US Army Corps of Engineers®

WATERTOWN, SOUTH DAKOTA FLOOD RISK MANAGEMENT GENERAL INVESTIGATIONS STUDY

DRAFT INTEGRATED FEASIBILITY REPORT & ENVIRONMENTAL ASSESSMENT

OMAHA DISTRICT
NORTHWESTERN DIVISION

IN PARTNERSHIP WITH

CITY OF WATERTOWN

September 2024

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Executive Summary

1. Introduction – The city of Watertown, SD and vicinity have experienced 11 major flood events since 1943, including the flood of record in 1997. This has resulted in damages to housing and infrastructure, loss of access to emergency services, and millions of dollars in insurance claims. The U.S. Army Corps of Engineers (USACE) completed a feasibility study and submitted a Chief's Report in 1994 recommending construction of the Mahoney Creek Dry Dam upstream of Watertown; however, due to opposition from landowners, Congress did not approve the project for construction.

USACE conducted additional studies of Watertown and vicinity between 2005 to 2012 which included reviewing additional alternatives, updating modeling, and conducting a value engineering study. No new alternatives were recommended for construction after these studies.

The most recent Letter of Request, received by USACE on 7 April 2020, was submitted by the City of Watertown (City). Section 201(a)(62) of the Water Resources Development Act of 2022 authorized the funding for the Flood Risk Management (FRM) study on the Big Sioux River in Watertown and its vicinity. A Feasibility Cost Sharing Agreement was executed between USACE and the City (the Non-Federal Sponsor) on 19 August 2022 officially starting the feasibility study.

2. Purpose and Need – The purpose of the project is to address flood risk along the Big Sioux River in and around the vicinity of Watertown, SD. There are approximately 1000 structures that are currently vulnerable at the one-percent annual exceedance probability event within the study area. Several critical facilities are either directly impacted or access has been greatly reduced.

3. Plan Formulation – General Investigation studies are utilized to address large-scale, complex water resource problems such as FRM, navigation, water supply, and other needs. They require two types of congressional authority: authorization and appropriation. Due to the size and complexity, there are no cost restrictions for the construction of these projects. There are two phases for the study: Feasibility and Preconstruction Engineering and Design (PED). In FRM studies, the Recommended Plan is often focused on the cost-effectiveness of the plan in delivering all benefits, consistent with protecting the environment and achieving planning objectives, and is otherwise known as the National Economic Development plan. Another plan may be selected but would require a waiver from the Assistant Secretary of the Army (Civil Works).

4. Tentatively Selected Plan – The Tentatively Selected Plan (TSP) for this study consists of a combination of seasonally lowering Lake Kampeska, constructing an earthen levee along the left bank, and channel widening of the Big Sioux River. This alternative would examine altering the existing operations of Lake Kampeska to gain approximately 3,300 acre-feet of additional flood water storage in the lake. The left bank levee would start near West Kemp Avenue and extend south where it would tie off just north of U.S. Highway 212 (US-212). The levee alignment would generally follow the existing temporary levee alignment, constructed as flood fight measures by USACE in 2010, in order to minimize disturbance. A flood wall would be built in the center of the levee alignment to avoid the Watertown Iron and Metal facility which is documented as a Recognized Environmental Condition under the Phase I Hazardous, Toxic, and Radioactive Waste assessment (USACE, 2023). The channel widening component involves widening 4.6 miles of the Big Sioux River starting just north of 14th Avenue and continuing south past US-212, where it crosses both 5th Street and 20th Avenue and ends approximately 1,600

feet south of the 20th Avenue bridge. The channel would be widened approximately 50 feet to the east and west and would start approximately 3-3.5 feet above the invert of the existing channel.

5. Significant Resources/Environmental Considerations – During alternative formulation, consideration of nature-based solutions (NBS) as stand-alone measures and integrated into hybrid FRM measures. Stand-alone NBS measures included construction of a wetland/riparian habitat complex upstream of Watertown to provide storage capacity for floodwaters while dually serving as mitigation. NBS measures hybridized into the TSP included the use native plantings (non-woody species) on constructed levee features and maintenance of a low-flow channel in the newly widened cross section with boulder cluster installed throughout. Integration of NBS in the TSP resulted in a 24% decrease of required mitigation as compared to implementing the with no NBS incorporation.

Following avoidance and minimization strategies, the remaining unavoidable impacts that necessitate compensatory mitigation are 3.26 average annual habitat units (AAHUs). Unavoidable impacts are primarily the result of levee construction in the floodplain and the perpetual operation and maintenance (O&M) of the levee system. Direct fill in 0.05 acre of palustrine emergent (PEM-C) wetlands would result from levee construction and 0.14 acre below the ordinary high water mark of the Big Sioux River for implementation of the aquatic NBS from placement of boulder clusters. Approximately 0.13 acre of PEM-C wetlands would be indirectly impacted from permanent isolation from the new levee feature. Approximately 12.19 acres of woody vegetation would be removed for construction of the levee and to accommodate the channel widening. Throughout the levee right-of-way (ROW), tree recruitment would be perpetually inhibited a minimum of 15 feet on both sides of the levee toe within approximately 4.71 acres. Approximately 52.4 acres of upland herbaceous habitat within the floodplain would be excavated to accommodate the newly widened channel cross section. Construction and operation of Alternative 8 would result in 4,149 metric ton equivalent emissions of CO2, or the annual emissions of approximately 900 passenger cars. For additional information on the quantitative and qualitative methods utilized for capturing impacts and benefits, see Appendix G1, for discussion on mitigation and monitoring, see Appendix G2, for discussion on wetland impacts refer to the 404(b)1, see Appendix G5, and for discussion on greenhouse gas impacts see Appendix G4. Informal coordination with the U.S. Fish and Wildlife Service is ongoing and will be finalized when the Recommended Plan is selected.

Other significant resources include previously recorded historic properties and other possible cultural resources within the study area. A full survey will be deferred to the PED phase of the project. Consultation with the South Dakota State Historic Preservation Office, the Non-Federal Sponsor, affected Tribes, and other interested parties is ongoing. USACE will be drafting a project-specific Programmatic Agreement with these consulting parties, to meet requirements of the National Historic Preservation Act.

6. Plan Implementation – The feasibility study is scheduled to be completed in May 2026, followed by one year of design and two years of construction. The Non-Federal Sponsor supports the TSP and the proposed implementation plan. Following public review of the draft report, optimization of the TSP will be conducted to further reduce uncertainties.

7. Views of the Public, Agencies, Stakeholders, and Tribes – Several meetings have been held with the public, Federal and State agencies, stakeholders, and Tribes since the start of the

study. Opposition from the public and the Tribe to the previously recommended Mahoney Creek Dry Dam alternative continued under the current study. Coordination also began with the Sisseton Wahpeton Oyate and alternatives were removed from within their Lake Traverse Reservation boundary. Additional engagements are planned to coordinate and gather input from agencies, stakeholders, and the public. These future engagements include a stakeholder and public meeting on September 17, 2024 as well as virtual meetings planned for October 2024 with agencies and Tribes.

8. Reviews – District Quality Control, Agency Technical Review (ATR), Targeted ATR, Independent External Peer Review, Dam and Levee Safety Risk Assessment, Public and Agency Reviews, and Policy and Legal Compliance Reviews were conducted on this study.

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AAHU	Average Annual Habitat Units
AEP	Annual Exceedance Probability
ASTM	American Society for Testing of Materials
ATR	Agency Technical Review
BCR	Benefits Cost Ratio
BFE	Base Flood Elevation
BGEPA	Bald and Golden Eagle Protection Act
BIA	Bureau of Indian Affairs
BMPs	Best Management Practices
BNSF	Burlington Northern Railway
CAA	Clean Air Act

CEJST	Climate and Economic Justice Screening Tool
CEQ	Council of Environmental Quality
CFR	Code of Federal Regulation
CFS	Cubic Feet per Second
CO2	Carbon Dioxide
CRS	Community Rating System
CWA	Clean Water Act
DANR	Department of Agriculture and Natural Resources
DO	Dissolved Oxygen
DoD	Department of Defense
EPA	Environmental Protection Agency
EA	Environmental Assessment
EQ	Environmental Quality
EOPs	Environmental Operating Principles
ER	Engineering Regulation
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
FWP	Future with Project
FWOP	Future Without Project
FCSA	Feasibility Cost Sharing Agreement
FRM	Flood Risk Management
GI	General Investigation
GHG	Green House Gases
HEC-RAS	Hydrologic Engineering Center's River Analysis System
HEC-SSP	Hydrologic Engineering Center's Statistical Software Package
HTRW	Hazardous, Toxic, Radioactive, Waste
IFR/EA	Integrated Feasibility Report and Environmental Assessment
LERRDS	Lands Easements, Right of Ways, Relocations and Disposal Areas
MBTA	Migratory Bird Treaty Act
NAAQS	National Ambient Air Quality Standards
NBS	Nature Based Solutions
NED	National Economic Development
NEPA	National Environmental Policy Act
NFS	Non Federal Sponsor
NHL	National Historic Landmark
NHPA	National Historic Preservation Act
NLCD	National Land Cover Database
NNBF	Natural and Nature Based Features
NRCS	Natural Resources Conservation Service
NWI	National Wetland Inventory
O&M	Operation and Maintenance

OHWM	Ordinary High Wide Mark
OMRR&R	Operations, Maintenance, Repair, Replacement, and Rehabilitation
OSE	Other Social Effects
P&G	Principles and Guidelines
PED	Preconstruction Engineering and Design
PEM-C	Seasonally Flooded, Palustrine Emergent Wetlands
PGN	Planning Guidance Notebook
PDT	Project Delivery Team
RED	Regional Economic Development
ROW	Right of Way
S&A	Supervision and Adminstration
SD	South Dakota
SDGFP	South Dakota Game Fish and Parks
SHPO	State Historical Preservation Office
SWO	Sisseton Wahpeton Oyate
TMDL	Total Maximum Daily Load
TSP	Tentatively Selected Plan
US	United States
USACE	US Army Corps of Engineers
USC	United States Code
USDA	US Department of Agriculture
USFWS	US Fish and Wildife Service
WOTUS	Waters of the United States
WQC	Water Quality Certification

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1 INTRODUCTION

This General Investigations (GI) study is being conducted by the U.S. Army Corps of Engineers, Omaha District (USACE), under resolutions adopted by the Committee on Public Works, U.S. Senate on 8 May 1964, and 26 March 1968; and a resolution adopted by the Committee on Public Works, U.S. House of Representatives on 1 August 1963. These authorize a review of utilization of storage reservoirs for flood control and related water problems in the Big Sioux River basin in South Dakota and Iowa.

The city of Watertown and its vicinity has experienced 11 major flood events since 1943 including the flood of record in 1997. This has resulted in damages to housing and infrastructure, loss of access to emergency services, and millions of dollars in insurance claims. This study is necessary to evaluate the feasibility of reducing flood risk throughout the community of Watertown, SD.

This Integrated Feasibility Report and Environmental Assessment (IFR/EA) documents the existing conditions, evaluation of alternatives, and recommendations for the flood risk management (FRM) of the Big Sioux River in Watertown and its vicinity. These recommendations are intended for authorization and implementation following the approval of this report. The integrated Environmental Assessment (EA) has been completed in accordance with the National Environmental Policy Act (NEPA; 42 U.S.C. § 4331 et seq, as amended) and its implementing Council of Environmental Quality (CEQ) regulations (2024), and satisfies the requirements of USACE policies that guide water resource development studies, including the Planning Guidance Notebook (Engineer Regulation (ER) 1105-2-100), Planning Policy for Conducting Civil Works Planning Studies (ER 1105-2-103), Procedures for Implementing NEPA (ER 200-2-2), and other related guidance.

The Sisseton Wahpeton Oyate (SWO) and the Bureau of Indian Affairs (BIA) were invited to be cooperating agencies because they have jurisdiction by law or have special expertise with respect to potential environmental issues (Code of Federal Regulations (CFR) 1501.8). BIA accepted the invitation to formally participate. USACE continues to coordinate with SWO throughout the study and their input is discussed later in this report.

1.1 USACE Planning Process

USACE uses an iterative six-step planning process (Figure 1) to guide project execution, as detailed in ER 1105-2-103. This process is a structured approach to problem solving and provides a rational framework for federal project decision making, with steps repeated as new information is learned and applied. The six steps are:

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

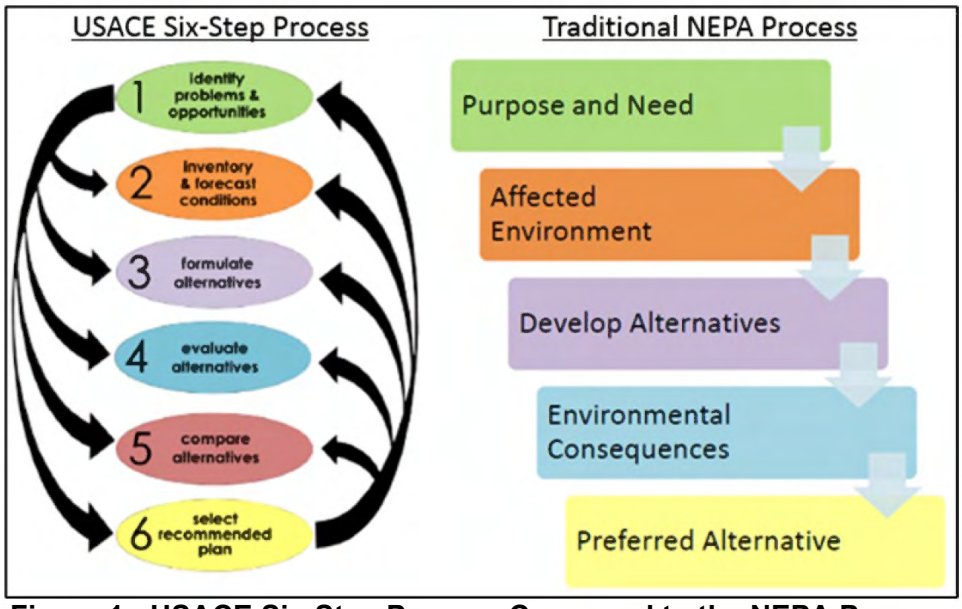

Figure 1 - USACE Six-Step Process Compared to the NEPA Process

USACE conducts FRM studies using a risk-informed planning process which incorporates the steps outlined above with qualitative and quantitative risk assessment information (Figure 2). Study teams will use risk analysis to formulate, evaluate, and compare plans in terms of the likelihood and variability of their benefits, costs, impacts, and residual risks. Risks will be communicated to Tribes, the public, partners, stakeholders, and decision makers so that the problems and potential alternatives are understood, and risk management decisions can be made about who will take what actions to reduce and manage risks.

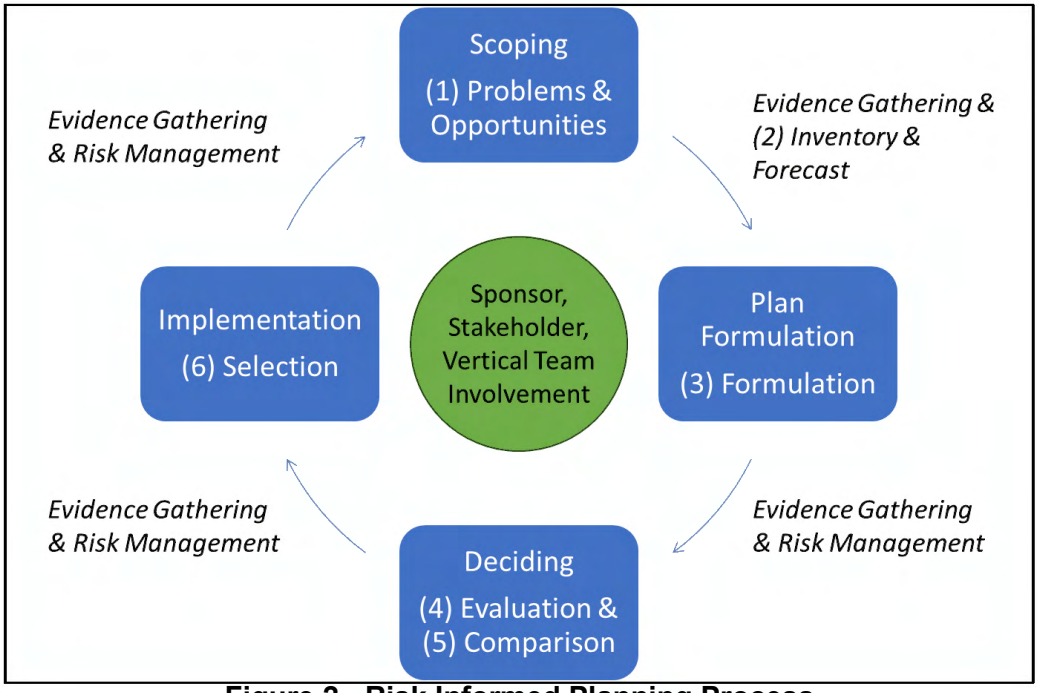

Figure 2 - Risk Informed Planning Process

Plan formulation is the process of evaluating existing conditions and building alternative plans that meet planning objectives and avoid planning constraints. This study examines and

addresses the federal criteria of completeness, efficiency, effectiveness, and acceptability. To adequately address these criteria, the development and early screening of potential alternatives considered several evaluation factors. Primary among those factors are the following:

- Engineering and FRM adequacy (effectiveness/completeness).
- Ability to contribute to meeting the planning objectives (effectiveness/completeness).
- Consistency with planning constraints and authorities.
- Acceptability (includes law and policy, sponsor, environmental, cultural, and public aspects).
- Early cost indicators (early efficiency indicators for screening purposes).
- Construction site constraints and real estate requirements (location conflicts, adjacent development, etc.).

A measure is a feature or activity that can be implemented at a specific geographic site to address one or more planning objectives. Alternative plans are sets of one or more FRM measures functioning together to address one or more planning objectives. The alternative plan formulation process has been performed iteratively throughout this study (Section 3).

Following alternative plan formulation and evaluation of impacts (Section 4), alternatives were compared to identify the National Economic Development (NED) plan (Section 5) that maximizes net NED benefits, consistent with protecting the Nation's environment. Identification of the Tentatively Selected Plan (TSP) (Section 6) relied on a more detailed analysis considering all four planning accounts established by the Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (P&G) which were developed pursuant to the Water Resources Planning Act of 1965 PL 89-80, as amended (42 U.S.C. 1962a-2 and d-1).

The four accounts are used by all Federal agencies in considering water resources projects and consist of 1) NED; 2) Environmental Quality (EQ); 3) Regional Economic Development (RED); and 4) Other Social Effects (OSE). Following public review of the draft report, optimization of the TSP will be conducted, if necessary, to further refine the plan and reduce uncertainties culminating in identifying the plan that maximizes net NED benefits and reasonably maximizes all benefits before ultimately selecting a Recommended Plan.

1.2 Study Authority

This project was authorized under resolutions adopted by the Committee on Public Works, U.S. Senate on 8 May 1964, and 26 March 1968; and a resolution adopted by the Committee on Public Works, U.S. House of Representatives on 1 August 1963, which a review the reports on the Big Sioux River and its Tributaries, Iowa and South Dakota and other reports, with a view to determining if any modifications should be made in the recommendations therein, with particular reference flood control and related water problems,.

The Letter of Request for a study of flood risk related issues was submitted by the City of Watertown to USACE on 7 April 2020. A Feasibility Cost Sharing Agreement (FCSA) was executed between USACE and the City of Watertown, the Non-Federal Sponsor (NFS), on 19 August 2022, officially starting the feasibility study. Feasibility study costs are shared 50 percent federal and 50 percent non-federal; design and implementation costs are shared 65 percent federal and 35 percent non-federal. Subsequent to signing the FCSA and initiating the study,

additional Congressional authority was provided by Section 201(a)(62) of the Water Resources Development Act of 2022, which authorized the Secretary to conduct a flood risk management study of the Big Sioux River in the City of Watertown and vicinity, South Dakota.

1.3 Study Area

The study area encompasses a portion of the Upper Big Sioux River subbasin (Hydrologic Unit Code 10170201), within northeastern South Dakota. The Upper Big Sioux River subbasin watershed covers most of Codington County, and parts of Grant, Roberts, Day, and Hamlin Counties in South Dakota. It drains an area of approximately 1600 square miles. The three major streams draining into the Upper Big Sioux River are Indian River, Willow Creek, and Mud Creek.

A study area map is shown in Figure 3. For the purposes of studying FRM, including the entirety of the Upper Big Sioux River subbasin in the study area is not necessary, due to the topography of the upper western half of the subbasin containing numerous prairie pothole catchments that do not contribute to the main watershed. Therefore, the study area is defined as the existing .02-percent Annual Exceedance Probability (AEP) floodplain with a buffer of 500 feet. The southern tip of the SWO Lake Traverse Reservation is also intersected by the study area. Detention in the upper parts of the basin, structural measures, and nonstructural measures in the lower part of the basin are all being considered in the alternatives analysis; therefore, the project area is consistent with the study area.

Current congressional representatives for the state of South Dakota are Senators Mike Rounds and John Thune and Representative Dusty Johnson.

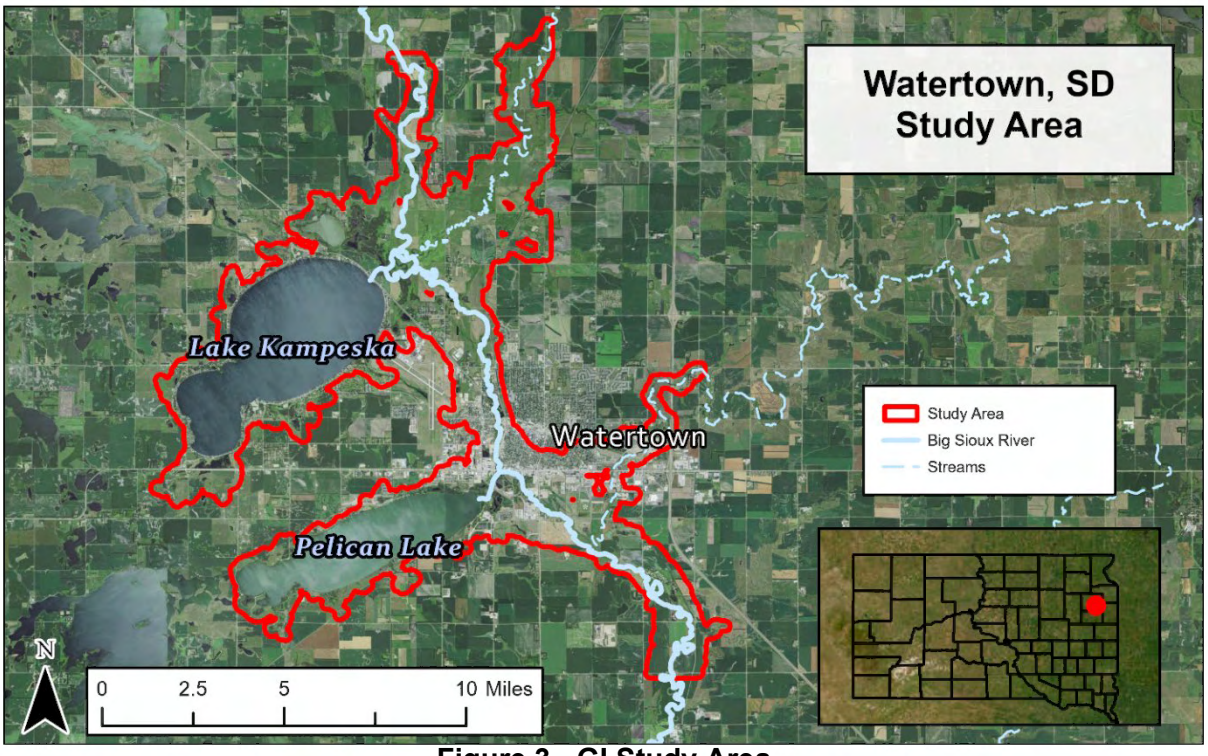

Figure 3 - GI Study Area

1.4 Background and History

1.4.1 Prior Reports, Studies, and Projects

The flood risk problem has been studied previously several times by USACE and other agencies dating back to the 1970s. USACE completed a Feasibility Study and submitted a Chief's Report in 1994 recommending the construction of the Mahoney Creek Dry Dam upstream of Watertown; however, due to opposition from landowners, Congress did not approve the project for construction.

Watertown and the surrounding areas experienced the flood of record in 1997 leading the city to request USACE re-evaluate alternatives with updated hydrological and hydraulic (H&H) models utilizing 1997 flood data as well as impacts to economic land use. USACE completed a Re-evaluation Report in 2000 that still recommended the Mahoney Creek Dry Dam. Lack of local support for the dry dam alternative still existed which again prevented its implementation.

USACE conducted additional studies for Watertown and its vicinity between 2005 and 2012 which included reviewing additional alternatives, updating H&H modeling, and conducting a Value Engineering Study. No new alternatives were recommended for construction after these studies.

1.4.2 Flood History

There have been several significant floods within the study area in 1943, 1952, 1969, 1972, 1986, 1993, 1997, 2001, 2010, 2011, and 2019. These floods have been caused by snowmelt, rain-on-snow, and rainfall events. The study area sustained damage to critical infrastructure, such as utilities, sewers, and roadways during each flood event. The 1997 event was the most severe flood on record for the Big Sioux River and Lake Kampeska. There are no recorded fatalities for any of the flooding events. For the USGS gage near Watertown, the record peak discharge for the 1997 event was 7,820 cubic feet per second (cfs); the previous record peak discharge was 5,950 cfs in 1969. See Figure 4 below for comparison of peak flow events for 1969, and 1997 to 2023. The figure shows the peak flows for the Big Sioux River near Watertown and at Watertown streamgages from 1997 to 2023. The 1969 flood is included as a historical event with available peak flows.

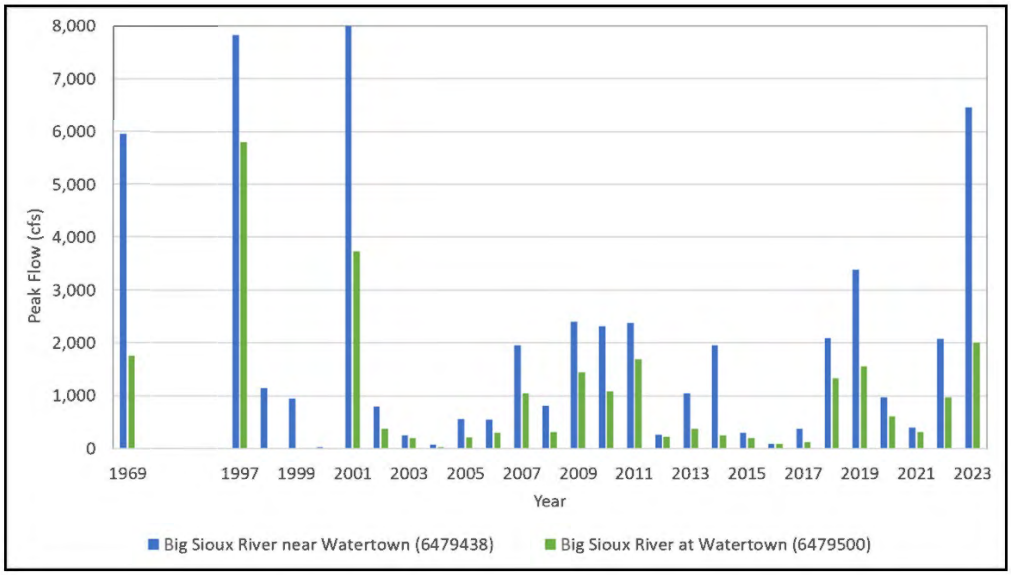

Figure 4 - Comparison of Peak Flow Events for Big Sioux River

1.5 Purpose and Need

The purpose of this project is to examine flooding along the Big Sioux River in and around the vicinity of Watertown, SD in order to reduce flood and life safety risks. Purpose is defined in greater detail in Section 1.7. There are approximately 1000 structures that are currently vulnerable at the one-percent AEP event within the vicinity of Watertown. Several critical facilities are either directly impacted or access has been greatly reduced. This includes the area hospital which is difficult for residents who live west of the Big Sioux River to access during flood events. Need is defined in greater detail in Section 1.6.

1.6 Problems and Opportunities

This section discusses problems and opportunities within the study area. While problem statements characterize the primary need for a federal action, opportunity statements may identify secondary needs that may be addressed, if feasible, at the same.

1.6.1 Problems

There are four main problems occurring in and around Watertown due to flooding of the Big Sioux River:

1. Risks to property and infrastructure within the city of Watertown and its vicinity due to recurring flooding from the Big Sioux River and its tributaries.
    a. In addition to the risk of structures affected by an one-percent AEP event, there are roughly 2,800 structures in the 0.2-percent AEP (a 1 in 500 chance of occurring) floodplain with an approximate structure value of just under one billion dollars in the vicinity of Watertown. The majority of these structures (2,300) are residential with the remaining 500 consisting of a variety of nonresidential structures.
2. Frequency and severity of flood-fighting and cleanup costs are high.
    a. Since 2010, the City of Watertown has spent nearly two million dollars in advanced protection measures and damage repairs.

3. Safety risks associated with flooding, road closures, and water and wastewater infrastructure.
4. Impacts to the wastewater treatment plant and risks of releasing untreated water into the Big Sioux River.

1.6.2 Opportunities

The opportunities below were developed by the USACE Project Delivery Team (PDT) through scoping, data gathering, and characterization of existing conditions. The opportunities in the project area are:

- Reduce the cost and time spent on flood-fighting.
- Accrue benefits downstream depending on alternatives.
- Improve/Increase natural habitat.
- Lower the number of houses that require flood insurance and/or the premiums for flood insurance.
- Improve the Federal Emergency Management Agency (FEMA) Community Rating System (CRS) classification for the community (currently CRS Class 7)
- Increase outdoor recreation.
- Improve water quality within lakes/river.

1.7 Objectives and Constraints

Objectives help define the purpose of the project. Objectives developed for this study are all measured over a 50-year period of analysis and include the following:

- Reduce the damages and severity of flooding within the vicinity of Watertown.
- Reduce impacts to health and life safety from flooding within the vicinity of Watertown.
- Reduce cost and frequency of deploying emergency response efforts during flood events.
- Provide benefits to and avoid disproportionate impacts to the underserved and disadvantaged communities within Watertown and Lake Traverse Reservation.
- Reduce the number of structures within the floodplain in Watertown.
- Increase resiliency of infrastructure to flooding in the vicinity of Watertown.
- Create natural and nature-based features (NNBF) with FRM measures.

Constraints are identified for the planning effort. Alternatives were formulated to avoid the planning constraints. Constraints identified include the following:

- The City of Watertown Airport – must avoid measures in close proximity to airport.
- Burlington Northern Railway (BNSF) – must avoid measures that would require railway relocation.

1.8 Study Scope

The general scope of this study is to define and quantify flood risks and related problems associated with the Big Sioux River within the vicinity of Watertown, SD and to determine the feasibility of structural and nonstructural solutions to reduce those flood risks. The study results present the economic feasibility of the alternatives evaluated and details any environmental and socioeconomic impacts that could occur along with any associated mitigation. The primary

purpose of implementing an FRM project is to reduce the risk of property and infrastructure damages, injury, and possible loss of life due to flooding.

The study considered FRM alternatives along the Big Sioux River to fully address the study's objectives. The study reviewed existing and future without-project conditions, developed and evaluated alternatives, compared the costs and benefits of those alternatives, and tentatively selected an FRM plan. In addition to the City of Watertown, this study has been conducted in coordination with SWO, South Dakota Game, Fish, and Parks (SDGFP), U.S. Fish and Wildlife Service (USFWS), U.S. Environmental Protection Agency (EPA), and BIA, as well as other Tribes, state and federal agencies, stakeholders, and the general public to ensure the study adequately considers and reflects all input.

1.9 Period of Analysis

The period of analysis for this study is 50 years, which is assumed to begin following construction of a flood risk management project. Construction is assumed to be complete in 2030; therefore, the period of analysis is 2026 + 1 through 2030 + 50. The period of analysis for this study includes existing conditions; future conditions without a constructed project (FWOP), also defined as the No Action Alternative; and future conditions with project (FWP), defined through the Action Alternatives; and attempts to capture project benefits, deferred installation costs, monitoring and adaptive management costs, and operation and maintenance costs.

2 EXISTING AND FUTURE WITHOUT-PROJECT CONDITIONS

2.1 General Setting

The study area is located in south-central Codington County, in northeastern South Dakota, within EPA Level IV Ecoregion *Big Sioux Basin*, which is within the *Northern Glaciated Plains* Level III Ecoregion. USDA's Major Land Resource Area 52 classifies this area as the *Prairie Coteau*, of the Land Resource Region Central Feed Grains and Livestock Region.

Watertown is located on both banks of the Big Sioux River. With a population of 22,655 at the time of the 2020 Census, Watertown is the second largest community in northeastern South Dakota. Watertown is the trade center for thousands of people in the area. Three industrial parks and an established business community serve local, national, and global markets.

Three major lakes exist as off-channel storage to the Big Sioux River: Lake Kampeska, Pelican Lake, and Lake Poinsett. Lake Kampeska and Pelican Lake are located in Watertown and affect flows on the Big Sioux River through town. Lake Poinsett is located much farther downstream and its impact on Big Sioux River flows does not affect the Watertown area. Lake Kampeska and Pelican Lake are further described in Section 2.4.2.2.

2.2 Physical Environment

2.2.1 Climate

The climate of the Upper Big Sioux River basin in and around Codington County, SD, is classified as humid continental. The region experiences long, cold winters and short, warm to hot summers, with seasonal and daily temperature changes occurring abruptly and frequently (Beck et al., 2023). The average annual air temperature is approximately 42.9 °F (6.1 °C), with average daily maximums ranging from 12 °F (-11.1 °C) during January to 70.8 °F (21.6 °C) during July. While the first freeze occurs, on average, during the last week of October, the last freeze usually occurs during the third week of April. This gives an average annual growing season of approximately 190 days.

The average annual precipitation for the region is 24.1 inches, with the highest monthly precipitation occurring in June with an average of 3.94 inches. Within the past 50 years, 1976 had the least precipitation and 2019 had the most, with annual precipitations of 9.69 inches and 38.50 inches, respectively (PRISM Climate Group, 2024). Average windspeeds are approximately 19.5 miles per hour (mph), originating from the southwest. Winds in excess of 40 mph occur annually with prolonged periods of strong winds (25-30 mph) being common in the spring, fall, and winter. High winds occur frequently from all directions (NREL, 2024).

A climate assessment consistent with Engineering and Construction Bulletin 2018-14 requirements was completed and provided in Appendix A1. This screening-level assessment considered flows for FRM. Based on this screening-level assessment, climate change has a low likelihood of impacting the function of the proposed project.

Changes in temperature, precipitation, and streamflow due to climate change were considered. Annual average temperature in the study area is projected to continue to increase over time. In South Dakota, winter and spring precipitation is projected to increase. Projections of regional, future stream-flows are mixed and depend on the climate model and its assumptions; however, the intensity of weather events is expected to increase, with the frequency of two-day heavy

precipitation events increasing by 50 percent while the amount of precipitation in single-day events is projected to increase by 8-10 percent (Conant et al., 2018). Since 1990, South Dakota has seen a 22 percent increase in two-inch rain events compared to the long-term average. This can increase the risk of flooding (Frankson et al., 2022).

Table 1 – Climate Change Assessment

Project Feature or Measure	Trigger	Hazard	Harm	Qualitative Likelihood	Justification for Rating
Flood mitigation measures (e.g., levees, channel improvement, nonstructural, etc.)	Increased flows with climate change	Future floods may increase in the project area	Flows could exceed channel capacity.	Low	Observed streamflow shows an increasing trend but the trend is not statistically significant over a long period of record. Projected streamflow in the HUC do not have a statistically significant increasing trend for the lower emissions scenario.

2.2.2 Geology, Soils, and Groundwater

The Coteau region is a broad and shallow trough running north to south and stretches up to 60 miles wide. Higher along its western and eastern edges than the middle, this highland escaped the last of the Pleistocene glacial advances. As the Wisconsin ice sheets retreated northward, the Big Sioux River became a major drainage pathway for glacial melt water and outwash. Consequently, throughout much of this region, buried outwash gravels are saturated with groundwater and numerous stream systems flow through this landform. During dry periods, these groundwater sources provide critical inflows to various surface-water stream segments in the Big Sioux River Basin. In relatively wet years, high amounts of precipitation during the spring and early summer months lead to seasonal fluctuation in the Big Sioux River and its tributaries.

USACE performed five soil borings in 2023 along existing non-federal levees/berms. Existing embankments consist of 2-5 feet of lean clay below natural ground surface, 6-15 feet of poorly to well-graded sand, underlain by Pierre Shale (characterized as fat clay).

Under the FWOP condition, no work would be completed, and it is anticipated that no change to the soils and groundwater-surface water interaction in the area would occur.

2.2.3 Hydrology and Hydraulics

Generally, the Big Sioux River and tributaries upstream of the city are characterized by gently sloping shallow channels with heavy vegetation. As the streams flow downstream, the streams maintain their gentle slopes but transition to urbanized overbanks with less vegetation. The hydrology of the watershed is complex with Lake Kampeska and Lake Pelican acting as off channel storage to the Big Sioux River. The hydrologic and hydraulic modeling approach used the USACE Hydrologic Engineering Center's Statistical Software Package (HEC-SSP) to estimate flow frequency curves for the river and tributaries upstream of Lake Kampeska. Then an HEC-River Analysis System (HEC-RAS) model was created to route flows through the Big Sioux River, Lake Kampeska, Lake Pelican, and the City of Watertown.

For existing conditions, a new HEC-RAS model was developed that utilizes the current terrain and incorporates updated hydrology and gage data through 2022. The HEC-RAS model utilized past USACE, South Dakota Department of Agriculture and Natural Resources (DANR), and RESPEC studies to leverage information. Two-dimensional (2D) unsteady-flow hydraulic modeling was used. There are no federal levees in the modeled area, however, there are locally constructed discontinuous berms in some reaches that are used by the City during flood fights. These were removed from the model because they are only effective if the City adds temporary measures (e.g., sandbags) to tie them off. Figure 8 provides a map of the discontinuous berms in the City of Watertown.

Flow frequency estimates were calculated for the all-season annual maximum series by using HEC-SSP version 2.3 to calculate Bulletin 17C analyses. Weighted skew was used to improve the flood frequency estimates for the stream gages by helping to adjust for the shorter record lengths. Peak flow frequency results were compared to previous USACE and FEMA studies. Volume frequency and critical duration were used to create balanced flow hydrographs from the peak flow frequencies for the hydraulic simulations.

The RESPEC model results documented in the 2020 Topical report RSI-3015 were compared to the modeling of this study and showed similar peak flood elevations. The USACE model results show a small increase of peak discharge and peak Lake Kampeska elevation for the frequency events compared to the 2020 model. The model peaks for the USACE and RESPEC models compare well with each other showing that both models have confidence in predicting the flood events.

The FWOP uses the model and assumptions from the existing conditions. The model assumes the same hydrology and hydraulic HEC-RAS model configurations. The discontinuous berms were not included for the FWOP because of the reliance on temporary measures for tie offs.

2.2.4 Floodplain

Floodplain regulation and floodplain management are effective tools in reducing flood risk and flood damage. The Federal Emergency Management Agency (FEMA) manages the National Flood Insurance Program (NFIP) which requires minimum standards of floodplain management and floodplain regulation for those communities that participate. Standards that exceed the minimum required by the NFIP may be enacted by the states and communities to provide greater flood risk management. Floodplain mapping provides the identification of flood hazards in the form of a map which portrays flood boundaries. FEMA Flood Insurance Rate Map (FIRM) Panels exist for the entirety of the study area and both floodplain and floodway delineations are

shown. FEMA defines a regulatory floodway as the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height (44 CFR 59.1). The initial Flood Insurance Study (FIS) report for the City of Watertown, Codington County, South Dakota, number 460016V000 was initially effective July 4, 1989. The current effective FIS Report is dated January 16, 2009. The city is undergoing a remapping project with FEMA and a preliminary FIS was issued on March 29, 2024.

The State of South Dakota and City of Watertown have adopted floodplain regulations that are more restrictive than the NFIP minimum standards. Watertown's minimum standards for floodplain management require that all new construction and substantial improvements of residential structures shall have the top of the lowest floor and all utilities at least one foot above the base flood elevation (BFE). The national standard is that new or substantially improved structures shall have the lowest floor elevated to or above the BFE. The more stringent requirements for Watertown are intended to help reduce flood impacts and account for uncertainty of changes into the future. Watertown also regulates digging and filling within the floodplain. Any proposed fill within the floodplain will be required to provide compensatory storage.

The Federal Flood Risk Management Standard (FFRMS) was reinstated in 2021 through Executive Order 14030 C*limate Related Financial Risk* which re-enacted the 2015 Executive Order 13690 *Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input.* FFRMS directs federal agencies to incorporate climate–related risk and resiliency into project design and agency processes and planning to ensure longevity of federal investments. FEMA's Final Rule policy goes into effect September 9, 2024. The FWOP assumes the FFRMS will be implemented by the City of Watertown into the local floodplain regulations. The General Investigations design and implementation phase will ensure the approved alternative plan meets compliance standards of the FFRMS.

2.2.5 Land Use

Land use types in the study area include residential, commercial, industrial, agricultural, and open space. The City of Watertown has regulatory authority over land use within the city boundaries which encompasses the majority of the study area. The City of Watertown's Comprehensive Land Use Plan (2020) is the major planning document for the city.

The National Land Cover Database (NLCD) provides land cover data for the United States. From the NLCD 2021 release, the largest land cover type within the study area is open water, comprising 8,470 acres and covering 28.2 percent of the study area. Agriculture is also a primary land use within the study area, with cultivated crops and pastures composing 16.6 percent and 15.5 percent of the study area, respectively. Data from the 2021 NLCD release is shown in Figure 5 and Table 1 below. The study area encompasses a large amount of developed land within the City of Watertown and adjacent areas. All classifications of developed land account for 16.6 percent of the study area, concentrated in the center of the study area. The City of Watertown has seen a trend of increased developed land, with new development being concentrated toward the fringes of the city (City of Watertown, 2020). This trend of conversion to developed land is expected to continue under the FWOP conditions.

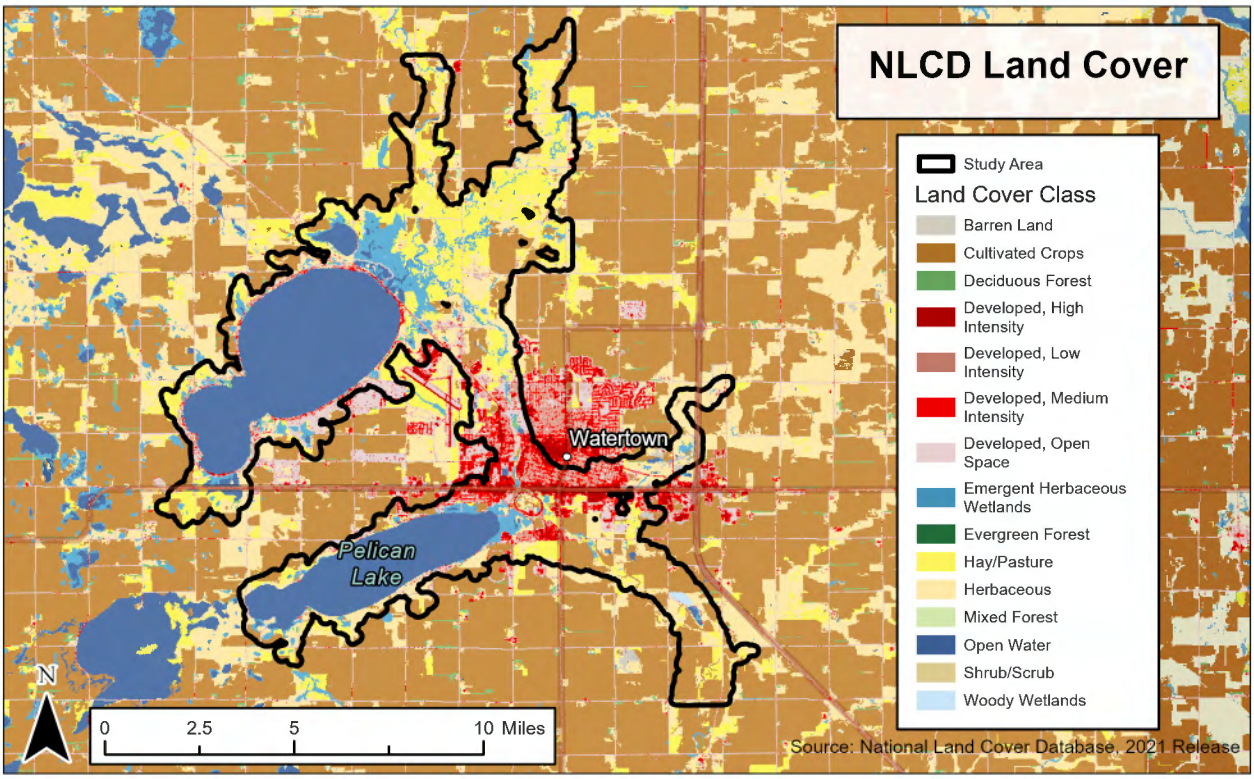

Figure 5: NLCD 2021 within Study Area

Table 2: NLCD Within Study Area

NLCD Land Classification	Acres in Study Area	Percent of Study Area
Open Water	8,470.6	28.2%
Cultivated Crops	4,994.7	16.6%
Hay/Pasture	4,663.5	15.5%
Herbaceous	4,581.5	15.2%
Emergent Herbaceous Wetlands	2,075.7	6.9%
Developed, Open Space	1,628.0	5.4%
Developed, Low Intensity	1,484.7	4.9%
Developed, Medium Intensity	1,358.5	4.5%
Developed, High Intensity	524.5	1.7%
Barren Land	110.0	0.4%
Deciduous Forest	92.4	0.3%
Woody Wetlands	55.2	0.2%
Mixed Forest	5.2	0.0%
Shrub/Scrub	4.9	0.0%
Total	30,049.3	100.0%

Prime farmland, as defined by the Natural Resources Conservation Service (NRCS), is land that has the best combination of physical and chemical characteristics for producing crops. The study area is primarily composed of non-prime farmland (15,800 acres; 52.7%). Prime farmland if drained (5,200 acres; 17.4%), prime farmland if irrigated (4,800 acres, 16%), prime farmland

(3,600 acres; 12%), and farmland of statewide importance (590 acres, 2%) compose a minority of the study area (USDA, 2024). The majority of these areas are already developed, although there is agriculture on farmland classifications towards the north and south ends of the study area.

2.2.6 Water Quality

In accordance with the Clean Water Act (CWA) (33 United States Code (U.S.C.) §1251), states, Tribes, or the Environmental Protection Agency (EPA) must develop water quality standards for their jurisdiction. Pursuant to the CWA, water quality consists of three components: 1) designated and existing uses, 2) water quality criteria necessary to protect these uses, and 3) an anti-degradation policy (40 CFR Part 131.6). Designated uses for waterbodies and streams within the Upper Big Sioux River basin include warmwater semipermanent fish life, warmwater marginal fish life, warmwater permanent fish life, recreation, fish and wildlife propagation, irrigation, and water supply use.

South Dakota's 2024 Integrated Report for Surface Water Quality Assessment lists 5 impairment rating categories.

- Category 1 - Data indicates that all designated uses are supported with no threat.
- Category 2 - Available data and/or information indicate that at least one designated use is supported, while one or more other uses are either indeterminate or not assessed.
- Category 3 - Available data and/or information are either insufficient or inconclusive and designated use support cannot be determined for any uses.
- Category 4 - Available data and/or information indicate that at least one designated use is not being supported or is threatened, but a total maximum daily load (TMDL) is not needed.
    - 4a - A state-developed TMDL has been approved by or established by USEPA for any segment-pollutant combination.
    - 4b - Designated use support is expected to be restored in a reasonable period of time through other pollution control measures.
- Category 5 waters are placed on South Dakota's 303(d) List of impaired waters requiring TMDLs.

Within the study area, two streams and one lake are currently listed as 303(d) impaired waters: Big Sioux River, Willow Creek and Lake Kampeska. Impairments are listed in Table 3 below. Impaired waterbodies are shown in Figure 6 below.

Table 3: Impairment Status – Waterbodies Within Study Area

Waterbody Name	Location	Impairments and Causes	EPA Category	TMDLs (status)
Big Sioux River	To Lake Kampeska	Warmwater Semipermanent Fish Life (DO), Limited Contact Recreation (DO, *E. coli*)	5	*E. coli* (approved 2020), DO (scheduled 2035, low priority)

Big Sioux River	Lake Kampeska to Willow Creek	Limited Contact Recreation (*E. coli*)	5	*E. coli* (scheduled 2036, high priority)
Big Sioux River	Willow Creek to Stray Horse Creek	Limited Contact Recreation (*E. coli*)	4A	Fecal coliform (approved 2008), *E. coli* (approved 2011)
Willow Creek	Big Sioux River to S7, T117N, R50W	Limited Contact Recreation (*E. coli*)	5	Fecal coliform (approved 2008)
Pelican Lake	Codington County	N/A	1	Nutrients/Sediment (approved 1996)
Lake Kampeska	Codington County	Warmwater Permanent Fish Life (MeHg), Fish and Wildlife Prop, Rec, Stock (MeHg)	4a	Nutrients/Sediment (approved 1996), Mercury in Fish Tissue (approved 2016)

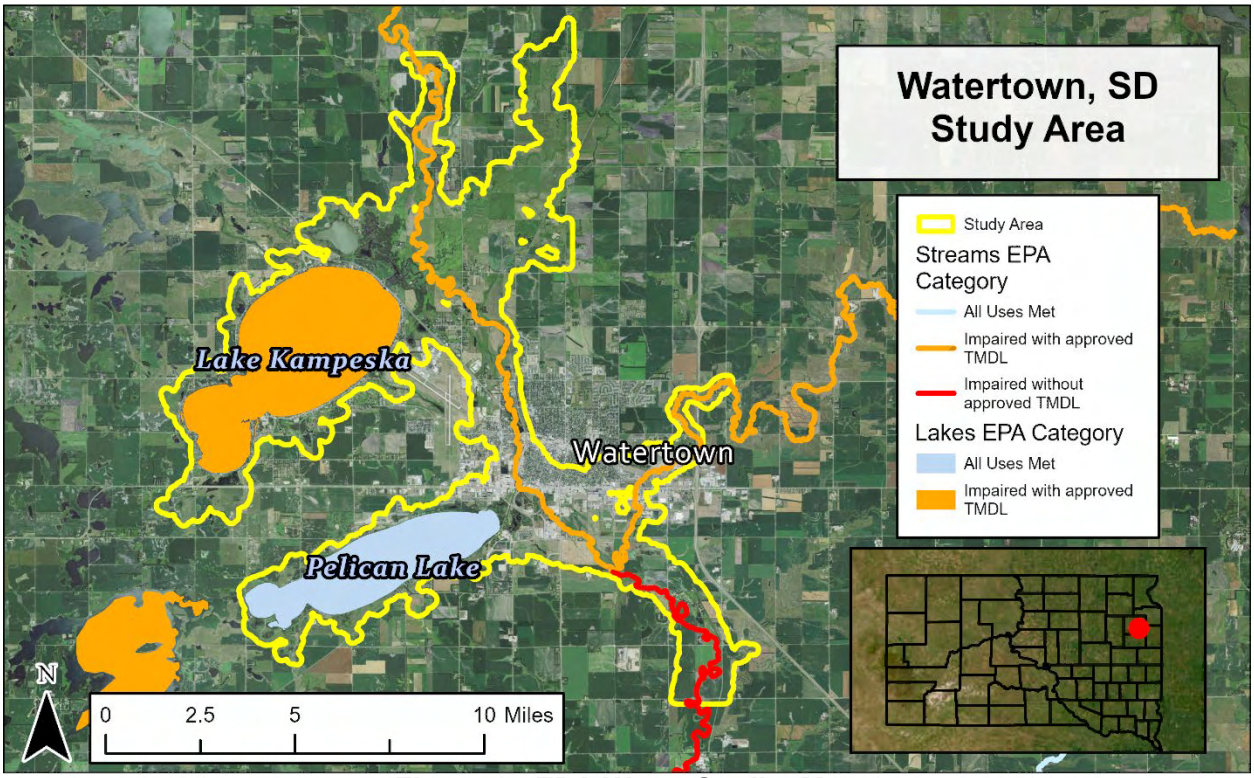

Figure 6 - EPA Water Quality Map

Flood events, such as that experienced in 1997, can overwhelm the City of Watertown's drainage and wastewater systems. This increases the risk of releasing untreated and contaminated water into the Big Sioux River, thereby decreasing the water quality. This can increase the *E. coli* concentration in surrounding streams, which are already impaired due to *E. coli* contamination.

Pelican Lake is classified as a eutrophic lake while Lake Kampeska is classified as a mesotrophic lake. The Big Sioux River to Lake Kampeska was included in the nutrient-related assessment sampling where it was found to meet targets for total nitrogen and phosphorus in the water (DANR, 2024).

Under the FWOP conditions, those waterbodies with an impairment category of 5 would be expected to remain impaired until the establishment of a TMDL. Following flood events, water quality can be expected to decrease due to the risks of releasing untreated stormwater and wastewater directly into the Big Sioux River.

2.2.7 Air Quality

The Clean Air Act (CAA) (42 U.S.C. § 7401 et seq.), of 1970 tasked the EPA to establish National Ambient Air Quality Standards (NAAQS) to protect public health and welfare and to regulate emissions of hazardous pollutants. The CAA identifies two types of NAAQS. Primary standards provide public health protection, including protecting the health of “sensitive” populations such as asthmatics, children, and the elderly. Secondary standards provide public health welfare protection, including protection against decreased visibility and damage to animals, vegetation, and buildings. The NAAQS include maximum allowable pollution levels for the criteria pollutants: particulate matter, ozone, sulfur dioxide, nitrogen dioxide, lead, and carbon monoxide. A designation of non-attainment indicates that an area does not meet these standards. Air quality in the study area is influenced by a combination of factors, which include climate, meteorology, and density and geographic distribution of local and regional air pollution sources. The dispersion of pollutants is influenced by the properties of the pollutants as well as the way air masses interact with the regional topography. Sources of suspended particulate matter and air pollutants in the proposed project area include industrial and commercial businesses, agricultural activities, residential areas and local and railway traffic.

According to the EPA Green Book, Codington County, South Dakota is in attainment with the NAAQS for all criteria pollutants (EPA 2024). Attainment means that an area is meeting or is below a given safe standard set by the EPA for a particular criteria pollutant.

Air quality in the State of South Dakota is monitored by DANR. DANR operates static air quality monitoring stations, including within the City of Watertown. The monitoring station in Watertown monitors ozone, and particulate matter. PM2.5 samplers collect data on particulate matter pollution 2.5 microns and smaller in size (fine dust). Sources of this type of pollution are fuel combustion and burning activities. PM_{10} samplers collect data on particulate matter pollution 10 microns and smaller in size (coarse dust). Sources of PM_{10} include larger particle sizes from roads, construction projects, and farm tillage and includes the fine particulate matter pollution.

From DANR 2023 testing, concentrations of PM_{10} have approached and in some cases exceeded the 24-hour standard, largely due to high winds and dry soil conditions. Ozone concentration is largely under the 8-hour standard of 0.070 ppm, with the yearly 4th highest 8-hour average being slightly above the standard at 0.072 ppm. Across years of SDNR testing, PM_{10} and ozone concentrations have been slightly increasing annually, with $PM_{2.5}$ concentrations decreasing (SDNR, 2024). Under the FWOP, these trends are expected to continue.

2.2.8 Hazardous, Toxic, and Radioactive Waste (HTRW)

A Phase I Environmental Site Assessment was completed of the study area in July 2023 in conformance with the scope and limitations of the American Society for Testing of Materials (ASTM) Practice E1527. The objective of a Phase I Environmental Site Assessment is to ascertain the likeliness of the presence of hazardous substances due to a past, present, or potential future release to the environment. This assessment revealed nine recognized

environmental conditions (RECs) four data gaps within the study area. A REC means the presence of any hazardous substances or petroleum products in, on, or at the property: (1) due to any release to the environment; (2) under conditions indicative of a release to the environment; or (3) under conditions that pose a material threat of a future release to the environment (ASTM 2021). See Appendix K for more information.

2.2.9 Noise

According to EPA (2011), the traditional definition of noise is “unwanted or disturbing sound.” The units used in identifying noise are decibels on a logarithmic scale. Since human hearing is not equally sensitive to all sound frequencies, certain frequencies are given more weight. These frequencies for human hearing are measured on the A-weighted scale. The USEPA has set values that should not be exceeded. While the primary responsibility of regulating noise was transferred from the EPA to state and local governments in 1981, the Noise Control Act of 1972 and the Quiet Communities Act of 1978 are still in effect.

The majority of the study area is urbanized, with human activities related to commercial, industrial, and business operations, construction projects, and transportation being noise sources throughout the year. Although not included within the study area, the Watertown Regional Airport is located directly adjacent to the study area between Lake Kampeska and Watertown’s city center. Watertown Regional Airport is utilized by primarily single engine general aviation aircraft, with a reported 8,000 annual general aviation local operations (FAA, 2024). Generalized noise below EPA thresholds exists in the project area due to urban and airport activities. Noise levels are expected to remain consistent under the FWOP condition.

2.2.10 Recreation

The city of Watertown offers a diverse range of recreational opportunities. Its parks and recreation system is well-developed with numerous recreation facilities. Watertown has several parks which offer playgrounds, sports fields, picnic areas, and walking trails. There are multiple sports complexes with facilities for a variety of sports that host local leagues, tournaments, and community sports programs. Recreational trails traverse along the Big Sioux River within the City. Two of the most visited parks in Watertown are Stokes-Thomas Lake City Park and Bramble Park. Other parks with relatively high visitation within and adjacent to the study area are Lions Park, Riverside Park, and McKinley Park. Lake Kampeska has approximately 6 boat ramps and several recreation areas along the shore. Lake Kampeska public access areas and parks include Sandy Shore State Recreation Area and Codington County’s Memorial Park. These parks provide public access to boating, camping, nature trails and swimming. Pelican Lake offers similar public recreation opportunities with 4 boat ramps, Pelican Lake State Recreation Area, Thompson’s Point and Northwest Lakeside Use Areas. Two golf courses are located adjacent to the south edge of Lake Kampeska.

2.2.11 Cultural Resources

54 U.S.C. 306108 (Section 106) of the National Historic Preservation Act, as amended, requires Federal agencies to “take into account the effect of the undertaking on any historic property” prior to expending any Federal funds, or prior to the issuance of any license. Historic property is defined in 36 CFR 800.16(l)(1) as “any prehistoric or historic district, site, building, structure, or NHL by the Secretary of the Interior.” Execution of any of the alternatives identified within this

report would constitute a Federal Undertaking, and therefore require compliance with Section 106.

While Section 106 restricts its focus strictly to Historic Property, NEPA requires consideration of the affected human environment, and this includes, among others, aesthetic, historic, and cultural resources. These terms are not as restrictive as historic property, and therefore require the Federal agency to consider effects to all cultural resources, not strictly those considered historic property. The following discussion considers all currently identified cultural resources that may be affected by the project, and briefly discusses those resources that are not currently known but may still be present.

A records search encompassing the overall study area was conducted by the South Dakota State Archaeological Research Center (SARC) on July 21, 2023 on behalf of USACE. The records search identified 74 previously conducted surveys in the area. It also returned records for 546 cultural resources. These resources were broken into 5 categories: Sites, Historic Districts, Bridges, Cemeteries, and Structures (though the term structure here primarily includes “buildings” as defined in National Register Bulletin 15). Of the total 546 cultural resources, 28 are sites, 1 is a Historic District, 18 are Bridges, 4 are Cemeteries, and 495 are Structures.

Of the 546 cultural resources identified above, 493 are considered historic properties for the purposes of this study, meaning they are unevaluated, eligible, or listed for the National Register of Historic Places (NRHP). Of these 493, 19 are Sites, 1 is a Historic District, 4 are Bridges, 4 are Cemeteries, and 465 are Structures.

On July 25, 2024, USACE conducted a more refined search of the data received from SARC to identify what cultural resources are present within the Area of Potential Effects (APE). Of the 546 cultural resources known in the larger study area, 8 of these are within the current APE. These include CD00000009 (Kemp Ave. Bridge) listed on the National Register of Historic Places (NRHP), 39CD2000 (Burlington Northern Railroad) and 39CD2003 (Chicago Northwestern Railroad), both determined eligible for the NRHP, CD00000455 (Round Building of the Railroad) and CD00000432 (Railway Bridge Over the Sioux River) both unevaluated for the NRHP, CD00000577 and CD00000579, both historic bridges determined Not Eligible for the NRHP, and CD00000458 (Watertown Light and Power Company Plant) that was previously listed on the NRHP, but has since been demolished and removed from listing.

Given the density of previously recorded historic properties, and the lack of 100% survey coverage within the study area, it is reasonable to expect that there are currently unidentified historic properties located within the study area. Consultation with South Dakota SHPO, the Project Sponsor, Affected Tribes, and Interested Parties is ongoing. USACE will be drafting a project-specific Programmatic Agreement, in consultation with these consulting parties, to meet requirements under the NHPA. Please see Appendix H for a more detailed consideration of cultural resources within the APE, and Section 6.9.2 for details regarding the Programmatic Agreement.

Under FWOP, some historic properties in the floodplain would still experience flooding, otherwise, most cultural resources outside of the project footprint would remain undisturbed.

2.3 Natural Environment

2.3.1 Ecoregions

Ecoregions are defined as mostly homogenous ecological areas with similar climates, landforms, soils, natural vegetation, hydrology, and other ecological parameters. Identifying ecoregion classifications at a watershed scale becomes important for understanding similarities and differences in the watershed landscape. The study area and the Upper Big Sioux River Basin are within the Northern Glaciated Plains Level III ecoregion.

Glacial drift in the Northern Glaciated Plains ecoregion have resulted in a landscape that is largely flat to gently rolling hills. Vegetation in the region is characterized as transitional between tall and shortgrass prairie caused by the subhumid climate conditions. Retreating glaciers resulted in a high concentration of temporary and seasonal wetlands which are utilized by waterfowl for nesting and migration (EPA, 2024).

2.3.2 Surface Water Resources

2.3.2.1 Watersheds & Drainage Basins

The study area is located within the Big Sioux River Basin (hydraulic unit code 101702) which originates in northeastern South Dakota, has a length of approximately 210 miles (338 kilometers) and a maximum width of 75 miles (121 kilometers). It has an area of approximately 8,850 square miles, of which 6,014 square miles (15576 square kilometers) are located in South Dakota. The study area is located in the northern-most sub-watershed, the Upper Big Sioux Watershed (hydraulic unit code 10170201). The Upper Big Sioux Watershed has an area of approximately 1,633 square miles (4,330 square kilometers), draining portions of Marshall, Roberts, Day, Grant, Clark, Codington, Duel, and Hamlin Counties. The Upper Big Sioux Watershed is broad, largely without alluvial bottoms nor bordering bluffs. The northern Upper Big Sioux Watershed maintains a channel slope of approximately one foot/mile (0.19 meter/kilometer), while the average slope in the Watertown vicinity is approximately seven feet/mile (1.33 meter/kilometer).

2.3.2.2 Streams, Lakes, and Ponds

The upper portion of the Big Sioux River is broad, largely without alluvial bottoms and bordering bluffs. The drainage area of the Big Sioux River (including Willow Creek) upstream from Watertown is 1,902 square miles of which 1,391 square miles are usually non-contributing (213 square miles of the non-contributing area contributed starting in 1994). The Big Sioux River also receives storm sewer discharges or additional runoff from the City of Watertown. Direct runoff to the river, as well as numerous tributaries, contributes loadings of sediment and nutrients. The river and tributaries also recharge shallow aquifers found adjacent to these water bodies. These shallow aquifers are the principle source of drinking water for the residents of the region. Other flow alterations of the Big Sioux River include channelization, culverts, and bridges at numerous road crossings of the river and tributaries. Main tributaries to the Big Sioux River in the study area are Mud Creek and Willow Creek.

The retreat of glaciers some 14,000 years ago formed the majority of lakes and ponds in Northeastern South Dakota, including prairie potholes and larger glacial lakes. Within the project area, these glacial lakes include Lake Kampeska and Pelican Lake. Lake Kampeska is a lacustrine lake with an approximate area of 5,250 acres, average depth of ten feet, and a

maximum depth of 15 ft. Pelican Lake is a lacustrine lake with an approximate area of 2,800 acres, average depth of six feet, and a maximum depth of seven ft.

Lake Kampeska is a natural lake formed during the glacial period that has now been modified by human development. Historically, the lake has been a heavily used recreation resource; developed primarily with cabins. Few were inhabited permanently. However, in the last 45 years, most cabins have been upgraded, remodeled, or removed and replaced with high-cost housing. A low weir has been installed in the channel of the Big Sioux River where the inlet/outlet channel meets the river to ensure a water supply to the lake and to prevent it from draining too quickly during extended droughts. During major flooding, large portions of flows on the Big Sioux River are diverted into Lake Kampeska and stored. After the Big Sioux River starts to recede, flows are slowly drained from the lake. Another uncontrolled weir structure was constructed in 2002 on the inlet/outlet channel to Lake Kampeska to reduce sediment loading into the lake by diverting the low flows downstream. The length of the weir is 330 feet with the crest at 1719.16 feet North American Vertical Datum of 1988 (NAVD88). It includes a 3ft fish passage weir and two 7ft X 8ft sluice gates that allow for lowering of the lake after flood events or filling of the lake during drought periods.

Lake Pelican is also a natural glacial lake located just downstream of U.S. Highway 212 (US-212), one mile southwest of Watertown and about three miles south of Lake Kampeska. At a normal pool of 1709 feet NAVD88, Lake Pelican is about five miles long and one mile wide. The maximum depth is seven feet, with a storage capacity of about 7,400 acre-feet at normal pool. A diversion dam across the Big Sioux River with a crest elevation of 1710.7 feet NAVD88 controls flow elevations just downstream of US-212 and the confluence with the Lake Pelican inlet channel. This channel also includes a low weir at elevation 1713.3 feet NAVD88 that acts to reduce sediment loading to the lake by diverting low flows downstream. Lake Pelican functions similarly to Lake Kampeska (though not as significantly) in that part of the flood flows on the Big Sioux River are diverted into the lake and stored then released when flows on the Big Sioux River recede.

2.3.2.3 Wetlands

Wetlands are important landscape features that provide a multitude of beneficial services to people and fish and wildlife. This includes protection and improvement of water quality, storing floodwaters, maintaining surface water during dry periods and providing habitat for numerous fish and wildlife species (EPA, 2002). Wetlands improve water quality for future use by acting as a filter for surface water that enters a wetland and percolates through the vegetation, depositing suspended sediment and settling to the wetland floor where plant roots and microorganisms absorb excess nutrients before the water enters the groundwater system. Wetlands also provide vital habitat conditions that cultivates biodiversity. While wetlands only cover approximately 5% of the land surface in the lower 48 states, they provide habitat to 31% of plant species and more than one-third of threatened and endangered plant and animal species live explicitly in wetland habitats and another 20% of threatened and endangered species rely on wetland habitat at least once in their lifecycle (EPA, 2006). The density of wetlands in this highly dissected part of the Big Sioux basin is relatively low, at 13 wetlands per square mile (U.S. Fish and Wildlife Service (FWS) Wetlands Map, 1982). Over 30 percent of the historic wetlands in the Big Sioux basin have been drained or otherwise altered (Wittmier, 1984). A total of 46 percent of existing wetlands are being used for agricultural purposes, such as tilling, haying, or grazing (Ibid.). This may have affected the hydrology of the area, as well as reducing the quality and availability of

wetland habitat for wildlife. Wetlands as inventoried by the U.S. Fish and Wildlife Service's National Wetlands Inventory (NWI) are shown in Figure 7.

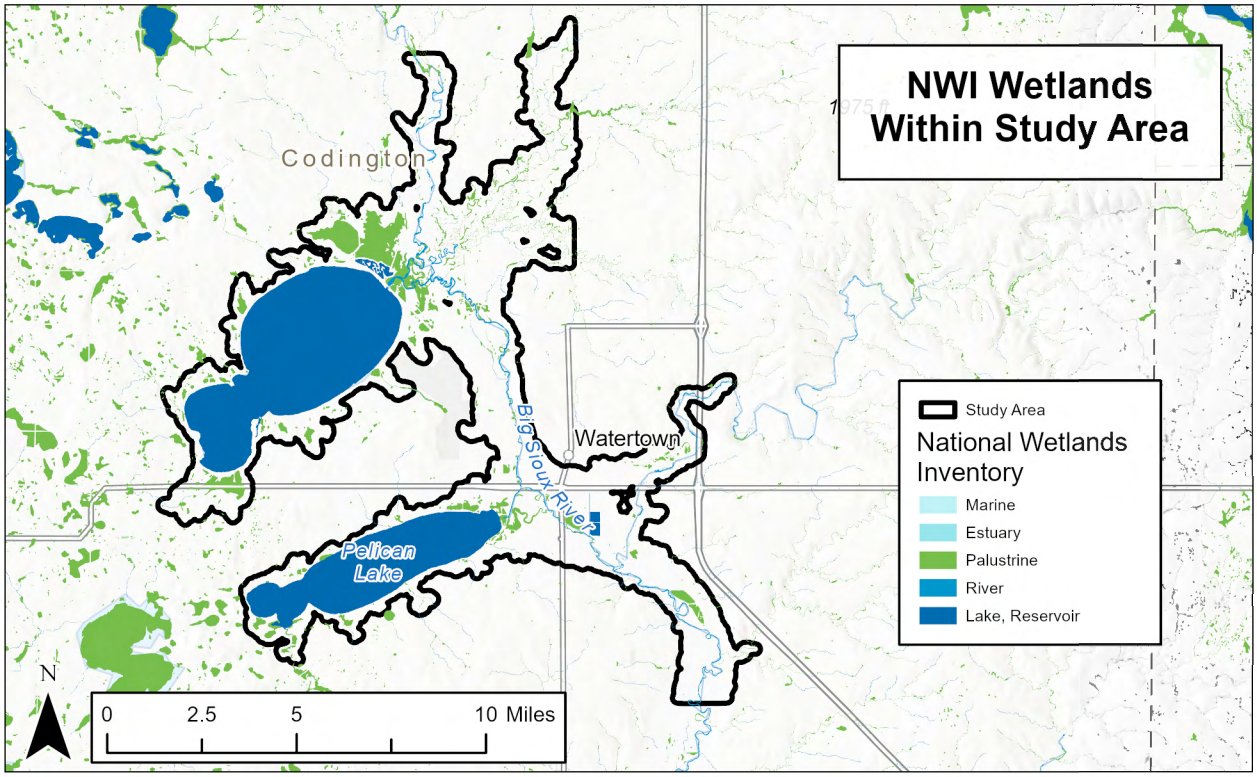

Figure 7 – NWI Wetlands Within Study Area

2.3.3 Vegetation

Tall-grass prairie and wetland vegetation dominated the study area vicinity prior to settlement, but much of the area is now used for agricultural purposes. Only isolated remnants of the virgin tall-grass prairie remain, primarily along rivers, glacial lakes, or in rocky, hummocky upland areas. In the Big Sioux bottom lands, areas of tall-grass prairie or subirrigated meadow vegetation persist in a few areas and are used for hay or pasture. Dominant native species are switchgrass (*Panicum virgatum*), prairie cordgrass (*Spartina pectinata*), slough sedge (*Carex obnupta*), big bluestem (*Andropogon gerardi*), bluejoint reedgrass (*Calamagrostis canadensis*), cattails (*Typha spp.*), and western wheat-grass (*Pascopyrum smithii*). Native woodlands in the region are nearly absent. Scattered patches of trees may be found along the larger glacial lakes, consisting largely of peachleaf willow (*Salix amygdaloides*), sandbar willow (*Salix exigua*), and cottonwood (*Populus deltoides*). Field shelterbelts have been planted on the river terraces and on upland soils of the watershed. They contain a mixture of native and introduced woody trees and shrubs. Submerged and emergent aquatic vegetation is present along littoral and pool habitats and in the Big Sioux River. Common species include cattail, curly leaf pondweed (*Potamogeton crispus*), horned pondweed (*Zannichellia palustris*), hardstem bulrush (*Schoenoplectus acutus*), horsetail (*Equisetum arvense*), common elodea (*Elodea canadensis*), sago pondweed (*Stuckenia pectinate*), duckweed (*Lemnoideae spp.*), and spike rush (*Eleocharis palustris*). These areas provide important cover for juvenile fish and minnows, as well as food for migratory ducks. Some wet pasture lands along the river upstream and

downstream from the site provide spawning habitat for vegetation-spawning fish during wet years.

The Functional Assessment of Colorado Streams (FACStream) Method (Version 1.0, 2016) was selected to assess the existing habitat conditions within the study area, as well as FWP and FWOP conditions (see Appendix G1). A site visit to collect data and verify analysis was conducted June 2023. Dominant native vegetation observed along the Big Sioux River included cottonwood, green ash (*Fraxinus pennsylvanica*), sandbar willow, false indigo (*Amorpha frucitosa*), prairie cordgrass (*Spartina pectinate*), nettle (*Urtica dioica*), poison ivy (*Toxicodendron radicans*), cattail, and common milkweed (*Asclepias syriaca*). Typical native species observed at the representative data points at Lake Kampeska include cottonwood, sandbar willow, swamp rose (*Rosa palustris*), common milkweed, nettle and cattail.

2.3.3.1 Invasive Species

EO 13112 seeks to prevent the introduction of invasive species and authorizes control of said species to minimize economic, ecological, and human health impacts. This EO directs all Federal agencies to address invasive species concerns and refrain from actions likely to increase invasive species problems. EO 13112 was later amended by EO 13751 which directed continuation of coordination for Federal prevention and control efforts. This order also maintains and expands the National Invasive Species Council and further incorporates considerations of human and environmental health, climate change, technological innovation and other emerging priorities into Federal efforts to address invasive species in a cost-efficient manner. EO 11987 directs agencies to restrict the introduction of exotic species into the natural ecosystems on lands and waters which they own, lease, or hold for purpose of administration and encourage State and local governments as well as private citizens to prevent the introduction of exotic species in natural ecosystems of the United States.

According to the Coddington County Weed and Pest Department, seven State noxious species and three local noxious species are present within the County. Noxious species are legally designated as any plant that may be injurious to public health, agriculture, recreation, wildlife, or property. The State listed species include Canada thistle (*Cirsium arvense*), leafy spurge (*Euphorbia esula*), perennial sowthistle (*Sonchus oleraceus*), hoary cress (*Lepidium draba*), saltcedar (*Tamarix spp.*), absinth wormwood (*Artemisia absinthium*), and purple loosestrife (*Lythrum salicaria*). Locally noxious species include musk thistle (*Carduus nutans*), bull thistle (*Cirsium vulgare*), and plumless thistle (*C. acanthoides*).

During the June 2023 site visit, dominant nonnative vegetation observed included autumn olive (*Elaegnus umbellata*), reed canarygrass (*Phalaris arundinacea*), Kentucky bluegrass (*Poa pratensis*), leafy spurge, and Canada thistle. The dominant nonnative species located at Lake Kampeska included curly dock (*Rumex crispus*), reed canarygrass, Kentucky bluegrass, Canada thistle, and leafy spurge. The dominant native species observed at Pelican Lake included cottonwood, sandbar willow, silver maple (*Acer saccharinum*), prairie cordgrass, cattail, and field mint (*Mentha arvensis*). The dominant nonnative species at Pelican Lake included autumn olive, reed canarygrass, leafy spurge, curly dock, and field bindweed (*Convolvulus arvensis*).

2.3.4 Fish and Wildlife

General quality of upland habitat for fish and wildlife within the study area is relatively poor in proximity to the City, with some areas of moderate quality for game production. Diversity and

interspersion of cover types, which is an essential condition to the establishment of optimum productivity of both game and non-game populations, has been greatly diminished because of intensive agricultural activities. Intensive cultivation and pasturing of wetlands along the Big Sioux River flood plains have limited wildlife production potential. Lack of winter cover types, especially in close association with food, after crop harvest is judged to be a major limiting factor in assuring survival of local game species. The riparian zone, a habitat area that is extremely important to many forms of wildlife, is lacking in quantity and quality and is of little wildlife significance in the study area.

Semipermanent, seasonal, and temporary wetlands that provide excellent wildlife cover are particularly scarce along the Big Sioux, especially in the central portions of the study area. Most of the wetlands are located upstream of the study area near the Still Lake basins and in the northern portions of Codington County and southern Grant County. Bach State Game Production Area, a 110-acre tract just east from Still Lake, is a "wildlife oasis" just outside the study area. It provides the diverse wildlife habitat in the form of wetlands, upland cover, and food plots. Approximately 20 acres of open water have been maintained within its wetland basins during the summer.

The FACStream assessment conducted for this study (Appendix G1) provided a functional capacity index (FCI) model output on a scale between 0 and 1. This qualitative output was then multiplied by the assessment area, measured in acres. This value is a quantified measure of environmental output, known as a habitat unit (HU). The HUs are then annualized throughout the 50-year study period to provide an overall average annual HU, or AAHU. The existing and FWOP area of analysis provides approximately 780 HUs on an average annual basis. Reference the calculation sheets (Sub-appendix G1c) for a detailed description of assumptions used for scoring.

Table 4: Existing and Future Without Project Habitat Acreages and Corresponding AAHUs

Reach	Condition	TY	Year Interval	FCI	Acres	HU at TY	Interval HUs	Cumulative HUs	AAHUs
1	Existing/FWOP	0	0	0.76	560	424.95		*20,096.31*	**401.93**
		10	10	0.74	560	412.12	4,185.38		
		25	15	0.71	560	399.34	6,085.96		
		50	25	0.69	560	386.66	9,824.97		
2	Existing/FWOP	0	0	0.73	238	174.49		*8,303.35*	**166.07**
		10	10	0.71	238	169.96	1,722.24		
		25	15	0.69	238	165.21	2,513.72		
		50	25	0.67	238	160.18	4,067.40		
3	Existing/FWOP	0	0	0.76	296	224.62		*10,622.33*	**212.45**
		10	10	0.74	296	217.84	2,212.27		
		25	15	0.71	296	211.08	3,216.86		
		50	25	0.69	296	204.38	5,193.20		
Study Area Total:								*39,021.99*	**780.44**

Note: Calculated with the composite FCI for the three reaches of the FACStream Assessment Area.

2.3.4.1 Threatened and Endangered Species

Section 7 of the Endangered Species Act (ESA) (7 U.S.C. § 136, 16 U.S.C. § 1531 et seq.) states that all federal departments and agencies shall, in consultation with the assistance of the Secretary of the Interior, ensure that any actions authorized, funded or carried out by them do not jeopardize the continued existence of any threatened or endangered species. An official list of federally-listed threatened and endangered species was obtained through the USFWS Information for Planning and Conservation (IPaC) tool on August 19, 2024, 2024 (See Appendix G6). The website listed three federally listed threatened and endangered species, one proposed threatened, and one candidate species that may occur in the study area. Informal coordination with USFWS is ongoing.

Table 5: Federally Listed Species Potentially Present in Project Area

Common Name	Scientific Name	ESA Listing
Rufa Red Knot	*Calidris canutus rufa*	Threatened
Topeka Shiner	*Notropis topeka*	Endangered
Dakota Skipper	*Hesperia dacotae*	Threatened
Monarch Butterfly	*Danaus plexippus*	Candidate
Western Regal Fritillary	*Argynnis idalia occidentalis*	Proposed Threatened

Rufa Red Knot: The rufa red knot was listed as threatened on January 12, 2015 (79 FR 73705). They are medium-sized shorebirds that have a large range due to its extensive migratory route, ranging across nearly the full latitude gradient of the Western Hemisphere. The rufa red knot breeds in the Arctic and uses a network of migratory stopover habitats as seasons change (USFWS 2020). As molluscivorous, rufa red knots eat hard-shelled mollusks but sometimes softer invertebrate prey such as shrimp, crabs, marine worms, and horseshoe crab eggs. They are also known to eat grass shoots, seeds, and other vegetable matter. What they eat largely depend on the season and their location along their migratory route (USFWS 2024b).

The main threats rufa red knots face are pollution, climate change, hunting in the Caribbean and the Brazilian/Guianan coast, and hunting of horseshoe crabs (affecting availability of horseshoe crab eggs). Climate change poses as a major threat because rufa red knot habitat spans nearly the entire globe. Sea level rise, warming of the arctic, and an increase in frequency of tropical storms negatively impact the rufa red knot (Bognar et al. 2022).

Topeka Shiner: In January 1999, the Topeka shiner was officially listed as endangered under the Endangered Species Act. The shiner is not currently state-listed as threatened or endangered in South Dakota, however it is a state Species of Greatest Conservation Need. The South Dakota Natural Heritage Program monitors and recognizes the Topeka shiner as a sensitive species. It has been found frequently in low order prairie stream systems, similar to those in the project area in east-central and southeastern South Dakota. The Topeka shiner spawns from late-May to mid-August, depending on water temperature (Tabor 1998, Hatch 2001; Wall and Berry 2004; Watt et al. 2004). Currently, the most northern population of Topeka shiner located outside of but within the vicinity of the action area, is located along a tributary to Willow Creek. Willow Creek flows into the Big Sioux River, approximately 0.65 miles south of

the proposed project area. According to the South Dakota National Heritage Dataset, multiple populations of Topeka Shiner have been found within tributaries to Willow Creek.

The three main threats to the Topeka shiner include habitat loss, increased sedimentation in small streams, and reduced water quality (USFWS 2018). Additional threats include the creation of dams or impoundments on small streams and ponds being stocked with larger predatory fish which prey upon many smaller fish.

Dakota Skipper: The Dakota skipper was listed as a threatened species under ESA on October 23, 2014 (78 FR 63574). Dakota skippers currently range in scattered, mostly isolated, sites in Minnesota, the Dakotas, and southern Canada. The most significant populations are thought to be in North Dakota, northeastern South Dakota, western Minnesota and southern Manitoba (USFWS 2024c). The Dakota skipper is an obligate resident of undisturbed (remnant, untilled) high-quality prairie, ranging from wet-mesic tallgrass prairie to dry-mesic mixed-grass prairie habitat, which typically contains a high diversity of native plant species, including flowering herbaceous plants (forbs) (FR 2014).

The main threats causing the decline of the Dakota skipper are loss of native prairie and degradation of the remaining patches of habitat left. Habitat loss, fragmentation, and degradation has been caused by conversion of native prairie for agriculture or urbanization, ecological succession of native prairie to habitats dominated by brush or trees, invasive species, effects of pesticides and herbicides, flooding, and land management regimes such as grazing, haying, and prescribed fires (USFWS 2018b).

Monarch Butterfly: Monarch butterflies were identified as a candidate species for federal listing on December 17, 2020 (85 FR 81813). Candidate species are those species that the USFWS has sufficient evidence for listing as endangered or threatened under the ESA, but listing regulation has been precluded by higher priority listing activities. These species receive no statutory protection under the ESA but may warrant federal protection in the future.

These butterflies have large, bright orange wings surrounded by a black border and covered with black veins. They can be found throughout the United States during the summer breeding season, where they rely on common milkweed plants to lay their eggs and feed larvae. Monarchs in temperate climates migrate south to winter in warmer climates and can travel up to 2,000 miles (USFWS, 2024d). Monarch population declines in the U.S. have been attributed to climate change, loss of habitat, disease, and the use of pesticides.

Western Regal Fritillary: The western regal fritillary was proposed to be listed as a threatened species under the ESA on August 6, 2024 (89 FR 63888). As a species proposed under the ESA, this species currently has no statutory protection under the ESA but will likely warrant federal protection in the future.

The western regal fritillary is a subspecies of the regal fritillary, a large, nonmigratory butterfly found in unaltered grassland landscapes. This butterfly cannot survive in landscapes altered by row crop fields, nonnative pasture, and developed areas with isolated prairie remnants. In early spring, larvae emerge and search for violets (their only food source). By the early summer, larvae pupate in leaf litter of warm season grasses and emerge as adults in the beginning of June where they then rely on nectar sources for food. The main threats causing the decline of the western regal fritillary are grassland conversion to agriculture, herbicides, drought, invasive grasses, and climate change (USFWS 2023).

2.3.4.2 State Listed Species

The SDGFP Environmental Review Report generated for the study area lists three state species of greatest conservation need as being documented within 800 meters of the study area. These are the silver-haired bat (*Lasionycteris noctivagans*), logperch (*Percina caprodes*), and the trout-perch (*Percopsis omiscomaycus*). Geospatial data provided by the SDGFP shows there are no recordings of silver-haired bat within the riparian area of the BSR in the study area. Similarly, there are no recorded observations of the trout-perch nor logperch within the reach of the BSR within the study area. There are no state special status species documented within the study area.

2.3.4.3 Migratory Birds

Migratory birds are protected under the Migratory Bird Treaty Act (MBTA) (16 USC §§ 703-711), which prohibits the taking of any migratory bird, or a part, nest, or eggs of any such bird, except under the terms of a valid permit issued, pursuant to federal regulations. EO 13186 (66 Federal Register 3853) directs federal agencies to identify where unintentional take is likely to have a measurable negative effect on migratory bird populations and to avoid or minimize adverse effects on migratory birds through enhanced collaboration with the USFWS. EO 13186 states that emphasis should be placed on species of concern, priority habitats, and key risk factors, and that particular focus should be given to addressing population-level impacts.

Bald and golden eagles are protected under the MBTA, as well as the Bald and Golden Eagle Protection Act (BGEPA) (16 USC §§ 668-668d). The BGEPA prohibits the take of a bald or golden eagle adults, juveniles, or chicks including their parts, nests, or eggs without a permit; “take” is defined by the BGEPA as to pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb. The BGEPA also addresses impacts resulting from human-induced alterations occurring around previously used nesting sites. Construction activities are prohibited within a certain distance of an active bald eagle nest during the nesting season (February 1 - July 31); the disturbance buffer may be 330 feet or 660 feet, depending on the activity and the presence of similar activities in the vicinity. Area bird counts by Audubon Society members have shown that over 215 species of birds utilize local habitats, including eagles, hawks, owls, warblers, sparrows, shorebirds, and waterfowl. Pair counts from area Waterfowl Production Areas, as well as information gathered from field visits, indicate that the following species may use study area wetlands: mallard, widgeon, blue-winged teal, pintail, redhead, lesser scaup, ring necked duck, American egret, white pelican, gadwall, green-winged teal, shoveler, wood duck, canvasback, ruddy duck, Canada geese, and black cormorant. Information from the SDGFP indicates that the Still Lake basin generally attracts from 400 to 500 canvasbacks during spring and fall migrations.

Nesting opportunities for migratory waterfowl and upland game birds, such as pheasant and Hungarian (gray) partridge, are limited to occasional narrow strips of grassland cover. This situation normally subjects game birds to high predation. Shelterbelts provide excellent nesting, feeding, and escape cover. In the study area, however, this cover type is also quite limited and generally quite narrow, providing limited wildlife benefits. Persistent, emergent cover, such as cattail, bulrush, or phragmites, were absent along the Big Sioux River within the study area. This type of cover is essential to the survival of young broods of migratory waterfowl through the flight stage, as it provides optimum feeding opportunities and valuable escape cover. The relative absence of migratory waterfowl broods was noted during a July reconnaissance of the

riverine area by USFWS personnel. One brood of blue-wing teal was observed on an excavated pond within the Mahoney Creek drainage (FWS Coordination Report, 1989).

2.3.4.4 Fish and Aquatic Organisms

Of the 48 species found in the Big Sioux River, fathead minnow (*Pimephales promelas*), black bullhead (*Ameiurus melas*), sand shiner (*Notropis ludibundus*), white sucker (*Catostomus commersoni*), red shiner (*Cyprinella lutrensis*), common shiner (*Luxilus comutus*), Johnny darter (*Etheostoma nigrum*), channel catfish (*Ictalurus punctatus*), and creek chub (*Semotilus atromaculatus*) were recorded as the most abundant species (Dieterman & Berry Jr, 1998). Sections of the Upper Big Sioux River within the project area are designated as having biological use for warmwater semipermanent fish (DANR, 2024). The hydrologic characteristics of the stream (shallow, intermittent flows) do not allow most game fishes to grow into catchable sizes, except for the black bullhead (*Ameiurus melas*).

The SDGFP lists smallmouth bass (*Micropterus dolomieu*) and walleye (*Sander vitreus*) as the primary fish species occurring in Lake Kampeska. The walleye population in Lake Kampeska is supported by both natural reproduction and fry stocking. Other species occurring in Lake Kampeska include black crappie (*Pomoxis nigromaculatus*), white crappie (*Pomoxis annularis*), channel catfish, northern pike (*Esox Lucius*), white bass (*Morone chrysops*), and yellow perch (*Perca flavescens*) (SDGFP, 2015).

2.3.4.5 Reptiles and Amphibians

Amphibians likely to be in and adjacent to the study area include the western tiger salamander (*Ambystoma mavortium*), American toad (*Bufo americanus*), Great Plains toad (*Anaxyrus cognatus*), Canadian toad (*Anaxyrus hemiophrys*), boreal chorus frog (*Pseudacris maculate*), and northern leopard frog (*Lithobates pipiens*). Reptiles likely to be in and adjacent to the study area include the common snapping turtle (*Chelydra serpentina*), painted turtle (*Chrysemys picta*) and the red-bellied snake (*Storeria occipitomaculata*).

2.3.4.6 Mammals

Large mammal species that are likely to be found in the study area include white- tailed deer (*Odocoileus virginianus*) and mule deer (Odocoileus hemionus). Smaller mammals likely to use the study area include the white-tailed jackrabbit (*Lepus townsendii*), which inhabits croplands and grasslands, the eastern cottontail (*Sylvilagus floridanus*), and the Virginia opossum (*Didelphis virginiana*),

Although semi-aquatic furbearers such as the beaver, mink, weasel, and muskrat can be found adjacent to the project they are uncommon in the study area due to the lack of suitable habitat. The eroding banks of Lake Kampeska and Pelican Lake are steep and devoid of vegetation, and the near-shore area lacks vegetation and wetlands due to the constant wave-action, high turbidity, and unstable substrate. Each of these semi-aquatic species relies on wetland vegetation and/or riparian forest for survival.

Bats species potentially within and adjacent to the study area include the silver-haired bat (*Lasionycteris noctivagans*), hoary bat (*Lasiurus cinereus*), big brown bat (*Eptesicus fuscus*), eastern red bat (*Lasiurus borealis*), and the northern long-eared bat (*Myotis septentrionalis*). Common rodents include the Richardson’s ground squirrel (Urocitellus richardsonii), thirteen-

lined ground squirrel (Ictidomys tridecemlineatus), Franklin's ground squirrel (*Poliocitellus franklinii*), pocket gopher (Microtus ochrogaster), voles, and various mice.

2.3.4.7 Invasive Species

Aquatic invasive species (AIS) are present within the study area. The SDGFP first identified zebra mussels (*Dreissena polymorpha*) in Lake Kampeska in 2020 and in the Big Sioux River in 2023. Zebra mussels are now considered prevalent within Lake Kampeska and the Big Sioux River from Lake Kampeska to the confluence with the Missouri River now considered infested. Common carp (*Cyprinus carpio*) and bighead carp (*Hypophthalmichthys nobilis*) are also present in the Big Sioux River (Dieterman & Berry Jr, 1998).

2.4 Built Environment

2.4.1 Existing Federal and Local Projects

The Lake Kampeska Water Project District (LKWPD) is a local agency tasked with protecting the water resources of Lake Kampeska by implementing projects to improve water quality and flood protection. From 1998 through April 2006, the LKWPD has funded the Upper Big Sioux Water Project with $130,102 for conservation projects. These projects have included riverbank stabilization, assisting in agricultural-waste management strategies and an assortment of other projects that have contributed to the removal of waste products from the Big Sioux River. More work is needed and the LKWPD will continue to provide financial support for this area due to the strong influence the Big Sioux has on the water quality of Lake Kampeska.

The LKWPD board approved a $10,000 water quality improvement project in the Hidden Valley channel on the south end of Lake Kampeska in 2017. The project included installing an aeration system and applying MuckAway (bacteria and enzymes) designed to decrease algae and organic material in the channel.

Rip-rapping large sections of the shores of Lake Kampeska started during the 1990's with financial assistance from the federal government. Also, in 2002, the LKWPD undertook a project to erect a weir at the inlet/outlet of the river. The purpose of the structure is to divert early spring runoff and not allow this sediment into the lake. The weir has a crest of 1719.2 feet NAVD88 and a length of 330 feet. The weir height is set to divert low-river flows, so in the event of a major flood, the lake still will take in a substantial amount of river water. (LKWPD, 2024.) The weir includes a 3 feet fish passage and two 7 feet by 8 feet low flow sluice gates that allow for lowering the lake after floods and filling the lake during drought periods (USACE, 2005).

The City of Watertown repaired and improved the Big Sioux River channel weir in 2016. This weir is located in the Big Sioux River directly downstream of the Lake Kampeska channel. The weir was originally constructed in 1954 to assure water supply to Lake Kampeska and prevent it from draining too quickly during extended droughts. During floods large portions of flows in the Big Sioux River are diverted into Lake Kampeska and stored. After the Big Sioux River starts to recede, flows are slowly drained from the lake back into the river. The Big Sioux River channel weir has a crest height of 1718.8 feet NAVD88 and contains two five feet stop log sections (USACE, 2005).

The Lake Pelican Water Project District (LPWPD) formed in 1988 to improve the quality of the water in Lake Pelican and became a local taxing entity in 1991. Since its formation various projects have been done to improve the quality of water such as: fencing all cattle away from

the lake, shoreline stabilization and constructing a silt diversion weir in the inlet-outlet channel of the lake. (LPWPD, 2024.) The silt diversion weir was constructed in 1998 and has a crest elevation of 1713.3 feet NAVD88. The weir is located directly downstream of US-212 at the entrance of the Lake Pelican channel. This structure also contains a weir across the Big Sioux River channel that has a lower crest elevation of 1710.7 feet NAVD88 (USACE, 2005).

2.4.2 Existing Dams and Levee Features

There exists a non-federal locally constructed embankment system along the Big Sioux River going through the City of Watertown. These berms are not part of the PL84-99 program and are not documented in the National Levee Database. These embankments are non-continuous and come from different sources. Most of the embankments along the Big Sioux River are modified USACE advance measures from the 1997 and 2010 flood fights. There is one stretch of abandoned railroad embankment that acts as a levee. There are also private levees along the Big Sioux River. Preliminary soil borings indicate the modified advance measures, and the railroad embankment are made of lean clay. The private levees were not explored as part of this feasibility study.

Figure 8:Non-federal Locally Constructed Embankment System

2.4.3 Planned Federal and Local Projects

Future planned projects include bridge replacement at 14th Ave. over the Big Sioux River. This project is in the design phase and is being completed by Codington County and the City of Watertown. The existing bridge elevation is currently designed to be the same, but the bridge will be wider than the existing.

2.5 Economic Environment

The economic environment is a discussion of the existing economic conditions as well as assumptions used to generate the FWOP conditions. Subjects may include economic models (if applicable), environmental justice, and economic trends.

2.5.1 Economic Models

This section provides an overview of the framework used to compute economic benefits including a discussion of the models and qualitative criteria used.

2.5.1.1 Economic Analysis Model: HEC-FDA

The economic analysis uses the Hydrologic Engineering Center Flood Damage Analysis (HEC-FDA) program to estimate flood damages. Flood damages prevented serve as a major component for computing net economic benefits and the benefit-cost ratio (BCR). HEC-FDA is a USACE-certified risk-based program and is standard for economic computations for FRM studies. HEC-FDA integrates engineering data (hydrologic, hydraulic, and geotechnical when applicable) and economic data (structure/content inventory and depth-percent damage curves) to model the potential flood risk for the existing/without-project condition and study alternatives. HEC-FDA version 1.4.3 is used in this analysis.

ER 1105-2-101 requires incorporating risk and uncertainty in calculating damage estimates for flood events. This is best represented by a range of possible damage values and their likelihood of occurring, or a probability distribution. HEC-FDA uses Monte Carlo simulation to obtain a random sample of the contributing relationships and computes stage-damage functions, exceedance probability discharge curves, and conditional stage-discharge relationships to generate expected annual damages (EAD) values. EAD estimates capture the mean of the probability distribution of annual damage and are the basis for calculating equivalent annual damages and benefits. Uncertainty is incorporated into EAD estimates using Monte Carlo simulation; each iteration of a simulation randomly samples the uncertainty distributions, and the resulting values are used to transform the flow and stage distributions to a damage distribution. The area under the curve of the distribution is integrated to compute EAD. Thousands of iterations of this process are repeated to infer the EAD distribution and estimate EAD as the probability weighted average of all possible peak annual damages, where damage is a continuous random variable. This process is depicted in Figure 9.

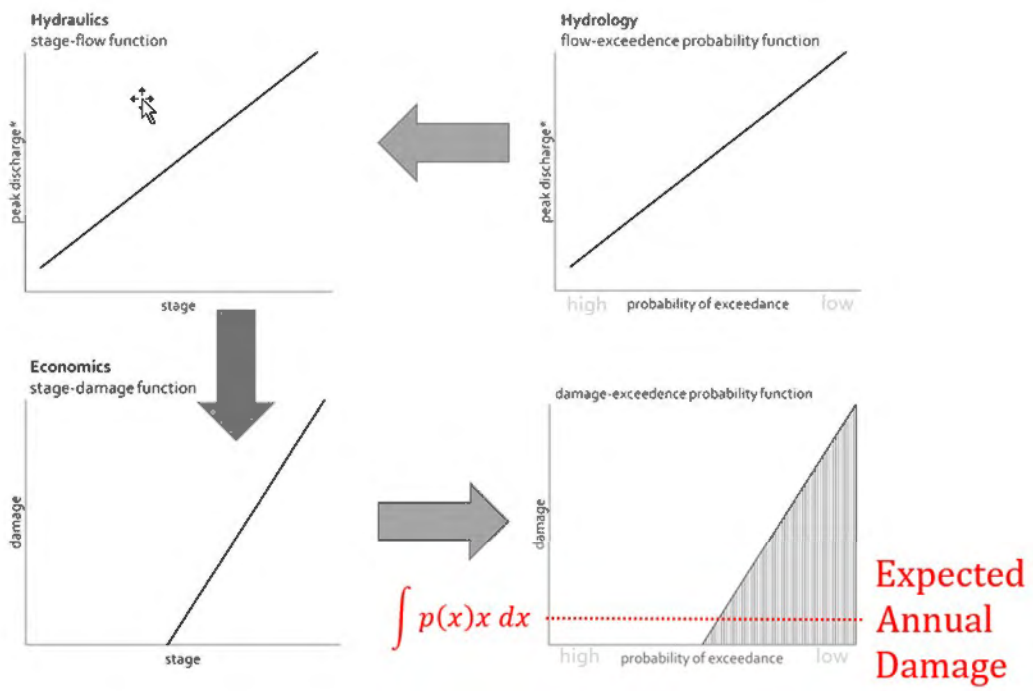

Figure 9 - EAD Computation Process

To compute EAD values, HEC-FDA requires the following data:

- **Structure Inventory Data –** This includes a structure identification number, a use category (industrial, commercial, residential, etc.), stream location, first floor elevation, and depreciated structure and content values.
- **Hydrologic and Hydraulic Data** – This data includes water surface profiles, exceedance probability-discharge relationships, stage-discharge relationships, and levee fragility curves.
- **Depth-Damage Functions –** Depth-damage functions are used to calculate the percent damage a structure will incur at a specific water elevation in a flood event.
- **Risk and Uncertainty Parameters –** Many inputs into the model are inherently uncertain and are assigned various uncertainty parameters as appropriate.

Discharge-exceedance probability, stage-discharge, and damage-stage functions derived at a damage reach index location are used to compute the damage-exceedance probability function. Monte Carlo simulation is a computationally efficient method of obtaining the damage-exceedance probability function due to uncertainty in input parameters. This numerical integration process requires all these relationships, and risk and uncertainty parameters to be input into HEC-FDA. EAD values are obtained from the cumulative distribution function produced in successive iterations of the Monte Carlo process.

2.5.1.2 Economic Analysis Model: LifeSim

The economic analysis uses the LifeSim 2.0.5 model to estimate life loss. A life safety analysis includes the estimation of the population at risk and associated statistical parameters for life loss. For this analysis, life loss was calculated using LifeSim 2.0.5 for the future without-project (FWOP) condition and future with-project (FWP) condition for the final array of alternatives. This

software uses Monte Carlo simulation to estimate the number of individuals at risk of life loss by probabilistic event for nighttime and daytime populations. Life loss was calculated for each frequency event used in the HEC-FDA model. The hydraulic results of the FWOP and FWP conditions were compared to estimate residual life loss after the project is implemented and to assess life safety risk during flood events at various flood frequencies. Inputs, assumptions, modeling results, and average annual life loss calculations are detailed in subsequent sections.

2.5.1.3 Economic Analysis Model: RECONS

The U.S. Army Corps of Engineers (USACE) Institute for Water Resources, Louis Berger, and Michigan State University have developed a regional economic impact modeling tool, RECONS (Regional ECONomic System), that provides estimates of jobs and other economic measures such as labor income, value added, and sales that are supported by USACE programs, projects, and activities. This modeling tool automates calculations and generates estimates of jobs, labor income, value added, and sales through use of the economic impact analysis tool IMPLAN®'s multipliers and ratios, customized impact areas for USACE project locations, and customized spending profiles for USACE projects, business lines, and work activities. RECONS allows the USACE to evaluate the regional economic impact and contribution associated with USACE expenditures, activities, and infrastructure.

2.5.2 Socioeconomics and Environmental Justice

The socioeconomic environment refers to the interaction between social processes and economic activity. Populations that are economically disadvantaged will have a more difficult time responding to economic shocks due to the limited resources available. It is important to identify the socioeconomic factors in the community that will impact how it will be able to respond to future events.

Demographic and socioeconomic data is useful for understanding the make-up of the population and, when used in conjunction with Environmental Justice screening criteria, can help explain the story of disadvantaged communities within the study area.

2.5.2.1 Population Characteristics

The City of Watertown experienced a modest population growth of 5.55% over the last ten years according to the American Community Survey (ACS). However, the more rural census tract in the study area, 954600, experienced a population decline of 7.37% over the same period. Table 6 below provides the population trends for all census tracts in the study area between 2012 and 2022.

Table 6: Population Trends by Census Tract

	Watertown City	954100	954301	954302	954401*	9544 (01/02)*	954502	954600
Total Population (2012: ACS)	21,524	3,344	4,270	4,658	*2,648*	5,296	4,648	2,605
Total Population (2022: ACS)	22,718	3,483	4,639	5,091	2,855	5,340	4,651	2,413
% Change	5.55%	4.16%	8.64%	9.30%	*7.82%*	0.83%	0.06%	-7.37%

Note: Census tracts 954401 and 954402 were one tract (954400) in 2012.

Census tract 954100 is located north and east of the city and encompasses a large area but does not contain many structures within the study area. Census tracts 954301 and 954302 represent the east and north side of Watertown respectively. 954301 surrounds Willow Creek and is an area of new development. 954302 mostly consists of areas in the north of Watertown that have very little overlap in the study area. This area has a lot of new development as well. Census tracts 954401 and 954402 are primarily residential areas in Watertown with some commercial structures along US-212 and downtown along the northern edges. This area of town is more established with little new construction but there are redevelopment efforts in and around the downtown area outside of the study area. There are areas of mobile homes, apartments, and multifamily houses throughout. Census tracts 954501 and 954502 represent two very different populations. 954501 is primarily commercial and industrial buildings south of US-212. The residential structures in this census tract are almost exclusively mobile home parks with very limited new construction of single-family houses occurring on the shores of Pelican Lake. Census tract 954502 encompasses the west side of Watertown with some industrial areas along US-212, a newer construction neighborhood, and the regional airport. This tract also includes the areas around Lake Kampeska which has the most valuable real estate in the study area. Interestingly, the population increase has occurred in 954501 with the largest population increase by percentage in the entire study area. Tract 954600 is primarily rural land to the west and north of Lake Kampeska. This area has seen the only decreases in population over the last 10 years. Lake Traverse Indian Reservation also intersects with the study area, but no structures within tribe lands are also within the study area.

Table 7 provides the demographic breakdown of the census tracts within the study area. The study area is comprised primarily of people who are white. The largest minority groups in the study area are Hispanic or Latino and American Indian. Census tract 954401 and 954501 have the largest minority populations and have around 20% of the population within those census tracts identifying as non-white. Specifically, Hispanic or Latino people have disproportionately large presences in those census tracts compared to the rest of the study area.

Table 7: Demographics by Census Tract (%)

	Watertown City	954100	954301	954302	954401*	954402*	954501	954502	954600
White	89.6	94.5	89.4	93.0	80.4	93.6	82.3	93.8	96.1
Hispanic or Latino (of any race)	3.70	2.50	1.90	1.10	13.70	0.40	12.40	0.00	0.00
Black or African American	0.70	0.90	0.40	1.80	0.50	0.00	0.00	0.01	0.00
American Indian and Alaska Native	2.70	1.20	3.40	2.60	0.50	3.60	2.20	2.60	1.50
Asian	0.60	0.20	2.90	0.00	0.20	0.00	0.00	0.00	0.70
Native Hawaiian and Other Pacific Islander	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Some Other Race	0.50	0.00	0.00	0.00	0.00	0.00	0.00	2.40	0.50
Two or More Races	2.20	0.60	1.90	1.50	4.80	2.40	3.20	1.10	1.10

Note: Data from 2022 ACS

Table 8 provides a breakdown of the age and sex of the population in the study area. Watertown City has a median age of about 39 and is majority female. Specific areas of interest are tracts 954501, which has the largest population under the age of 18 at over 31%, and 954402 which has the largest population over 65 at over 27%. 954501 is primarily mobile home parks for housing with some single-family development along Pelican Lake. 954501 is in the heart of Watertown and has many apartment buildings and multifamily houses. This area also has the oldest homes in Watertown.

Table 8: Age and Sex by Census Tract

	Watertown City	954100	954301	954302	954401*	954402*	954501	954502	954600
Under 18 Years (%)	22.6	27.6	19.4	26.7	17.6	20.5	31.3	18.8	28.3
18 Years and Over (%)	77.4	72.4	80.6	73.3	82.4	79.5	68.7	81.2	71.7
65 Years and Over (%)	18.9	17.1	15.8	19.2	17.1	27.4	11.7	20.7	19.4
Median Age	38.9	39.1	36.2	40.0	34.5	37.3	35.4	45.3	42.8
Male (%)	46.3	52.1	53.4	50.0	53.4	48.9	43.2	51.9	48.7
Female (%)	53.7	47.9	46.6	50.0	46.6	51.1	56.8	48.1	51.3

Note: Data from 2022 ACS

Table 9 provides an overview of the household and family characteristics within the study area. There are over 10,000 households in Watertown with an average household size of 2.21. The median household income is just over $61,000 per year. About 6% of all families were below the poverty line in the past 12 months. Tract 954402 has the lowest median household income, but the percentage of families below the poverty line is in line with the rest of the study area. This tract has the largest population of people over the age of 65 and would have more people on fixed incomes. It also has the smallest average household size. Tract 954301 has a median household income slightly below the median of the City but has the largest share of families below the poverty line. The area is seeing an increase in development, but there are populations that are disadvantaged in the area.

Table 9: Household and Family Data by Census Tract

	Watertown City	954100	954301	954302	954401*	954402*	954501	954502	954600

Total Households	10,018	1,323	2,199	2,067	1,231	1,295	1,014	2,118	918
Median Household Income ($)	61,320	79,596	56,541	91,455	52,292	39,162	61,406	78,458	77,321
Average Household Size	2.21	2.61	2.07	2.45	2.23	1.72	2.68	2.18	2.63
Average Family Size	2.89	3.08	2.86	2.95	2.81	3.06	3.34	2.65	3.09
Below Poverty Level* (%)	5.8	3.0	8.2	5.0	4.9	5.7	7.6	4.5	3.8
Owner-occupied Units (%)	62.4	81.6	57.4	78.0	51.2	40.1	67.0	73.7	89.9
Renter-occupied Units (%)	37.6	18.4	42.6	22.0	48.8	59.9	33.0	26.3	10.1

Note: Data from 2022 ACS
**Past 12 months; all families.*

Table 10 provides an overview of the education attainment of the population of the study area. There are higher than average populations of people in census tracts 954401 and 954402 with less than a 9th grade education. These tracts also have the lowest attainment of bachelor's degrees in the study area. As a result, these two tracts also have the lowest median household incomes in the study area.

Table 10: Education Levels by Census Tract

	Watertown City	954100	954301	954302	954401*	954402*	954501	954502	954600
Population 25 Years and Over	15,428	2,365	2,982	3,467	2,045	1,782	1,652	3,384	1,664
Less than 9th Grade (%)	4.0	0.9	1.2	2.9	15.3	5.0	1.5	1.2	1.8
9th to 12th Grade, No Diploma (%)	5.6	1.9	9.1	5.9	1.6	8.3	3.9	4.2	1.0
High School Graduate (%)	38.3	41.1	45.4	27.3	38.9	54.3	45.3	34.1	44.7
Some College, No Degree (%)	17.5	15.7	8.6	18.4	20.6	21.0	18.7	20.8	23.0
Associate's Degree (%)	14.1	14.1	12.3	20.9	14.2	5.9	13.7	12.5	14.7
Bachelor's Degree (%)	14.0	18.1	13.1	16.4	6.5	5.4	12.0	21.1	11.6
Graduate or Professional Degree (%)	6.5	8.2	10.3	8.1	2.9	0.0	4.9	6.0	3.2

Note: Data from 2022 ACS

Table 11 provides an overview of the employment within each census tract by industry. Watertown's primary industries are education and healthcare services, manufacturing, and retail trade. Tracts 954100 and 954600 are rural and have a more agriculture heavy employment base. In a 2023 Housing Demand Analysis from Maxfield Research and Consulting, the top employers in Watertown were Watertown School District, Prairie Lakes Healthcare System, Terex Utilities, Hy-Vee, Premier Bankcard, City of Watertown, Worthington Industries, Walmart, Dakota Bodies, and Jenkins Living Center. These represent a range of education, healthcare, manufacturing, retail, government, and financial employers.

Table 11: Employment Industries by Census Tract (%)

	Watertown City	954100	954301	954302	954401*	954402*	954501	954502	954600
Agriculture, Forestry, Fishing and Hunting, and Mining	4.4	10.2	3.2	2.6	7.5	3.1	5.7	7.3	15.2
Construction	5.6	11.6	6.0	3.4	1.6	10.1	8.3	7.3	10.1
Manufacturing	17.7	10.8	16.1	21.5	23.4	2.9	21.1	15.9	18.2
Wholesale Trade	3.9	3.0	7.1	0.5	2.2	8.7	6.2	2.9	1.3
Retail Trade	13.4	13.2	14.3	7.8	18.9	16.2	20.6	11.2	17.9
Transportation and Warehousing, and Utilities	3.0	6.2	1.9	3.3	1.7	8.1	2.1	2.9	4.3
Information	1.9	2.1	2.3	1.6	0.3	2.3	0.0	2.8	2.2
Finance And Insurance, and Real Estate and Rental and Leasing	5.4	3.4	4.1	6.6	1.3	5.3	1.1	9.7	3.8
Professional, Scientific, and Management, and Administrative and Waste Management Services	3.8	4.9	5.8	3.6	2.3	3.9	0.6	3.9	5.6
Educational Services, and Health Care and Social Assistance	20.3	20.8	21.9	24.4	16.9	13.1	18.1	19.8	12.6
Arts, Entertainment, and Recreation, and Accommodation and Food Services	10.0	4.2	9.6	3.7	15.6	26.3	9.4	7.8	4.5
Other Services, Except Public Administration	5.9	4.4	7.8	8.5	3.8	0.0	3.4	5.9	2.6
Public Administration	4.7	5.3	0.0	12.5	4.5	0.0	3.3	2.5	1.7
Unemployment Rate (Civilian Labor Force)	1.5	0.9	0.7	0.0	2.8	4.6	2.2	2.6	0.5

Note: Data from 2022 ACS

2.5.2.2 Environmental Justice

In January 2021, Executive Order 14008 directed the CEQ to develop a tool called the Climate and Economic Justice Screening Tool. Federal Agencies are directed to use the tool to identify disadvantaged communities that will benefit from programs in the Justice40 Initiative which seeks to deliver 40% of the overall benefits of investments in climate, clean energy, and related areas to disadvantaged communities.

This tool is intended to be part of a more thorough analysis of the community to tell the complete story of the population. This analysis will utilize the Climate and Economic Justice

Screening Tool (CEJST), the National Risk Index (NRI), and the Environmental Justice Screening and Mapping Tool (EJScreen).

2.5.2.2.1 Climate and Economic Justice Screening Tool

The Climate and Economic Justice Screening Tool uses various datasets as indicators of burdens. The burdens are divided into eight categories with a community being identified as disadvantaged if the census tract is at or above the threshold for one or more burden and at or above the threshold for an associated socioeconomic burden. The eight categories of burdens are climate change, energy, health, housing, legacy pollution, transportation, water and wastewater, and workforce development. The burden thresholds are in terms of national percentile of the burden.

Table 12 below provides a breakdown of the categories and the burdens within them as well as the thresholds necessary to categorize a community as disadvantaged. Most of the burdens require a community to be in the 90th percentile in the nation as well as being in the 65th percentile for low income. Unique cases include having one abandoned mine or a formerly used defense site as well as being in the 65th percentile of low income qualifies a community to be considered disadvantaged. The workforce development category considers less than high school education as the socioeconomic factor.

Table 12: Climate and Economic Justice Screening Tool Categories and Burdens

	Categories							
	Climate Change	**Energy**	**Health**	**Housing**	**Legacy Pollution**	**Transportation**	**Water and Wastewater**	**Workforce Development**
Total Threshold Criteria	Expected Agriculture Loss Rate (90th)	Energy Costs (90th)	Asthma (90th)	Housing Cost (90th)	Abandoned Mine Land (At least 1)	Diesel Particulate Matter Exposure (90th)	Underground Storage Tanks and Releases (90th)	Linguistic Isolation (90th)
	Expected Building Loss Rate (90th)	PM 2.5 in the Air (Air Quality;90th)	Diabetes (90th)	Lack of Green Space (90th)	Formerly Used Defense Sites (At least 1)	Transportation Barriers (90th)	Wastewater Discharge (90th)	Low Median Income (90th)
	Expected Population Loss Rate (90th)	**And Low Income (65th)**	Heart Disease (90th)	Lack of Indoor Plumbing (90th)	Proximity to Hazardous Waste Facilities (90th)	Traffic Proximity and Volume (90th)	**And Low Income (65th)**	Poverty (90th)
	Projected Flood Risk (90th)		Low Life Expectancy (90th)	Lead Paint (90th)	Proximity to Risk Management Plan Facilities (90th)	**And Low Income (65th)**		Unemployment (90th)
	Projected wildfire risk (90th)		**And Low Income (65th)**	**And Low Income (65th)**	Proximity to Superfund Sites (90th)			**And Less Than Highschool Education (>10% of people aged 25+)**
	And Low Income (65th)				**And Low Income (65th)**			

Note: (Percentile)

All census tracts are identified as being above the 90th percentile in expected population loss rate. This burden refers to the fatalities and injuries from natural hazards each year. Tracts 954301, 954302, and 954400 are identified as being above the 90th percentile in lack of indoor plumbing burden. This burden refers to the share of homes without indoor kitchens or plumbing. Tracts 954501 and 954502 are identified as containing a formerly used defense site. Tracts 954400 and 954501 are identified as meeting the low-income socioeconomic burden. Tracts 954301 and 954400 are identified as meeting the less than high school education socioeconomic burden. Table 13 provides a complete breakdown for each tract and the percentile of each burden.

Table 13: Climate and Economic Justice Screening Tool Results by Census Tract

Categories	954100	954301	954302	954400*	954501	954502	954600
Climate Change							
Expected Agriculture Loss Rate	79th	79th	74th	12th	79th	82nd	75th
Expected Building Loss Rate	75th	73rd	73rd	74th	75th	76th	74th
Expected Pop. Loss Rate	97th	97th	96th	98th	97th	98th	97th
Projected Flood Risk	51st	66th	12th	82nd	73rd	22nd	64th
Projected Wildfire Risk	76th	80th	81st	89th	80th	80th	74th
Energy							
Energy Costs	3rd	46th	21st	61st	18th	12th	41st
PM 2.5 in the Air (Air Quality)	10th	11th	11th	11th	10th	11th	9th
Health							
Asthma	14th	32nd	9th	32nd	28th	24th	14th
Diabetes	20th	33rd	12th	46th	39th	41st	30th
Heart Disease	37th	60th	31st	75th	59th	64th	51st
Low Life Expectancy	0th	33rd	6th	85th	3rd	2nd	28th
Housing							
Housing Costs	9th	56th	21st	59th	53rd	56th	14th
Lack of Green Space	84th	50th	72nd	78th	73rd	51st	81st
Lack of Indoor Plumbing	74th	98th	99th	94th	48th	21st	73rd
Lead Paint	47th	57th	53rd	63rd	28th	55th	69th
Legacy Pollution							
Abandoned Mine Land	No	No	No	No	No	No	No
Formerly Used Defense Site	No	No	No	No	Yes	Yes	No
Proximity to Hazardous Waste Facilities	28th	38th	44th	34th	38th	51st	13th
Proximity to Risk Management Plan Facilities	20th	45th	38th	53rd	56th	36th	6th
Proximity to Superfund Sites	1st	1st	1st	1st	1st	1st	1st
Transportation							
Diesel Particulate Matter Exposure	5th	17th	11th	20th	8th	8th	4th
Transportation Barriers	48th	46th	4th	26th	14th	55th	56th
Traffic Proximity and Volume	11th	47th	28th	56th	38th	36th	6th
Water and Wastewater							
Underground Storage Tanks and Releases	9th	62nd	33rd	82nd	35th	65th	7th
Wastewater Discharge	28th	45th	36th	52nd	48th	41st	-
Workforce Development							
Linguistic Isolation	12th	51st	12th	31st	12th	12th	12th
Low Median Income	22nd	77th	16th	75th	60th	54th	22nd
Poverty	33rd	78th	11th	66th	69th	63rd	23rd
Unemployment	3rd	5th	0th	30th	18th	51st	4th
Socioeconomic							
Low Income	40th	51st	28th	74th	76th	56th	40th
Less than High School Education	6%	11%	8%	12%	6%	6%	4%

Disadvantaged	No	No	No	Yes	Yes	No	No

**Prior to 2012, census tracts 954401 and 954402 were combined into tract 954400 and the CEJST uses census tract data from 2010. For the purposes of this analysis, because tract 954400 is identified as disadvantaged in the CEJST, both 954401 and 954402 will be considered disadvantaged.*

A total of three census tracts are identified as disadvantaged using the CEJST tool: 954401, 954402, and 954501.

2.5.2.2.2 National Risk Index

Due to all tracts being identified as being in the 96th percentile or above by the CEJST for population loss rate, the natural disaster risk was analyzed more thoroughly. The National Risk Index (NRI) is a dataset that illustrates community risk for 18 natural hazards. It was designed and built by the Federal Emergency Management Agency (FEMA) with close collaboration with partners in academia; local, state, and federal government; and private industry. The risk equation in the NRI consists of three components: natural hazards component (expected annual loss), consequence enhancing component (social vulnerability), and consequence reduction component (community resilience).

Figure 10 below shows all 18 natural hazards used in the NRI from the technical documentation.

Figure 10: NRI Natural Hazard List

Each tract was analyzed by the NRI to give a percentile score across the 18 natural hazard types. All tracts in the study area are in the 97th percentile and above for winter weather and cold wave scoring. Tracts 954401, 954402, and 954502 are identified as exceeding the 95th percentile in riverine flooding risk as well. Table 14 provides a complete overview of the hazards for each census tract.

Table 14: National Risk Index Hazard Percentiles by Census Tract

Hazards	954100	954301	954302	954401	954402	954501	954502	954600
Cold Wave	99.8	99.8	99.7	99.6	99.4	99.5	99.9	99.8
Drought**	86.6	70.6	72	0	0	77.4	74.5	83.4
Earthquake	10.6	19	13.7	11.6	16.2	28.9	31	9.8
Hail	97.3	94.5	93.8	90.2	91.3	96.1	97.8	96.7
Heat Wave	75.5	86	81.7	77.4	72.4	73.4	86.7	66.8
Ice Storm	92.6	96.2	94.8	92.8	90.9	92.5	96.8	87.5
Landslide	51.8	92.6	93.1	0	87.9	51.9	91.6	42.4
Lightning	70.6	83.3	77.3	69.8	63.9	71.2	86.3	54.9
Riverine Flooding	91.8	92.1	73.3	95.5	95.8	89.9	97.5	68.3
Strong Wind	96	97	95.6	92.9	91	94.3	98.1	94.7
Tornado	92.8	96.5	93.9	86.8	85.2	94.3	98.7	76.4
Wildfire	92.1	72.2	79.7	0	0	89.8	92	90.5
Winter Weather	98.7	99.6	99.3	99	98.5	98.6	99.6	97.3

All tracts have expected annual losses above the 75th percentile in the NRI. The social vulnerability score varies across the tracts with the more rural tracts seeing vulnerabilities around the 10th percentile and areas through the city between the 50th and 73rd percentile. All tracts are assigned the same community resiliency score in the 76th percentile. Table 15 below shows the percentiles for all tracts in the three categories as well as the overall risk index percentile.

Table 15: National Risk Index National Percentiles by Tract

Categories	954100	954301	954302	954401	954402	954501	954502	954600
Expected Annual Loss	89.61	83.16	85.84	75.49	76.93	77.48	91.64	83.45
Social Vulnerability	15.48	73.04	16.33	70.22	53.08	63.29	66.04	9.66
Community Resiliency	76.39	76.39	76.39	76.39	76.39	76.39	76.39	76.39
Risk Index	**83.32**	**85.82**	**78.74**	**78.58**	**76.64**	**79.02**	**92.66**	**73.21**

All tracts in the study area face similar natural hazard losses but have varying degrees of social vulnerability and the community resiliency is identified as relatively high. Tract 954301 is identified as having the highest social vulnerability but was not identified as disadvantaged in the CEJST tool. The socioeconomic burden of 65th percentile for low income is not met – it is in the 50th percentile. This tract is not identified as disadvantaged. No additional tracts are identified as disadvantaged from this analysis.

2.5.2.2.3 Environmental Justice Screening and Mapping Tool

With all census tracts exceeding a burden threshold in CEJST, socioeconomic thresholds are the deciding factor if a community is included as disadvantaged. Environmental Justice Screening and Mapping Tool (EJScreen) is the Environmental Protection Agency (EPA)'s mapping and screening tool that provides the user a nationally consistent dataset for combining environmental and demographic socioeconomic indicators. It is useful in drilling down in communities to find the pockets of the most vulnerable populations to try and ensure that the story is being told fully about the community. The EJScreen tool uses block group data instead of census tract data which are smaller areas and can show subsets of communities within sometimes larger census tracts. .

EJScreen was used to isolate the national percentile of each block group for being low income. Low income is defined as the percentage of people less than or equal to twice the federal poverty level. This definition is the same as with the CEJST tool. So, if a block group is at or above the 65th percentile for low income in EJScreen, that block group is considered disadvantaged by the same criteria as the CEJST since all tracts in the area are subject to the expected population loss rate burden. Table 16 shows the result of this analysis and highlights the block groups that meet or exceed the burden threshold.

Table 16: EJScreen Block Group Low Income Percentiles

Block Group	Low Income Percentile
460299541001	49
460299541002	43
460299543011	50

460299543013	48
460299543021	27
460299543022	16
460299544011	**74**
460299544012	**68**
460299544013	**71**
460299544021	**68**
460299544022	44
460299545011	**75**
460299545012	**81**
460299545021	57
460299545022	**73**
460299545023	12
460299545024	40
460299546001	**65**
460299546002	44

2.5.2.3 Disadvantaged Populations

Census tracts 954401, 954402, and 954501 are identified as disadvantaged for the purposes of this study because they have been identified as disadvantaged in the CEJST for being socioeconomically disadvantaged and expected annual population loss exceeding the thresholds. Additionally, census block group 95455022 is identified as disadvantaged due to the low income in the block group. The tract includes areas of higher income that prevent the entire tract from being considered disadvantaged. Census tracts 954100 and 954600 are considered partially disadvantaged in the CEJST because it intersects with tribal land. However, these tracts are not considered disadvantaged in this study because no structures are being impacted on tribal lands. Census tract 954301 is identified as disadvantaged in EJScreen, but neither of the block groups in the study area qualify as disadvantaged for socioeconomic reasons. There are two additional block groups outside of the study area that are part of this tract that have low-income populations. Therefore, tract 954301 and its block groups in the study area are not considered disadvantaged for this analysis. See Table 17 below for a summary of census tracts within the study area that are considered disadvantaged.

Table 17: Disadvantaged Census Tracts

Census Tract	Block Group	CEJST	NRI	EJScreen	Identified as Disadvantaged
46029954100		Partially*	83.32	No	No
	1			No	No
	2			No	No
46029954301		No	85.82	Yes*	No
	1			No	No
	3			No	No
46029954302		No	78.74	No	No
	1			No	No

	2			No	No
46029954401		Yes	78.58	Yes	Yes
	1			Yes	Yes
	2			Yes	Yes
	3			Yes	Yes
46029954402		Yes	76.64	Yes	Yes
	1			Yes	Yes
	2			No	Yes
46029954501		Yes	79.02	Yes	Yes
	1			Yes	Yes
	2			Yes	Yes
46029954502		No	92.66	No	No
	1			No	No
	2			Yes	Yes
	3			No	No
	4			No	No
46029954600		Partially*	73.21	Yes	No
	1			No	No
	2			No	No

3 PLAN FORMULATION AND EVALUATION

3.1 Planning Framework

GI studies are utilized to address large-scale, complex water resource problems such as FRM, navigation, water supply, recreation, and other needs. They require specific congressional authority and appropriations as individual line items in the Federal budget. Projects developed under GI studies have no limits on the maximum cost of the project due to the size and complexity of the water resources problems they are addressing.

3.2 Assumptions

Critical assumptions used in this study are summarized below:

- There are existing, remnant flood fight measures (berms) in place along both banks of the Big Sioux River in some reaches within the study area. These discontinuous embankments have performance/reliability concerns and are used by the City as a starting point for flood fighting activities during floods. None of the embankments will perform without flood fighting intervention to address gaps and close off road crossings. Therefore, these features were not factored into the alternative development and hydraulic modeling.
- Sedimentation at Lake Kampeska and along the Big Sioux River is a known issue, and there is a high risk that sedimentation could impact implementing any alternatives along the Big Sioux River. This issue already exists within the study area and the objective is not to further increase it. Sediment transport capacity analysis will be conducted on the TSP during the optimization analysis.
- Compatible sites for wetland mitigation, borrow materials, and potential sediment retention are available within the study area potentially along Mud Creek tributary on the north side of the City.

3.3 Management Measures

Plan formulation is the process of evaluating existing conditions and building alternative plans that meet planning objectives and avoid planning constraints. Alternative plans are composed by combining one or more measures into comprehensive solutions that can then be evaluated and compared. A measure is a feature or activity that can be implemented at a specific location to address one or more planning objectives. The four planning criteria of completeness, effectiveness, efficiency, and acceptability can be used to help with the development and early screening of potential measures. For this study the following screening factors were used:

- Engineering and FRM adequacy (effectiveness/completeness)
- Ability to contribute to meeting the planning objectives (effectiveness/completeness)
- Consistency with planning constraints and authorities
- Acceptability (includes law and policy, environmental, cultural, and public aspects)
- Early cost indicators (early efficiency indicators for screening purposes)
- Construction site constraints and real estate requirements (topography, location conflicts, adjacent development, etc.)

USACE and the City (as well as a few other stakeholders) conducted a planning charrette on October 18, 2022, where the collective team worked to develop the problems, opportunities, objectives, and constraints that would become the basis for the plan formulation for the study. In addition, the team brainstormed a comprehensive list of FRM management measures that could meet the objectives and avoid any constraints. Some of these measures included lowering Lake Kampeska and/or Pelican Lake, channel widening, different combinations of levee systems, diversion channels, creating a wetland complex, constructing one or multiple dry dams, and nonstructural options. Each measure was developed into an initial description of what it would consist of and then the team screened those measures by applying the four screening criteria. Table 18 below provides a list of all of the measures, their descriptions, and the results of the initial screening.

Table 18 - Measures Screening Table

Measures		Description and Purpose	Screening Criteria				Carried Forward
			Completeness	Effectiveness	Efficiency	Acceptability	
A	No Action	If no FRM actions were to take place; considered a baseline for comparison to other alternatives; fulfills a NEPA requirement.	N	N	N	N	**Yes**
B	Diversion Channel Around Entire City	Divert the Big Sioux River (BSR) around the entire city of Watertown. It would re-connect to the main channel south of US-212.	Y	Y	N	N	No*
C	Lower Lake Kampeska in Fall for Water Storage	Alter the existing operations of Lake Kampeska to gain additional flood storage in the lake. Includes lowering the water surface elevation before winter to elevation 1718 feet NAVD88. Full pool for Lake Kampeska is 1718.8 feet NAVD88, so this measure would lower the lake by 0.8 feet each fall.	Y	Y	Y	Y	**Yes**
D	Channel Widening	Expand the width of the channel by approx. 50 feet on either side of existing banks for total width of approximately 150 feet for the approx. length of 4.6 miles to allow for more flow capacity during flood events. Existing channel bed elevation and alignment is expected to be the same as current conditions; widening would start about 3-3.5 feet above the channel inverts. Widening widths will vary depending on available space in the overbanks. A low-flow channel will be retained with the average dimensions of 50-foot top width and 3.5-feet deep.	Y	Y	Y	Y	**Yes**
E	Levee Right/Left Banks	Construct earthen embankment levees along both banks of the BSR to provide protection against the 5%-2% AEP flood.	Y	Y	Y	Y	**Yes**
F	Levee Left Bank Only	Construct earthen embankment levee along the left bank only of the BSR to provide protection against the 5%-2% AEP flood. The left bank provides protection to majority of the city and would be shorter than a levee on both banks.	Y	Y	Y	Y	**Yes**
G	Levee Right/Left Banks with Closure Structures	Right and left levee embankments that would be 9-12 feet tall with 4-foot-tall closure structures at 8 crossings.	Y	Y	Y	Y	**Yes**
H	Pelican Diversion to BSR	Excavate a new channel to connect to the BSR south of the existing connection and allow for flood water to be stored longer before diverting back into the river.	N	N	Y	Y	No*
I	Pelican Lake Lowering 1 foot	Alter how the existing weir operates to lower Pelican Lake by 1 foot before winter to allow for flood storage during spring/summer.	N	N	Y	Y	No*

Measures		Description and Purpose	Screening Criteria				Carried Forward
			Completeness	Effectiveness	Efficiency	Acceptability	
J	Wetland Complex	Incorporate NNBF to address FRM through the creation of an approx. 550-acre wetland habitat complex north of Watertown.	N	N	N	Y	No*
K	Mahoney Creek Dry Dam	Construct a dry dam upstream of Watertown near the confluence of Mahoney Creek and the BSR. The dry dam would hold back flood waters and slowly release back into the river and reduce flows diverted into Lake Kampeska and within the city.	N	Y	Y	N	No*
L	3-5 Smaller Dry Dams	Construct multiple smaller dry dams upstream of Watertown near the confluences of major creeks and the BSR. The dry dams would hold back flood waters and slowly release back into the river and reduce flows diverted into Lake Kampeska and within the city.	N	Y	N	N	No*
M	BSR Diversion through Lake Kampeska to Pelican Lake	Excavate a new channel to connect Lake Kampeska and Pelican Lake. This would also include an additional excavated channel connecting Pelican Lake back to the BSR	Y	N	N	Y	No*
N	Nonstructural	This measure would include an array of nonstructural methods including elevating, floodproofing, dry floodproofing, flood vents, etc for both residential and industrial structures throughout the study area.	Y	Y	Y	Y	**Yes**
O	Bridge Widening	Widen up to 8 bridge crossings across the BSR.	N	N	N	Y	No*
P	Re-routing BSR through Still Lake	Divert approximately 9,000 cfs from the BSR north of Mahoney Creek into a drainageway that flows to Still Lake.	N	Y	N	N	No*

*Further description of measures and reason for screening them out is in Section 3.3.1.

3.3.1 Screening of Measures

As stated above, each measure was screened against the Planning Guidance Criteria. The following sections provide brief summary of the rationale for screening out the measures that were not carried forward.

3.3.1.1 Diversion Channel Around City of Watertown

This measure would include excavating a new channel to divert the Big Sioux River starting north of the city and carrying floodwaters to the east and then south around Watertown. Based on the high elevations of the terrain north of town relative to the river, it would take an extraordinary amount of excavation to create a channel that would allow the river to properly divert and flow around the city. In addition, numerous bridges would need to be constructed where the channel crossed major roadways and the railroad, and a significant amount of real estate would be required for the channel. Based on the high excavation quantities, the bridges, and the real estate, the cost of this measure would be extremely high.

3.3.1.2 Pelican Lake Diversion to Big Sioux River

This measure would involve reshaping and reconfiguring the south outlet channel from Pelican Lake to the Big Sioux River. The existing outlet channel would be reconfigured by widening and adjusting the alignment to increase the discharge of the channel. This would allow Pelican Lake to drain faster and reduce its peak elevation during floods.

The measure was screened out because it produced only minor benefits. The new outlet channel only reduced the peak elevation of Pelican Lake during flood events by less than 0.5 feet. The measure also didn't produce enough benefits for downstream properties.

3.3.1.3 Pelican Lake Lowering One Foot

This measure would include lowering the Pelican Lake elevation by one foot before spring runoff begins. Normal pool for Pelican Lake is 1709 feet NAVD88. The inlet/outlet weir of Pelican Lake and south outlet channel would be modified to lower the elevation of the lake to 1708 feet. This would create approximately 2,800 acre-feet of storage for flood events.

This measure was screened out due to the lack of benefits when modeled. The model showed that the alternative would only slightly lessen water surface elevations for flood events and the effects were limited to the area in only the farthest south sections of the City. The inlet/outlet weir has also experienced sedimentation and there is uncertainty regarding how the modifications would be achieved.

3.3.1.4 Wetland Complex

This measure would incorporate NNBF to address FRM through the creation of an approximately 550-acre wetland habitat complex north of Watertown. Wetlands absorb and slowly release precipitation, snowmelt, and surface waters; roots from vegetation slow the speed of runoff and distribute water across the ecological floodplain. Wetlands are particularly valuable for storage of peak flows during flooding. In addition to FRM benefits, wetlands provide a host of other ecosystem services such as reduction of streambank erosion, improvement in water quality, and increased diversity of flora and fauna.

This was screened out as an FRM measure because of its inability to store enough water during flood events to lower the risk in the vicinity of Watertown. The design incorporated multiple

types of wetlands including permanently, seasonally, and temporarily flooded wetlands to avoid the creation of large, ponded areas but instead wetlands that represented the pothole region. The preliminary costs associated with excavation to create 550 acres of wetlands and the real estate combined with the lack of measurable flood storage (less than 500 acre-feet) resulted in this measure being screened.

3.3.1.5 Mahoney Creek Dry Dam

The Mahoney Creek Dry Dam measure would include constructing one large dry dam just below the confluence of the Mahoney Creek and Big Sioux River, approximately seven miles north of Watertown city limits. A dry dam would not be a permanent reservoir behind the dam instead operating as a large detention pond retaining flood waters during high flow and releasing them at a steady rate over time until the pool is empty. This area was selected compared to other dry dam locations due to the ability for the dam to tie off between two bluffs and the lower number of homesteads that would be impacted by the temporary pool created during flood events. This measure would provide FRM benefits to both the residents at Lake Kampeska and along the Big Sioux River through Watertown.

The Mahoney Creek Dry Dam was originally studied in the 1994 USACE Feasibility Study and was the Recommended Plan in the Chief's Report. At that time, this alternative was found to be the most economical and beneficial to Watertown. The Mahoney Creek Dry Dam was very controversial and vehemently opposed by local landowners upstream from the city where the dry dam was to be constructed, and thus the project was never authorized for construction. After the 1997 flood (the flood of record and the most damaging flood in recent history), the City requested USACE to restudy the Mahoney Creek Dry Dam. A General Reevaluation Report was completed in 2000 and found that the Mahoney Creek Dry Dam was still economically viable and recommended that alternative, but there was still strong resistance from the local community. During the initial months of starting the current Feasibility Study, two public meetings were held in 2022 and 2023 to gather input on the study and assess the landowners' current position on the dry dam alternative and the feedback was unanimously negative.

The Mahoney Creek Dam as previously evaluated would have a maximum storage capacity of approximately 48,000 acre-ft. The dry dam infrastructure itself included two earthen embankments for the main dam and a saddle dam on one of the arms to contain the pool in the event of a very large event. The spillway was to be an earthen cut spillway on the east end of the main dam embankment and was set at between a 1% and 0.5% AEP crest elevation (100-200 year flood event) and did not include erosion protection. Based on current dam safety standards, it is likely the spillway would have to be evaluated for erosion potential in greater detail, and if necessary, lined to protect it. A spillway armoring project for an earthen spillway at Pipestem Dam in Jamestown, ND is costing in excess of $150M and if armoring were required for the Mahoney Creek Dry Dam it would no longer be economically viable.

In discussing the Mahoney Creek Dry Dam measure with the City, all parties are aware of the controversy surrounding this option and its opposition. The City, as the non-federal sponsor would have the responsibility of acquiring any necessary real estate for the Mahoney Creek Dry Dam (or any plan), and because the dry dam location is so far beyond the City's extra jurisdictional limits, they likely would need willing sellers in order to acquire the land themselves. Otherwise, if condemnation or eminent domain authority were necessary, the City would need the assistance of either Coddington County or the State of South Dakota to pursue those land

interests, which is highly unlikely and not desirable by any of the elected officials. Due to the uncertainty of how the measure would be implemented without ability to secure the land the dry dam is not a complete measure.

USACE also met and coordinated with SWO on multiple occasions under the current Feasibility Study to discuss the Mahoney Creek Dry Dam Alternative as well as any other measures that may occur within the Lake Traverse Reservation boundary. Based on documentation in the report, and feedback from SWO, coordination with the Tribe during the 1994 Feasibility Study was minimal and pre-dated EO 13175: *Consultation and Coordination with Indian Tribal Governments* that established regular and meaningful consultation and collaboration with Tribal Officials. During the SWO Tribal Council meeting on 4 October 2023, the Council verbally expressed their concerns about any alternative that would occur within the Lake Traverse Reservation boundary.

As a follow up, the SWO Tribal Council adopted a resolution which they sent to USACE on 8 November 2023 stating the Tribe supports only the No Action Alternative and opposes the proposed Watertown FRM project. In consideration of current federal Tribal policies as well as the USACE Civil Works Tribal Consultation Policy, the USACE PDT determined that the Mahoney Creek Dry Dam did not follow these policies, particularly, “USACE will support Tribal self-determination, self-reliance, and capacity building, to the fullest extent permitted by law and policy,” (USACE, 2023). The Mahoney Creek Dry Dam would create a large land public land interest within the reservation that would impose a constraint on the Tribe’s opportunity to pursue future land acquisitions to expand Tribally held lands located within their Tribal boundaries. The dry dam would not provide any benefits to the Tribe and would only cause negative effects associated with permanent land loss from the dam’s operational pool. Permanent flood easements would be required and wouldn’t allow for habitable structures within the operation pool. These reasons listed above fail to meet Justice40 environmental justice (EJ) policy and the planning objective of providing benefits to and avoid disproportionate impacts to the underserved and disadvantaged communities within the City of Watertown and the Lake Traverse Reservation.

This measure was screened out for not meeting the completeness or acceptability criteria due to public opinion, real estate acquisition, and federal Tribal and EJ policies.

3.3.1.6 3-5 Smaller Dry Dams

This measure would include constructing three to five medium-sized dry dams on tributaries to the Big Sioux River located upstream of Watertown, including Mud Creek, Mahoney Creek, and Soo Creek.

This measure was screened out for not meeting the completeness or acceptability criteria due to the same public opinions, real estate concerns, and federal Tribal and EJ policies listed above under the Mahoney Creek Dry Dam measure. This measure is also lacking efficiency with costs estimated to be much higher due to initial construction costs and the high annual costs associated with operation and maintenance of several dam structures.

3.3.1.7 Big Sioux River Diversion through Lake Kampeska and Pelican Lake

This measure would divert water from the Big Sioux River north of Watertown into Lake Kampeska, then through a constructed diversion channel between Lake Kampeska and Pelican Lake, then connecting to a final channel that ties back into the Big Sioux River south of

Watertown. This measure would be extremely costly due to the large amount of excavation required to tie the new channel back into the Big Sioux River downstream. There are also water quality concerns between the lakes and increased sedimentation because of the diversion.

3.3.1.8 Bridge Widening

There are several bridge crossings on the Big Sioux River through the center of the city. This measure would include widening up to seven roadway bridges, one railroad bridge, and one pedestrian bridge. Bridge widening would ideally allow more flow and minimize “pinch points” during flood events. It would also allow for the roadways to remain open such as 10th and 14th Avenues during flooding and keep access to critical infrastructure such as hospitals, schools, and other emergency medical facilities. Due to the extremely slow velocities of the channel during flood events though, this measure would hardly make a difference in lowering flood risk. Widening this many bridges would also be extremely costly with little benefits in return.

3.3.1.9 Re-routing Big Sioux River through Still Lake

This measure was studied previously in the 1960s and 1970s for a way to divert floodwaters from the Big Sioux River north of Watertown into a system of channels and lakes near Florence, SD. This would allow for approximately up to a week of delay before the floodwaters of the Big Sioux River reach the Lake Kampeska and Watertown areas. There would be significant concern of shifting the flood risk from one location to another. This measure would also be very costly due to the structures needed to divert water, as well as possible pumping stations needed to remove excess water in the existing channels and lakes near Florence to allow room for floodwaters from the Big Sioux River. This measure also raised several concerns with environmental and cultural resources as well as similar concerns listed above with lack of real estate and favorable public opinion. This measure was screened out for not meeting the completeness, efficiency, or acceptability criteria due to shifting flood risk to other populations, high costs and maintenance, and real estate concerns.

3.4 Array of Alternatives

Alternative plans are sets of one or more FRM measures functioning together to address one or more planning objectives within the constraints. Throughout this study, multiple planning process iterations to formulate alternative plans have been performed. The first iteration was conducted at the start of the study using readily available data and existing knowledge to consider, evaluate, and screen potential measures and identify the initial alternatives. A second and third iteration, based on new data, approximate modeling, and evaluations, were completed to identify the final array of alternatives, and reduce uncertainty to the extent practicable. A final iteration used the results of detailed modeling to identify the TSP. Following public review of the draft report, optimization of the TSP will be conducted to refine the plan and further reduce uncertainties.

Following the development and screening of measures, detailed descriptions of an array of alternatives were developed to specify how each alternative could be implemented using the FRM measures carried forward. At this point, alternative plans and conceptual-level engineering designs were developed to a level of detail appropriate for this phase of the study process.

Different combinations of measures were formulated in the initial array of alternatives based on evaluation criteria including:

- First-hand experience from the NFS on how effective existing non-federal levees have performed during flood fights.
- Hydrology data demonstrating a large difference in water flows between the gages upstream versus downstream of Lake Kampeska.
- The number of structures impacted by existing conditions along the left and right bank of the Big Sioux River within the center of the city.

Considering these initial criteria, the PDT and NFS identified the 13 alternatives listed below in Table 19. These alternatives consisted of different combinations of seasonally lowering Lake Kampeska, widening the Big Sioux River, constructing earthen levees, and nonstructural measures.

Table 19: Initial Array of Alternatives

Alternative	Measures Included	Description
1	A	No Action
2	D, E	Channel widening + Levee Right/Left Banks
3	D, F	Channel widening + Levee Left Bank Only
4	D, G	Channel widening + Levee Right/Left Banks w/ Closure Structures.
5	C, D	Lowering Lake Kampeska + Channel Widening
6	C, E	Lowering Lake Kampeska + Levee Right/Left Banks
7	C, F	Lowering Lake Kampeska + Levee Left Bank Only
8	C, D, F	Lowering Lake Kampeska + Channel Widening + Levee Left Bank Only
9	C, D, E	Lowering Lake Kampeska + Channel Widening + Levee Right/Left Banks
10	C, D, G	Lowering Lake Kampeska + Channel Widening + Levee Right/Left Banks w/ Closure Structures
11	C, G	Lowering Lake Kampeska + Levee Right/Left Banks w/ Closure Structures
12	N	Nonstructural
13	C	Lowering Lake Kampeska

This initial array of alternatives was compared, rated, and screened against the decision criteria that were developed based on federal and study objectives. The decision criteria included constructability and cost, lowering flood risk, induced damages, avoiding adverse environmental and cultural resource impacts, providing benefits to disadvantaged communities, and the NFS's ability to acquire necessary land. Based on these decision criteria, 10 alternatives were carried forward for further analysis and comparison (Table 20). Alternative 11 was optimized (into Alternatives 11a, 11b, and 11c) to review effects of different levee heights in combination with seasonally lowering Lake Kampeska.

Table 20: Interim Screening of Alternatives

Alternative	Description
1	No Action
6	Lowering Lake Kampeska to Elev 1718 + Levee Right/Left Banks (no closures)
7	Lowering Lake Kampeska to Elev 1718 + Levee Left Bank (no closures)
8	Lowering Lake Kampeska to Elev 1718 + Channel Widening + Levee Left Bank (no closures)
9	Lowering Lake Kampeska to Elev 1718 + Channel Widening + Levee Right/Left Banks (no closures)
10	Lowering Lake Kampeska to Elev 1718 + Channel Widening + Levee Right/Left Banks (all 4-foot closure structures)
11a	Lowering Lake Kampeska to Elev 1718 + Levee Right/Left Banks (all 4-foot closure structures)
11b	Lowering Lake Kampeska to Elev 1718 + Levee Right/Left Banks (one 3-foot closure structure)
11c	Lowering Lake Kampeska to Elev 1718 + Levee Right/Left Banks (two 3-4-foot closure structures)
12	Nonstructural standalone

Preliminary costs and economic benefits were developed for these 10 alternatives. As a result, the team further screened this list to remove alternatives 6, 9, 10, and 11a, due to much higher costs and lower economic benefits when compared to the other alternatives. The remaining six alternatives were carried into the final array, further analyzed and compared, and are described below.

3.4.1 Alternative 1 – No Action

The No Action Alternative (FWOP condition) is if no FRM measures were to take place. It is considered a baseline of comparison for action alternatives and also fulfills a NEPA requirement.

If action does not occur, the Big Sioux River will continue to flood within the vicinity of Watertown and the risks and damages would remain the same or increase. The City would continue to expend resources flood-fighting and rebuilding damaged infrastructure after each flood event. Flooding would continue to act as a barrier for access to critical facilities such as the hospital during flood events.

3.4.2 Alternative 7 – Seasonally Lowering Lake Kampeska to Elevation 1718 + Levee Left Bank (No Closures)

Alternative 7 (Figure 11) includes a combination of seasonally lowering Lake Kampeska and constructing an earthen levee along the left bank. This alternative would examine altering the existing operations of Lake Kampeska to gain approximately 3,300 acre-feet of additional flood storage in the lake. The measure includes lowering the water surface elevation of Lake Kampeska before winter to elevation 1718 feet NAVD88. Full pool for Lake Kampeska is 1718.8 feet NAVD88, so this measure would lower the lake by 0.8 feet each fall. Lowering the lake

elevation in the fall would allow storage to be available for spring runoff. This would lessen downstream impacts by avoiding higher winter releases.

The full pool elevation would return to 1718.8 feet NAVD88 during the late spring, and summer lake levels would be expected to be similar to current conditions. This alternative would utilize the existing low-flow gates to lower Lake Kampeska. The Big Sioux River channel weir operation would need to be modified to draw the elevation down to 1718 feet which includes changing the portion of the existing weir where the flashboards are located. To draw the pool down 0.8 feet is estimated to take approximately 80 days with a discharge of 22 cfs.

The left bank levee, approximately 4,435 feet-long (0.84 miles) would start near West Kemp Avenue and extend south where it would tie off just north of US-212. The levee alignment would generally follow the existing flood-fight measures to minimize disturbance. On average, the embankment would be two-to-four-feet tall with a twelve-foot-wide gravel surfaced crest and 1:3 side slopes. The left bank levee would require the excavation of approximately 9,800 cubic yards (cy) to remove the existing discontinuous existing berm. This material would then be mixed with approximately 4,000 cy of clean, clay loam from a borrow source and then shaped and graded to construct the levee alignment. The existing berm is made of well-graded sand, underlain by Pierre Shale (characterized as fat clay); this material is suitable to reuse for construction of the new levee. Clearing and grubbing existing vegetation would occur within the levee footprint, and woody vegetation would be removed 15 feet on either side of the levee toe. The area encompassed by the levee footprint and the additional 15 feet on either side would perpetually inhibit the growth and establishment of woody vegetation in accordance with ER-1110-2-1913. NNBF that would be incorporated include native herbaceous plantings within the levee footprint and 15 feet on either side.

A flood wall would be built in the center of the levee alignment in order to avoid the Watertown Iron and Metal facility which is a documented REC under the Phase I HTRW Assessment (USACE, 2023). The flood wall would be 1,287-feet-long, two-feet-high, and one-foot-wide. The wall would be a cast-in-place reinforced-concrete T-shaped wall and would be designed to resist the hydrostatic and dynamic flood pressures. The foundation of the wall would extend 4.5 feet below grade for protection from frost heave. Waterstops would be provided between wall segments. Additionally, all six storm sewer crossings on the left bank are each planned to be replaced with a 36-inch pipe and a gatewell.

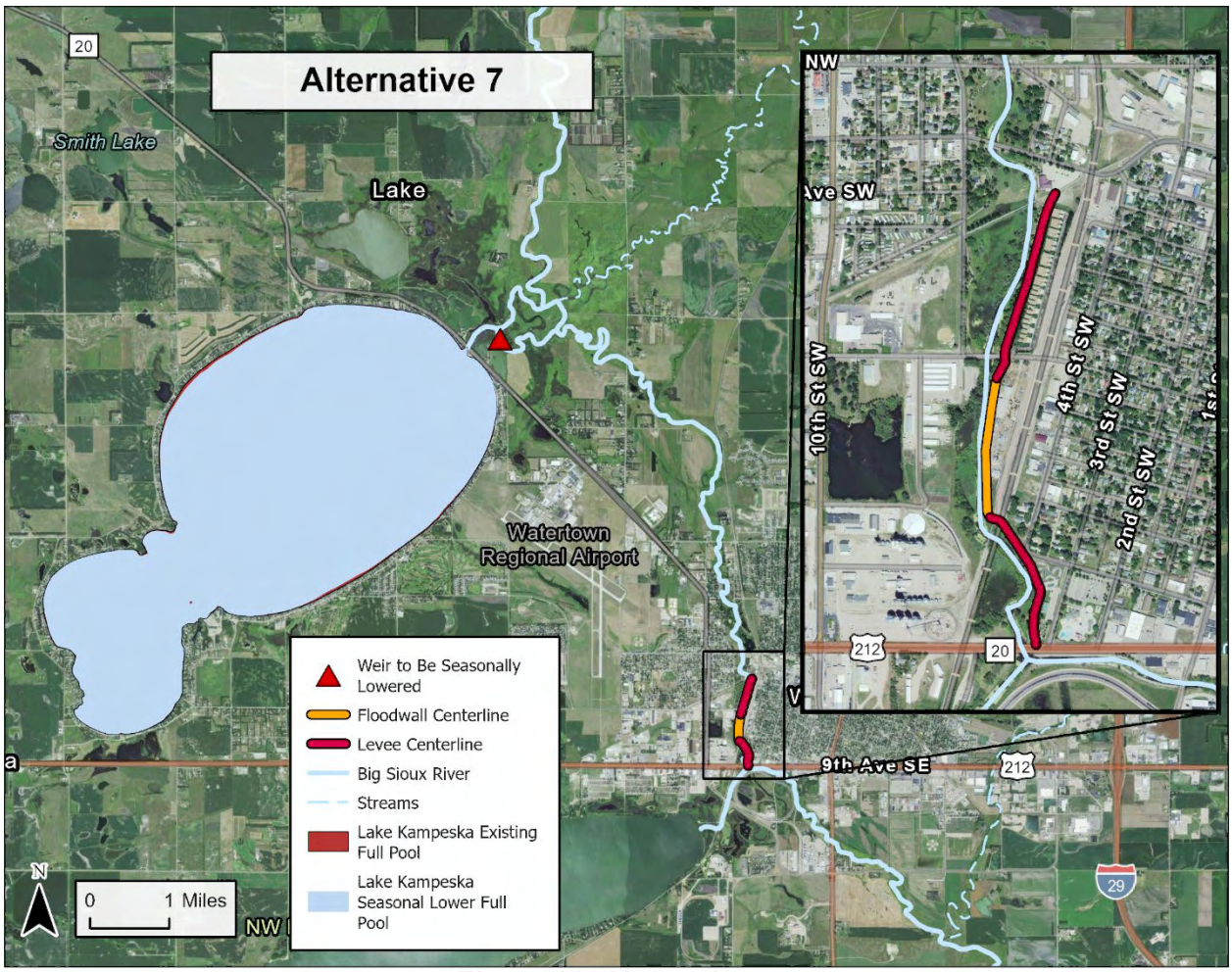

Figure 11: Alternative 7

3.4.3 Alternative 8 - Seasonally Lowering Lake Kampeska to Elevation 1718 + Channel Widening + Levee Left Bank (no closures)

Alternative 8 (Figure 12) would be similar to Alternative 7, but with the addition of channel widening. This alternative includes Alternative 7's features of seasonally lowering Lake Kampeska and constructing an earthen levee along the left bank of the Big Sioux River with a T-shaped flood wall protecting the Watertown Iron and Metal facility. Alternative 8's channel widening component consists of widening the Big Sioux River starting just north of 14th Avenue and continuing south past US-212, where it crosses both 5th Street and 20th Avenue and ends approximately 1,600 feet south of the 20th Avenue bridge. The channel would be widened approximately 50 feet to the east and west and would start approximately 3-3.5 feet above the invert of the existing channel. The existing channel bed would be retained to an approximately 50-feet-wide and three-feet deep low-flow channel which would allow for better fish passage and assist with limiting sedimentation. The total length of the BSR that would be widened is approximately 24,366 feet (4.6 miles) and would require the excavation of approximately 296,100 cy of material. Additionally, all six storm sewer crossings on the left bank would be replaced with a 36-inch pipe.

NNBF incorporated into channel widening would consist of maintaining a low-flow channel and installing boulder clusters throughout. Boulder clusters are simple, low risk, add visual appeal, and provide proven ecological benefit to aquatic life in uniform reaches of river. Boulder placement is a common method of fish habitat improvement which provides in-stream cover.

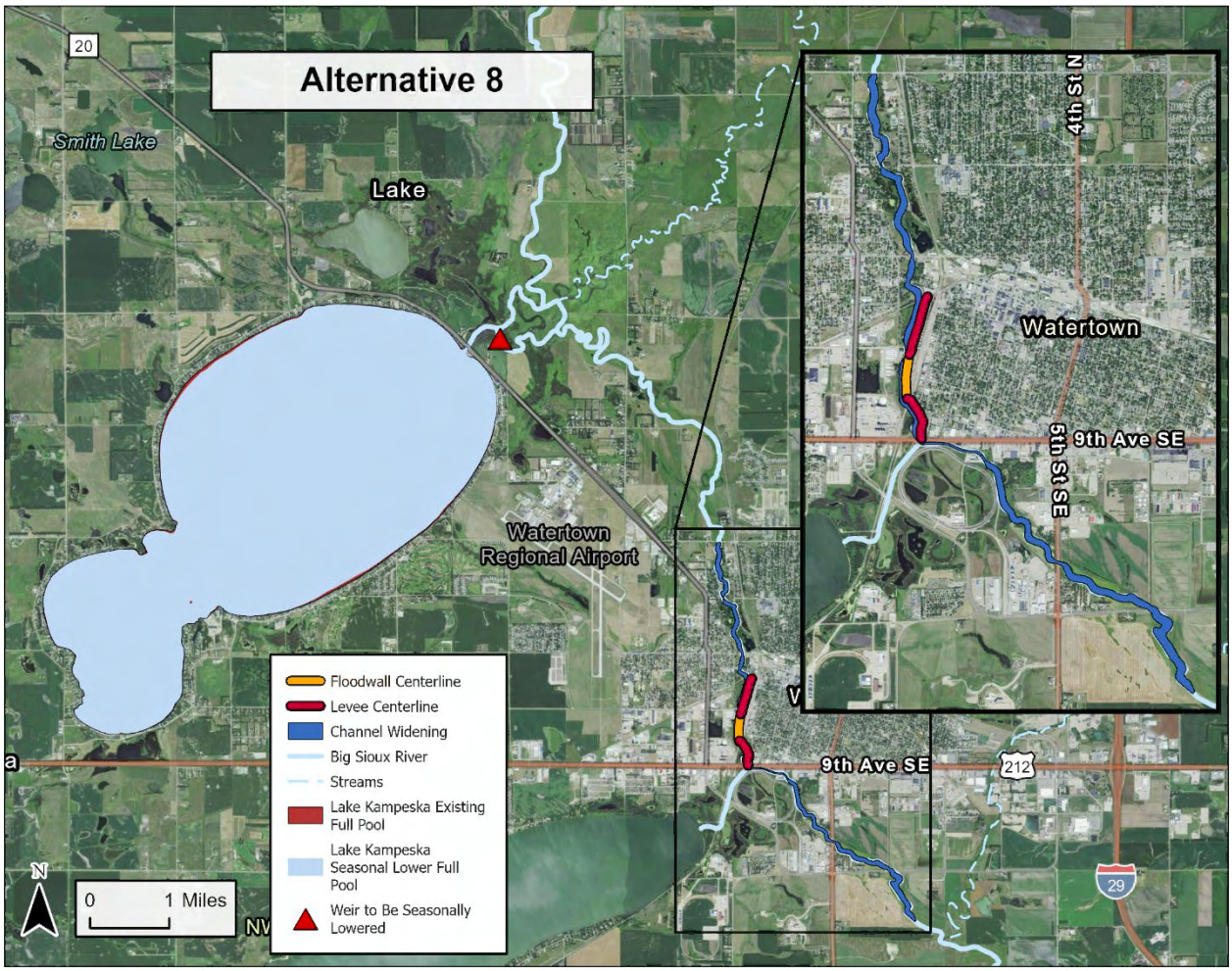

Figure 12: Alternative 8

3.4.4 Alternative 11B - Seasonally Lowering Lake Kampeska to Elevation 1718 + Levee Right/Left Bank (one 3-foot closure structure)

Alternative 11B (Figure 13) is an optimized version of constructing earthen levees along both the left and right banks of the Big Sioux River combined with seasonally lowering Lake Kampeska to an elevation of 1718 feet. The left bank levee and floodwall would be constructed the same as described above for Alternatives 7 and 8. The right bank levee, approximately 14,208 feet (2.7 miles) long, would start just north of 14th Avenue and extend south until tying off before the BNSF railroad crossing. On average, the embankment would be five to seven feet tall with a 12-foot-wide gravel surfaced crest and 1:3 side slopes. A right bank levee would require a cut of approximately 46,000 cy to remove the existing discontinuous embankments and require approximately 96,700 cy of fill for construction.

A T-shaped flood wall would be constructed around a mobile housing community. The flood wall will be 300 feet long, 5.25 feet high, and one foot wide. The wall would be a cast-in-place reinforced-concrete T-shaped wall and would be designed to resist the hydrostatic and dynamic flood pressures. The foundation of the wall would extend 4.5 feet below grade for protection from frost heave. Waterstops would be provided between wall segments. Additionally, according to the current plan, all six storm sewer crossings on the left bank and 17 crossings on the right bank would be replaced with a 36-inch pipe and a gatewell until more information on existing structures is gathered and the proposed plan can be optimized.

Due to the height of the levee, one permanent post and panel closure structure would be installed at 3rd Avenue. This closure structure would be 3 feet tall by 45 feet wide by 63 feet long. The remaining roadway crossings would utilize HESCO® barriers (or similar) set to a height of three feet or shorter.

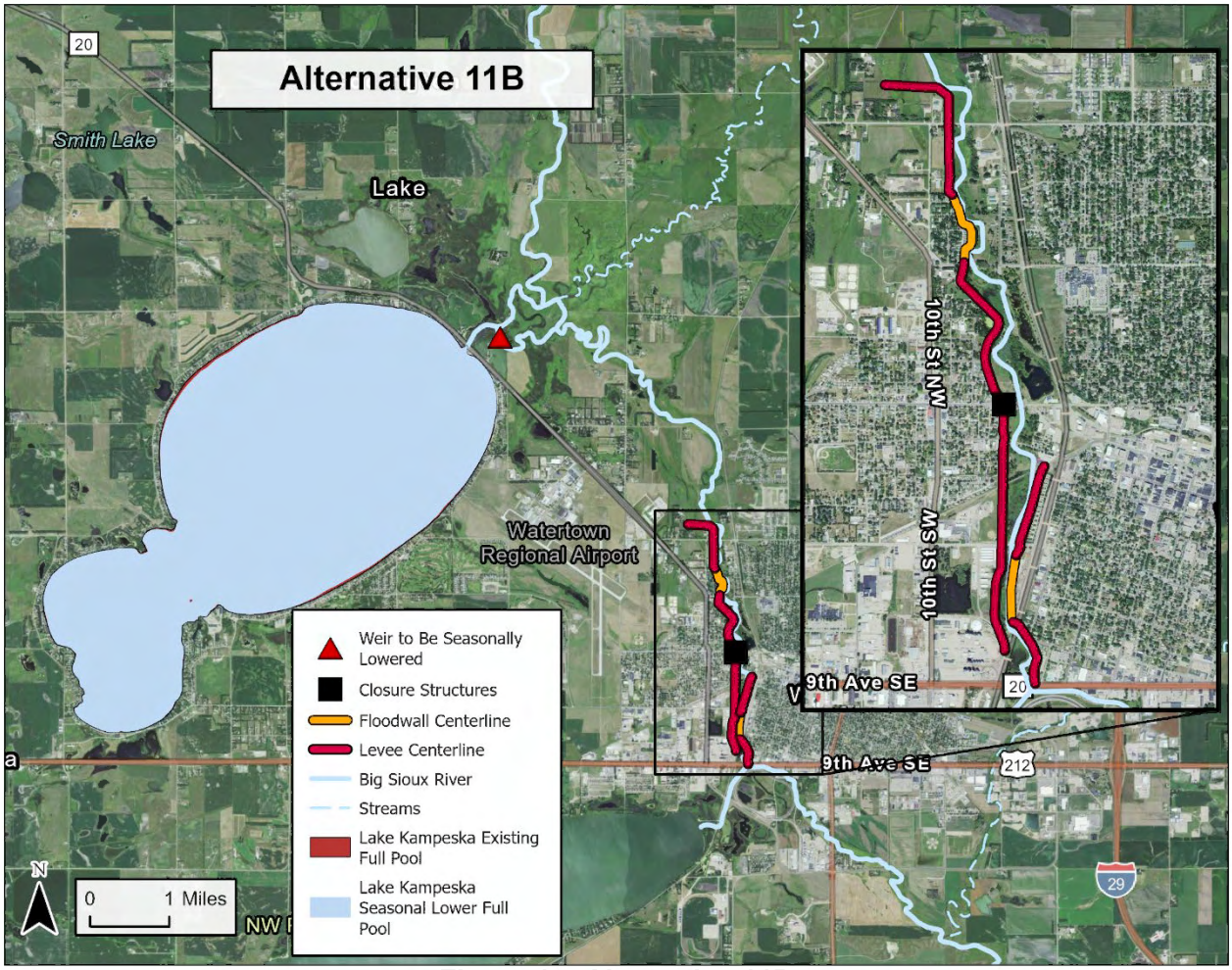

Figure 13: Alternative 11B

3.4.5 Alternative 11C - Seasonally Lowering Lake Kampeska to Elevation 1718 + Levee Right/Left Bank (two 3-4ft closure structure)

Alternative 11C (Figure 14) is very similar to 11B except the levees would be constructed one foot higher and would require closure structures at West Kemp Avenue and 3rd Avenue along

the right bank levee alignment. This right bank levee configuration would require a cut of approximately 46,000 cy to remove the existing discontinuous embankments and require approximately 116,700 cy of fill for construction.

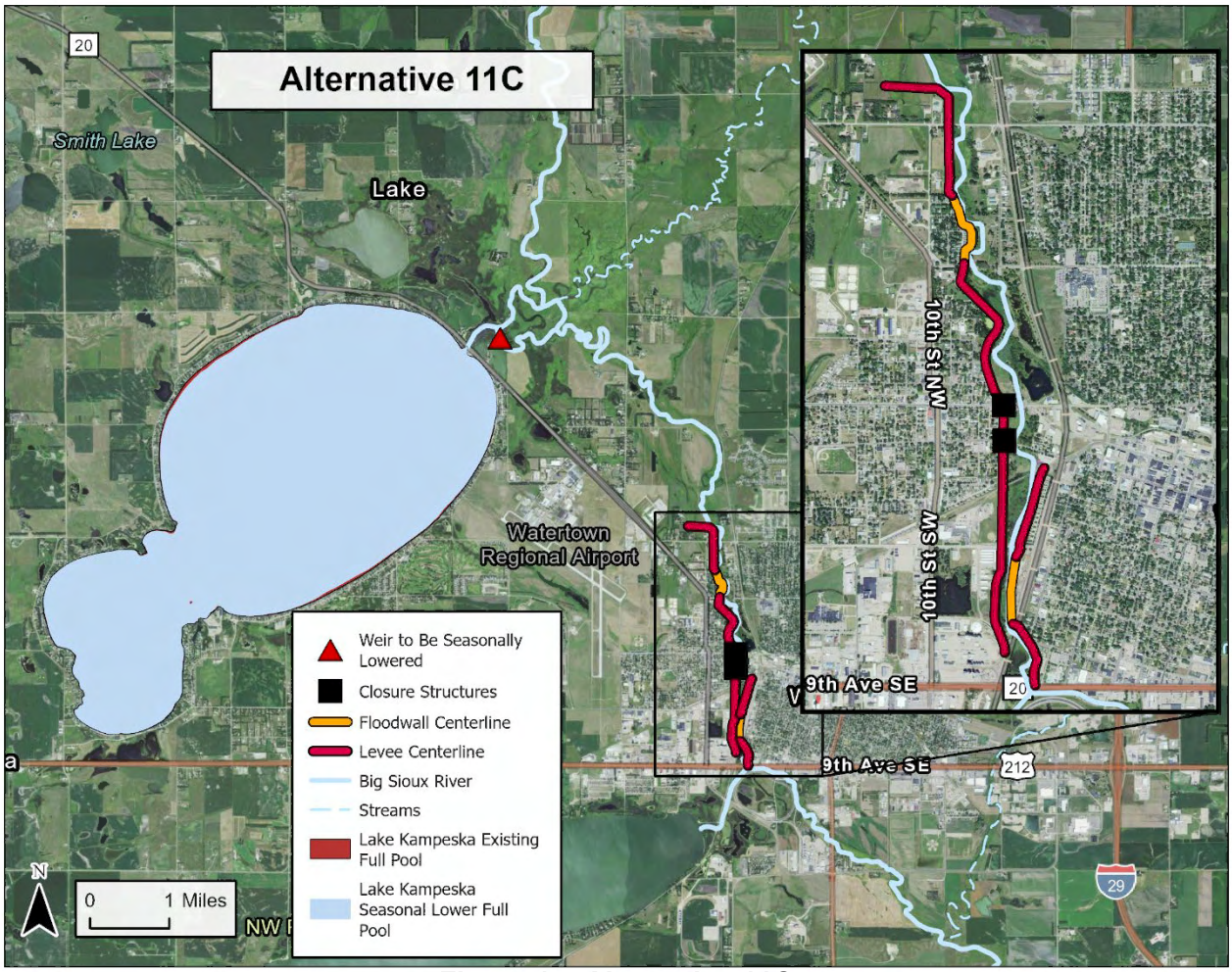

Figure 14: Alternative 11C

3.4.6 Alternative 12 - Nonstructural

Alternative 12 (Figure 15) is an optimized nonstructural-standalone alternative which analyzed elevation, dry floodproofing, wet floodproofing, and buyouts/relocations throughout the study area. The damage reaches were constructed so that each reflected a logical aggregation of structures, based on flooding source and political boundaries, with the different flood plains used to find the optimized aggregation within the reach, based on flooding characteristics. Critical infrastructure was considered, but none ended up in the final array.

Based on the analysis of this standalone alternative, no other alternatives currently include nonstructural measures; however, they will be considered during optimization to potentially address residual damages and/or economically disadvantaged communities.

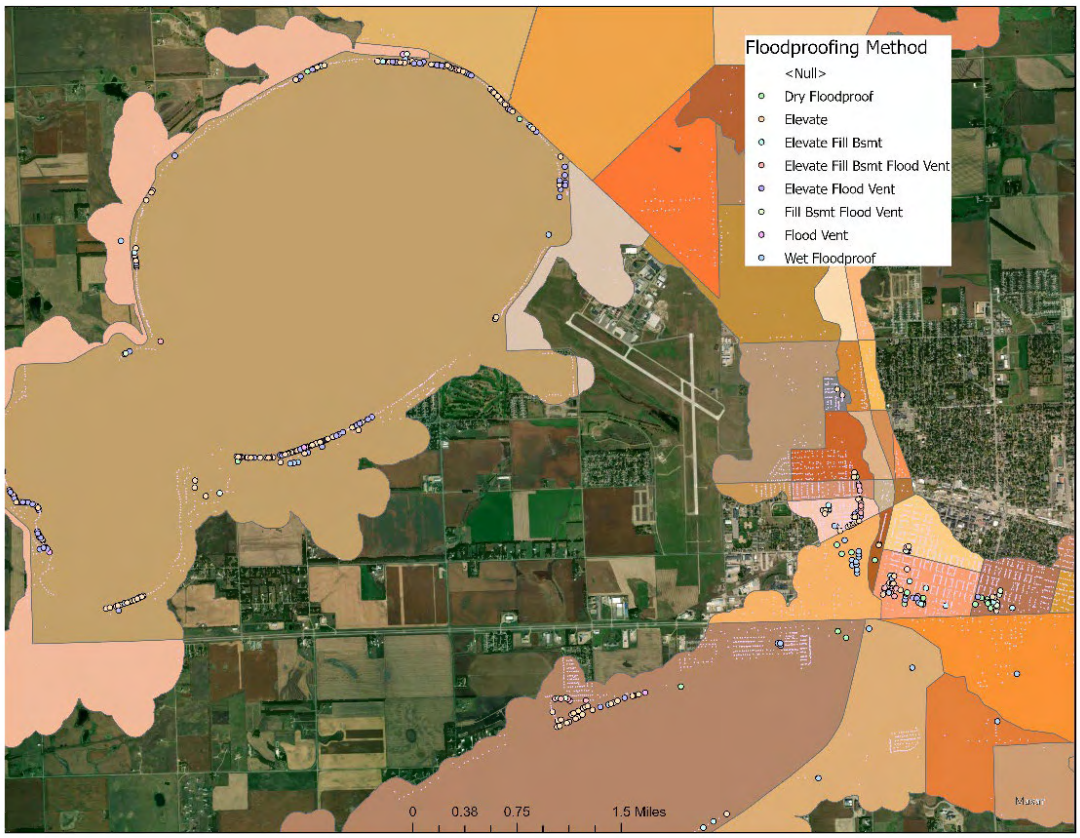

Figure 15 – Alternative 12 Nonstructural Areas evaluated

3.5 Plan Evaluation

The final array of alternatives was evaluated by comparing the FWP and FWOP conditions. The evaluation included comparing the alternatives against the federal and study objectives, the P&G criteria, the four accounts, and risks and uncertainties. A summary of the comparison and evaluation is in sections 3.5.1 to 3.5.4.

3.5.1 Federal and Study Objectives

Table 21: Federal and Study Objectives Comparison

Objectives	Alt. 7	Alt. 8	Alt. 11B	Alt. 11C	Alt. 12
Federal Objectives					
Provide contributions to NED consistent with protecting the Nation's environment, pursuant to federal environmental statutes, applicable executive orders, and other federal planning requirements.	Y	Y	N	N	N
Incorporate NNBF in compliance with Section 1184 of the WRDA 2016, and subsequent policy guidance.	Y	Y	Y	Y	N

Objectives	Alt. 7	Alt. 8	Alt. 11B	Alt. 11C	Alt. 12
Study Objectives					
Reduce the damages and severity of flooding within the vicinity of Watertown.	Y	Y	Y	Y	P
Reduce health and life safety impacts from flooding within the vicinity of Watertown.	Y	Y	Y	Y	Y
Reduce cost and frequency of deploying emergency response efforts during flood events.	P	Y	Y	Y	P
Provide benefits and avoid disproportionate impacts to the underserved and economically disadvantaged communities within Watertown and Lake Traverse Reservation.	Y	Y	Y	Y	N
Reduce the number of structures within the floodplain in Watertown.	P	Y	Y	Y	P
Increase resiliency of infrastructure to flooding within the vicinity of Watertown.	Y	Y	Y	Y	Y

Y = Yes, P = Potentially, N = No

3.5.2 P&G Criteria – Effectiveness, Efficiency, Acceptance, and Completeness

All the alternatives within the final array except Alternative 1 (No Action) meet the P&G criteria for effectiveness, efficiency, acceptance, and completeness. The alternatives may differ in level of protection and efficiency, but they all lower flood risk and are complete, standalone actions.

3.5.3 System of Accounts – NED, EQ, RED, and OSE

3.5.3.1 NED Account

Economic costs and benefits resulting from a project are evaluated in terms of their impacts on national wealth, without regard to where in the United States the impacts may occur. NED benefits must result directly from a project and must represent net increases in the economic value of goods and services to the national economy, not simply to a locality. NED costs represent the costs of diverting resources from other uses in implementing the project, as well as the costs of uncompensated economic losses resulting from detrimental effects of the project.

NED benefits, the BCR, and the net NED benefits are calculated during the evaluation process. Net benefits represent the amount by which the NED benefits exceed NED costs, thereby defining the plan's contribution to the Nation's economic output. The plan with the highest net benefits is often considered to be the NED plan, assuming technical feasibility, environmental soundness, and public acceptability. Note that the plan with highest net benefits is not necessarily the plan with the highest BCR. The BCR helps identify which plans have likely economic feasibility and can be carried forward for further analysis but is not decisive in identifying the NED plan from among those plans that are economically feasible.

Table 22 below analyzes the final array of alternatives across the NED account which includes total first costs, average annual costs, average annual benefits, BCR, and net NED benefits.

Table 22: NED Account Comparison

Alternatives	NED Account				
	Total First Costs	Average Annual Costs	Average Annual Benefits	BCR	Net Benefits
1	N/A	N/A	N/A	N/A	N/A
7	$14,035,874	$536,040	$582,280	1.09	$46,240
8	$22,934,329	$947,650	$1,034,920	1.09	$87,270
11B	$44,401,229	$1,708,140	$915,540	0.54	-$792,600
11C	$49,431,360	$1,822,770	$960,360	0.53	-$862,410
12	$139,863,000	$5,197,000	$655,000	0.13	-$4,542,130

3.5.3.2 RED Account

The RED account displays changes in the distribution of regional economic activity such as income and employment. Under the RED account, the study analyzed both direct and secondary impacts related to expenditures, local economic output, and job creation for each alternative. Alternative 7 had the lowest expenditures, local economic output, and job creation. Alternatives 8, 11B and 11C all had similar expenditures, output, and job creation. Alternative 12 is the most costly alternative which results in the highest economic output and job creation. See Table 23 below for a full comparison of the final array of alternatives under the RED account.

Table 23: RED Account Comparison

Alternatives	RED Account		
	Expenditures	Local Economic Output	Jobs (Full-time Equivalence)
1	N/A	N/A	N/A
7	$7,155,351	$8,185,480	75.3
8	$25,010,299	$28,610,936	263.0
11B	$27,190,730	$31,105,277	285.9
11C	$30,368,684	$34,740,748	319.4
12	$126,568,809	$144,790,440	1,331

3.5.3.3 EQ Account

The EQ Account measures contributions and/or impacts to the natural environment and cultural resources. Projects are required to be formulated to avoid, minimize, or mitigate adverse environmental and cultural resource impacts. The team reviewed all the alternatives within the final array and compared impacts.

Of the structural alternatives in the list (i.e., not including the No Action and Nonstructural alternatives), Alternatives 7 and 8 had the least environmental impacts. Alternatives 7 and 8 had similar wetland impacts but Alternative 7 has less overall environmental impacts due to a much smaller construction footprint. Alternative 8 will incorporate more nature-based features into its design though, which includes wetland plantings and in-stream boulder clusters.

Alternatives 11B and 11C have much higher impacts to wetlands and overall environmental impacts due to the much larger footprint associated with the right bank levee. Alternative 12 would not have any environmental impacts since it only includes nonstructural measures on existing structures. For effects to aesthetics, alternatives 7 and 8 would have the lowest impact and alternatives 11B and 11C having the highest impact due to the length and impact of the right levee embankment. The effects to aesthetics from alternative 12 could be both low or high depending on the type of nonstructural measure so it was given a rating of medium. All the alternatives would potentially have some impacts to cultural resources which includes both historic properties and other culturally significant areas. Alternative 12 would potentially have the highest impacts due to the age of the proposed structures that would require a nonstructural solution. Table 24 below summarizes the final array of alternatives compared to EQ account metrics.

Table 24: EQ Account Comparison

Alternatives	EQ Account			
	Wetland Impacts (acres)	Total Environmental Impacts (AAHUs)	Effects to Aesthetics	Impacts to Cultural Resources
1	0	N/A	N/A	N/A
7	0.05	-2.16	Low	Medium
8	0.05	-3.26	Low	Medium
11B	1.57	-3.97	High	Medium
11C	1.76	-4.22	High	Medium
12	0	N/A	Medium	High

3.5.3.4 OSE Account

The OSE account displays plan effects on social aspects such as life safety, economic vitality, and community resilience or vulnerability. Life safety includes the estimation of the population at risk and associated statistical parameters for life loss. Economic vitality benefits are quantified by the number of commercial and industrial structures that are removed from a given flood plain. Community resilience or vulnerability considers how difficult it is for communities to recover after economic disasters such as a flood event. These events can be much more impactful for populations that are economically disadvantaged or experience repetitive flooding. Community resilience or vulnerability was quantified by the number of residential structures that are removed from a given floodplain.

Overall life safety risk for this study is low and for flood events under the 1% AEP it remains at zero for both day and night for all alternatives. For economic vitality, the commercial and industrial structures benefit most from alternatives 11B and 11C; however alternative 8 has very

similar protection with a lot less overall cost. For social vulnerability and resiliency, again alternatives 11B and 11C provide the most which is likely due to the proposed levee along the entire right bank. Alternative 8 provides approximately 15% less in social vulnerability and resiliency. Alternatives 7 and 12 provide the lowest numbers for both economic vitality and social vulnerability and resiliency.

Table 25: OSE Account Comparison at One-Percent AEP Floodplain

Alternatives	OSE Account			
	Life Safety Risk (Population at Risk at Day/Night*)		Economic Vitality (Structures**)	Social Vulnerability and Resiliency (Structures**)
1	Day: 0	Night: 0	N/A	N/A
7	Day: 0	Night: 0	29	144
8	Day: 0	Night: 0	95	408
11B	Day: 0	Night: 0	108	476
11C	Day: 0	Night: 0	108	476
12	Day: 0	Night: 0	68	338

**Average Life Loss for 1% AEP Event*
***Number of structures removed from the 1% AEP floodplain.*

3.5.4 Risk and Uncertainty

A risk register was developed at the beginning of the study documenting all initial risks and uncertainties for each technical discipline. This list was expanded and modified throughout the study as new information was received. A description of risks for each alternative and assigned risk rating is provided below.

3.5.4.1 No Action Alternative

The risks with the No Action Alternative are the same risks that exist currently which is the increasing probability of flood events occurring and increased damages to structures within the floodplain.

3.5.4.2 Alternative 7

The risks with Alternative 7 include limited flood protection along the right bank of the river and flanking along the left bank after a two-percent AEP event. These risks increase with the size of the flood event. The advantages of Alternative 7 include significantly lower costs and positive net NED benefits; however, there are higher risks at the larger flood events.

3.5.4.3 Alternative 8

There are four main risks identified specifically for Alternative 8 which include the hydraulic capacity of channel widening, sedimentation, hydrology for single population analysis, and induced damages from levees. Hydrology for single population analysis and induced damages from levees were both given a risk rating of low and will be further examined during optimization.

The hydraulic capacity of channel widening, and threat of increased sedimentation were both given a risk rating of high. The current hydraulic capacity of channel widening utilizes a two-stage channel; however, additional channel configurations will need to be simulated in order to determine capacity changes. Reviewing the hydraulic capacity will also be necessary to manage the risk of sedimentation in addition to completing a Sedimentation Channel Capacity Analysis. The additional analysis will be completed during optimization to lower risks.

3.5.4.4 Alternatives 11B & 11C

The highest risks with Alternative 11B and 11C are the possibility of induced damages downstream at flood events larger than the one-percent AEP. The current calculations are extremely minimal and show less than one foot of added flooding on structures; however, if this alternative is carried forward as the TSP, then additional model refinements would be completed during optimization.

3.5.4.5 Alternative 12

The risks identified for Alternative 12 include lack of economically justified options and buy-in from the landowners. Costs for nonstructural measures has risen considerably, making it challenging to find economically justified solutions. Landowners also may not want to participate in a nonstructural alternative due to the cost-sharing requirements.

4 ENVIRONMENTAL EFFECTS AND CONSEQUENCES

A qualitative assessment of the final array of alternatives was conducted to analyze and consider environmental impacts to resources within the study area during the decision-making/screening process. The No Action Alternative is consistent with FWOP conditions, which is the baseline from which to compare all alternatives.

Pursuant to NEPA, this chapter addresses the impacts in proportion to their significance (40 CFR § 1502.2.b, 2019). Significance requires consideration of context and intensity (40 CFR § 1508.27, 2019). The depth of analysis of the alternatives corresponds to the scope and magnitude of the potential environmental impact. Impacts are considered to be any adverse or beneficial consequences on the human or natural environment caused by the implementation of an action and include any irreversible or irretrievable commitments of resources should the action be implemented.

In addition, impacts on the human and natural environment can be direct or indirect. Direct impacts are those that are caused by the action and occur at the same time and place (40 CFR § 150.8.8.a, 2002). Indirect impacts are those that are caused by the action and are later in time or farther removed in distance but are still reasonably foreseeable (40 CFR § 1508.8.b, 2002). 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.

The terms "adverse" and "beneficial" are used in this document with respect to impacts from the proposed action:

Adverse – is a negative impact on the human, natural, and/or physical environment.

Beneficial – is a positive impact on the human, natural, and/or physical environment.

For the purposes of this analysis, to assist in describing the context, impact duration is classified as short-term or long-term:

Short-term – Temporary impacts caused by the construction and/or implementation of an alternative.

Long-term – Impact persists after the action has been completed and/or after the action is in full and complete operation.

From the purposes of this analysis, the magnitude of impacts is classified as negligible, minor, moderate, or significant:

Negligible – A resource was not affected, or the effects were at or below the level of detection; changes were not of any measurable or perceptible consequence.

Minor – Effects on a resource were detectable, although the effects were localized, small, and of little consequence to the sustainability of the resource.

Moderate – Effects on a resource were readily detectable, long-term, localized, and measurable.

Significant – a substantial, or potentially substantial, change to a resource at a degree which the majority of the resource will either be eliminated or unable to stabilize and will continue to decline.

4.1 Physical Environment

4.1.1 Climate, Greenhouse Gases, and Air Quality

No Action Alternative

Under the No Action Alternative, no federally funded construction activities related to FRM would occur within Watertown and thus no direct impacts to the climate, greenhouse gas (GHG) emissions, and air quality would result; however, it is likely that indirect effects to GHG emissions and air quality would result as the City of Watertown and other responding entities would continue to conduct flood fighting measures or pursue other funding sources to construct an FRM project. These effects would be unquantifiable, but presumed temporary, lasting the duration of flood flighting or potential construction. The No Action Alternative would not address the purpose and need of the project.

All Action Alternatives

Structural Alternatives 7, 8, 11B, and 11C would result in a temporary increase of emissions from constructing levee alignments, and for Alternative 8, construction of channel widening. These activities would involve the use of heavy machinery. Alternative 7 has the lowest net GHG emissions of the structural alternatives with a net total of 411 metric tons of CO_2 equivalent. Alternative 8 has the greatest GHG emissions as a result of channel widening activities, with a net total of 4,149 metric tons of CO_2 equivalent produced over the 50-year period of analysis. This is equivalent to the annual emissions of approximately 900 passenger cars and would not significantly, adversely affect the climate. The nonstructural Alternative 12 produces the least emissions. See Appendix G4 for a detailed analysis on GHG emissions.

Table 26. Fifty-Year Greenhouse Gas Emissions from Action Alternatives

Alternative	CO_2 Emissions (metric tons)	CH_4 Emissions (kg)	N_2O Emissions (kg)	CO_2 Equivalent Emissions (metric tons)
7	394	95.08	48.77	411
8	4,051	380.86	297.55	4149
11B	2,052	192.98	150.76	2102
11C	2,494	234.47	183.18	2554
12	55	5.13	4.01	56

If any of the action alternatives are implemented, it is anticipated localized emissions from construction equipment may temporarily and minimally affect air quality; however, best management practices (BMPs) such as powering off equipment while not in use, would be implemented to reduce impacts to air quality. The temporary operation of construction machinery (scrapers, front-end loaders, all-terrain vehicles, trucks, etc.) would not negatively attribute to the overall air quality. It is anticipated that air quality conditions would return to ambient levels associated with the existing conditions upon completion of construction activities as no impacts to the climate, GHG, or air quality would occur from operations and maintenance (O&M) activities. Therefore, impacts to the localized project area as a result from any activity of any proposed action alternative is determined to be minor and short-term.

The increased level of flood protection from all action alternatives increases community climate resiliency to the climate trend of increased potential for catastrophic flooding detailed in the Fourth National Climate Assessment (Frankson et al., 2022).

4.1.2 Geology and Soils

4.1.2.1 No Action Alternative

Under the No Action Alternative, no construction/demolition, staging, or land use changes would occur from a federally funded project so no direct impacts to the geology and soils within the study area would occur; however, these types of effects may occur indirectly as the City of Watertown would continue to conduct flood fighting, cleanup activities from flood damage, and seek other sources of funding to construct an FRM project. Additional indirect effects to soils from persistent flooding would continue to result in erosion from floodwater damages.

4.1.2.2 All Structural Alternatives

Structural Alternatives 7, 8, 11B, and 11C with constructing levee alignments, would require extensive grading, and cut and fill activities. Under Alternatives 7 and 8, the 0.84-mile-long left bank levee would be, on average, a two-to-four-foot-tall, and 12-foot-wide gravel surface with a 1:3 sideslope. The left bank levee would require a cut of approximately 9,800 cy to remove the existing discontinuous embankments and approximately 13,800 cy fill for construction. Alternatives 11B and 11C would also include the left bank levee alignment and the additional effects from construction of the 2.7-mile-long right bank levee. Total cut and fill quantities for 11B and 11 C would require a cut of approximately 46,000 cy to remove the existing discontinuous embankments and require approximately 96,700 cy of fill for construction.

Alternative 8 would require an additional excavation of approximately 296,100 cy of material to widen approximately 4.6 miles of the Big Sioux River from just north of 14th Avenue to southeast of US-212. Should Alternative 8 be selected, it is not likely that material excavated from the channel would be suitable for levee construction.

Borrow areas would be required to obtain soil material. Two potential locations have been assessed for borrow: one site is located east of Watertown on Willow Creek, and another north of Watertown on Mud Creek. It was assumed the potential borrow area could also be utilized as the mitigation site. See Appendix G2 for additional information on these locations. Disposal areas would be required to place excavated material; this has not yet been identified. Access would be obtained using existing roads. Staging areas would also be required to contain all construction material. Staging sites and access areas would occur within the construction right of way.

Other minor and temporary impacts associated with these alternatives result from the use of typical earth-moving equipment to dig, grade, trench, and shape the soils during construction. Erosion BMPs such as silt fencing and natural fiber erosion control blankets would be utilized to lessen these effects. Soil would be disked and loosened and disturbed areas would be seeded with a native seed mix immediately following construction. Direct effects to soils under all structural alternatives are anticipated to be short-term and minor. No long-term, adverse effects to soils are anticipated. No impacts to geology, direct or indirect, are anticipated under any of the structural alternatives.

4.1.2.3 Nonstructural Alternative 12

The scope of this alternative identified multiple structures for elevating, flood venting, wet floodproofing, dry floodproofing, and buyouts/relocations. Excavation around the existing structure is anticipated to elevate the structure. Soil exposed during the excavation would be prone to erosion and sedimentation. Silt fences could be placed around the exposed/excavated soils to reduce the amount of soil transportation. After the structure is elevated, the disturbed soils should be properly compacted and regraded, as approved by the Geotechnical Engineer of Record, to allow proper drainage and water flow away from the structure. The regraded soil should be covered with approved vegetation to reduce the amount of erosion and sedimentation. Short-term and negligible impacts to soils would occur under Alternative 12 and no impacts are anticipated to geology.

4.1.3 Hydrology and Hydraulics

4.1.3.1 No Action Alternative

Under the NAA, no federally funded construction activities related to FRM would occur within the City of Watertown and thus no direct impacts to hydrology and hydraulics would result. However, it is likely that indirect effects would result as the City of Watertown and other responding entities would continue to conduct flood fighting measures or pursue other funding sources to construct a FRM project. These effects would be unquantifiable, but presumed temporary, lasting the duration of flood flighting or potential construction. The NAA would not address the purpose and need of the project.

4.1.3.2 All Structural Alternatives

Structural Alternatives 7, 8, 11B, and 11C with constructing levee alignments would have direct impacts on hydrology within the study area through reduction of flooding in areas where it occurs compared to FWOP conditions. Maps of the two-percent, one-percent, and 0.2-percent AEP inundation extents under each Alternative 7, 8, 11B, and 11C are provided in Economics Appendix F and Hydraulics Appendix B2. This array of maps highlights the impacts of levee(s) associated with each alternative when compared to the maps of existing conditions.

All structural alternatives also involve the seasonal lowering of Lake Kampeska, from full pool elevation 1718.8 feet to 1718.0 feet. These alternatives would see a marginal decrease in the lake footprint at full pool from fall to early spring, decreasing by approximately 1.2% from 5,060 acres to 5,000 acres.

4.1.3.3 Nonstructural Alternative 12

Alternative 12 would see buyouts and floodproofing measures applied to existing structures. There would be no impacts anticipated to hydrology or hydraulics under this alternative. There are no unique maximum inundation extents found in Hydraulic Appendix B1 for Alternative 12 because Alternative 12 is assumed to have the same results as the NAA Alternative 1.

4.1.4 Floodplain

Executive Order (EO) 11988 requires that federal agencies avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a

practicable alternative. In accomplishing this objective, "each agency shall provide leadership and shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities." This directive is reflected in USACE's Engineer Regulation 1165-2-26 I*mplementation of Executive Order 11988 on Flood Plain Management.*

4.1.4.1 No Action Alternative

Under the NAA, no federally funded construction activities related to FRM would occur within the City of Watertown. It is likely that the City of Watertown would continue to pursue other funding sources to construct a FRM project. Local floodplain regulations would continue to be implemented as described in Section 2.2.4. The NAA would not address the purpose and need of the project, and long-term, moderate adverse impacts to the floodplain would continue to persist.

4.1.4.2 All Structural Alternatives

Structural alternatives 7, 8, 11B and 11C with constructing levee alignments would have direct impacts to the floodplain within the study area through reduction of flooding in areas where it occurs compared to FWOP.

Maps of the 2%, 1%, and 0.2% AEP inundation extents under each Alternative 7, 8, 11B and 11C are provided in Economics Appendix F and Hydraulics Appendix B2. This array of maps highlights the impacts of levee(s) associated with each alternative when compared to the maps of existing conditions.

The structural alternatives 7, 8, 11B, and 11C meet Executive Order 11988 compliance. Alternatives 11B and 11C have shown the potential of induced flooding of less than 1 foot. These alternatives will need to be further evaluated to determine if they are injurious to the public.

4.1.4.3 Nonstructural Alternative 12

Alternative 12 would provide various non-structural measures applied to existing structures. There would be negligible impacts anticipated to floodplain under this alternative, due to removing or modifying existing structures within the floodplain.

4.1.5 Land Use

4.1.5.1 No Action Alternative

Under the NAA, there would be no federally funded FRM project. There is potential that the Sponsor would continue to seek other funding sources to construct a FRM project. Should no measures be taken to address flood risk within the community, long-term adverse impacts to the residential, urban, and agricultural land use categories within the study area may result from continued flooding.

4.1.5.2 All Structural Alternatives

Alternatives 7, 8, 11B and 11C with constructing levee alignments would traverse along mostly previously disturbed urban areas along the BSR. Parcels within the levee footprints would be acquired to construct the levee alignment, but all existing roadways would remain

connected through the study area. Overall, these alternatives would have a minor, long-term direct impact on land use.

Parcels landward of the levee alignments are predominantly residential and business properties, with some public parks. Construction of the levees would allow the landward parcels to remain in current use; however, parcels within the immediate footprint would be acquired for construction of the structural alternative. Overall, the alternative would have no significant indirect impacts to land use.

Prime farmlands, as described in Section 3.3.5 would be impacted by the levee footprints and channel widening. Acreages of impacts are shown in Table 27. No special farmland classifications which would be impacted under any action alternative are under current agricultural use.

Table 27. Impacts to Farmland Classifications

Alternative	Farmland Classifications Impacted (acres)		
	Not Prime Farmland	Prime Farmland if Drained	Prime Farmland if Irrigated
7	0.0	4.7	0.0
8	68.0	33.2	0.4
11B	2.6	17.7	1.5
11C	2.9	19.1	1.7

Once a recommended plan is selected, Farmland Conversion Impact Rating Forms will be prepared and sent to NRCS for Farmland Protection Policy Act compliance.

4.1.5.3 Nonstructural Alternative 12

In cases of buyouts and relocations as part of the nonstructural alternative, the parcel to be bought out would transition to an undeveloped, upland land use. This change in land use would be offset by conversion to developed land further away from the floodplain. Negligible impacts to land use would be expected from the nonstructural alternative.

4.1.6 Water Quality

4.1.6.1 No Action Alternative

Under the NAA, no federally funded FRM project would be implemented, and thus, no direct effects to water quality from construction activities would result. Long-term adverse effects to water quality may persist as the Big Sioux River continues to flood out of bank. As floodwaters move across the urbanized and agrarian areas of the floodplain, contaminants such as pesticides, road treatment chemicals, sediment, refuse, and debris may accumulated and be transported along the river. Additionally, the risks of releasing untreated stormwater and wastewater directly into the Big Sioux River would also continue to persist. The NAA does not support the project purpose and need.

4.1.6.2 All Structural Alternatives

Under Section 401 of the CWA, an applicant for a Federal license or permit (i.e. Section 404) must obtain a water quality certification (WQC) that the discharge and activity is consistent with State or Tribal effluent limitations (Section 301 of the CWA), water quality related effluent limitations (Section 302 of the CWA), water quality standards and implementation plans (Section 303 of the CWA), national standards of performance (Section 306 of the CWA), toxic and pretreatment effluent standards (Section 307 of the CWA) and "any other appropriate requirement of State or Tribal law set forth in such certification." South Dakota Department of Agriculture and Natural Resources (DANR) is the certifying authority for the study area. As discussed in Section 3.3.6, BSR and Lake Kampeska are listed as 303(d) impaired waters, with state-developed TMDL approved by USEPA.

The CWA requires preparation and submission of a general stormwater permit and preparation of a Stormwater Pollution Prevention Plan (SWPPP) before construction activities can begin. The SWPPP would be based on BMPs such as seeding and mulching bare slopes as soon as practicable and measures to contain spillage of any contaminants into waterways.

Alternatives 7, 8, 11B and 11C with constructing levee alignments would not cross any streams. Access would be obtained using existing roads. Construction of the levees may increase turbidity because of runoff; however, a SWPPP and BMPs would be used to minimize the amount. Such BMPs include but are not limited to: the use of erosion control fences; storing equipment and solid waste and petroleum products above the ordinary high water mark and away from areas prone to runoff and requiring that all equipment is clean and free of leaks. To prevent fill from reaching water sources by wind or runoff, fill would be covered, stabilized or mulched and silt fences used as required. Runoff not captured using BMPs would minimally increase turbidity. These effects would subside upon project completion and would revert to preconstruction conditions; therefore, adverse impacts to water quality would be minor and short-term.

Negligible effects to water quality from the seasonal lowering of Lake Kampeska as the target surface water elevation is within its normal band of operations.

Alternative 8 construction of the channel widening measure would temporarily increase turbidity; however, a WQC and SWPPP would be obtained from DANR, and BMPs would be used to minimize the turbidity. These effects would subside upon project completion and the newly vegetated channel banks would help decrease turbidity. These adverse impacts to water quality would be moderate and short-term, lasting the duration of construction. Minor, limited benefits to water quality from the installation of boulder clusters in the low-flow channel may occur as a result of providing a localized flow gradient which may improve certain water quality parameters like temperature in dissolved oxygen within these areas.

Although not specifically formulated for, all structural alternatives would incidentally result in long-term, minor improvements in water quality as they would decrease the inundation in developed areas under flood conditions. The decrease in floodwaters would decrease the load on Watertown's stormwater and wastewater systems, thereby decreasing the likelihood of untreated stormwater and wastewater discharges.

4.1.6.3 Nonstructural Alternative 12

Under the nonstructural alternative, no construction would occur within the immediate vicinity of streams. Floodproofing construction within each parcel would contain runoff through the use of BMPs. This alternative will not reduce erosion, sedimentation or stormwater runoff within the basin and therefore is not expected to impact water quality, adversely or beneficially.

4.1.7 Hazardous, Toxic, and Radioactive Waste (HTRW)

4.1.7.1 No Action Alternative

Under the NAA, no federally funded FRM project would be implemented, and thus, no direct effects to HTRW from construction activities would result. Long-term adverse effects to HTRW may persist as the Big Sioux River continues to flood out of bank. As floodwaters move across known RECs, these conditions may become disturbed, exposed, and the contaminants may spread. Additionally, new HTRW sites may form as a result of floodwaters moving across the urbanized and agrarian areas of the floodplain, disturbing areas that store or utilize contaminants and chemicals.

4.1.7.2 All Structural Alternatives

All alternatives with a left bank levee (7, 8, 11B, and 11C) have been designed with a floodwall segment along Watertown Iron & Metal (600 4th Avenue SW) to minimize the footprint and need for soil excavation in the vicinity of this HTRW. Excavated soil in the HTRW site vicinity if necessary would require testing for proper disposal or use, in accordance with all applicable regulations. The left bank levee would reduce flooding impacts to HTRW sites along the left/east portion of the study area.

All alternatives with a right bank levee (11B & 11C) would traverse the Watertown Sewer Line Project (LUST Trust) at the intersection of 4th Avenue SW and Kampeska Boulevard. The project design would minimize the footprint and need for soil excavation in the vicinity of this HTRW. Excavated soil in the HTRW site vicinity if necessary would require testing for proper disposal or use, in accordance with all applicable regulations.

4.1.7.3 Nonstructural Alternative 12

The nonstructural alternative would not impact any known HTRW. This alternative will require the Sponsor to be the responsible party for identifying underground storage tanks (USTs) and above ground storage tanks (ASTs) located within the project area. Location of USTs and ASTs will be completed during the PED phase of the project. USTs (including septic systems will be capped and covered and left in place), ASTs will be strapped down and secured in the floodway. Retrofitting of the USTs and ASTs will be designed in accordance with the FEMA guidance: *Engineering Principles and Practices for Retrofitting Flood-Prone Residential Structures (2012)*. Additionally, during the PED phase the Sponsor would conduct asbestos and lead based paint investigations as part of the Phase 1 review of each property to be elevated or floodproofed. Any property containing asbestos or lead based paint would be abated and disposed of properly. This alternative would not adversely impact hazardous and toxic materials located in the proximity of proposed project area, nor would it produce new hazardous and toxic materials.

4.1.8 Noise

4.1.8.1 No Action Alternative

Under the NAA, the current levels of noise in the study area will persist. See Section 2.2.7 for existing conditions.

4.1.8.2 All Action Alternatives

Temporary impacts due to increased construction noise may be experienced by nearby homeowners during the project construction. Construction activities will require the use of heavy construction equipment. An increase in road traffic and possibly traffic interruption can also be anticipated. Construction activities are temporary in nature and would last for approximately 8 months. Construction noise will typically only be generated Monday through Friday during normal working hours. Similarly, any noise from Operations, Maintenance, Repair, Replacement, and Rehabilitation (OMRR&R) activities, such as occasional mowing, would be negligible and short term. There will be no long-term adverse impacts associated with any alternative, as noise levels would return to ambient conditions.

4.1.9 Recreation

4.1.9.1 No Action Alternative

Under the NAA, no federally funded FRM project would be implemented, and thus, no direct effects to recreational activities or recreational traffic would occur from construction. Indirect impacts to recreation within flood prone areas in the form of periodic disruption and facilities damages may occur as a result of continued flooding and flood fighting response efforts. The Sponsor is likely to continue to pursue other funding sources to implement a FRM project, but the NAA would not address the project purpose and need.

4.1.9.2 All Structural Alternatives

Structural alternatives 7, 8, 11B and 11C with constructing levee alignments would traverse the city-owned parks and existing trails, therefore, would have moderate, short-term impacts on parks and recreation for the duration of construction activities. These construction impacts are anticipated to last approximately 8 months. Levee features would include incorporate trails on the top width and native plantings would increase the species diversity, providing long-term minor to moderate benefits to hikers, bikers, bird watchers, and wildlife viewers. Recreational features will continue be considered throughout plan optimization.

Other direct effects to recreation associated with all four structural alternatives result from the seasonal lowering of Lake Kampeska. Water-based and shoreline recreation activities would experience negligible disruption due to the lake pool elevations being lowered by 0.8 feet each fall. The resulting seasonally lowered full pool is shown in Figure 14. The target surface water elevation is within the band of normal operational levels at Lake Kampeska. Minor, short-term impacts to ice recreational activities may result for the duration of 80 days from the months of September through November for years when ice cover occurs early.

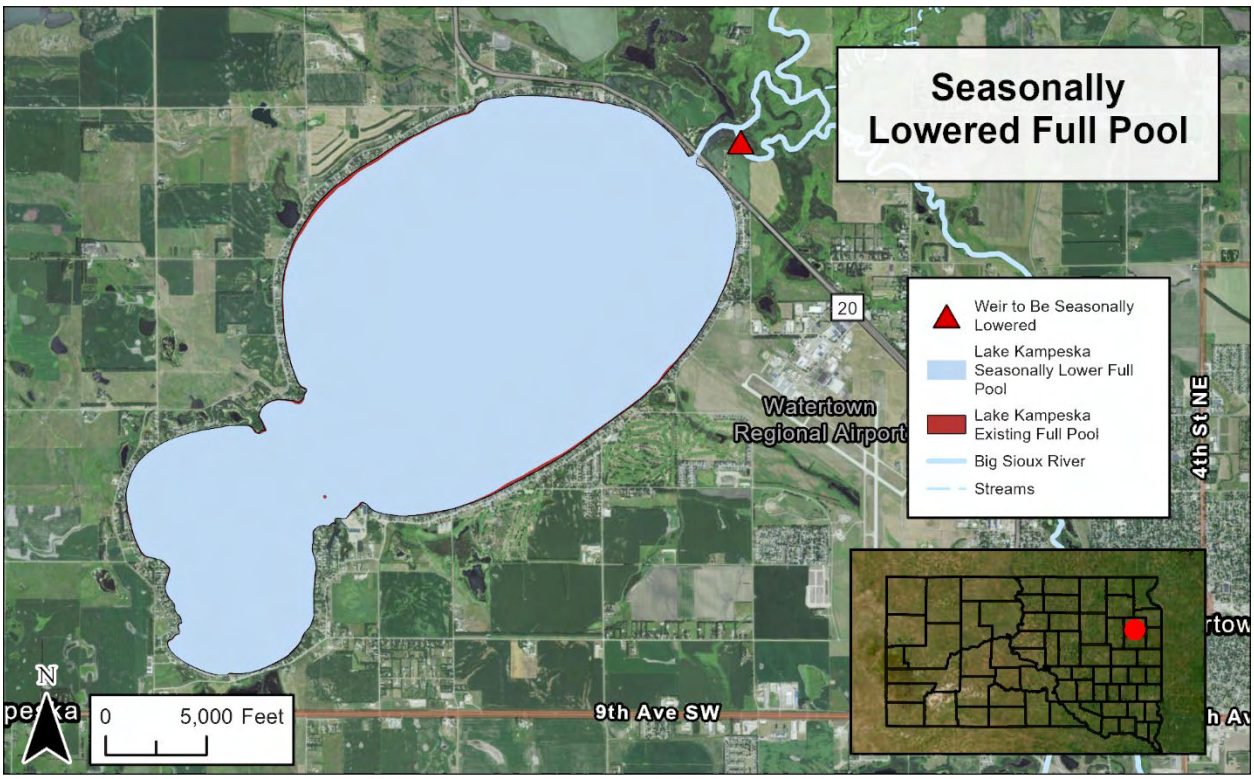

Figure 16 – Lake Kampeska Seasonally Lowered Full Pool

For Alternative 8, channel widening may provide long-term, minor benefits to fisherman as a result of incorporating NBS features such as the low-flow channel and boulder clusters that will provide localized enhancements to the aquatic conditions in the river.

4.1.9.3 Nonstructural Alternative 12

The nonstructural alternative would have no impacts on recreation.

4.1.10 Cultural Resources

4.1.10.1 No Action

Under the NAA, USACE would not implement any FRM project in the City of Watertown. As a result, frequent inundation within the City would continue to occur. These inundation events impact many standing buildings and structures whenever they occur. Among those buildings and structures impacted are numerous historic properties, mostly associated with the creation and growth of the City of Watertown itself. Inundation of these historic properties is likely causing deterioration and adversely affecting their integrity. Inundation also leads to additional erosion which can adversely affect subsurface cultural resources and historic properties wherever present.

4.1.10.2 Alternative 7

Construction of Alternative 7 could impact cultural resources in multiple ways. Lowering the operating pool of Lake Kampeska would expose shoreline that is typically inundated, both exposing it to erosion and making it newly accessible for potential unauthorized excavation. With that said, the shoreline along Lake Kampeska has been heavily modified by development,

and sedimentation within the Lake has likely partially covered any cultural resources present on the lakebed.

Levee construction and installation of a floodwall would involve subsurface excavation that could impact any buried cultural resources present within the construction footprints. Subsurface excavation for the earthen levee is relatively limited, generally only requiring surface grubbing with some deeper excavation associated with drainage features. Floodwall installation would have greater subsurface impact, requiring excavation to approximately 4.5-feet below ground surface, 12-feet wide, but would have significantly smaller horizontal impact that a levee prism. Levee construction would also require access roads, equipment and material storage, borrow acquisition, and potentially land modification for environmental mitigation.

According to background data procured from the South Dakota Archaeological Research Center (SARC) on 21 July, 2023 regarding previously identified cultural resources in the Study area, there are six previously identified cultural resources known to exist within the current APE for Alternative 7. These include CD00000455 (Round Building of the Railroad; Determined Eligible), segments of 39CD2003 (Chicago Northwestern Railroad; Determined Eligible) and 39CD2000 (Burlington Northern Railroad; Determined Eligible), CD00000432 (Railway Bridge Over the Sioux River; Unevaluated), CD00000577 (historic bridge; determined Not Eligible), and CD00000458 (Watertown Light and Power Company Plant; Destroyed but Previously Listed).

No determination of effects has been made, and research, consultation, and coordination are ongoing. At this stage, USACE does not anticipate impacts to CD00000432 or CD00000577 as the alternative was formulated to avoid modifications or impacts to extant bridges. CD00000455 is located in an area where a flood wall would be constructed, limiting the horizontal impacts of construction. Through use of the floodwall, USACE does not anticipate impact to the resource. CD00000458 is on the edge of the Left-Bank Levee APE, across the railroad from any proposed construction. If the resource was extant, construction of the Left-Bank Levee would be unlikely to affect it given its recorded location. Additionally, the resource is recorded as destroyed, and therefore construction is highly unlikely to cause additional impact. Construction of this alternative could impact portions of 39CD2000 and 39CD2003, as levee installation could require modifications to or degradation of extant railroad grades for appropriate installation.

4.1.10.3 Alternative 8

Construction of Alternative 8 could impact cultural resources in multiple ways. Lowering the operating pool of Lake Kampeska would expose shoreline that is typically inundated, both exposing it to erosion and making it newly accessible for potential unauthorized excavation. With that said, the shoreline along Lake Kampeska has been heavily modified by development, and sedimentation within the Lake has likely partially covered any cultural resources present on the lakebed.

Levee construction and installation of a floodwall would involve subsurface excavation that could impact any buried cultural resources present within the construction footprints. Subsurface excavation for the earthen levee is relatively limited, generally only requiring surface grubbing with some deeper excavation associated with drainage features. Floodwall installation would have greater subsurface impact, requiring excavation to approximately 4.5-feet below ground surface, 12-feet wide, but would have significantly smaller horizontal impact that a levee prism.

Channel widening would involve excavation of bank material along the Big Sioux River to widen the channel itself, and would require the use of heavy equipment. There are portions of the channel-widening area, specifically south of the City of Watertown, that have not been meaningfully impacted by City development with relatively intact subsurface integrity. The likelihood that there could be intact subsurface cultural resources in these locations that would be impacted by channel widening are considered high, but no surveys have been conducted to confirm or deny this at this time.

Levee construction and channel widening would also require access roads, equipment and material storage, borrow acquisition, and potentially land modification for environmental mitigation.

According to background data procured from the South Dakota Archaeological Research Center (SARC) on 21 July, 2023 regarding previously identified cultural resources in the Study area, there are eight previously identified cultural resources known to exist within the current APE for Alternative 8. These include CD00000009 (Kemp Avenue Bridge; Listed), CD00000455 (Round Building of the Railroad; Determined Eligible), segments of 39CD2003 (Chicago Northwestern Railroad; Determined Eligible) and 39CD2000 (Burlington Northern Railroad; Determined Eligible), CD00000432 (Railway Bridge Over the Sioux River; Unevaluated), CD00000577 (historic bridge; determined Not Eligible), CD00000579 (historic bridge; not eligible), and CD00000458 (Watertown Light and Power Company Plant; Destroyed but Previously Listed).

No determination of effects has been made, and research, consultation, and coordination are ongoing. At this stage, USACE does not anticipate impacts to CD00000009, CD00000432, CD00000577, or CD00000579 as the alternative was formulated to avoid modifications or impacts to extant bridges. CD00000455 is located in an area where a flood wall would be constructed, limiting the horizontal impacts of construction. Through use of the floodwall, USACE does not anticipate impact to the resource. CD00000458 is on the edge of the Left-Bank Levee APE, across the railroad from any proposed construction. If the resource was extant, construction of the Left-Bank Levee would be unlikely to affect it given its recorded location. Additionally, the resource is recorded as destroyed, and therefore construction is highly unlikely to cause additional impact. Construction of this alternative could impact portions of 39CD2000 and 39CD2003, as levee installation and/or channel widening could require modifications to or degradation of extant railroad grades for appropriate installation of structural measures.

4.1.10.4 Alternatives 11B and 11C

Construction of Alternative 8 could impact cultural resources in multiple ways. Lowering the operating pool of Lake Kampeska would expose shoreline that is typically inundated, both exposing it to erosion and making it newly accessible for potential unauthorized excavation. With that said, the shoreline along Lake Kampeska has been heavily modified by development, and sedimentation within the Lake has likely partially covered any cultural resources present on the lakebed.

Levee construction and installation of a floodwall would involve subsurface excavation that could impact any buried cultural resources present within the construction footprints. Subsurface excavation for the earthen levee is relatively limited, generally only requiring surface grubbing with some deeper excavation associated with drainage features. Floodwall installation would have greater subsurface impact, requiring excavation to approximately 4.5-feet below ground

surface, 12-feet wide, but would have significantly smaller horizontal impact that a levee prism. It is likely that Alternatives 11B and 11C would impact more cultural resources than Alternative 7, simply because of the increased length of the levee system.

Levee construction would also require access roads, equipment and material storage, borrow acquisition, and potentially land modification for environmental mitigation.

According to background data procured from the South Dakota Archaeological Research Center (SARC) on 21 July, 2023 regarding previously identified cultural resources in the Study area, there are eight previously identified cultural resources known to exist within the current APE for Alternative 7. These include CD00000009 (Kemp Avenue Bridge; Listed), CD00000455 (Round Building of the Railroad; Determined Eligible), segments of 39CD2003 (Chicago Northwestern Railroad; Determined Eligible) and 39CD2000 (Burlington Northern Railroad; Determined Eligible), CD00000432 (Railway Bridge Over the Sioux River; Unevaluated), CD00000577 (historic bridge; determined Not Eligible), CD00000579 (historic bridge; not eligible), and CD00000458 (Watertown Light and Power Company Plant; Destroyed but Previously Listed).

No determination of effects has been made, and research, consultation, and coordination are ongoing. At this stage, USACE does not anticipate impacts to CD00000009, CD00000432, CD00000577, or CD00000579 as the alternative was formulated to avoid modifications or impacts to extant bridges. CD00000455 is located in an area where a flood wall would be constructed, limiting the horizontal impacts of construction. Through use of the floodwall, USACE does not anticipate impact to the resource. CD00000458 is on the edge of the Left-Bank Levee APE, across the railroad from any proposed construction. If the resource was extant, construction of the Left-Bank Levee would be unlikely to affect it given its recorded location. Additionally, the resource is recorded as destroyed, and therefore construction is highly unlikely to cause additional impact.

Construction of this alternative could impact portions of 39CD2000 and 39CD2003, as levee installation could require modifications to or degradation of extant railroad grades for appropriate installation. Specifically, it is worth noting that a portion of the proposed right-bank levee would be built on a recorded segment of 39CD2003 near the Bramble Park Zoo. This segment of 39CD2003 has been paved and converted to a City walking trail.

4.1.10.5 Nonstructural Alternative 12

Nonstructural measures would primarily effect above-ground buildings and structures. Many of these measures directly impact buildings and structures that may be historic properties, often involving modifications to their facades and/or foundations, and occasionally involving their removal from the area. The impact of fully implementing the nonstructural alternative to historic properties would likely be high.

4.2 Natural Environment

4.2.1 Surface Water Resources

4.2.1.1 No Action Alternative

Under the NAA, no federally funded FRM project would be implemented, and thus, no direct effects to surface waters from construction activities would result. Long-term adverse effects to water quality may persist as the Big Sioux River continues to flood out of bank as described in Section 4.1.6.1.

4.2.1.2 All Structural Alternatives

All structural alternatives involving the seasonal lowering of Lake Kampeska's full pool elevation from 1718.8 feet to 1718.0 feet would see a marginal decrease in the lake footprint at full pool from fall to early spring, decreasing by approximately 1.2% from 5,060 acres to 5,000 acres. Shoreline advance under a lower full pool is also expected to be minor with most locations experiencing less than 50 ft of shoreline advance and a maximum of approximately 110 ft. The lowering of full pool elevation will be accomplished by utilizing the existing weir structure and removing flash boards. In early spring, flash boards will be replaced, restoring the full pool elevation to 1718.8 feet. Therefore, summer lake levels are expected to be similar to existing conditions. The seasonal lowering of Lake Kampeska would be expected to have minor long-term impacts to surface water resources.

Alternative 8 incorporates channel widening of the Big Sioux River from just north of the bridge at 14th Ave, ending approximately 1,600 ft south of the 20th Ave Bridge. Channel widening would consist of a low flow channel to continuously convey perennial flows and a wider overbank channel which would be temporarily to seasonally flooded. At most locations the existing river channel will be utilized as the low flow channel and the current river alignment would be retained. No other streams are expected to be directly impacted. NBS, such as small in-stream boulder clusters providing and native vegetation plantings, will be incorporated into the final design of this measure, therefore reducing impacts and increasing habitat diversity within the Big Sioux River.

4.2.1.3 Nonstructural Alternative 12

Alternative 12 would see floodproofing measures applied to existing structures. There would be no impacts anticipated to surface water resources under this alternative.

4.2.2 Terrestrial and Riparian Vegetation

4.2.2.1 No Action

Under the No Action Alternative, it is likely that the area would see little change or a gradual decrease in species diversity of flora and fauna and an increase of nonnative and undesirable species. This would decrease the quality of terrestrial and riparian vegetation in the area.

4.2.2.2 All Structural Alternatives

Alternatives 7, 8, 11B, and 11C incorporate the building of levees along the downtown reaches of the Big Sioux River. Levee construction would require the clearing of trees and vegetation during the construction process and the perpetual inhibition of woody growth within the levee footprint and a minimum of 15 feet from the riverside and landside levee toes in accordance with ER-1110-2-1913. Dependent on the extents of the levee footprints described in Section 3.4, each alternative will require differing levels of vegetation clearing, tree clearing, and perpetual inhibition of woody vegetation as outlined in Table 28.

Table 28. Terrestrial and Riparian Vegetation Impacts

Alternative	Riparian Impacts (acres)		Upland Herbaceous Impacts (acres)
	Tree Removal	Perpetual Inhibition of Woody Growth	

7	2.03	4.71	2.37
8	12.19	4.71	52.40
11b	6.97	21.85	13.11
11c	7.58	23.70	14.20

Through the implementation of an intentional co-benefit NBS, upland native plantings within the levee footprint would improve the species biodiversity compared to existing and FWOP conditions, providing pollinator habitat and ecological services within a largely urban surrounding area. For compliance with levee O&M standards, woody vegetation would be removed and not allowed to establish within the levee footprint and a minimum of 15 feet from the levee toe. Although the structural alternatives would result in overall increasing biodiversity of the study area, the vegetative community will see a decrease in the amount of woody vegetation.

Outside of the levee footprint and critical area, vegetation disturbances are anticipated from degrading existing embankments for construction material and the utilization of temporary haul routes and work areas. Following degrading, the existing embankment footprint will be graded and seeded with the same native upland seed mix utilized for the levee footprint. Following construction, temporary haul routes will be restored by regrading and reseeding.

Alternative 8 would incorporate channel widening to create a two-stage channel with an approximately 100 ft overbank area, 50ft on either side of the existing channel alignment. Excavation of the overbank channel would see the removal of approximately 57 acres of existing herbaceous and woody vegetation. The newly constructed overbank area would be flooded temporarily, and at most seasonally flooded. Native, herbaceous hydrophytic vegetation resilient to periodic flooding would be planted within the overbank area. This planting would provide increased species biodiversity compared to FWOP conditions, although with a lower composition of woody species.

The incorporation of the NBS features minimize the impacts, reducing the amount of required mitigation (Table 29). See Section 6.9.1 and Appendix G2 for additional discussion on mitigation requirements.

Table 29. Net AAHU Loss with and without the incorporation of NBS

NBS Incorporated?	AAHUs	FWOP	FWP			
		Alt 1	Alt 7	Alt 8	Alt 11b	Alt 11c
No	Area Total	780.45	777.07	776.13	774.95	774.62
	Net Loss	N/A	-3.37	-4.31	-5.49	-5.82
Yes	Area Total	780.45	778.28	777.18	776.47	776.22
	Net Loss	N/A	-2.16	-3.26	-3.97	-4.22
Percent Reduction in Required Mitigation			36%	24%	28%	27%

In summary, both long-term minor adverse impacts to woody vegetation and long-term moderate beneficial impacts to herbaceous vegetation would result to the terrestrial and riparian habitat.

4.2.2.3 Nonstructural Alternative 12

For construction activities associated with elevating and floodproofing existing structures, most of the substantial impacts will be occurring on previously disturbed ground, and it not likely new impacts will occur outside of the previously disturbed footprint of the structure site. If any minor tree/vegetation removal or trimming is needed it would be for access to the property for equipment to complete the structure elevating and floodproofing. Any vegetation trimmed or removed would be allowed to regenerate after construction is completed making the impact mostly temporary in nature. Any impacts to vegetation surrounding the construction sites for the structure elevation and floodproofing of individual structures would be temporary and last approximately 90 days. Although no cutting or trimming of vegetation is planned at this stage of the study, this alternative does not include replanting of any native species at the structure elevation or floodproofing site so there could be the potential for additional invasive species to regrow within elevation/floodproofing areas which could have a long-term negative impact to surrounding native vegetation, though minor.

4.2.3 Wetlands and Waters of the United States

4.2.3.1 No Action Alternative

Under the NAA, no construction activities would take place within wetlands or Waters of the United States (WOTUS). It is possible that non-federal sponsors may continue to implement flood risk reduction measures such as channel improvement and dam construction with local funding. Non-federal sponsors would have to comply with Section 404 of the CWA.

4.2.3.2 All Structural Alternatives

Per the USFWS NWI data, permanent impacts to wetlands would occur under all action alternatives. Construction of the left bank levee, associated with all action alternatives, and the right bank levee, associated with alternatives 11b and 11c, would require the placement of fill in areas that have wetlands and result in the isolation of wetlands on the landward side of the proposed levee alignments. Placement of boulder cluster structures under Alternative 8 would require the placement of fill within the Big Sioux River below the ordinary high-water mark (OHWM) but would also convert 52.4 acres of upland herbaceous habitat into riverine habitat. A 404(b)(1) analysis has been completed and may be found in Appendix G5.

Table 30: Wetlands and WOTUS Impacts

Alternative	Impacts			
	Direct Fill - Wetlands		Direct Fill - Channel	Indirect Impacts - Isolated Wetlands
	PEM-C	Riverine	The Big Sioux River (Below the OHWM)	
7	0.05	0.00	0.00	0.13
8	0.05	0.00	0.14	0.13
11b	0.27	1.30	0.00	3.47
11c	0.3	1.46	0.00	3.41

4.2.3.3 Nonstructural Alternative 12

Nonstructural alternatives are not expected to result in impacts to wetlands or WOTUS because floodproofing measures would be applied to existing structures and within an already developed

area. If specific nonstructural alternatives are considered during optimization, potential impacts to wetlands and WOTUS will be assessed.

4.2.4 Terrestrial Wildlife, Including Reptile, Amphibians, and Mammals

4.2.4.1 No Action Alternative

Under the NAA, no construction/demolition, staging, or land use changes would occur from a federally funded project, therefore, no direct impacts to the terrestrial wildlife within the study area would occur. However, these types of activities may occur indirectly as the City of Watertown would continue to conduct flood fighting, cleanup activities from flood damage, and seek other sources of funding to construct a FRM project. The NAA would not meet the project purpose and need.

4.2.4.2 All Structural Alternatives

Implementation of all the structural alternatives would result in minor, temporary impacts to existing wildlife resources from construction activities and minor, permanent impacts from the construction of the levee. The impacts to wildlife resources would be related to noise and visual disturbance during the construction activity. Following construction, conditions would revert back to pre-construction conditions, thus impacts to wildlife resources are not considered significant.

Construction activities would cause minor, temporary disturbances to terrestrial wildlife. The removal of tree species and the permanent inhibition of woody growth within the levee footprint would have minor, permanent impacts to terrestrial species. These impacts would be lessened by the inclusion of native, upland plantings within the levee footprint. These native, upland plantings would provide increased biodiversity of herbaceous species and provide habitat for terrestrial species. Through the incorporation of NBS features and the habitat mitigation described in Section 6.9.1, these unavoidable effects will be minimized.

Levee O&M would necessitate annual inspections, which typically involve mowing of vegetation to not only prohibit the growth of woody species, but to also allow for visual assessment of the levee condition. Any burrowing wildlife would be discouraged and discovered dens would be filled and packed to maintain the integrity of the levee. These activities would cause long-term, minor adverse impacts to wildlife from human disruption and den destruction for the life of the project.

Additionally under Alternative 8, permanent impacts to existing wildlife resources would occur from the construction of the low-flow channel. Trees would be removed during the construction of the overbank area, which would impact wildlife which utilizes tree species. Although the extent of the floodplain inundated under flood conditions would decrease, sections of this area are currently identified as upland, ornamental species which provide minimal wildlife value. Impacts from the low-flow channel would be mitigated by the inclusion of native, herbaceous wetland plantings within the overbank areas. These wetland plantings would contribute to the overall vegetative complexity and structure of the habitat. The area would be able to support forage, breeding, and rearing habitat for a variety of wildlife species. The planting of emergent wetlands would support herpetofauna that was prevalent in the area prior to urbanization.

4.2.4.3 Nonstructural Alternative 12

Alternative 12 would see floodproofing measures applied to existing structures. Disturbance wildlife habitat such as terrestrial and riparian vegetation as described in Section 4.2.2.3 would

be limited. As floodproofing measures would be applied to existing structures and within an already developed area, temporary negligible impacts to terrestrial species would be anticipated from Alternative 12.

4.2.5 Migratory Birds, Including Bald and Golden Eagles

4.2.5.1 No Action Alternative

Under the NAA, no construction/demolition, staging, or land use changes would occur from a federally funded project, therefore, no direct impacts to migratory birds or bald and golden eagles within the study area would occur. However, these types of activities may occur as the City of Watertown would continue to conduct flood fighting, cleanup activities from flood damage, and seek other sources of funding to construct a FRM project. Local entities must comply with provisions of the MBTA. The NAA would not meet the project purpose and need.

4.2.5.2 All Structural Alternatives

All action alternatives would result in removal of trees and permanent inhibition of woody species as detailed in Section 4.2.2. To minimize construction related impacts such as mortality on generalist migrating species common to the existing habitat, no tree removal would occur during the general nesting season from May 1 to August 15. Most raptor nesting, to include bald and golden eagles, in this region occurs from February 1 to July 15. The best time to avoid all nesting birds is between September 15 and January 31. Should any clearing and grubbing occur within any of the nesting seasons, a qualified biologist would conduct a field survey not more than 10 days prior to any proposed clearing and grubbing activities to determine the presence or absence of any nesting migratory birds and raptors. If any nesting species be found in the project area, the USFWS would be contacted immediately for further guidance and assistance. Proposed construction activities involved with this project could have the potential to result in temporarily disturbing migratory birds in the form of displacement and determent of utilization of the area during construction.

Once the woody vegetation has been cleared from the area, it is presumed that the auditory, visual, and vibrational disturbances from construction activities would deter migrating species from returning to the area. It is anticipated that once construction activities are complete, migratory birds would return to the area, able to nest in trees that remain in the immediate vicinity. For these reasons, it is expected that all structural alternatives would result in minor, permanent impacts to migratory bird species due to tree removal and inhibition of woody species within the levee right of way.

4.2.5.3 Nonstructural Alternative 12

Alternative 12 would see floodproofing measures applied to existing structures. Disturbance of bird habitat such as terrestrial and riparian vegetation as described in Section 4.2.2.3 would be limited. As floodproofing measures would be applied to existing structures and within an already developed area, temporary negligible impacts to migratory birds would be anticipated from Alternative 12.

4.2.6 Fish and Aquatic Species

4.2.6.1 No Action Alternative

Under the NAA, no federally funded FRM project would be implemented, and thus, no direct effects to fish and aquatic species from construction activities would result. Long-term adverse effects to water quality, as described in Section 4.1.6.1, may persist as the Big Sioux River continues to flood out of bank, causing adverse impacts to aquatic species. It is likely that the Sponsor would continue to seek funding sources to implement a FRM project, as well as continue to conduct flood fighting measures and cleanup activities. The NAA does not support the project purpose and need.

4.2.6.2 All Structural Alternatives

All structural alternatives would incorporate the seasonal lowering of Lake Kampeska by 0.8 feet at full pool from September through November. This would be accomplished by the removal of flashboards from the existing weir structure at the inlet/outlet of Lake Kampeska to the Big Sioux River. Given the overall depth of Lake Kampeska, a seasonal 0.8-foot decrease in the full pool elevation will have negligible effects on the use of Lake Kampeska by warm-water permanent fish species. A lower weir elevation may see negligible benefits to fish during fall through late-spring as a result of increased connectivity between the upstream and downstream reaches of the Big Sioux River. Overall, Lowering of Lake Kampeska would have negligible impacts to fish and aquatic species.

Impacts from levee construction under all structural alternatives to fish and aquatic species are anticipated to be minor and short-term, lasting the duration of construction activities. These impacts are a result of human disturbance in the form of auditory and vibratory effects from the use of heavy machinery. The use of BMPs, as described in Section 4.1.6.2, would minimize effects to water quality.

Alternative 8 incorporates channel widening in the Big Sioux River with the existing channel being used as a low-flow channel and a wider overbank channel that starts 3-3.5 feet above the existing channel invert. Excavation of the widened channel would result in short-term, moderate impacts to fish and aquatic species. While the existing channel would be left as is and excavation would occur in the overbank 50ft on either side, effects from heavy machinery and a temporary increase in turbidity is likely. As discussed in Section 4.1.6.2, a Section 401 WQC would be sought from SDNER during design and implementation, and the contractor would develop a SWPPP to help minimize impacts.

The newly widened channel would incorporate NBS. The existing channel would continue to function as a low-flow channel and would be constructed to minimize adverse impacts on aquatic life and retain fish passage. Water temperatures would potentially increase throughout the majority of the channel cross section with the exception of the low-flow channel. Boulder clusters placed in the low-flow channel would increase aeration of the water and provide cover habitat for fish. Boulder clusters are simple, low risk, nature-based features that add visual appeal and provide concrete ecological benefit to aquatic life in degraded, uniform reaches of river. Boulder placement is a common method of fish habitat improvement which provides in-stream cover. Flow separation around the boulders lead to the formation of eddies (circular current of water). These eddies diffuse sunlight and create overhead cover for fish (Fischenich and Seal, 2000) and small pools may form on the downstream side of some boulder clusters.

Velocities are increased surrounding the boulder cluster such that scour forms around the structure (Rosgen, 1996) and a localized flow velocity gradient develops in the “flow shadow” of the boulder cluster that can function as current-break resting habitat for migrating fishes. The scour, or developed pockets of deeper water, and the associated course substrate to add to the physical diversity of the habitat (Fischenich and Seal, 2000). The increased surface area would enhance macroinvertebrate productivity, which would serve as a food source to other aquatic species. By placing boulder clusters randomly throughout the entire reach, depth diversity, velocity diversity, habitat availability, and visual aesthetics would increase along the Big Sioux River within the project footprint. Overall, Alternative 8 would be expected to have minor, long-term beneficial impacts to fish and aquatic species with the incorporation of these NBS structures.

4.2.6.3 Nonstructural Alternative 12

Nonstructural measures included in Alternative 12 would not affect fish nor aquatic species. No impact, beneficial or adverse, would be anticipated to fish and aquatic species.

4.2.7 Threatened and Endangered Species and State Species of Concern

4.2.7.1 No Action Alternative

Under the NAA, no construction/demolition, staging, or land use changes would occur from a federally funded project, therefore, no direct impacts to any specially listed species within the study area would occur. However, these types of activities may occur indirectly as the City of Watertown would continue to conduct flood fighting, cleanup activities from flood damage, and seek other sources of funding to construct a FRM project. The Sponsor would be required to comply with the provisions of the ESA and work with SDGFP for any considerations of state listed species. The NAA would not meet the project purpose and need.

4.2.7.2 All Action Alternatives

Rufa Red Knot: Red knots may use the lakeshores and prairie potholes within Codington County as stopover habitat or resting habitat during their long migrations. However, red knots prefer migration corridors along the entire Atlantic coast and are faithful to those specific routes. Thus, red knots would be considered extremely rare visitors to the proposed project area. While unlikely, if the rufa red knot were to use the project area as a stopover location, the lowering of Lake Kampeska (Alternative 7, 8, 11b, and 11c) could offer the potential for suitable habitat during migratory periods due to more sandy areas being exposed within the fall and spring. The proposed project may indirectly benefit the rufa red knot; however, the benefit would be negligible. Adverse impacts to the rufa red knot are not expected under all action alternatives.

Topeka Shiner: Construction activities associated with alternatives 7, 8, 11b, and 11c have the potential to cause temporary sedimentation impacts downstream of the Big Sioux River, temporarily impacting water quality; however, according to the South Dakota National Heritage Database, known Topeka Shiner populations within the vicinity of the study area are located upstream of the proposed impacted portions of the Big Sioux River within tributaries to Willow Creek. Because Mitigation Alternative 1 is proposed along Willow Creek, it is reasonable to assume potential for Topeka shiner to be within the vicinity of the area proposed for Mitigation Alternative 1. Under this assumption, there are potential for indirect effects to Topeka shiner from construction such as temporary sedimentation, affecting water quality and overall habitat

suitability if Mitigation Alternative 1 is chosen; these impacts would be short term and minor. Informal coordination with USFWS is ongoing.

Dakota Skipper: Given that Dakota skipper is an obligate resident of undisturbed (remnant, untilled) high-quality prairie, ranging from wet-mesic tallgrass prairie to dry-mesic mixed-grass prairie habitat, it is unlikely that suitable habitat along the Big Sioux River throughout the City of Watertown exists. The two potential sites assessed for mitigation may potentially provide suitable habitat as these areas contain grasslands and fall within potentially undisturbed areas, designated within the South Dakota Environmental Review Tool. Construction of the mitigation sites may directly or indirectly effect the Dakota skipper. A field evaluation will need to be completed to determine the presence of suitable vegetation to support the species. Upon completion of a field evaluation, an occupancy survey may be warranted. USACE will coordinate with USFWS at that time.

Monarch Butterfly: Common milkweed was found to be present within the study area. Construction activities under all of the action alternatives have the potential to directly result in minor, short-term adverse impacts as a result of clearing and grubbing activities. Minor, long-term beneficial impacts to Monarch butterfly may occur through the incorporation of native plantings, which would include milkweed species.

Western Regal Fritillary: Common milkweed and swamp milkweed *(Asclepias incarnata),* favored nectar sources of the western regal fritillary, were observed to be present within the study area. Honeysuckle *(Lonicera tatarica),* a shrub known to provide shelter for the western regal fritillary, was also observed within the study area. Given that the western regal fritillary requires large landscapes of native grasslands, it is unlikely that suitable habitat along the Big Sioux River throughout the City of Watertown exists. The two potential sites assessed for mitigation may potentially provide suitable habitat as these areas contain grasslands and fall within potentially undisturbed areas. Construction of the mitigation sites may directly or indirectly effect the western regal fritillary. A field evaluation will need to be completed to determine the presence of suitable vegetation to support the species. Upon completion of a field evaluation, an occupancy survey may be warranted. USACE will coordinate with USFWS at that time.

State Species of Conservation Concern: As outlined in Section 2.3.4.2, there are no state listed species recorded within the study area, and state species of greatest conservation need would not be expected within the action area. Therefore, impacts to state species of state greatest conservation need would be negligible.

4.2.7.3 Nonstructural Alternative 12

Alternative 12 would see floodproofing measures applied to existing structures. No impacts to federally listed species or state listed species would be anticipated.

4.2.8 Aquatic and Terrestrial Invasive Species

4.2.8.1 No Action Alternative

Under the NAA, no construction/demolition, staging, or land use changes would occur from a federally funded project, therefore, no direct impacts to invasive species within the study area would occur. However, these types of activities may occur indirectly as the City of Watertown would continue to conduct flood fighting, cleanup activities from flood damage, and seek other

sources of funding to construct a FRM project. The NAA would not meet the project purpose and need.

4.2.8.2 All Structural Alternatives

Alternatives 7, 8, 11B, and 11C incorporate the building of levees along the downtown reaches of the Big Sioux River. Levee construction would require the clearing of existing vegetation during the construction process and the perpetual inhibition of woody growth within the levee footprint and a minimum of 15 feet from the riverside and landside levee toes. BMPs would be utilized during construction to prevent spread of invasive species. NBS, such as native vegetation plantings, will be incorporated into the final design of this measure, therefore providing long-term, beneficial impacts to the biodiversity of the area. Management of invasive species would be addressed following construction during adaptive management and monitoring as well as identified in the Operations and Maintenance Manual.

All of the structural alternatives result in the seasonal lowering of Lake Kampeska from September through November by 0.8 feet and Alternative 8 incorporates channel widening in the Big Sioux River. Both of these waterbodies are infested with zebra mussels. BMPs would be incorporated to minimize the spread of zebra mussels, such as cleaning all equipment and personal gear that have come into contact with the water. A Integrated Pest Management Plan would be developed by the Contractor during the design and implementation phase. As such, impacts to aquatic and terrestrial invasive species are anticipated to be minor and short-term, lasting the duration of construction activities.

4.2.8.3 Nonstructural Alternative 12

Alternative 12 would see floodproofing measures applied to existing structures. As floodproofing measures would be applied to existing structures and within an already developed area, no would be anticipated from Alternative 12.

4.3 Built Environment

4.3.1 Existing & Planned Federal and Local Projects

4.3.1.1 No Action Alternative

In the absence of a federal project, it is estimated that flood events will continue to impact existing infrastructure. The existing non-federal levee features would likely be utilized in current conditions until degraded, maintained or modified by local sponsors.

4.3.1.2 All Structural Alternatives

Alternatives 7, 8, 11B, and 11C incorporate the building of levees along the downtown reaches of the Big Sioux River would protect existing infrastructure. Alternatives 7 & 8 with left bank only levees would remove the existing locally constructed left bank levee to build the new one, but leave the existing locally constructed right bank levee in place. All alternatives would contribute to the flood risk reduction purposed of existing local projects.

4.3.1.3 Nonstructural Alternative 12

Alternative 12 would see floodproofing measures applied to existing structures. No impacts to existing or planned projects is anticipated.

4.4 Economic Environment

4.4.1 Socioeconomics and Environmental Justice

4.4.1.1 No Action Alternative

In the absence of a federal project, it is estimated that flood events will continue to impact the population at risk. Groups that will be disproportionately impacted by these flood events include disadvantaged communities identified in Section 3.2.2. Flood events will continue to impact local businesses, causing temporary closures and loss of wages.

4.4.1.1.1 All Structural Alternatives

Alternatives 7, 8, 11B, and 11C incorporate the building of levees along the downtown reaches of the Big Sioux River would protect existing residential, commercial and industrial areas. The Economic Appendix F identifies the number of structures removed from the floodplain for each alternative. Social vulnerability and resiliency benefits are quantified by the number of residential structures that are removed from a given floodplain. This represents individuals not experiencing flooding and the financial, emotional, or physical costs associated with that event.

4.4.1.2 Nonstructural Alternative 12

Under Alternative 12, the risk of flooding will be reduced for structures that are floodproofed and elevated. The proposed measures may cause disproportionately high and adverse impacts on minority populations or low-income populations as described in Section 3.2.2, due to the burden of funding nonstructural floodproofing being passed onto these populations if the non-federal sponsor is not able to assist. There would be no induced flooding in any areas. Residents will remain in their current communities and economic growth will be sustained.

4.5 Cumulative Effects

Cumulative impacts are those that result from the added incremental effects of an action when taken in the context of the past, present, and reasonably foreseeable future actions within a region. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time. For this discussion, the cumulative impact analysis area includes the full extent of the study area.

4.5.1 Effects of Past and Present Land Use

The dominant past and present land uses include farming, grazing, rural, and urban development, industrial operations, and recreation. These uses have affected the following resources in the past or currently: soils, water resources, wetlands, threatened and endangered species, vegetation and invasive species, socioeconomics, wildlife, noise, cultural resources, and recreation.

Urbanization and recreation have also affected the vegetative community within the study area. Management of areas for recreation and aesthetic values have led to an increase in trees and other woody species beyond their natural historical prevalence. Aerial imagery from 1952 shows few trees upstream of 3rd Ave NW and suggests a predominately herbaceous vegetative community (Figure 13).

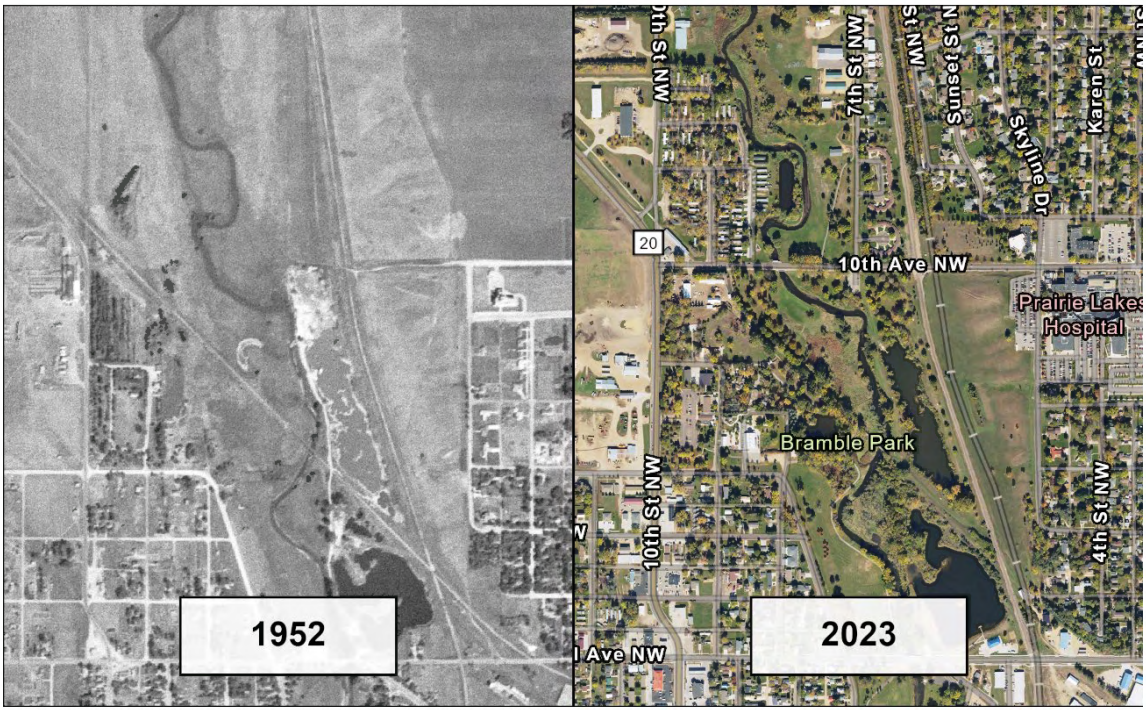

Figure 17. Historical Aerial Imagery

4.5.2 Reasonably Foreseeable Effects

Of the reasonably foreseeable projects and associated impacts that would be expected to occur, further urbanization of the area and climate change would probably have the greatest impact on the previously mentioned resources. Continued agricultural use within the surrounding area would also likely continue. The possibility of wetland conversion and the clearing of riparian habitat are ever present, and these activities tend to further impact valuable resources.

The channel widening will only affect a small portion of BSR. The habitat upstream and downstream of the project is nearly identical, but with less urbanization, to that found along the project area. Plant and animal species that utilize this portion of the creek will not be adversely affected because no unique and critical habitat is found along the project. It is anticipated that following construction and seeding with native grass and wetland mixtures, the quality of habitat will improve and increase in diversity.

The adverse effects associated with the proposed project are short term and minor associated with project construction. These minor adverse effects would be greatly offset by providing the citizens of Watertown an increased measure of flood risk management.

5 PLAN COMPARISON AND SELECTION

5.1 Plan Comparison

Alternatives 7, 8, 11B and 12 were compared to each other looking at the four P&G accounts NED, RED, EQ and OSE. Alternative 11C was not included in the comparison due to similarities to Alternative 11B that included similar benefits but higher costs. Under each account, metrics were established and either quantitative or qualitative rankings were given to each. Under the NED account the total benefits, total net benefits and BCRs were all analyzed and compared. Under the RED account, the alternatives were compared by local economic output and loss of businesses or industry. Under the OSE account the alternatives were compared to life safety, access to critical infrastructure, reduction of structures within the floodplain, and social vulnerability. The EQ account compared total environmental impacts, wetland impacts, GHG emissions, and mitigation requirements.

Table 31 below compares the alternatives in the final array and examines important tradeoffs within economic, social, and environmental quality metrics. Overall, Alternative 8 maximizes benefits across all accounts and ranks the highest under the NED account. Alternative 8 produces the most annual benefits and reduces the highest annual flood damages. Although Alternative 8 doesn't rank the highest for RED account, it is comparable to Alternative 11B for local economic output from construction and it does rank the highest for loss avoidance to businesses and industry. Under the OSE account, again Alternative 8 doesn't rank the highest but it does rank comparable to 11B across all OSE metrics and the number of structures removed within the 1% AEP floodplain only differs by nine between Alternatives 8 and 11B. Lastly under the EQ account, alternative 8 ranks in the middle for overall environmental impacts. It has the lowest impacts to wetlands but also has the highest GHG emissions from the construction along the channel.

In consideration of the 404(b)1 Guidelines defined in 40 CFR 230, Alternatives 7 and 8 both resulted in the direct fill of 0.05 acre and indirect isolation of 0.13 acre of palustrine emergent wetlands from the construction of the left bank levee. Alternative 8 includes an additional 0.14 acre fill below the OHWM from the placement of boulder clusters in the low flow channel and converts 52.4 acre of upland herbaceous habitat into riverine habitat from channel widening which is an overall benefit to the aquatic habitat of the Big Sioux River. Alternative 11b requires the direct fill of 0.27 acre and indirect isolation of 3.47 acres of palustrine wetlands and the direct fill of 1.3 acre of riverine habitat while Alternative 11c requires the direct fill of 0.3 acre and indirect isolation of 3.41 acres of palustrine wetlands and the direct fill of 1.46 acre of riverine habitat from construction of the left and right bank levees. Alternative 8 was determined to be the least environmentally damaging, practicable alternative (LEDPA) as a result of the beneficial boulder clusters and creation of aquatic habitat.

Alternative 7 and 11B were comparable to Alternative 8 under some of the metrics; however when looking at tradeoffs both of these alternatives fell short when compared to Alternative 8. Alternative 7 does have lower total costs, positive net benefits, and limited environmental impacts but it also provides a lot less protection against flooding compared to the other alternatives. Alternative 7 provides the same protection as under existing conditions along the right bank and only provides protection along the left bank until the 2% AEP event before the river starts to flank the levee and impact the residential properties. Alternative 11B has higher costs, negative net benefits, but does provide slightly more protection for structures along both

the right and left banks of the river. The slight increase in flood protection doesn't outweigh the cost increase and lower economic benefits.

Alternative 12 has the lowest impacts to the environment and does provide regional economic benefits, but the total project costs are extremely high compared to the other alternatives with very limited benefits. Alternative 12 ranked the lowest when comparing all accounts.

Table 31: Comprehensive Benefits Comparison

Federal Objectives	Maximize Economic Development					Avoid Unwise Use of Floodplains		
Guiding Principles	Sustainable Economic Development					Public Safety	Floodplains	
Planning Objectives	Reduce the damages and severity of flooding within the vicinity of Watertown and reduce cost and frequency of deploying emergency response efforts during flood events.					Reduce health and life safety impacts from flooding	Reduce floodplain requirements	Increase resiliency of infrastructure to flooding
P&G Accounts	NED			RED		OSE		
Evaluation Criteria	Efficiency		Effectiveness	Effectiveness		Effectiveness		
Metrics	Project Costs ($)	Annual Net Benefits ($)	Annual Flood Damages Reduced ($)	RED Benefits (Local Economic Output) from/during Construction ($)	RED business/industry loss avoidance	Life Safety Risk (Avg LL Day/Night @ 1%,0.2% AEP)*	Reduction of structures within the 1% floodplain	Reduces inundation for critical infrastructure
Alt. 1	0	0	0	0	-	D: 0,1 N: 0,5	-	-
Alt 7	14,035,000	37,000	582,000	8,200,000	Low	D: 0,1 N: 0,8	173	Little
Alt 8	32,000,000	84,500	1,310,000	28,600,000	Medium to High	D: 0,0 N: 0,2	576	Some
Alt 11B	44,400,000	(786,000)	915,000	31,100,000	Medium	D: 0,0 N: 0,1	585	More
Alt 11C	49,400,000	(862,000)	960,000	34,700,000	Medium	D: 0,0 N: 0,1	585	Most
Alt 12	139,860,000	(4,542,000)	655,000	144,800,000	Low to Medium	*	386	Little to no reduction

Table 31 continued: Comprehensive Benefits Comparison

Guiding Principles	Healthy and Resilient Ecosystems			Environmental Justice and Equity				
Planning Objectives	Restore floodplain connectivity and create nature-based features with flood risk management measures.			Provide benefits to and avoid disproportionate impacts to the underserved and disadvantaged communities within the City of Watertown and Lake Traverse Reservation.				
P&G Accounts	EQ			NED	EQ	OSE		
Evaluation Criteria	Acceptability			Effectiveness				
Metrics	Environmental Impacts (AAHUs)	Permanent Wetland Impacts (acres)	CO2 Emissions (metric tons)	Flood Damage Reduced to EJ Communities**	Avoidance of Cultural Resources	Reduction of structures within the 1% floodplain (EJ structures)	Social Community Cohesion	Social Vulnerability and Resiliency
Alt 1	-	-	-	-	High	-	Low	Low
Alt 7	-2.16	0.05	394	$445,000	Medium	173 (160)	Low to Medium	Low
Alt 8	-3.26	0.05	4,051	$793,000	Medium	503 (468)	Medium	Low
Alt 11B	-3.97	1.57	2,052	$785,000	Medium	584 (539)	High	Medium
Alt 11C	-4.23	1.76	2,494	843,000	Medium	585 (539)	High	Medium
Alt 12	-	-	55	**	Low	386	Medium	Low

5.2 Identification of the NED Plan

The NED plan is the alternative plan that maximizes net NED benefits consistent with protecting the Nation's environment. The NED plan for this study is Alternative 8 - Seasonally Lowering Lake Kampeska to Elevation 1718 + Channel Widening + Levee Left Bank (no closures) because it has the highest net NED Benefits at $84,500 compared to the other alternatives in the final array.

5.3 Plan Selection

After comparing the alternatives using the P&G criteria, four accounts, environmental and socioeconomic consequences, the alternatives were ranked. Alternative 8 is both the NED Plan and the Comprehensive Benefits plan and therefore is identified as the TSP. Table 32 below displays the ranking of the alternatives across the four accounts.

Table 32: Alternatives Ranked by Account

Alternatives	NED Rank	RED Rank	EQ Rank	OSE Rank
No Action	5	5	1	5
Alternative 7	2	4	3	3
Alternative 8	1	3	4	2
Alternative 11B	3	1	5	1
Alternative 12	4	2	2	4

6 THE TENTATIVELY SELECTED PLAN

6.1 Plan Accomplishments

The TSP, Alternative 8, maximizes benefits across all accounts and ranks the highest under the NED account with total net NED benefits of $87,270. This plan produces the most annual benefits at $1,034,920 and has a BCR of 1.09. The cost for this plan is approximately $22 million which is about half of the total cost for constructing a second levee along the right bank of the Big Sioux River. The TSP utilizes channel widening versus a structural alternative to provide protection to properties along the right bank. Comparing both alternatives demonstrated they had similar protection up until the 1% AEP where inundation begins to occur south of Kampeska Blvd to Industrial Ave. These areas that see inundation starting at the 1% AEP will be analyzed during the next phase of the feasibility study to develop additional measures that may lower flood risk.

6.2 Plan Components

The TSP includes a combination of seasonally lowering Lake Kampeska, constructing an earthen levee along the left bank, and channel widening of the Big Sioux River. This alternative would examine altering the existing operations of Lake Kampeska to gain approximately 3,300 acre-ft of additional flood storage in the lake. The measure includes lowering the water surface elevation of Lake Kampeska before winter to an elevation 1718 ft NAVD88. Full pool for Lake Kampeska is 1718.8 feet NAVD88, so this measure would lower the lake by 0.8 feet each fall. The design would be to lower the lake elevation in the fall so storage is available for spring runoff. This would lessen downstream impacts by not having higher winter releases. The full pool elevation would return to 1718.8 feet NAVD88 during the late spring, and summer lake levels would be expected to be similar to current conditions. This alternative would utilize the existing low flow gates to lower Lake Kampeska. The Big Sioux River channel weir operation would need to be modified to draw the elevation down to 1718 ft which includes changing the portion of the existing weir where the flashboards are located.

The left bank levee would start near West Kemp Ave. and extend south where it would tie off just north of US-212. The levee alignment will generally follow the existing flood fight measures in place in order to minimize disturbance. On average, the embankment would be 2-4 ft tall with a twelve-foot-wide gravel surfaced crest and 1:3 side slopes. A flood wall would be built in the center of the levee alignment to avoid the Watertown Iron and Metal facility which is documented as a REC under the phase I HTRW assessment (USACE, 2023). The flood wall will be 1,287 ft long, 2 ft high, and 1 ft wide. The wall will be cast in place reinforced concrete T shape wall and will be designed to resist the hydrostatic and dynamic flood pressure. The foundation of the wall will extend 4.5 ft below grade for protection from frost heave. Waterstops will be provided between wall segments. Additionally, all six storm sewer crossings on the left bank are planned to be replaced with a 36-inch pipe and a gatewell.

The channel widening component consists of widening 4.6 miles of the Big Sioux River starting just north of 14th Ave. and continuing south past US-212, where it crosses both 5th St. and 20th Ave and ends approximately 1,600 ft south of the 20th Ave. bridge. The channel would be widened approximately 50 feet to the east and west and would start approximately 3-3.5 ft above the invert of the existing channel. The existing channel bed would be retained to approximately 50-ft wide and 3-ft deep which would allow for better fish passage and assist with

limiting sedimentation. Additionally, all six storm sewer crossings on the left bank are planned to be replaced with a 36-inch pipe.

Due to the construction of the left bank levee, loss of mature riparian trees, and the perpetual inhibition of additional tree recruitment in the future due to O&M, approximately 41.5 acres of mitigation are required. The recommended mitigation plan includes constructing a wetland/riparian complex north of the city near the confluence of Mud Creek and Big Sioux River. This wetland/riparian complex may also assist with sedimentation concerns by expanding the mitigation to include a sediment detention basin to capture material and prevent it from entering both Lake Kampeska and the Big Sioux River. This will be further analyzed during the next phase of the feasibility study by conducting a sedimentation channel capacity analysis. See Section 6.9.1 and Appendix G2 for additional discussion on mitigation.

6.3 Cost Estimate

Table 33: Preliminary Cost Estimate

	Contract Costs	Percent Contingency	Total Contingency	Total Costs
Construction Costs	$12,091,401	30%	$3,627,420	$15,718,821
Planning, Engineering, and Design	$1,088,226	30%	$326,468	$1,414,694
Construction Management	$725,484	30%	$217,645	$943,129
Total Construction Costs	**$13,905,111**		**$4,171,533**	**$18,076,644**
Real Estate	$4,043,345	0%	$0	$4,043,345
Environmental	$544,709	49.5%	$269,631	$814,340
Total Project Costs	**$4,588,054**		**$269,631**	**$4,857,685**
Total Costs	**$18,493,165**		$4,441,164	**$22,934,329**
Interest During Construction				$838,851
Operation and Maintenance Costs				$4,460,000
Monitoring Costs				$97,920
Total Investment Cost				$28,331,100
Total Annual Costs				**$947,650**

6.4 Lands, Easements, Rights-of-Way, Relocations, and Disposal (LERRDs)

The TSP footprint has a total of 391.21 acres of impacted LERRDs. The Non-Federal sponsor, City of Watertown, owns 78.64 Acres of land within the TSP. The City will need to provide deeds to the property needed for the project. The tract register below outlines the required acreages and recommended estates needed for the project:

Table 34: Acreage Register – Required Acreages and Recommended Estates

Type	Acreage	Remarks
Fee	±109	Includes Parcels: 2456, 2457, 560

Flood Protection Levee Easement	±7.35	Includes Parcels: 5938, 6325, 6327, 6328, 6429, 10883, 10948, 10949, 15265, 16241
Channel Improvement Easement	±0	Includes Parcels:
Temporary Work Easement	±144.06	Includes Parcels: 696, 697, 698, 701, 706

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

The OMRR&R for the TSP will include both annual and long-term requirements for the levee and channel widening. The levee will generally require annual requirements consisting of mowing and levee maintenance. Periodic inspection and maintenance of drainage structures for the levee will also be needed. The channel widening portion will require some woody vegetation removal from the channel to ensure it remains herbaceous. Sedimentation would be removed on a 15-yr cycle by utilizing a wetland detention basin upstream along Mud Creek. Sedimentation is already an issue along the Big Sioux River and its tributaries so regular sediment maintenance would assist with lowering this risk. Overall costs for OMRR&R are approximately $4 million due to the higher costs associated with sediment removal.

6.6 Project Risks

There are four main risks identified specifically for the TSP which include the hydraulic capacity of channel widening, sedimentation, and hydrology for single population analysis. Hydrology for single population analysis and induced damages from levees were both given a rating of low and will be further examined during optimization. The hydraulic capacity of channel widening, and threat of increased sedimentation were both given a risk rating of high. The current hydraulic capacity of channel widening utilizes a two-stage channel; however, additional channel configurations will need to be simulated in order to determine capacity changes. Reviewing the hydraulic capacity will also be necessary to manage the risk of sedimentation in addition to completing a sedimentation channel capacity analysis. The additional analysis will be completed during optimization to lower risks.

6.7 Cost Sharing

Table 35 - Preliminary Cost Share Estimate

	Federal	Non-Federal	Total
Construction			$16,533,161
Planning, Engineering, and Design			$1,414,694
Construction Management			$943,129
Total Construction Cost			**$18,890,984**
Total LERRDs			$4,043,345
Total First Costs			**$22,934,329**

	Federal	Non-Federal	Total
Cost-Sharing Breakdown			
Non-Federal LERRD		$4,049,345	
Non-Federal minimum 5% cash		$1,146,716	
Non-Federal additional cash		$2,836,954	
Total Cost-Share Amount	**$14,907,314**	**$8,027,015**	**$22,934,329**
Cost Share Percentage	**65%**	**35%**	**100%**

Note: FY24 price levels

Table 35 above does not include mitigation costs for historic properties because it is unknown at this time if mitigation will be required. Determinations regarding the need for mitigation will occur following Feasibility but prior to construction and will utilize the results of cultural resources investigations as the basis for estimation. It should be noted that Section 208 of the NHPA Amendments of 1980 (Public Law 96-515, codified in 54 U.S.C. 312507), requires that, if mitigation of historic properties is required for a construction project that the cost of that mitigation may not exceed 1% of the total amount appropriated for the project. USACE Planning Policy (ER 1105-2-100 Appendix C) further clarifies that the 1% amount is calculated using the total Federal appropriations for a project, describes and outlines a waiver process with the Office of the Assistant Secretary of the Army for Civil Works if data recovery costs would exceed the 1% limit, and describes how these costs are cost-shared. If a waiver is not pursued, any costs beyond the 1% would be the responsibility of the non-federal sponsor.

6.8 Design and Construction

The feasibility phase of the report will be complete by May 2026 and design will immediately follow in October 2027. Design will last approximately 12-18 months, with 6 months scheduled for the construction contract acquisition and an award planned for September 2028. Mobilizing and site preparation won't be started until Spring 2029 due to weather conditions in the winter. Construction is anticipated to be completed by summer 2030.

6.9 Environmental Commitments

Several environmental commitments and compliance activities would be necessary to implement the TSP including the following:

- CWA, Section 401 – A Section 401 Letter of No Objection must be obtained for the recommended plan. A Section 401 WQC will be obtained during PED. Design and Construction of the plan must comply with the WQC.
- CWA, Section 402 – The construction contractor would be required to obtain a CWA Section 402 National Pollutant Discharge Elimination System stormwater permit from prior to implementation. This will include a SWPPP with sedimentation and erosion control BMPs.
- CWA, Section 404 - While a Section 404 permit is not required, impacts on wetlands would require mitigation. Mitigation is described below in Section 6.9.1.
- ESA, Section 7 – Concurrence from USFWS must be obtained with the determination that the proposed action may affect but not likely to adversely affect threatened and

endangered species under their jurisdiction. Final design and construction will include BMPs and conservation measures to avoid and minimize impacts to the Topeka shiner and Dakota skipper. This approval will be obtained prior to signing the FONSI.

- Engineering with Nature (EWN)/NNBF – Native plantings and seed mixes will be utilized.
- Farmland Protection Policy Act - Farmland Conversion Impact Rating Forms will be prepared and sent to NRCS for compliance.
- Fish and Wildlife Coordination Act (FWCA) – USFWS has not provided a Planning Aid letter or FWCA Report, however coordination with USFWS and SDGFP ongoing. Final design and construction will ensure aquatic life movement is maintained.
- HTRW – Final design and construction will ensure avoidance of HTRW sites.
- Invasive Species – Final design and construction will include BMPs to avoid and minimize the spread of invasive species.
- MBTA - Final design and construction will include BMPs for avoiding and minimizing impacts to Migratory Birds.
- NHPA, Section 106 – Construction must occur in accordance with the Programmatic Agreement, which is discussed in Section 6.9.2 below.

6.9.1 Mitigation, Monitoring, and Adaptive Management

Mitigation planning includes a sequencing approach: avoiding an impact altogether by not taking a certain action; minimizing impacts by limiting the degree or magnitude of an action; rectifying the impact by repairing, rehabilitating, or restoring the affected environment; reducing or eliminating the impact over time; and compensating for non-negligible losses to significant ecological resources through in-kind mitigation employing a watershed approach. ER 1105-2-103 requires that mitigation planning be an integral part of the overall planning process.

As described in Section 2.3.4, FACStream was utilized to assess existing conditions and environmental impacts to the floodplain, riparian and wetland habitats. FACStream received regional approval use from the USACE Ecosystem Restoration Planning Center of Expertise on 28 July 2023 within the Omaha and Kansas City District Civil Works boundaries (see sub-appendix G1a). FACStream is a reach-scale functional assessment tool that rates functional condition based on the degree of impairment in comparison to a reference standard condition. FACStream is a weight-of-evidence approach that utilizes the best evidence available through desktop analysis and field verification within a rapid assessment timeframe to develop and support ratings for 10 variables and their 28 associated sub-variables. The resulting qualitative output, a composite functional capacity index (FCI) is then utilized to develop AAHUs.

For the TSP, unavoidable impacts resulting in a net loss of 3.26 AAHUs require compensatory mitigation. Three mitigation alternatives were assessed, compared, and evaluated, with Mitigation Alternative 2 selected as the preferred mitigation site. See Figure 18 below for locations of the three mitigation alternatives.

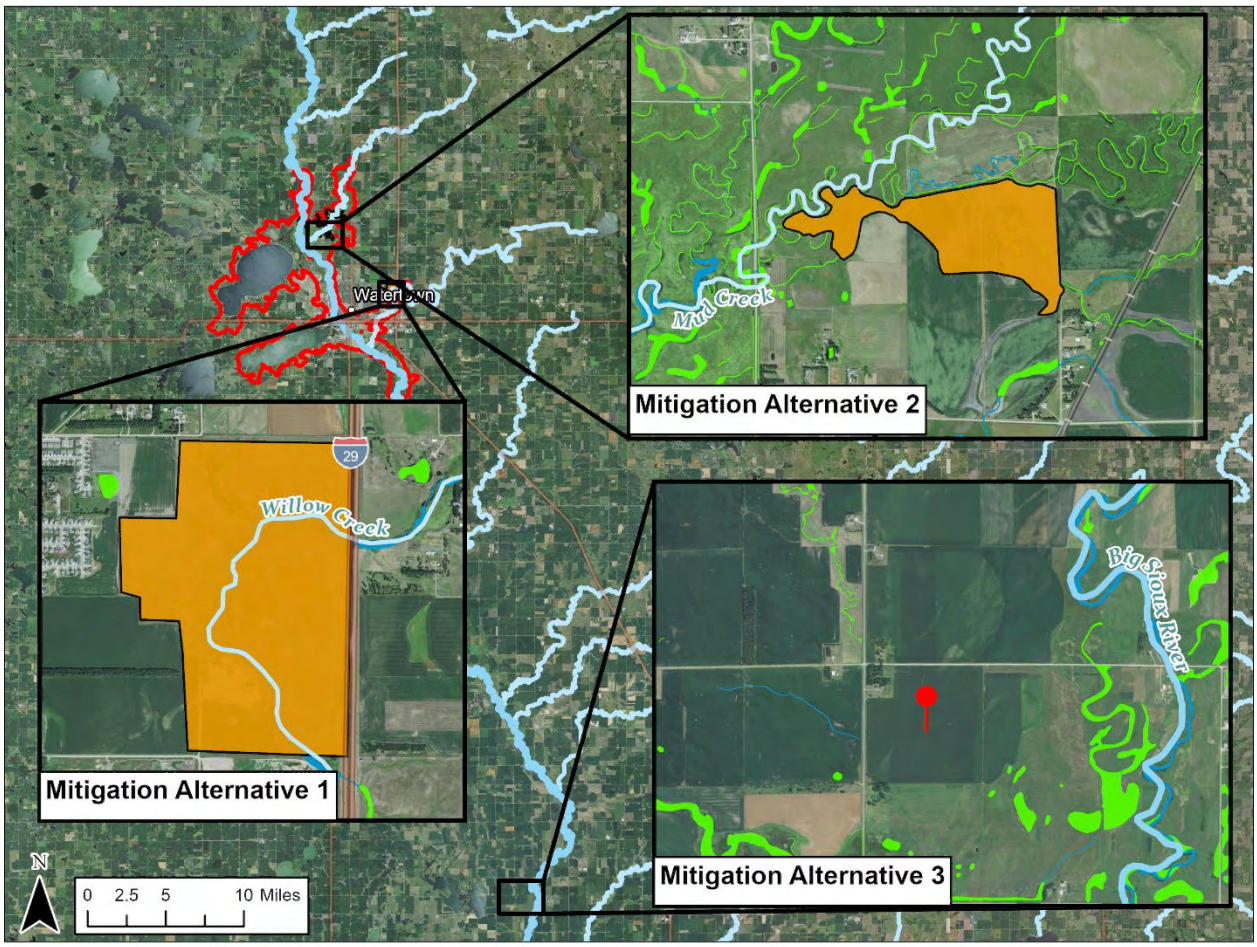

Figure 18. Mitigation alternatives in context with the Watertown Study Area

To achieve the habitat mosaic and restore the lost function (see Appendix G1 and G2), the following minimum requirements must be met:

To compensate for the overarching Mitigation Objective and replace the loss of 3.26 AAHUs would require restoration of wetland, riparian, and upland habitat types within 41.5 acres under Mitigation Alternative 2.

- Mitigation Objective #1: To compensate for the direct loss of 0.05 acres of freshwater emergent wetlands and indirect impact of isolating 0.13 acres of freshwater emergent wetlands, totaling 0.18 acres of impacted wetlands from levee construction- a minimum of 1 acre of emergent wetlands must be created.
- Mitigation Objective #2: To compensate for the direct loss of an estimated 12.19 acres of mature riparian trees and perpetual inhibition of an additional 4.71 acres of tree recruitment throughout the levee ROW, totaling 16.9 acres of riparian tree impacts- a minimum of 25.35 acres of woody vegetation must be restored.
- Mitigation Objective #3: To compensate for the constricted ecological floodplain along 4,435 linear feet (0.84 miles) of the BSR on the left bank from levee construction, the newly established vegetation achieved from Mitigation Objectives #1 and #2 would occur along Willow Creek and Mud Creek, providing enhanced floodplain connectivity and interaction between aquatic, wetland, and riparian habitats.

- Mitigation Objective #4: To compensate for the loss of 52.4 acres of upland herbaceous vegetation from channel widening construction, a minimum of 10 acres of an upland buffer should be applied surrounding the wetland and riparian habitats achieved in Mitigation Objectives #1 and #2. The plantings shall incorporate species that are found in "Type B" Dakota skipper habitat, such as bluestem (*Andropogon, Schizachyrium*), needlegrasses (*Stipa spp.*), pale purple coneflower (*Echinacea pallida*), upright coneflower (*E. angustifolia*), blanketflower (*Gaillardia spp.*), bluebell blueflower (*Campanula rotudifolia*) and wood lily (*Lilium philadelphicum*) as well as common milkweed (*Asclepias syriaca*) for the monarch butterfly.

See Appendix G2 for the complete Mitigation Plan which describes in detail the mitigation planning objectives, alternative formulation, comparison, and selection as well as the monitoring requirements associated with mitigation and the NBS features. See Appendix G3 for discussion on Adaptive Management requirements for the incorporated NBS features.

6.9.2 Section 106 Programmatic Agreement

Implementation of any of the action alternatives under consideration constitutes a Federal undertaking, and every action alternative has the ability to affect historic properties, assuming such properties are present. Given these facts, USACE is required to comply with 54 U.S.C. 306108 (Section 106) of the National Historic Preservation Act, as amended (NHPA).

USACE has elected to use a phased approach to identify historic properties, to evaluate historic properties and, if required, for application of the criteria of adverse effect in accordance with 36 C.F.R. §§ 800.4(b)(2) and 800.5(a)(3). To achieve compliance with Section 106 using a phased approach, USACE is pursuing creation and execution of a project-specific Programmatic Agreement. The PA must be executed prior to signature of a ROD/FONSI.

The PA would outline the processes that would be followed for the Identification of cultural resources and Historic Properties, the Evaluation of cultural resources and Historic Properties that have been identified in the Area of Potential Affects for their eligibility on the National Register of Historic Places, and the Treatment of Historic Properties that would be impacted by the Project (assuming such properties exist). Studies required to achieve the above goals would be completed in PED per the stipulations of the agreement. The PA also outlines administrative processes including requirements for monitoring and reporting on activities that occur under the purview of the Agreement, methods for dispute resolution, paths to amend the document if necessary, and processes for termination of the agreement. Finally, the Agreement also describes how Post-Review Discoveries would be handled if a Discovery is made during project implementation. An initial Draft of this document has been prepared, and consultation on the document is ongoing.

6.10 Views of the Non-Federal Sponsor

The City of Watertown supports Alternative 8 which is the TSP and includes seasonally lowering Lake Kampeska, constructing an earthen levee along the left bank and channel widening along the Big Sioux River. They are interested in gathering input through the public review process to see whether there could be refinements to the TSP to better meet community needs.

7 ENVIRONMENTAL COMPLIANCE

7.1 Environmental Compliance Table

Table 36: Environmental Compliance Summary

Law, Regulation or Executive Order (EO)	Status
American Indian Religious Freedom Act of 1978, 42 U.S.C. 1996	Compliant.
Bald and Golden Eagle Protection Act, 16 U.S.C. Sec. 668, 668 note, 669a-668d	Full compliance anticipated. Surveys for bald eagle nests will be completed within a mile of selected plan's footprint.
Clean Air Act, as amended, 42 U.S.C. 185711-7., et seq.	Full compliance anticipated.
Clean Water Act, as amended, (Federal Water Pollution Control Act) 33 U.S.C. 1251, et seq.	Full compliance anticipated. A CWA (Section 401) Water Quality Certificate is required and will be obtained in PED. A draft CWA Section 404(b)(1) analysis is included.
Endangered Species Act, as amended, 16 U.S.C. 1531, et seq.	Full compliance anticipated. Informal consultation with USFWS is ongoing. Draft Biological Assessment being completed.
Environmental Justice (E.O. 12898)	Full compliance. No disproportionate impacts to underserved communities anticipated.
Farmland Protection Policy Act	Full compliance anticipated. Coordination with USDA-NRCS will occur as needed, for the recommended plan.
Fish and Wildlife Coordination Act, 16 U.S.C. 661, et seq.	Coordination with USFWS and SDGFP ongoing. Full compliance anticipated.
Floodplain Management (E.O. 11988)	Full compliance anticipated. The draft and final Integrated Feasibility Report(IFR)/EA will be publicly available documents.
Invasive Species (E.O. 13112)	Full compliance anticipated.
Migratory Bird Treaty Act of 1918 as amended, 16 U.S.C. 703-711, et seq.	Full compliance anticipated. Best Management Practices for Migratory Birds would be adhered to during construction.
National Environmental Policy Act, as amended, 42 U.S.C. 4321, et seq.	Preparation and circulation of the Draft IFR/EA partially fulfills requirements. Full compliance achieved with signed FONSI.
National Historic Preservation Act, as amended, 54 U.S.C. 300101, et seq.	Full compliance anticipated. USACE will draft and execute a Programmatic Agreement for the phased identification of, evaluation of, and (if identified) resolution of adverse effect to, Historic Properties, in consultation with Signatories and Consulting Parties.
Noise Control Act of 1972, 42 U.S.C. 4901, et seq.	Full compliance.
Protection of Wetlands (E.O. 11990)	Full compliance anticipated with mitigation.
Resource Conservation and Recovery Act of 1976 42 U.S.C. 6901 et seq.	Full compliance. Testing, quantification, and notification for any hazardous materials to occur as needed during Preconstruction, Engineering, and Design (PED) Phase.
Rivers and Harbors Act, 33 U.S.C. 401, et seq.	Not applicable.
Wild and Scenic Rivers Act, as amended, 16 U.S.C. 1271, et seq.	Not applicable.

7.2 Public Involvement

7.2.1 Scoping

In an effort to engage interested parties early in the planning process, the U.S. Army Corps of Engineers study team in cooperation with the non-federal sponsor, the City of Watertown, provided numerous opportunities for the public to offer input into the problems, opportunities, objectives, and constraints of the Watertown FRM GI study. These opportunities included two public scoping meetings, a preliminary alternatives City Council/public meeting, and a draft feasibility report public meeting.

A brief summary of the major coordination and outreach events that have occurred throughout the Watertown Flood Risk Management GI study process is as follows:

- Landowner Informational Meeting (10/19/2022)
- Public Scoping Meeting (01/31/2023)
- Non-federal Sponsor Postcard Scoping Survey (12/29/2023)
- City of Watertown Council/Public Meeting (6/10/2024)
- Draft Feasibility Report Public Meeting (09/17/2024)

See Appendix J for additional information regarding these public engagements.

7.2.2 Agency Coordination

Agency scoping letters have been sent to USFWS, EPA, USDA-NRCS, BIA, SDGFP, SDSHPO, SWO THPO, DANR, and SD Bureau of Administration. An agency scoping meeting was held on January 31, 2023. Cooperating agency requests were sent to SWO and BIA, with BIA signing an MOU to become a cooperating agency for this project. A future virtual meeting with agencies will be scheduled after the release of the draft feasibility report.

7.2.3 Tribal Consultation

USACE strives to establish relationships that focus on successful communication and a collaborative process to include Tribal involvement in project development and implementation. Tribal consultation and coordination have occurred and will continue to occur according to USACE Tribal Consultation Policy throughout the life of this study and any project implemented following its completion. Tribal consultation was initiated on January 5, 2023 and a virtual scoping meeting was held on February 9, 2023. Due to the proximity of the project to the Lake Traverse Reservation, additional coordination meetings were held specifically with SWO both virtually and in-person. USACE also received an Executive Resolution from SWO's Council endorsing the No Action Alternative. Future coordination and consultation meetings will be scheduled following the release of the draft feasibility report. See Appendix K for a detailed summary of Tribal coordination and consultation that has occurred to date on the study.

7.2.4 List of Statement Recipients

Refer to Appendix K that includes a list of the agencies, organizations, and persons to whom USACE sent copies of the draft report for review.

7.2.5 Public Comments Received and Responses

Approximately 50 members of the public were present during the January 2023 public scoping meeting. Comments received during the public scoping meeting broadly fit within four categories:

- Scope:
  - Questions regarding how the study boundary was determined and concern that the pothole lakes to the north should also be considered.
- North of Watertown & Mahoney Creek Dam:
  - Strong feelings of opposition for any alternatives in this area (including Mahoney Creek Dry Dam).
  - Residents have expressed they feel this project will likely not benefit them.
- Floodplain Development & City of Watertown Government:
  - Criticisms of the local government mostly concerning historic development within the floodplain.
  - Complaints regarding flood insurance (including cost and necessity).
- Funding:
  - Questions regarding how much the study will cost and how much a potential project could cost.
  - Additional questions/concerns regarding how the City of Watertown will pay to construct the proposed project.

See Appendix J for a more detailed breakdown of repeated themes from public comments. Appendix J also contains attachments including: Public meeting materials, scanned comment forms, scanned sign-in sheet, and public notices.

Another public meeting is tentatively scheduled for September 17, 2024, coinciding with the release of the draft report and environmental assessment (EA) for public review. The USACE team as well as representatives from the City of Watertown will be available for questions and discussion with the community regarding the tentatively selected plan. The public will have at least 30 days to read and provide comments on the draft report and EA. Interested members of the public are encouraged to visit the project website to access materials presented during public meetings and stay up to date with the project.

Link to the project website: https://www.nwo.usace.army.mil/Missions/Civil-Works/Planning/Planning-Projects/Watertown-SD/

8 DISTRICT ENGINEER RECOMMENDATION

I have carefully reviewed the FRM study and the proposed solutions along the Big Sioux River within the vicinity of Watertown, SD. History has shown the City of Watertown experiences a major flood event at least once a decade which leaves the City, State, and Federal entities spending more on flood fighting. The flood risk can be significantly reduced with the construction of the recommended project.

Multiple alternatives were developed to reduce flood risk within the vicinity of Watertown. These alternatives were evaluated for engineering feasibility, economic viability, and environmental, Tribal, and public acceptability. Furthermore, these alternatives were validated against national and project specific planning objectives.

I find that the TSP would lower flood risk by increasing the level of protection against different flood events. The TSP consists of a combination of seasonally lowering Lake Kampeska, constructing an earthen levee along the left bank, and channel widening of the Big Sioux River. This alternative would examine altering the existing operations of Lake Kampeska to gain approximately 3,300 acre-ft of additional flood storage in the lake. The left bank levee would start near West Kemp Ave. and extend south where it would tie off just north of US-212. The levee alignment will generally follow the existing flood fight measures in place in order to minimize disturbance. A flood wall would be built in the center of the levee alignment to avoid the Watertown Iron and Metal facility which is documented as a REC under the phase I HTRW assessment (USACE, 2023). The channel widening component consists of widening 4.6 miles of the Big Sioux River starting just north of 14th Ave. and continuing south past US-212, where it crosses both 5th St. and 20th Ave and ends approximately 1,600 ft south of the 20th Ave. bridge. The channel would be widened approximately 50 feet to the east and west and would start approximately 3-3.5 ft above the invert of the existing channel. The TSP ranked high under the EQ account and is considered the LEDPA. There would be impacts to 0.05 acres of wetlands and 0.14 acres of fill within the Big Sioux River due to construction. Overall, there are unavoidable impacts resulting in a net loss of 3.26 AAHUs requiring restoration of wetland, riparian, and upland habitat types within 41.5 acres at the mitigation site 2 alternative along Mud Creek just upstream of Lake Kampeska.

I further find the TSP for the Watertown, SD General Investigation provides the maximum net NED benefits and is therefore the NED Plan. While the TSP did not have the highest RED, OSE, or EQ benefits, it did rank higher in all three accounts compared to the other alternative and is considered the Comprehensive Benefits Plan. The City of Watertown supports the TSP and release of the draft report for public review.

The TSP is estimated to be $22,934,329 for total first costs, which will be cost-shared $14,907,314 Federal, $8,027,015 non-Federal. The non-Federal cost includes projected LERRD value of $4,049,345 with the balance of $3,977,670 to be provided in cash. This plan is expected to produce net annual benefits to the nation of nearly $84,500 and has a benefit to cost ratio of 1.09.

The recommendations contained herein reflect the information available at this time and current departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction

program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to higher authority as proposals for authorization and implementation funding. However, prior to transmittal to higher authority, the sponsor, the states, interested federal agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further.

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Robert J. Newbauer, P.E.
Colonel, U.S. Army Corps of Engineers
Omaha District Engineer

9 LIST OF PREPARERS

Role / Discipline	Name
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Chief, Environmental Resources	Rebecca Podkowka
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Economist	Tyler Kelley
Chief, Economics & PQR	Justin Brewer
Structural Engineer	Nabil Askar
Chief, Structural Engineering	Sean Denning
Geotechnical Engineer	Joshua Porter / Tucker Richey
Chief, Geotechnical Engineering	Klaidas Hall
Hydraulic Engineer	Ben Lorenzen
Chief, Hydraulic Engineering	Ben Lorenzen
Hydrologic Engineer	Amanda Kingman
Chief, Hydrologic Engineering	Rachel Schulz
Floodplain Engineer	Jeff Mihulka
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10 LITERATURE CITED

Beck, H.E., McVicar, T.R., Vergopolan, N. et al. High-resolution (1 km) Köppen-Geiger maps for 1901–2099 based on constrained CMIP6 projections. Sci Data 10, 724 (2023). https://doi.org/10.1038/s41597-023-02549-6

Dieterman, Doug., & Berry Jr, Charles. (1998). Fish community and water quality changes in the Big Sioux River. Prairie Naturalist, 30(4), 199-224.

EPA. (2024, June 30). Green book | US EPA. https://www3.epa.gov/airquality/greenbook/ancl.html

Fischenich, C. and R. Seal. 2000. Boulder Clusters. EMRRP Technical Notes Collection. ERDC TN-EMRRP-SR-11. U.S. Army Engineer Research and Development Center, Vicksburg, MS.

Frankson, R., K.E. Kunkel, S.M. Champion, D.R. Easterling, N.A. Umphlett, and C.J. Stiles, 2022: South Dakota State Climate Summary 2022. NOAA Technical Report NESDIS 150-SD. NOAA/NESDIS, Silver Spring, MD, 5 pp.

LKWPD. (2024, August 9). http://lakekampeska.org/index.html

LPWPD. (2024, August 9). https://lakepelicanwaterprojdist.com

Rosgen, D. 1996. Applied River Morphology. Wildland Hydrology Books. Pagosa Springs, CO.

DANR. (2024). The 2024 South Dakota Integrated Report for Surface Water Quality Assessment. South Dakota Department of Agriculture and Natural Resources. https://danr.sd.gov/OfficeOfWater/SurfaceWaterQuality/docs/DANR_2024_IR_final.pdf

USACE Civil Work Tribal Consultation Policy. December 5, 2023.

USACE. (2005). Feasibility Study General ReEvaluation. Omaha, NE: U.S. Army Corps of Engineers.

USEPA. 2024. Level III and IV Ecoregions of the Continental United States. Retrieved from https://www.epa.gov/eco-research/level-iii-and-iv-ecoregions-continental-united-states