floodplain management plan for the project to be implemented not later than one year after completion of construction of the project; and publicize floodplain information in the area concerned and provide this information to zoning and other regulatory agencies for their use in adopting regulations, or taking other actions, to prevent unwise future development and to ensure compatibility with the project.

4. Operate, maintain, repair, rehabilitate, and replace the project or functional portion thereof at no cost to the Federal government, in a manner compatible with the project's authorized purposes and in accordance with applicable Federal laws and regulations and any specific directions prescribed by the Federal government.

5. Give the Federal government a right to enter, at reasonable times and in a reasonable manner, upon property that the non-Federal sponsor owns or controls for access to the project to inspect the project, and, if necessary, to undertake work necessary to the proper functioning of the project for its authorized purpose.

6. Hold and save the Federal government free from all damages arising from design, construction, operation, maintenance, repair, rehabilitation, and replacement of the project, except for damages due to the fault or negligence of the Federal government or its contractors.

7. Perform, or ensure performance of, any investigations for hazardous, toxic, and radioactive wastes (HTRW) that are determined necessary to identify the existence and extent of any HTRW regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. 9601-9675, and any other applicable law, that may exist in, on, or under real property interests that the Federal government determines to be necessary for construction, operation, and maintenance of the project;

8. Agree, as between the Federal government and the non-Federal sponsor, to be solely responsible for the performance and costs of cleanup and response of any HTRW regulated under applicable law that are located in, on, or under real property interests required for construction, operation, and maintenance of the project, including the costs of any studies and investigations necessary to determine an appropriate response to the contamination, without reimbursement or credit by the Federal government;

9. Agree, as between the Federal government and the non-Federal sponsor, that the 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

10. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended, (42 U.S.C. 4630 and 4655) and the Uniform Regulations contained in 49 C.F.R Part 24, in acquiring real property interests necessary for construction, operation, and maintenance of the project including those necessary for relocations, and placement area improvements; and inform all affected persons of applicable benefits, policies, and procedures in connection with said act.

10.8 COST SHARING REQUIREMENTS

The cost sharing requirement for this project is 65% Federal and 35% non-Federal. In addition to cash, the sponsor is anticipated to receive credit for LERRDs acquisition. The total project first cost is approximately $3,349,000. The Federal share of the project first cost is estimated to be approximately $2,177,000 and the non-Federal share is estimated to be approximately $1,172,000. The estimated value of LERRDs to be provided by the sponsor is approximately $438,000 and the rest of the sponsor contribution will be in cash or in-kind credit.

10.9 FINANCIAL ANALYSIS

The City of Fenton has the financial capability to cost-share the estimated implementation costs and are willing to sign the PPA at the appropriate time. Sponsor self-certification of financial capability will be included in the final report.

11. ENVIRONMENTAL COMPLIANCE AND PUBLIC INVOLVEMENT

11.1 ENVIRONMENTAL COMPLIANCE TABLE

Table will be provided for the final report.

11.2 SCOPING

A public scoping meeting was conducted on March 28, 2023, at Fenton City Hall. The public was provided the opportunity to offer verbal and written comments.

11.3 AGENCY COORDINATION

Agency coordination for flood risk management for the city of Fenton has been ongoing since March 2023. Appendix G – Environmental Compliance and Coordination contains additional information on the consultation and ongoing agency coordination.

11.4 TRIBAL CONSULTATION

Tribal consultation was initiated on August 23, 2023. The comment period ended on September 22, 2023. Correspondence is included in Appendix G

11.5 LIST OF RECIPIENTS

The list of recipients can be found in Appendix G.

11.6 PUBLIC COMMENTS RECEIVED AND RESPONSES

The public will have the opportunity to review and comment on the draft report during the 30-day public review period which will begin in December 2023. A public meeting is planned for January 2024 to present the TSP and allow the public to respond and ask questions. Comments received during the public review period will be included in Appendix G.

12. RECOMMENDATION

This Chapter will be fully developed following consideration of public input and feasibility level design efforts.

The recommendations contained herein reflect the information available at this time and current departmental policies governing the formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of the national civil works construction program or the perspective of higher levels within the executive branch. Consequently, the recommendations may be modified before the report is approved. However, prior to report approval, the City of Fenton, interested Federal agencies, and other parties will be advised of any significant modifications in the recommendations and may be afforded an opportunity to comment further.

COLONEL NAME

Colonel, Corps of Engineers

District Commander

13. LIST OF PREPARERS

Name	Role	Years of Experience
Matthew Jones	Project Management	7 years
Michelle Kniep	Plan Formulation	20 years
Bradley Kruse	Hydraulic Engineering	5 years
Jeff Asbed	Office of Counsel	20 years
Jennifer Skiles	Regulatory	15 years
Edwin Ramos	Real Estate	5 years
Kristen Fuld	Cultural Resources	5 years
Matt Hartman	Civil Engineering (Tech Lead)	5 years
Schuyler Bucher	Economics	5 years
Darrell Combs	Cost Engineering	5 years
Natalia I. Ramírez Irizarry	Environmental Compliance	5 years
Patty Osorio Gil	Geotechnical Engineering	5 years
Mike Skrabacz	HTRW; Water Quality	5 years
Cindy Wood	Program Analyst	15 years
Jeremy Noel	Project Scheduler	10 years
Meredith Trautt	Tribal Liaison	15 years
Portia Stagge	GIS	15 years

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DRAFT FINDING OF NO SIGNIFICANT IMPACT

CAP Section 205
FLOOD RISK MANAGEMENT STUDY,
CITY OF FENTON, MISSOURI

1. I have reviewed the documents concerned with the recommended flood risk management, City of Fenton, Missouri. The purpose of this project is to determine alternatives to reduce the flood risk in the City. The City of Fenton has recently experienced several large flood events which have resulted in substantial economic damages and social disruption. I have also evaluated pertinent data concerning practicable alternatives relative to my decision on this action. As part of this evaluation, I have considered the following alternatives:

   a. No Action Alternative: Under the no-action alternative, the Federal government would not reduce the flood risk in the City. It is assumed that the future flood risk will be similar to the existing conditions.

   b. Levees and Floodwall Alternative - This alternative includes one or more levee alignments within the City of Fenton. The locations of the levees target areas of concentrated structure damages where natural topography allows for the levees to tie into high ground at the target design elevation. This alternative was screened from further consideration due to strong opposition to levees in this area, both by the public and the City, as well no economically supportable levee alignment / design.

   c. Nonstructural Alternative: Under this alternative, address flood risk by floodproofing thirteen commercial structures using wet floodproofing techniques and elevating one residential structure.

   d. Levees and Nonstructural Alternative: This alternative would include one or both levees included in Alternative 2, as well as nonstructural measures applied to structures located outside of the leveed area(s). This alternative was screened from further consideration due to no economically supportable levee alignment / design.

2. The possible consequences of the No Action Alternative and Nonstructural Alternative have been studied for physical, environmental, cultural, social and economic effects. Major factors evaluated as part of this review included:

   a. The No Action Alternative was evaluated and would be unacceptable to recommended as it does not meet the project purpose and an acceptable alternative is available. Future flooding would expect to continue to cause risk of life loss and damage to infrastructure and recreational sites.

b. No appreciable effects to general environmental conditions (topography and geology, land use/landcover, air quality, noise, water quality) would result from the Nonstructural Alternative.

c. The Nonstructural Alternative is not expected to cause significant adverse impacts to general fish and wildlife resources.

d. No Federally endangered or threatened species would be adversely impacted by the Nonstructural Alternative.

e. No appreciable effects to socioeconomic conditions (aesthetics, recreation, traffic and roadways, demographics) would result from the Nonstructural Alternative.

f. No prime farmland would be adversely impacted as a result of the Nonstructural Alternative.

g. No significant impacts to historic properties (cultural resources) are anticipated as a result of the Nonstructural Alternative.

h. No adverse impacts to minority, low income, or other environmental justice communities are anticipated as a result of the Nonstructural Alternative.

3. Based upon my analysis, no significant impacts to the environment are anticipated from the Nonstructural Alternative. The proposed action has been coordinated with appropriate resource agencies, and there are no significant unresolved issues. Therefore, an Environmental Impact Statement will not be prepared prior to proceeding with this action.

______________________________ ______________________________

Date

Andy J. Pannier
Colonel, U.S. Army
District Commander