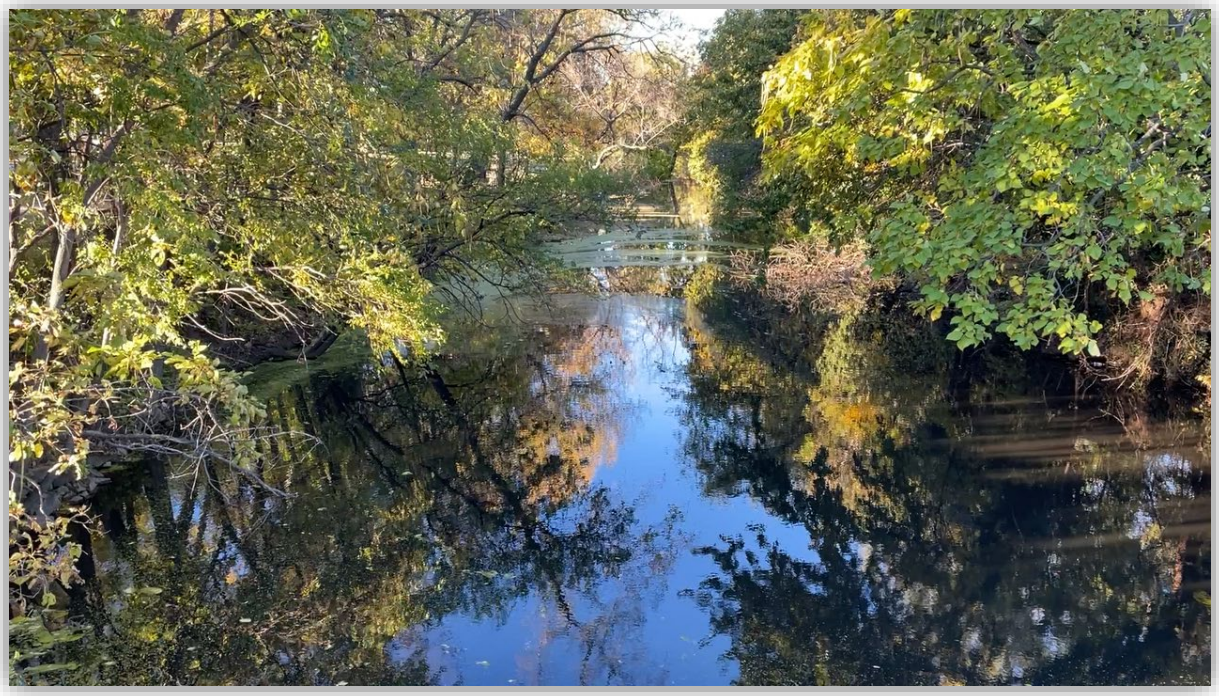
US Army Corps of Engineers



Smoky Hill River Aquatic Ecosystem Restoration Study

Salina, Kansas

Draft Feasibility Report and Integrated Environmental Assessment

NEPA ID: EAXX-202-00-G5P-1727859961

September 2025

City of Salina

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GLOSSARY OF TERMS, ACRONYMS, AND ABBREVIATIONS

AAHU	Average Annual Habitat Unit
AIRFA	American Religious Freedom Act of 1978
BMP	Best Management Practice
CE/ICA	Cost Effectiveness and Incremental Cost Analysis
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CENWD	US Army Corps of Engineers, Northwestern Division
CENWK	US Army Corps of Engineers, Northwestern Division, Kansas City District
CFR	Code of Federal Regulations
CFS	Cubic Feet per Second
CITY	City of Salina, Kansas
CM	Construction Management
CMP	Corrugated Metal Pipe
CWA	Clean Water Act
EA	Environmental Assessment
ECO-PCX	USACE Ecosystem Restoration Center of Expertise
EIS	Environmental Impact Statement
EO	Executive Order
EQ	Environmental Quality
ER	Engineering Regulation
°F	degree Fahrenheit
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FONSI	Finding of No Significant Impact

FPPA	The Farmland Protection Policy Act
FRM	Flood Risk Management
FWCA	Fish and Wildlife Coordination Act
FWOP	Future Without Project
FWP	Future With Project
FY18	Fiscal Year 2018
GI	General Investigations
HDR	Architect-Engineer, Henningson, Durham, and Richardson, Inc.
H&H	Hydrology & Hydraulics
HTRW	Hazardous, Toxic, And Radioactive Waste
HU	Habitat Unit
KS	Kansas
LERRDs	Lands, Easements, Rights-of-Way, Relocations, and Disposal Areas
LOMR	Letter of Map Revision
LPP	Locally Preferred Plan
MBTA	Migratory Bird Treaty Act of 1918
MOA	Memorandum of Agreement
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NAVD88	North American Vertical Datum of 1988
NED	National Economic Development
NEPA	National Environmental Policy Act
NER	National Ecosystem Restoration
Net AAHU	Net Average Annual Habitat Unit
NHPA	National Historic Preservation Act
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places

NWI	National Wetlands Inventory
NWP	Nationwide Permit
OMRR&R	Operations, Maintenance, Repair, Rehabilitation and Replacement
OSE	Other Social Effects
O&M	Operations and Maintenance
PED	Planning, Engineering, and Design
PPA	Project Partnership Agreement
PDT	Project Development Team
PR&G	Principles, Requirements and Guidelines for Federal Investments in Water Resources
PROJECT	Smoky Hill River Ecosystem Restoration
QHEI	Qualitative Habitat Evaluation Index
RCB	Reinforced Concrete Box
RECONS	Regional Economic System
RED	Regional Economic Development
ROW	Right-of-Way
SHPO	State Historic Preservation Office
T&E	Threatened and Endangered Species
TSP	Tentatively Selected Plan
TSS	Total Suspended Solids
USACE	United States Army Corps of Engineers
USC	United States Code
USCB	United States Census Bureau
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WRDA	Water Resources Development Act of 1986

WSS Web-based Soil Survey

1

Table of Contents

LIST OF TABLES

LIST OF FIGURES

APPENDICES

Executive Summary

Introduction

This report presents the findings of a feasibility study conducted under Section 216 of the Flood Control Act of 1970, Public Law (P.L.) 91-611 (33 U.S.C. § 549a). This study and project is being conducted under the U.S. Army Corps of Engineers (USACE) General Investigations (GI) Program.

A project may be recommended for construction after a detailed investigation shows it is technically feasible, environmentally acceptable, and economically efficient. The Integrated Environmental Assessment (EA) was prepared pursuant to the National Environmental Policy Act (NEPA) (42 U.S.C. § 4321 *et seq.*) to determine whether to prepare an Environmental Impact Statement (EIS) or Finding of No Significant Impact (FONSI). The City of Salina, as the non-federal Sponsor (Sponsor), provided a letter confirming its intent to sign a Project Partnership Agreement (PPA) for project design and implementation.

The study, carried out in partnership with the City of Salina as the Sponsor, was conducted along the “Old Channel” of the Smoky Hill River, in Salina, Kansas (KS), as well as adjacent riparian forest components and urban areas. If constructed, the total project costs would be cost-shared 65% Federal and 35% non-federal.

The Project area includes approximately 6.8 miles of the Old Channel corridor in Salina, KS, which is the original Smoky Hill River channel that was bypassed with construction of a Flood Risk Management (FRM) project in 1961. The Old Channel inlet continues to capture some flow from the Smoky Hill River and the channel winds its way through downtown Salina, finally exiting at a federal levee outlet control and pump station and re-connecting to the main channel of the Smoky Hill River. Due to excessive sedimentation within the Old Channel, gravity flow of water within the Old Channel from the inlet to the outlet is rare.

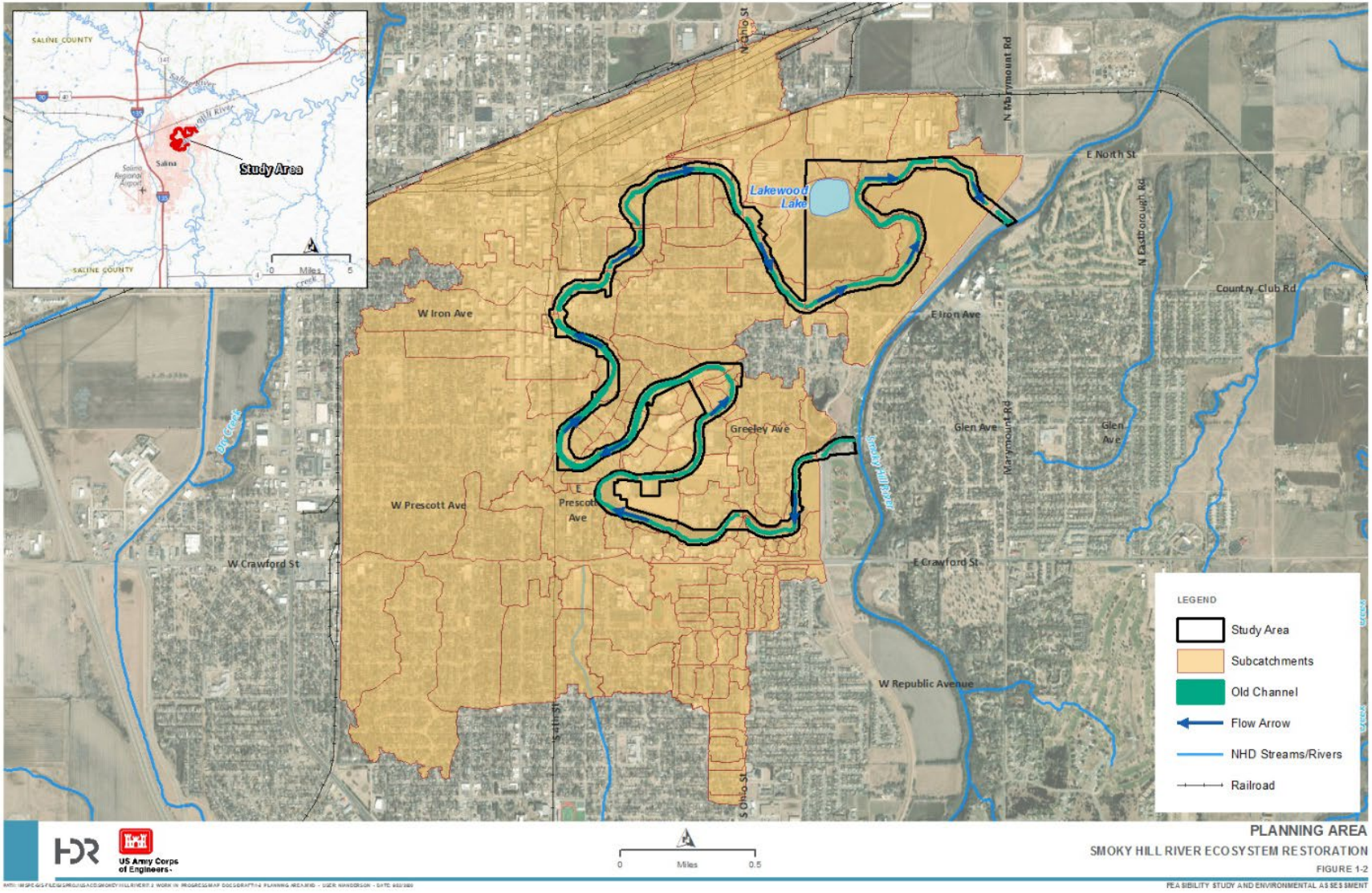

Figure ES-0-1: Smoky Hill River Project Area

A significant proportion of the Project area is owned by the City of Salina, KS; however, there are many privately owned parcels in the Project area. Both the upstream and downstream segments of the Old Channel contain a combination of high density residential, commercial, and recreational land uses. The Project area encompasses a fully developed, urbanized area with degraded natural habitats.

In 1951, a reported 0.2% (1/500) annual exceedance probability (AEP) flood affected more than 50 percent of the City's residential and commercial areas. As a result of the economic and social losses, State and federal funding was used to implement a Flood Risk Management (FRM) project authorized in the Flood Control Act of 1954, P.L. 83-780. The project reduced flow through downtown Salina by creating an excavated 1.1-mile channel (cut-off channel) and building an associated federal levee system. These management features constitute the Salina Kansas Federal FRM Project, which was constructed by USACE and completed in 1961. It is operated and maintained by the Sponsor to ensure flood risk benefits from the completed project. Though the FRM project made provisions to maintain a nominal base flow in the Old Channel, those flows were dramatically diminished relative to historic Old Channel flows. As a result, sedimentation of the Old Channel began within a decade of the completion of the FRM project, which gradually decreased channel capacity; created barriers to aquatic life movement; and degraded and reduced stream area, stream depth, riffle/pool sequences, and other in-stream habitat functions and features.

The purpose of the Smoky Hill River Aquatic Ecosystem Restoration Project (Project) is to restore aquatic habitat functions and features within and near the Old Channel that were lost because of the FRM Project. With restoration of the aquatic habitat functions and features, there are also opportunities to restore the limited extent of existing riparian forest along the Old Channel, create new off-channel emergent wetland habitat, and enhance deep-water habitat availability in Lakewood Lake. Restored habitats are intended to benefit native plants and animals to the greatest extent practicable within an urbanized watershed.

The Project is needed because without intervention, the ecosystem functions associated with the Old Channel's aquatic habitats would continue to degrade and remain unavailable to local, regional, and migratory species. The FRM project has permanently diverted a significant volume of surface water away from the Old Channel. It takes up to a week for diverted flows from the Smoky Hill River to reach the Western Star Mill Weir, approximately the half-way point (about 3.4 miles) along the Old Channel. This reduction in flow availability coupled with extensive sedimentation has caused habitat degradation, loss of aquatic habitat features, and impaired channel capacity.

In response, the Project's objectives aim to:

- Restore degraded in-stream aquatic and emergent wetland habitats within and surrounding the Old Channel during the 50-year period of analysis;
- Reestablish capacity in the Old Channel to convey appropriate flow rates throughout the year and during the 50-year period of analysis;
- Manage future Old Channel sedimentation during the 50-year period of analysis;

- Restore habitat connectivity for the 50-year period of analysis.

Plan Formulation

A series of habitat restoration measures were developed by the planning team to address the identified problems of excessive erosion and lack of high-quality habitat. The initial array of measures were screened based on the Principles, Requirements and Guidelines for Federal Investments in Water Resources (PR&G) Criteria of Completeness, Effectiveness, Efficiency and Acceptability. After screening, the following measures were retained for consideration in developing full restoration alternatives and plans:

- Channel Dredging Reach 1 – Uniform Trapezoidal Section and Profile
- Channel Dredging Reach 1 – Variable Depth Profile (Glide/Pool/Riffle/Run).
- Channel Dredging Reaches 1 & 2 – Variable Depth Profile (Glide/Pool/Riffle/Run)
- Channel Dredging Reaches 1 & 2 –Variable Depth Profile (Glide/Deeper Pool/Riffle/Run)
- Additional Pool Habitat (Reach 2)
- Sediment Forebay (Inlet Area)
- Old Channel Connected Wetlands
- Remove and Replace Western Star Mill Weir with Step Pools
- Restore/Create Wetland Habitat in Lakewood Lake

Using these measures, the Project team developed five alternatives, including the No Action Alternative. After developing the initial array of alternatives, a preliminary cost analysis was performed and Alternative A1 was found to be ineffective. Although the uniform trapezoidal channel shape restored flow to the channel, it did not provide a level of in-stream habitat to meet the Project objectives.

The final array of alternatives included the following:

- No Action Alternative – Does not implement any ecosystem restoration measures. This alternative is used as a baseline for comparison with Alternatives A2, A3, and A4 to determine the habitat benefits and effects between future with and without project conditions.
- Alternative A2 – Includes dredging of Reach 1 and establishing a variable depth profile (pools, riffles, runs, glides) in that reach, constructing a sediment forebay to minimize sediment loading, removal and replacement of Western Star Mill with five step-pools, installation of 2 weirs (one in Reach 1 and the other in Reach 2) to help manage water depths, creating wetland shelves along the old channel, improvement of existing trails at Lakewood Lake, and variable wetland depths around Lakewood Lake.
- Alternative A3 – In addition to all the measures in A2, A3 would include dredging of Reach 2 and establishing a variable depth profile (pools, riffles, runs, glides) along the full 6.8 miles of the Old Channel, improvement of existing trails at

Lakewood Lake, and a greater range of variable wetland depths around Lakewood Lake.

- Alternative A4 – This alternative includes all the same measures as A3 and is distinguished by having greater average pool depths along the 6.8 miles of channel and provides a slightly different configuration of wetlands around Lakewood Lake along with a more intricate network of recreational trails.

Preliminary cost estimates based on Fiscal Year (FY) 2025 price levels were developed. Habitat benefits were estimated using Average Annual Habitat Units (AAHUs) and calculated for each alternative by using the Qualitative Habitat Evaluation Index (QHEI) model and Dabbling Duck model. The costs and benefits for each alternative were evaluated using cost-effectiveness and incremental cost analysis (CE/ICA). This analysis, along with a consideration of study objectives, USACE Planning and Guidance evaluation criteria (Engineering Regulation, ER 1105-2-103) and the consideration of Comprehensive Benefits, was used to compare and evaluate the alternatives. Ultimately, Alternative A3 was identified as the Tentatively Selected Plan (TSP).

Tentatively Selected Plan

Alternative A3, the TSP, was also identified as the National Ecosystem Restoration (NER) plan, meaning that it is the plan that reasonably maximizes ecosystem restoration benefits as compared to costs. Alternative A3 yields 56.8 Net AAHUs for an average annual cost over the 50-year period of analysis (from 2030 to 2080) of $876,000. This equates to an average annual cost per AAHU of $15,425. Implementation of this alternative would restore and improve the aquatic ecosystem structure and function of roughly 6.8 miles of riverine habitat. The TSP is deemed acceptable by the City of Salina as the Sponsor.

The Project First Cost is $17,900,000, based on 2025 price levels. The design and construction of the Project would be cost shared at 65% federal and 35% non-federal, resulting in a federal share of $11,635,000 and a non-federal share of $6,265,000. This is in addition to the cost of the Feasibility Study, which was cost shared $800,000 federal and $800,000 non-federal. The annual operations, maintenance, repair, rehabilitation, and replacement (OMRR&R) costs are estimated at $182,000.

The City of Salina is responsible for acquiring lands and easements necessary for construction and for OMRR&R of the constructed Project. The lands, easements, and rights-of-way required for the Project is 181.45 acres of publicly and privately owned land. There would be three types of standard estates used to facilitate permanent features and construction of the Project. The first standard estate to be utilized is Fee. There is a total of 180.22 acres of fee land required for the Project; of the 180.22 acres, 154.33 acres are owned by the Sponsor and are currently utilized as river channel and other public rights-of-way. The remaining required 25.89 acres are privately owned. All Fee lands for the Project would be used to facilitate the habitat and ecosystem restoration features of the Project. The second estate to be utilized is a Temporary Road Easement, which requires 0.15 acre of privately owned land. The road easement will permit access to the land being utilized for work area during construction. The third estate that will be utilized is a Temporary Work Area Easement, which requires 1.08

acres of land for the Project. The 1.08 acres are currently owned by the Sponsor and would be utilized as work areas for the duration of the Project construction.

Table ES-0-1. Habitat Modelling Results

Alternative	Habitat Type	Habitat Acres	Net AAHUs by Habitat	Total Net AAHUs (QHEI + Dabbling Duck)
A0 (No Action)	Stream	66.6	0	0
	Wetland	36.7		
A1 (Base Alternative – Restores Base Flow)	Stream	66.6	19.8	**41**
	Wetland	36.7	21.1	
A2 (A1 plus Variable Dredging Reach 1)	Stream	66.6	27.5	**48.7**
	Wetland	36.7	21.2	
A3 (A2 plus Variable Dredging Reach 2)	Stream	66.6	35.6	**56.8**
	Wetland	36.7	21.2	
A4 (A3 plus Additional Reach 1 Dredging)	Stream	66.6	36.1	**58.4**
	Wetland	35.8	22.3	

Project Implementation

Under the current Project schedule, Feasibility Report approval would be expected in 2026. The Design and Implementation phase would occur pending the authorization and appropriation of funding, both federal and non-federal. Design is expected to take approximately two years, with construction contracts awarded after Design if funding is available.

Significant Resources/Environmental Concerns

Through the preparation of an EA, all significant resources in the Project area were evaluated. It was determined there would be no effect or less than significant effects on all resources, except for cultural resources, which would be affected by the removal of the Western Star Mill Weir. This adverse effect would be mitigated by actions agreed upon by USACE, the City of Salina, and the Kansas State Historic Preservation Office (SHPO) in a Memorandum of Agreement (MOA). A Finding of No Significant Impact (FONSI) was prepared.

Views of the Public, Agencies, Stakeholders and Tribes

The public is generally in support of an environmental restoration project along the Old Channel. In 2010, the City approved the Smoky Hill River Master Plan after soliciting public input. The intent of the Smoky Hill River Master Plan is to “identify appropriate planning, design and preliminary engineering responses to the specific opportunities associated with the restoration and redevelopment of the Old Channel area of the Smoky Hill River” (City of Salina, Kansas, 2010). This effort indicated that the Local Sponsor and general public strongly support restoring the Old Channel. The rehabilitation of the Smoky Hill River is generally seen by the City, public, and other stakeholders as a critical piece of the ongoing efforts to revitalize the downtown area of Salina.

Reviews

A District Quality Control (DQC) review of the Draft Report has been conducted, as well as Quality Assurance (QA) reviews of contractor provided products. In addition, an Agency Technical Review (ATR), will be conducted by subject matter experts outside of the Kansas City District. Other reviews that will be performed are a Policy Review by the USACE vertical team. Given the relatively small scale and low complexity of the Project, a Safety Assurance Review (SAR) is not anticipated.

The USACE Kansas City District Engineer reviewed the significance of the resources, estimated habitat benefits, economic costs, and identified risks and determined that implementation of the TSP, Alternative A3, would be in the federal interest; therefore, the District Engineer recommends release of the Draft Report and TSP for concurrent ATR, PR&G, and public reviews.

Unresolved Issues/Areas of Controversy

Real Estate coordination is ongoing for this Project.

1.0 Introduction

1.1. Introduction

This Project is being conducted under the U.S. Army Corps of Engineers (USACE) General Investigations (GI) Program. The Project consists of three phases including a Feasibility Phase, Design, Phase, and Construction Phase. This Draft Aquatic Ecosystem Restoration Feasibility Report and Integrated Environmental Assessment (EA) presents background information, analyses, potential alternatives, and recommendations for further Project implementation.

This Draft Feasibility Report documents the existing conditions within the proposed Project area; recommends restoration measures based upon the existing Project area conditions, problems, and opportunities; combines proposed restoration measures to create fully formed restoration alternatives; and evaluates and compares restoration alternatives based on habitat benefits and cost-effectiveness. Supporting information, calculations, and studies are provided in the appendices. The Integrated Environmental Assessment describes the environmental impacts of the proposed Project alternatives.

This Feasibility Study is being cost-shared between the City of Salina, KS as the non-federal cost-sharing Sponsor (50%) and the Kansas City District USACE (50%). Design and construction of the project would be cost-shared between the USACE (65%) and the City of Salina (35%). After project completion, the operation, maintenance, repair, replacement, and rehabilitation (OMRR&R) costs would be 100% the City of Salina's responsibility.

1.2. USACE Planning Process

USACE follows a six-step planning process that is documented in this Feasibility Report. The report is organized by the six steps, beginning with identification of the known problems and opportunities in the Project area (Chapter 1). The second step, and Chapter 2 of this report, focuses on inventorying and forecasting the existing and future without project (FWOP) conditions. This chapter determines if existing problems increase, decrease, or remain the same over the 50-year planning horizon from 2030 to 2080. The next steps are to formulate and evaluate proposed restoration measures and alternatives (Chapter 3), compare alternative costs, benefits, and consequences (Chapters 4 and 5), and identify a Tentatively Selected Plan (TSP) for potential implementation (Chapter 6).

Under the National Environmental Policy Act (NEPA), an environmental assessment (EA) is required for this Project, and is integrated into this report. The EA requires a statement of the purpose and need of the proposed action (included in Chapter 1), an assessment of the affected environment (also referred to as Existing Conditions, included in Chapter 2), a description of reasonable alternatives (portions of Chapter 3), an analysis of the environmental consequences of implementing each of the proposed alternatives (Chapter 4), and the compliance status of applicable environmental regulations (Chapter 7). Sections of the report that are required by NEPA and count towards Department of Defense NEPA Implementing Procedures page limits are identified by an asterisk (*).

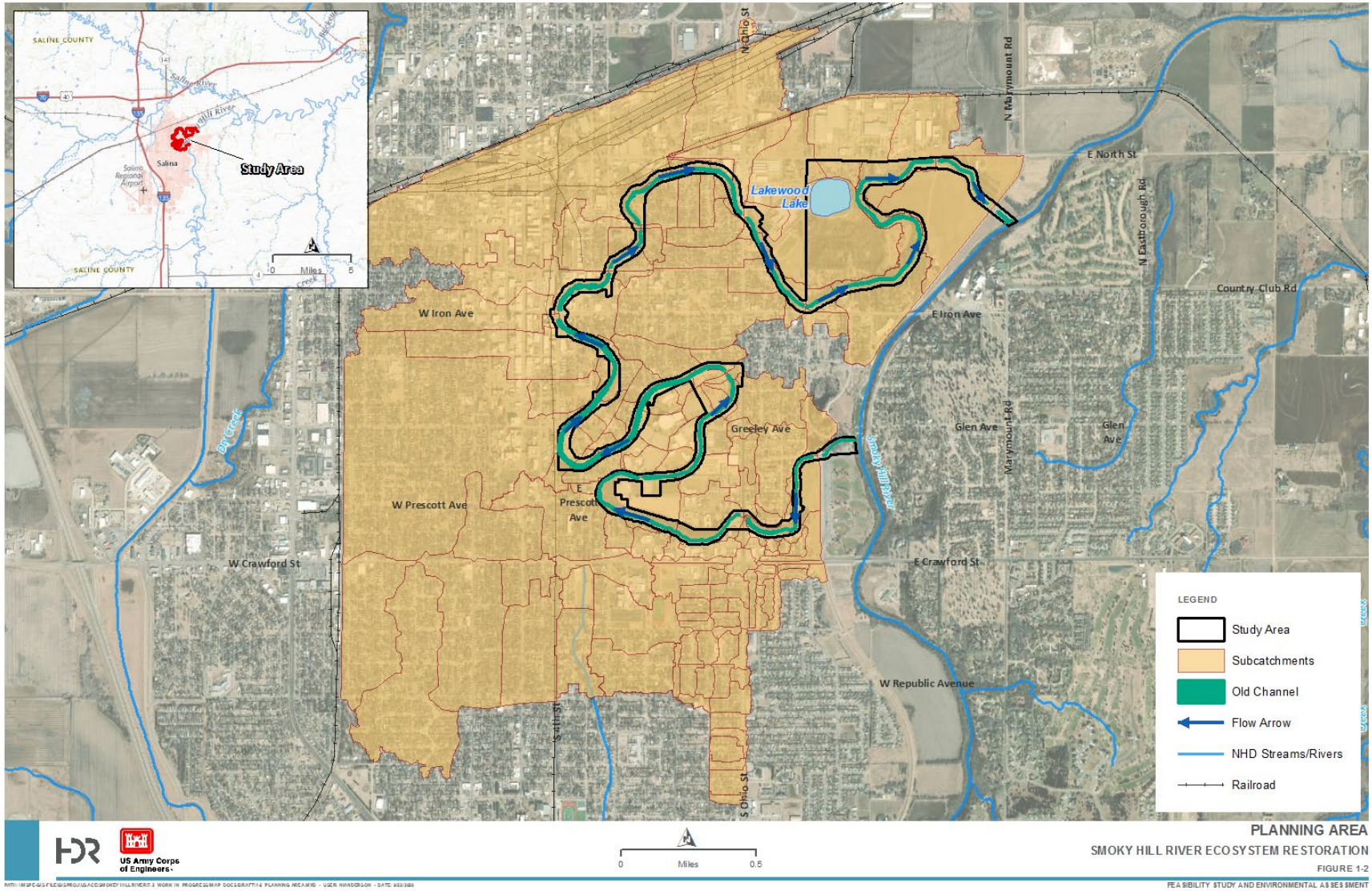

Figure 1-1. Smoky Hill River Planning Area

1.3. Study Authority

The Smoky Hill River Aquatic Ecosystem Restoration Project (Project) is being conducted under the authority of Section 216 of the Flood Control Act of 1970, Public Law (P.L.) 91-611, (33 U.S.C. § 549a). By letter dated July 15, 2024, the City of Salina, KS (City) expressed their desire to sponsor a Feasibility Study to evaluate aquatic ecosystem restoration opportunities within and adjacent to the relic mainstem side channel of the Smoky Hill River (Old Channel) cutoff from the construction of a federal levee in 1961.

1.4. Project Area

The Detailed Project area (see Figure 1-2) includes approximately 6.8 miles of the Old Channel corridor in Salina, KS, as well as adjacent riparian forest components and urban areas. The Old Channel inlet captures flow from the Smoky Hill River north of the Bill Burke Sports Complex, the channel meanders west through downtown Salina, then turns back east through Lakewood Lake Park, then drains any flows through a federal levee outlet control and pump station that re-connects to the Smoky Hill River south of East North Street. A significant proportion of the Project area is owned by the City of Salina, KS; however, there are also privately owned parcels in the Project area. Both the upstream and downstream segments of the Old Channel contain a combination of high density residential, commercial, and recreational land uses. The Project area encompasses a fully developed, urbanized area with degraded natural habitats.

1.5. Background and History

The Smoky Hill River has been an integral part of the City of Salina, KS (City) and associated community since the City's establishment. Historically the Smoky Hill River powered a flour mill at the Western Star Mill Weir and provided a navigable waterway for ferry boats (KSHS, 1935) supporting local and regional commerce, recreation, and travel. The Smoky Hill River has both been shaped by, and has shaped the character of, the City. With growing population density and structural development in the urban environment, increasingly more assets became vulnerable to the destructive forces of flooding from the Smoky Hill River. Additionally, the associated urban development yielded other consequences including stream bank and bed erosion, encroachment on the natural floodplains, resultant loss of habitat associated with natural riparian areas, and increased stormwater runoff.

In 1951, a reported 0.2% (1/500) annual exceedance probability (AEP) flood occurred within the City, which affected more than 50% of the City's residential and commercial areas (City of Salina, n.d.). As a result of the economic and social losses, State and federal funding was utilized to reduce flow through downtown Salina by channelizing the Smoky Hill River through a newly excavated 1.1 mile channel (Cut-off Channel – see Figure 1-2) and construction of a federal levee system that was authorized in the Flood Control Act of 1954, P.L. 83-780 and completed in 1961. These management features constitute the Salina Kansas Federal Flood Risk Management (FRM) Project, which was constructed by the USACE and is operated and maintained by the City. The FRM project is located along the eastern, northern, and southern perimeters of the City, providing reduced flood risk for the entire City.

The implementation of the FRM project degraded the ecosystem function of the Old Channel, approximately 6.8 miles of river channel running through the City. Sedimentation of the Old Channel, which started within a decade of completion of the FRM project, gradually reduced channel capacity and flow rates; created barriers to aquatic life movement; and degraded and reduced stream area, stream depth, riffle/pool sequences, and other important in-stream habitat functions and features.

Even though the FRM project made provisions to maintain a nominal base flow in the Old Channel for a potable water source from the Smoky Hill River to the downtown water treatment plant, the ongoing sedimentation reduced surface water availability for the treatment plant. In response, the City built a new water treatment plant on the Smoky Hill River in the 1980's. After the intake structure and pump station went into service, the Old Channel primarily served to provide seasonal aesthetics, stormwater management, and water quality functions.

In 2010, the City approved the Smoky Hill River Master Plan after soliciting public input. The intent of the Smoky Hill River Master Plan is to "identify appropriate planning, design and preliminary engineering responses to the specific opportunities associated with the restoration and redevelopment of the Old Channel area of the Smoky Hill River" (City of Salina, Kansas, 2010). This effort indicated that the City and general public strongly support restoring the Old Channel.

In 2018, the City entered into an official agreement with the USACE Kansas City District (NWK) to conduct a feasibility study under the Continuing Authorities Program (CAP) Section 1135 authority (33 U.S.C. § 2309a). The Tentatively Selected Plan (TSP) milestone was completed, and a preliminary draft report was developed for the feasibility study. However, the estimated cost exceeded the Federal Per Project Limit (PPL) under the CAP Section 1135 authority, requiring approval of the Assistant Secretary of the Army, Civil Works (ASA-CW). Based on the PPL exceedance, NWK and the City agreed the best path forward to implement the Project was to convert it from CAP to a new start in the General Investigation (GI) program.

In 2024, the City received a United States Department of Transportation (USDOT), Rebuilding American Infrastructure with Sustainability and Equity (RAISE) grant. The grant will help the City modernize infrastructure in the downtown Salina area, including bridge and culvert work that will improve Old Channel flow, consequently reducing sedimentation and complementing the aquatic ecosystem restoration efforts of this Project. It is critical to coordinate all phases on the Project (feasibility, design, and construction) with the City RAISE grant projects to ensure that the Project construction activities occur after city construction has been completed.

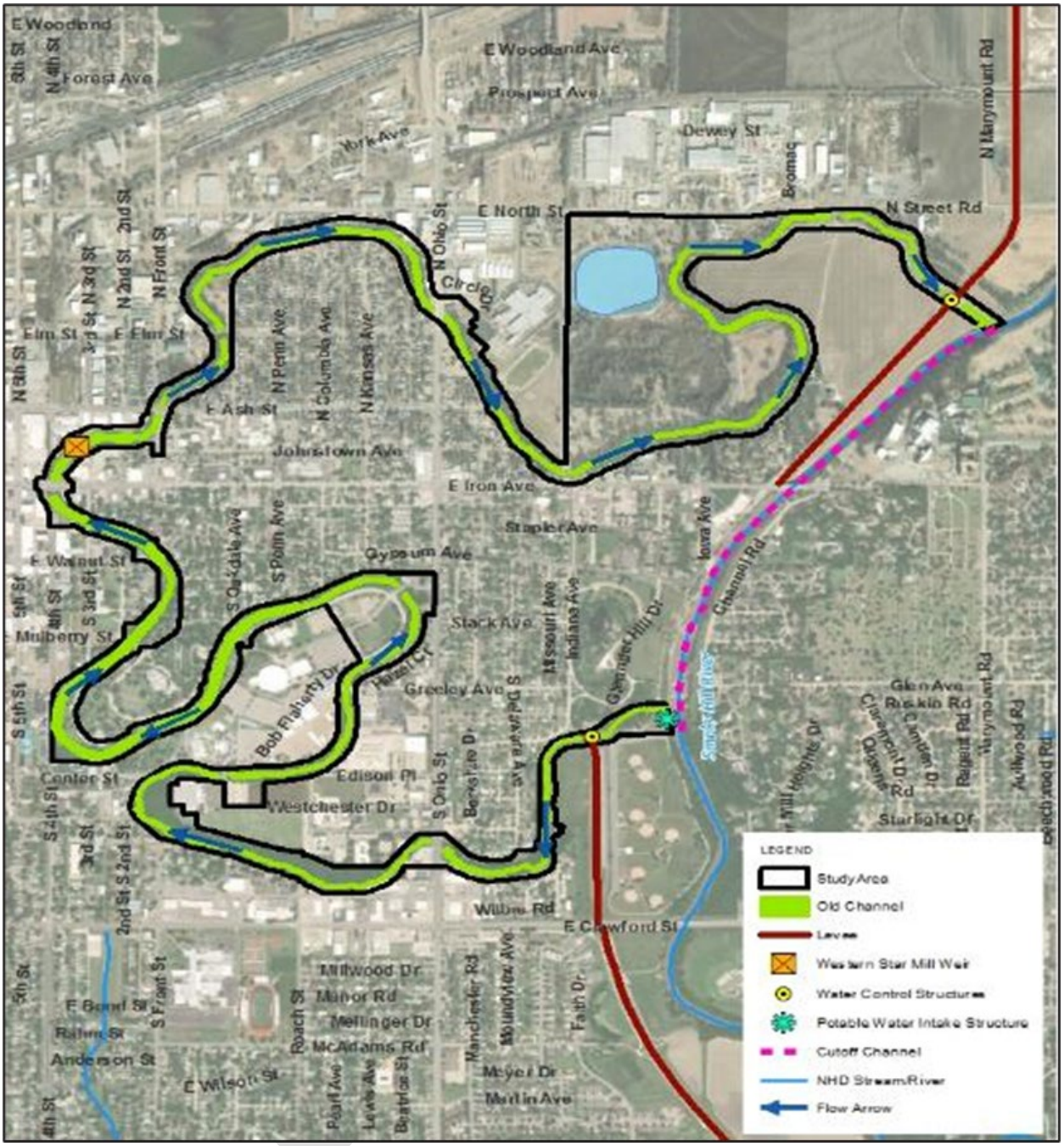

Figure 1-2. Detailed Project Area

1.6. Purpose and Need

The purpose of the Smoky Hill River Aquatic Ecosystem Restoration Project (Project) is to restore aquatic habitat functions and features within and near the Old Channel that were lost as a result of the FRM project. With restoration of the aquatic habitat functions and features, there are also opportunities to:

- Restore Old Channel capacity
- Restore and create wetland and in-stream aquatic habitat features

- Manage sedimentation
- Restore supporting aquatic habitat connectivity and species life movement functions
- Restore floodplain habitat and functionality
- Stabilize stream banks
- Support incidental water quality improvement
- Support incidental passive recreational opportunities
- Complement other City renewal development plans and activities

Restored habitats are intended to benefit native plants and animals to the greatest extent practicable within an urbanized watershed.

The Project is needed because without intervention, the ecosystem functions associated with the Old Channel's aquatic habitats would continue to degrade and remain unavailable to local, regional, and migratory species. Aquatic habitat features have been lost, principally due to a reduced flow regime and impaired channel capacity. In the interest of flood risk reduction, the FRM project has permanently diverted a significant volume of surface water away from the Old Channel. This flow reduction subsequently caused sedimentation and further loss of the channel's capacity to convey available flow. It takes up to a week for diverted flows from the Smoky Hill River to reach the Western Star Mill Weir, approximately the half-way point (about 3.4 miles) along the Old Channel (Figure 1-2). Flow discharge, coming from both appropriation water rights and localized stormwater outfall sources, is inadequate to re-mobilize sediment out of the Old Channel back into the Smoky Hill River. Further, the elimination of flood stage flows in the City has encouraged developmental closer to the Old Channel over time. Dominant urban development practices have resulted in riparian habitat loss adjacent to the Old Channel, which directly impacts aquatic habitat conditions. Reduction in flow availability coupled with extensive sedimentation has caused habitat degradation, including loss of stream flow area, loss of stream depth, loss of riffle/pool sequences, and loss of other important stream habitat functions such as in-stream habitat diversity and availability.

1.7. Problems and Opportunities

The problems in the Project area were identified through a combination of methods, including site visits, analysis of existing reports, analysis of geospatial data, consultation with State agencies, federal agencies, and other non-Governmental organizations (NGOs) familiar with the Project area, and consultation with the public. The identified problems and opportunities guided the Project's inventory of existing conditions, forecast of future conditions, and the development of the study objectives.

The following provides descriptions of on-going problems within the Project area:

- Loss of natural flow regime and sediment transport function. Historically, runoff from an 8,341 square mile drainage area of the watershed contributed seasonally variable flows averaging approximately 80,000 acre-feet annually through the Old Channel. Following completion of the FRM project, the drainage was reduced to

a 4.6 square mile urban drainage area that contributes an estimated 6,300 acre-feet of runoff into the Old Channel. The City has an appropriation water right enabling an annual diversion of base flow not to exceed 28,952 acre-feet, which is still much less than the 80,000 acre-feet average that historically flowed through the Old Channel. In essence, more than 50% of the annual volume during historic channel forming conditions is no longer available today. As such, the natural sediment transport function has been eliminated.

- Old Channel Sedimentation. Because sediment transport function has been eliminated, excessive sedimentation in the Old Channel is occurring that in turn has impaired water flow and travel time of seasonally available flows. Diversions from the Smoky Hill River into the Old Channel have subsequently increased levels of total suspended solids (TSS). High TSS loads have buried riffles and pools, reduced in-stream habitat diversity and availability, caused the loss of stream area and depth, and impacted other important stream habitat functions and features. Storm outfalls also contribute sediment and debris to the Old Channel, including sand and salt from winter road treatments. The diversion channel from the Smoky Hill River has a small cross-sectional area as compared to the cross-sectional area of the Cut-off Channel, resulting in a reduced flow volume to the levee intake control structure and Old Channel. The intake structure is limited to a 100 cubic feet per second (cfs) flow rate. Additionally, when the levee was constructed, a segment of the Old Channel was realigned. It was connected to the Cut-off Channel further downstream. As such, the bottom elevation of the diversion channel is nearly the same elevation as the top of Western Star Mill Weir. This created a very flat channel slope, which reduced the specific energy of flow. This slope, coupled with reduced flow volume, has encouraged sediment to drop out upstream of the weir to a depth averaging seven feet in thickness. In its current state, sedimentation has accumulated to such an extent near and in the South Ohio Street culvert that the culvert is completely blocked and the channel slopes upward, making downstream flow difficult. Only about 1-2 cfs of discharge passes the South Ohio Street culvert, primarily through ground seepage.
- Degradation of Supporting Habitat Functions. Floodplain encroachment and development, coupled with flow intermittency and volume reduction, have indirectly contributed to the degradation of supporting riparian and wetland habitat functions along the Old Channel. Fish kills occurred in Lakewood Lake in 2018 and 2006, which resulted in mainly catfish and trout mortality. In undeveloped areas along the Old Channel, native plant species have been replaced over time with invasive, opportunistic plant species that typically prefer dryer conditions. Associated ecosystem functions that are also likely in decline due to the loss of riparian forest and off-channel emergent wetland habitats include nutrient uptake, carbon sequestration, slope stabilization, biodiversity, soil building, and air quality.

Implementing this Project would enable the City to address the adverse impact of sedimentation, reduced flows, and degraded habitat over the 50-year future planning horizon. Opportunities from this Project include:

- Restoring the Old Channel's capacity to convey variable base flows ranging from 10 cfs up to 100 cfs at any time during the year. Establishing a sediment forebay within the Old Channel would help maintain desired base flows for the life of the Project by managing sediment loading.
- Recreating in-stream connectivity and aquatic habitat functions and features, through instream features such as glides, runs, riffles, pools, and enhancing stream flow area, and stream depth in the Old Channel. The removal of the Western Star Mill Weir would help reestablish connectivity and passage for aquatic life between the upper and lower Old Channel reaches.
- Regenerating functioning wetland habitat, between the Old Channel and Lakewood Lake through hydrologic connectivity.
- Fully utilizing existing recreational Water Appropriation # 47510 through Division of Water Resources.
- Establish a connected emergent wetland complex between the Old Channel and Lakewood Lake. This wetland would expand available habitats for biodiversity and various animal life stages by replacing habitat that has been lost through sedimentation, urbanization, agriculture, and the FRM project.

Conceptual Ecological Model

To further define the problems in the study area and to visualize and explain the interactions between primary drivers, intermediate outcomes and consequences, a conceptual ecological model (Figure 1-3) was developed. In summary, the FRM project resulted in hydraulic and hydrologic changes (primarily the loss of the base flow in the Old Channel, as well as loss of high-water flow events). The changes in water flow and availability led to sedimentation, water quality issues, loss and degradation of aquatic and riparian habitat, invasive species, and loss of aquatic connectivity. Additionally, infrastructure and development (the Western Star Mill Weir, stormwater outflows from the City of Salina, and undersized road and bridge culverts) have driven many of the same issues, including sedimentation, water quality issues, and loss of aquatic connectivity. While the conceptual model is not an exhaustive representation of the dynamics of the entire system, it helped the Project Delivery Team (PDT) to identify problems, opportunities, and constraints, and develop study objectives and potential measures.

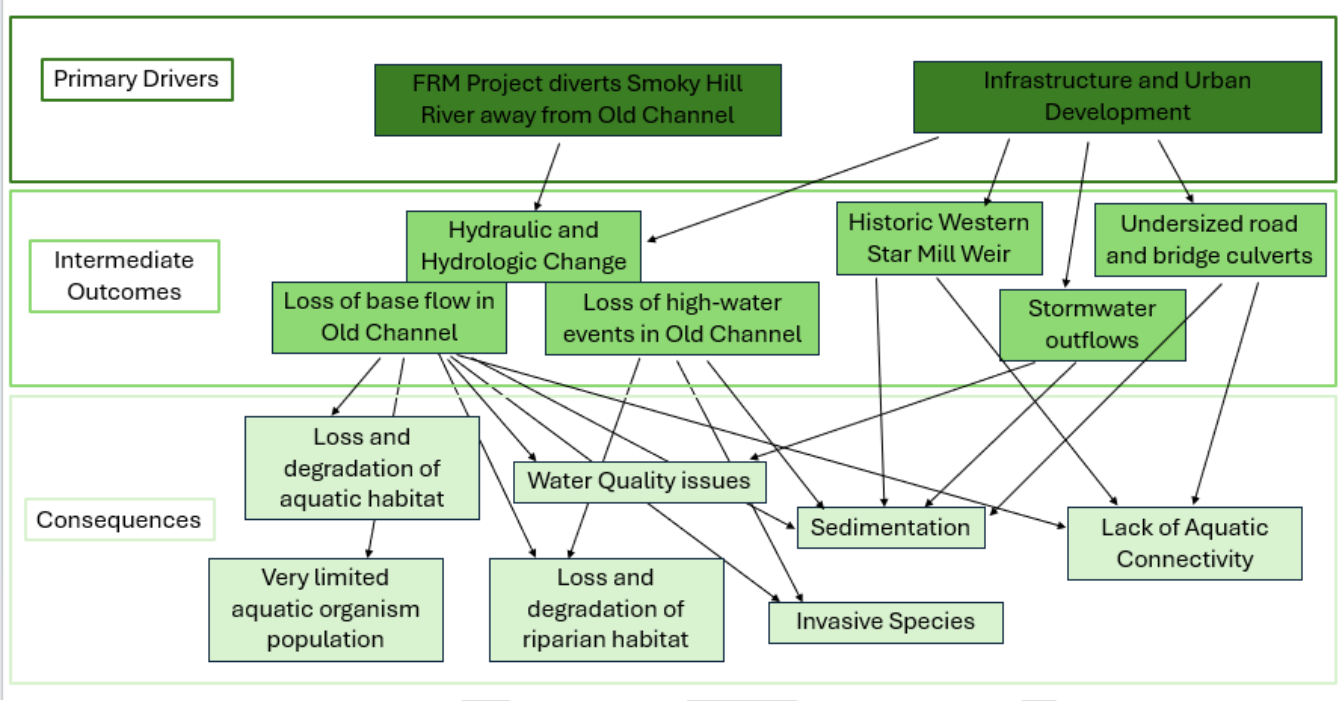

Figure 1-3: Conceptual Ecological Model for Smoky Hill Ecosystem Restoration Project

1.8. Objectives and Considerations

1.8.1. Objectives

The USACE national planning objective for ecosystem restoration is to contribute to the Nation's ecosystems by restoring degraded ecosystem structure, function, and dynamic processes to a less degraded, more natural condition. This study was conducted to examine the feasibility of an ecosystem restoration project and determine if federal participation in restoring habitat functionality within the study area is justified. Specific Project objectives were created to determine whether individual management measures can solve the Project area's problems while taking advantage of the opportunities identified and avoiding any Project constraints. The following Project objectives were developed based on the Project area problems and opportunities, as well as the federal objective and regulations.

Specific Project objectives are documented through the report, focusing on:

- Restore degraded in-stream aquatic and emergent wetland habitats within and surrounding the Old Channel during the 50-year period of analysis;
- Reestablish capacity in the Old Channel to convey appropriate flow rates throughout the year and during the 50-year period of analysis;
- Manage future Old Channel sedimentation during the 50-year period of analysis;
- Restore habitat connectivity for the 50-year period of analysis.

1.8.2. Considerations

The following planning considerations were established to guide and set boundaries on the formulation and evaluation of alternatives. Several of these considerations arose

during the plan formulation process and were used to screen and shape alternative plans.

1. Water right limitations. The City's recreational water appropriation right from the River is capped at 28,952 acre-feet annually, but year to year, it could be lower per appropriation limitations predicated on river flow conditions at the Mentor, Kansas Gage. This is less than half of the 80,000 acre-feet that historically flowed down the Smoky Hill River annually on average. In essence, more than 50% of the annual volume during historic channel forming conditions is no longer available today nor in the foreseeable future. As such, flow limitations are a planning constraint, particularly during future drought conditions. When appropriated water is available in normal flow years, the flow rate in the Old Channel during the recreational months (May to September) should be on average between 40 and 80 cfs. In the off-season months (October to April) flow rates should be on average, 10 to 40 cfs. Maximum flow rate in the Old Channel from the diversion is limited to 100 cfs, which is the maximum discharge capacity of the levee intake control structure. Minimum flow rates in the Old Channel could occur during severe drought conditions if the minimum 6 cfs environmental flow releases from Kanopolis Reservoir are routed through the Old Channel in-lieu of the Cut-off Channel.
2. Cannot unduly disrupt or modify local transportation systems. Ecosystem restoration alternatives must not realign adjacent roadways or unduly disrupt traffic flow patterns. Some bridge and culvert crossings over the Old Channel and within the Project limits are to be replaced by the City. These traffic-related major modifications would be coordinated between the USACE and the City to help mitigate any potential disruption to transportation systems and ensure synergy of the Project and other City projects.
3. Adverse flooding effects must not occur. Future with Project alternatives must not result in increased or induced flooding (a rise condition) over that of existing or FWOP conditions on adjacent, upstream, or downstream properties and infrastructure. Coordination with the City regarding planned Old Channel projects would ensure these projects are not adversely affected. Additionally, performance of the existing FRM Project must not be altered by proposed restoration alternatives. A hydrology and hydraulics (H&H) analysis was performed to identify potential alternative effects (see Appendix A – Hydrology and Hydraulics Assessment).
4. Project plans cannot incur unreasonable or costly construction, operations and maintenance requirements. To the greatest extent possible, restoration measures and alternatives would be designed to be self-sustaining with minimal long-term operations and maintenance requirements. Access to the stream channel and to aquatic and terrestrial habitat features would be necessary to support long-term operations and maintenance functions by the City.
5. To the greatest extent possible, coordinate the Project with the Sponsor's RAISE Grant. It is critical that USACE feasibility, design, and construction phases proceed in coordination with the RAISE grant work.

1.9. Resource Significance

1.9.1. Significance of Ecosystem Outputs

Engineering Regulation (ER) 1105-2-100 requires an explanation of the significance of ecosystem outputs. These outputs can provide institutional, public, or technical significance. Institutional significance means the environmental resource is acknowledged in laws, adopted plans, or other policy statements. Public recognition means that some segment of the general public recognizes the importance of an environmental resource. For example, some communities may hold annual festivals, fairs, or seasonal celebrations for an environmental resource. Technical recognition means that the resource qualifies as significant based on its "technical" merits, which are based on scientific knowledge or judgement of critical resource characteristics. This may include, but is not limited to scarcity, status and trend, connectivity, or biodiversity as a few examples. Table 1-1 summarizes the significance of several key resources, specifically the aquatic and wetland habitats, fish and wildlife, and riparian corridor in the Project area.

Table 1-1. Summary of Ecosystem Significance by Resource

	Institutional	Technical	Public
Aquatic & Wetland Habitat	City of Salina Master Plan Clean Water Act	Loss of over 50% of Kansas wetlands from historic highs. Riffle pool run sequences rare with channelized and degraded rivers in the Project area.	Improved habitat for public use including recreation, bird watching, fishing, water recreation. Restoration of Old Channel contributes to downtown Salina renewal.
Fish & Wildlife	Fish and Wildlife Coordination Act Migratory Bird Treaty Act Endangered Species Act	Scarcity of quality habitat for fish and wildlife in an urban area surrounded by agriculture.	Presence of fish and wildlife is recognized as strong potential recreational draw to the area.
Riparian Corridor	2023 CEQ Connectivity Memo	Riparian corridor habitat is scarce in the developed Salina area and serves as an important resource for maintaining connectivity and biodiversity.	Restored and functional riparian corridor increases public use and recreation through newly built trail network along the Old Channel.

1.9.2. Institutional

A resource gains institutional significance when its importance is recognized by laws, adopted plans, and other policy statements of public agencies, tribes, or private groups. This includes recognition on different scales—including federal, regional, state, and

local. Laws, plans, and policies provide sources of institutional recognition of the importance of resources.

Aquatic & Wetland Habitat: All our Nation's waters and wetlands are valuable resources, regardless of jurisdictional status under the Clean Water Act. They provide vital functions in protecting and improving water quality, absorbing and reducing flood waters, providing critical habitat for an abundance of species, and storing water in an era of water scarcity. As a result, wetlands support economic activity, supply drinking water, maintain essential agricultural and industrial water supplies, and improve opportunities for people to enjoy nature.

Fish and Wildlife: The Project area is located in the Central Flyway for bird migration. Several Audubon Important Bird Areas are located near the Project area in the migration corridor. The Flint Hill Region is a major migration linkage for grassland birds, raptors, and shorebirds.

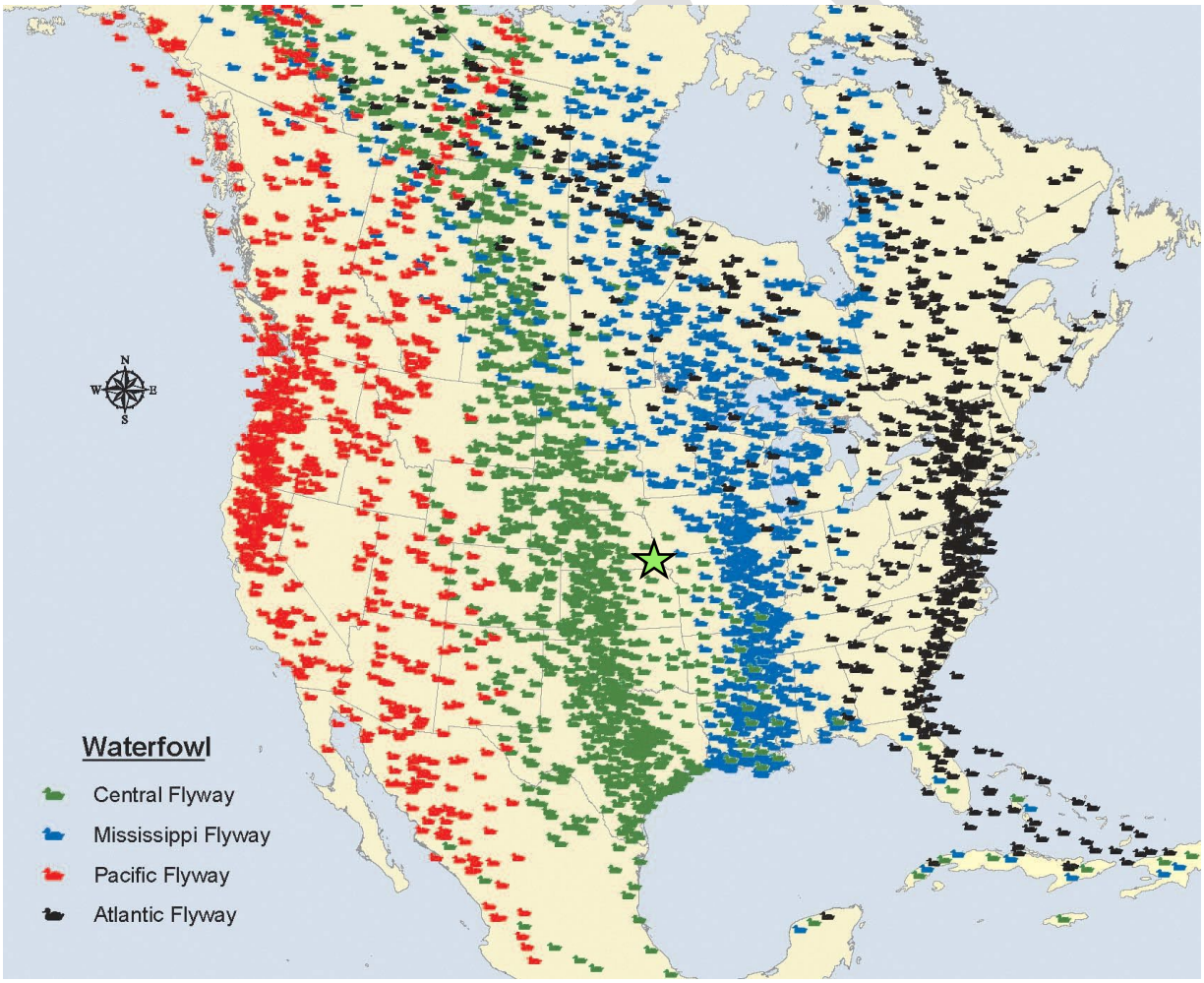

Figure 1-4: Major bird migratory corridors of the United States.

Quivira National Wildlife Refuge conserves land that has long sustained an abundance of wildlife. Whooping cranes, an endangered species once reduced to only 16 individuals during the 1940s, also rely on Quivira's wetland habitats. From mid-March to mid-April, whooping cranes pass through the Refuge. The cranes move through quickly

in the spring, often only staying overnight as the breeding urge pushes them northward. In the fall migration, usually during October, the cranes may spend up to two weeks on the Refuge, going slower as the young of the year make their first trip south. The west edge of the Big Salt Marsh is one of their favorite roosting areas. Up to 19 whooping cranes, out of a wild population of approximately 175, have been recorded using this area at one time.

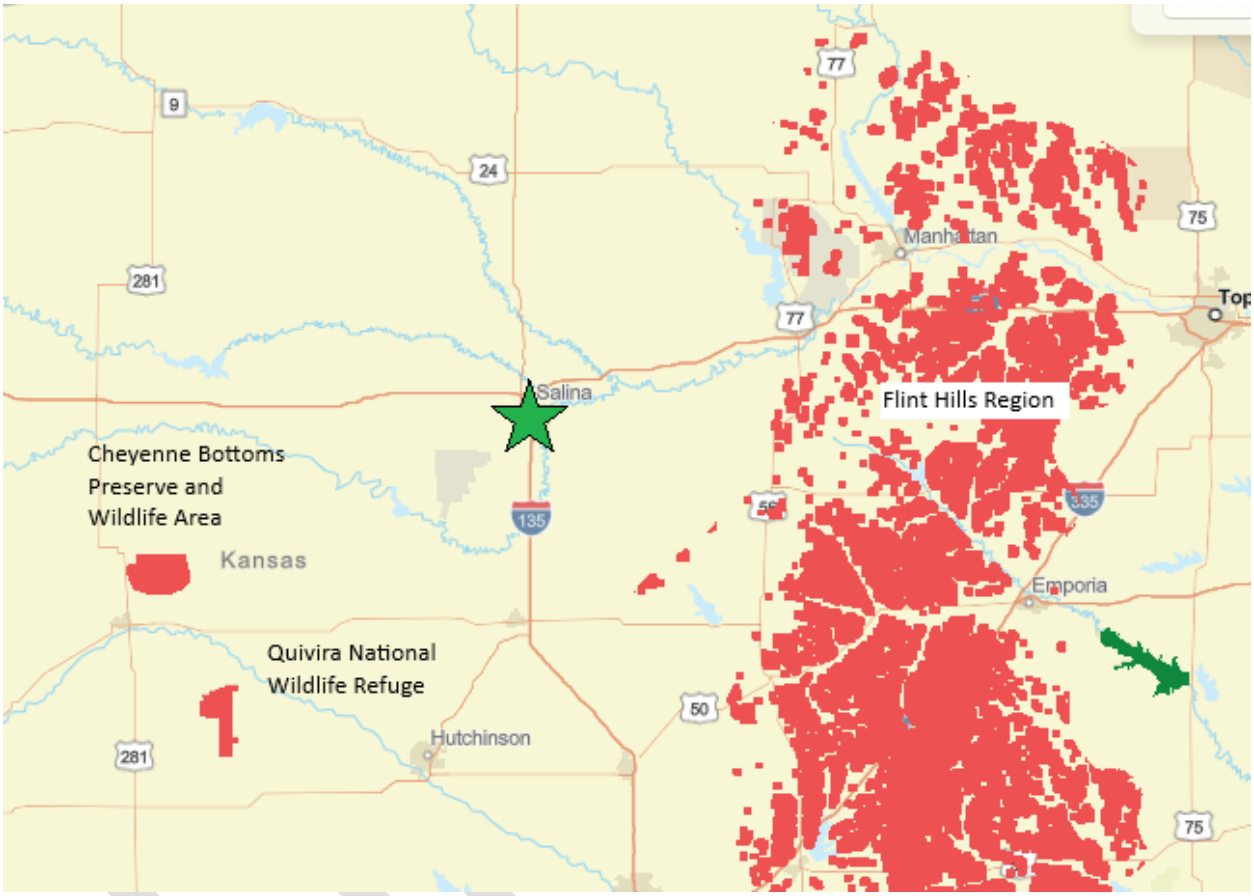

Figure 1-5: Audubon Important Bird Areas surrounding the Project Area

Additionally, several different federal laws address the institutional significance of threatened and endangered species in the area. The Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. §§ 1531 et seq.) and the Fish and Wildlife Coordination Act (FWCA) of 1958, as amended (16 U.S.C. §§ 661 et seq.) both require coordination with the U.S. Fish and Wildlife Service (USFWS) to protect species potentially impacted by the Project.

Riparian Corridor: A 2023 memo from the Council on Environmental Quality (CEQ), titled “Guidance for Federal Departments and Agencies on Ecological Connectivity and Wildlife Corridors” addresses the importance of connectivity and corridors for terrestrial, marine and freshwater environments. For terrestrial habitat, an intact riparian forest corridor along a river provides important habitat for migrating wildlife and increases species movement and resilience under changing environmental conditions. This memo encourages federal agencies to consider maintaining riparian connectivity in future Project planning and implementation.

1.9.3. Technical

Technical recognition means that the resource qualifies as significant based on "technical" merits that are based on scientific knowledge or judgement of its critical resource characteristics. Technical significance should be described using one or more of the following criteria or concepts: scarcity, representativeness, status and trends, connectivity, critical habitat, and biodiversity. Differences across geographical areas and spatial scales may determine whether a resource is significant. Table 1-1 details how each of the resource categories meet the technical criteria.

- *Scarcity* is a measure of a resource's relative abundance within a specified geographic range.
- *Representativeness* is a measure of a resource's ability to depict the natural habitat or ecosystems within a specified range.
- *Status and Trend* measures the relationship between previous, current, and future conditions.
- *Connectivity* is the measure of the potential for movement and dispersal of species throughout a given area or ecosystem.
- *Biodiversity* is a measure of the variety of distinct species and the genetic variability within them.

Table 1-2. Technical Resource Significance of Project Area

Resource	Aquatic & Wetland Habitat	Fish & Wildlife	Riparian Corridor
Scarcity	High quality aquatic habitat is scarce in the region. Kansas lost almost 50% of its wetland area. (Kansas Geological Survey, n.d.)	Threatened and Endangered (T&E) species are scarce by definition. USFWS indicates the whooping crane has a migration area in proximity as well as potential habitat for the proposed monarch butterfly.	Riparian corridor has been impacted by urban development and degradation of the Old Channel. The narrow riparian corridor provides important habitat in a developed area.
Representativeness	Representative of the Central Kansas ecoregion.	Project area representative of habitat in the ecoregion.	Representative of the riparian habitat in the ecoregion.
Status and Trend	Several reports show a reduction in quality and quantity of aquatic habitat in the Smoky Hill River.	Recent survey found very limited aquatic life present in the Old Channel. Historically, the Smoky Hill River through Salina would have supported a variety of aquatic organisms.	The area is experiencing forest fragmentation and loss over time due to urban and agricultural development.
Connectivity	Several reports show a high degree of disconnection in aquatic habitats throughout the Smoky Hill River. Lack of rifle-pool complexes.	Distribution of T&E species has changed throughout the Project area due to fragmented wetlands and migratory routes. Project area is in the Central Flyway for migratory birds, very important corridor for connectivity.	Continuous riparian habitat is a scarce resource in the area with development and agricultural practices.

Resource	Aquatic & Wetland Habitat	Fish & Wildlife	Riparian Corridor
Biodiversity	Biodiversity is representative of regional ecosystem.	There has been a loss of biodiversity in the Project area – due to development, agriculture, and habitat degradation.	An intact riparian corridor is important for maintaining biodiversity in the ecosystem.

1.9.4. Public

Public recognition means that some segment of the public recognizes the importance of an environmental resource, as evidenced by people engaged in activities that reflect an interest or concern for that particular resource. Such activities may involve membership in an organization, financial contributions to resource-related efforts, providing volunteer labor, and correspondence regarding the importance of the resource.

The main public advocacy group in the area is the Friends of the River, a non-governmental organization (NGO) formed in 1973. The group advocates, communicates, and educates for the good of the Smoky Hill River to benefit the community through which it flows. They are strongly supporting of this study.

Aquatic & Wetland Habitat: Public participation in the planning process and scoping phase has indicated strong public interest in a renewal project for the Old Channel. Restoring flow and improving the ecosystem is very popular, along with the associated benefits of improved public recreation access, and the establishment of fishing, kayaking and other recreational activities in the Project area.

Fish and Wildlife: Stakeholders are aware of the importance of migratory bird habitat and the potential presence in the Project area. Improved fish and wildlife habitat is recognized as improving recreation potential in the Project area (bird watching, fishing, etc.).

Riparian Corridor: Restoration of the riparian corridor along the Old Channel has high potential for improved recreational opportunities through expansion of the trail network in Salina. Stakeholders are enthusiastic about the renewal of a green space in downtown Salina.

1.9.5. Indigenous

Indigenous knowledge refers to the evolving knowledge acquired by indigenous and local peoples over hundreds or thousands of years through direct contact with the environment. Indigenous knowledge is a body of observations, oral and written knowledge, practices, and beliefs that promote environmental sustainability and the responsible stewardship of natural resources through relationships between humans and environmental systems.

To date, no indigenous knowledge has been provided by any tribes with an interest in the Project area.

2.0 Existing and Future Without Project Conditions

This chapter is organized by relevant resource topic. Seventeen resources were considered; however, this section is not a comprehensive discussion of every resource within the Project area but rather focuses on those aspects of the environment identified as relevant during scoping or had the potential to affect or be affected by the considered alternatives.

For each resource, the discussion begins with the baseline (existing conditions) and then includes reasonably foreseeable trends and planned actions in the affected area (future without project condition). The existing conditions presented in this chapter also represents the affected environment as required for NEPA purposes. The affected environment is subdivided into natural, physical, economic, and built environments.

The assessment of environmental impacts is based on a comparison of conditions with and without implementation of the proposed plan and reasonable range of alternatives. The descriptions in this chapter focus on the Project area. More focused discussions of the resources within the footprints of each plan alternative are included in Chapter 4.

2.1. Introduction

2.1.1. Period of Analysis and Planning Horizon

The period of analysis for this study, beginning in 2030, is 50 years, which is the standard length for USACE feasibility studies.

The planning horizon encompasses the planning study period, construction period, economic analysis period, and the effective life of the Project. The timeframe used when forecasting future with and without project conditions while considering impacts of alternative plans is called the period of economic and environmental analysis. It may also be referred to as simply the period of analysis. It is the period over which extending the analysis of the plan impacts is important. The period of analysis for this Project was 50 years (2030 to 2080), as is standard for the USACE planning process. Conditions of each attribute in the existing conditions analysis were evaluated in the present and at several habitat modeling time stamps over the forecasted 50 years (i.e., at year 10, 25, and 50).

2.1.2. General Setting

The Smoky Hill River Project area is in Central Kansas, within the City of Salina. The primary focus of the Project is the Old Channel of the Smoky Hill River, which has an urban watershed with degraded natural habitats. The Smoky Hill River flows from south to north, as does the Old Channel. The Project area within Salina is developed, and directly outside of city limits, the primary land use is agricultural.

2.2. Natural Environment

2.2.1. Aquatic Habitat and Resources

The Smoky Hill River flows approximately 575 miles from its headwaters in eastern Colorado before joining the Republican River to form the Kansas River in east-central Kansas. Within the City of Salina, KS, the river system includes both the main channel

of the Smoky Hill River and the "Old Channel" that historically flowed through the center of Salina.

Historically, the Smoky Hill River meandered naturally through the landscape of the Central Great Plains, with shallow braided channels with deep, shifting sand substrates. This created diverse aquatic habitats through seasonal flooding, channel migration, and the formation of features such as oxbows, backwaters, pools, and riffles. However, in the 1960s, the U.S. Army Corps of Engineers implemented a flood control project that significantly altered the river's natural hydrology in the Project area. A diversion channel was constructed to route most of the Smoky Hill River's flow around the city, disconnecting the Old Channel that runs through downtown Salina from its regular flow regime.

The Old Channel, approximately 6.8 miles in length, now receives minimal water flow primarily from stormwater runoff and groundwater seepage. This has resulted in a severely degraded aquatic system characterized by stagnant pools, excessive sedimentation, low dissolved oxygen levels, and limited habitat diversity. The historic Western Star Mill Weir and multiple undersized road culverts that cross the Old Channel further fragment the aquatic habitat by impeding organism passage and disrupting natural sediment transport processes. These structures vary in their impact on connectivity, from partial barriers that may be passable during high-flow events to complete blockages that permanently disconnect upstream and downstream habitats.

Water quality in the Old Channel has deteriorated significantly due to limited flow, urban runoff carrying pollutants, and excessive sedimentation. During summer months, portions of the Old Channel experience algal blooms and low dissolved oxygen levels that cannot support diverse aquatic communities. The substrate composition has shifted from a natural mix of gravel, sand, and organic materials to predominantly fine sediments that have filled in many of the deeper pool habitats that would have previously provided refuge during low-flow periods.

The main Smoky Hill River channel that bypasses Salina maintains more consistent flow but has also been modified through channelization, resulting in a more uniform aquatic environment with reduced habitat complexity compared to its historical condition. Bank erosion is evident in several reaches, contributing to elevated turbidity and sedimentation downstream. Outside the Project area, in 1948, USACE constructed a dam on the Smoky Hill River to form Kanopolis Lake for the purpose of flood control.

Lakewood Lake is 14-acre lake on the north side of the Old Channel (see Figure 1-2). The Lake was created after Putnam Sand Company bought the Lakewood Park area in 1918 and excavated enough sand over the years to form a 450-acre lake. Lakewood Lake fluctuated in size over the years with flooding from the Smoky Hill River. The levee system from the FRM project maintains the Lake at its ~14-acre size. (Salina Post, 2024) The area around Lakewood Lake is maintained as a park, with nature trails through the adjacent riparian and habitat and a nearby educational nature center.

The Clean Water Act (CWA) Section 404 regulates the discharge of dredged or fill materials into waters of the United States. “Waters of the United States” has most recently been defined by the Supreme Court in Sackett v. Environmental Protection Agency, 598 U.S. 651 (2023) as including “only those relatively permanent, standing, or

continuously flowing bodies of water" and "wetlands with a continuous surface connection to bodies that are 'waters of the United States' in their own right.'' Under this definition, the Smoky Hill River, the Old Channel and Lakewood Lake area would all likely be considered waters of the United States.

Under the future without project condition, aquatic habitat in the Old Channel is expected to continue degrading. The Old Channel would likely experience further sedimentation, water quality impairments, and habitat loss as urban development within the watershed continues. Connectivity barriers would persist, preventing the reestablishment of diverse aquatic communities. Projections of future precipitation patterns suggest a more variable precipitation regime for the region, which could exacerbate these conditions through more frequent drought periods interspersed with intense rainfall events that increase erosion and sedimentation.

2.2.2. Wetlands

Wetlands in Central and Eastern Kansas were historically marshes, areas of low-lying land that are covered by water for long periods of time and are dominated by herbaceous species. Kansas has lost over 50% of its wetlands since the 1800's, and the major remaining wetlands in East-Central Kansas are managed wildlife refuges with water control systems. (Kansas Geological Survey, n.d.)

In the Project area, a desktop and field wetland delineation (Appendix F - Environmental) was conducted in 2019. Two wetlands were identified in the Project area (Figure 2-1). Wetland 1 is a 9.93-acre woodland dominated wetland complex in the southern backwater area of Lakewood Lake. It is in an abandoned aggregate mining pit. Wetland 2 is a 1.98-acre herbaceous dominated wetland on an Old Channel sediment point bar. Both wetlands contain native and invasive species and neither wetland is considered floristically high quality.

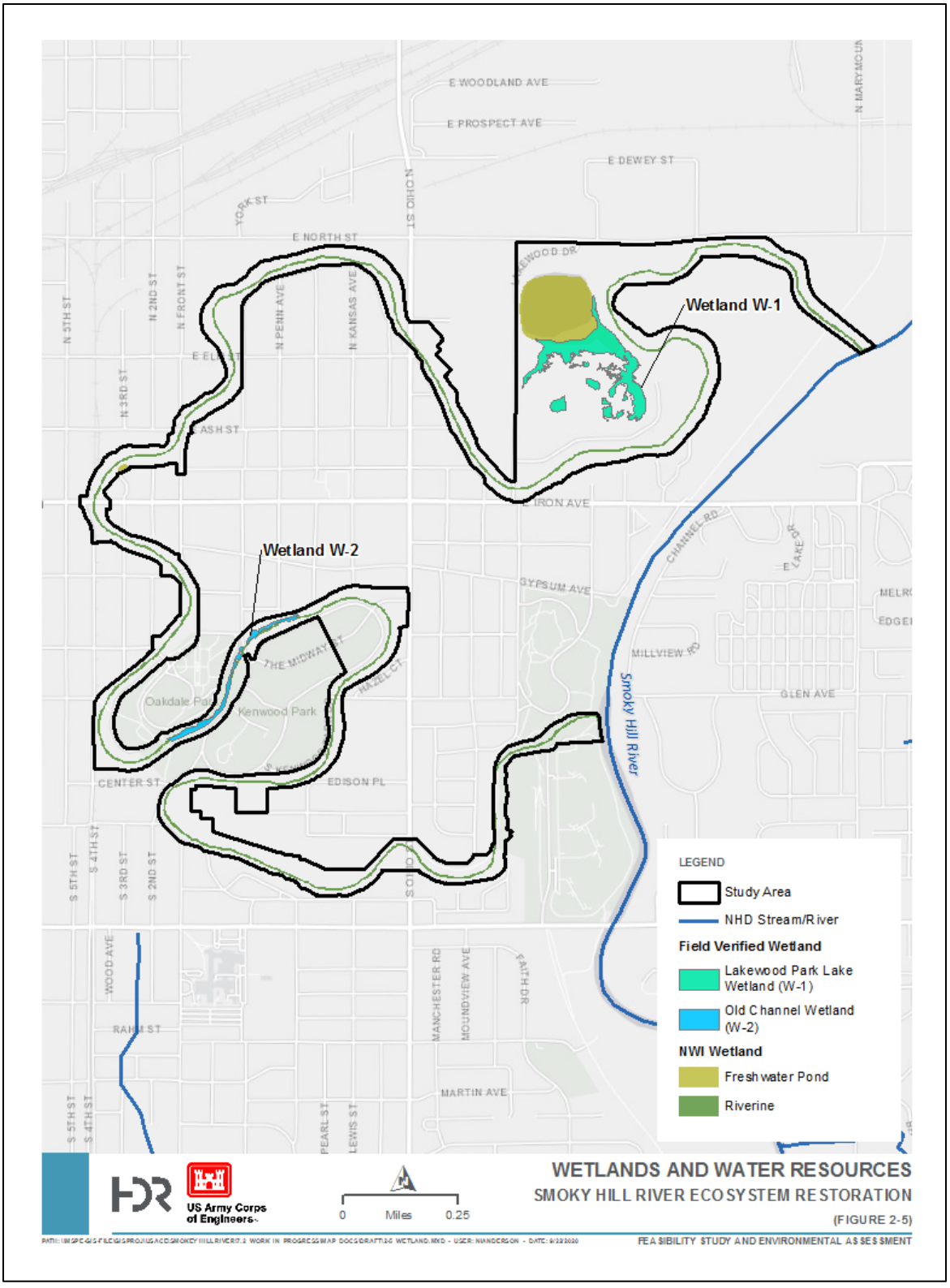

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Figure 2-1. Wetlands within the Project Area

Under the future without project condition, the existing wetlands in the Project area are expected to further degrade in quality, as invasive species continue to move into the area, and sedimentation and variability in precipitation patterns decrease the regular availability of water in the Old Channel and Lakewood Lake area.

2.2.3. Riparian Habitat

The riparian corridor habitat along the Old Channel is subject to significant urban encroachment, but even low-quality riparian corridors serve as important habitat and travel corridors for common wildlife species in developed areas.

The Project area contains narrow woodland corridors on each channel overbank area, with a few short reaches lacking forest. These areas without forest are urban grassland/parkland herbaceous habitats. Urban uses within and adjacent to the corridor have caused significant degradation to the vegetative communities in the riparian zone, including the introduction of invasive and exotic species. Intact wooded communities within the corridor include a dominance of eastern cottonwood (*Populus deltoides)* and hackberry (*Celtis occidentalis*) in the overstory. Lesser dominant species consist of American elm (*Ulmus americana*) and mulberry (Morus alba). Other species represented include green ash (*Fraxinus pennsylvanica*), black walnut (*Juglans nigra*) and silver maple (*Acer saccharinum*). Few other canopy species are present and are isolated individuals when they do occur.

The mid-canopy or sapling layer is dominated by bush honeysuckle (*Lonicera maackii*). Bush honeysuckle regularly comprises 100% coverage of the sapling layer and seldom anything less than 50% coverage when present. Bush honeysuckle species leaf out earlier in the spring than native shrub species and keep leaves on later in the fall, often into December. The intense coverage blocks available sunlight to other species and eventually the honeysuckle outcompetes all native species and becomes a monoculture. In addition, the sunlight limitations to the herbaceous layer suppress even the most shade tolerant species, leaving a denuded and bare forest floor. This effect seems to be dominant within the narrow woodland riparian areas along the Old Channel.

Herbaceous species present in the understory include Virginia wildrye (*Elymus virginicus*). Virginia wildrye is dominant in the few areas where bush honeysuckle is limited or was not identified. The sporadic pockets of wildrye indicate what conditions would be in-lieu of the dominant bush honeysuckle and should be considered a preferred indicator species for restoration activities in the riparian corridor.

Under the future without project condition, the riparian corridor is expected to continue to degrade over time, as invasive bush honeysuckle continues to spread and suppress the growth of other native species. Urban encroachment is expected to continue, as is the limited water availability.

2.2.4. Fish and Wildlife

The Smoky Hill River Project area provides habitat for many fish and wildlife species within an urbanized area. While the riparian corridor is low quality and dominated by invasive species, the presence of a connected, undeveloped corridor through the center of the city provides an important habitat and migration corridor for wildlife.

Due to the substantial development that has occurred in the Project area, much of the fauna that inhabit this location are edge and urban-adaptive species that can tolerate these disturbances. Large mammals such as White-tailed deer (*Odocoileus virginianus*), coyote (*Canis latrans*), raccoon (*Procyon lotor*), and red fox (*Vulpes vulpes*) are likely present in the area. Smaller mammals such as eastern cottontail (*Sylvilagus floridanus*), fox squirrel (*Scuirus nigra*) and other rodent species are common in the area.

Waterfowl and shore birds commonly use rivers, ponds, creeks and shallow emerging wetlands in the Project area. Other birds in the area include raptors and songbirds.

While there is a diversity of fish species present in the Smoky Hill River, the presence of fish in the Old Channel is severely limited. A 2010 survey by Wright Water Engineers, Inc. indicated few fish in the Old Channel and a very limited macro invertebrate community.

The lack of consistent flow, urban stormwater inflows with adverse physical (scour, temperature, erosion, etc.) and chemical (pollutants) effects, highly variable flow diversions from the main channel into the Old Channel, and extensive sediment deposits in the channel bottom all limit the use of the Old Channel for aquatic species. In recent years, there have been at least two fish kills, paradoxically attributed to both high and low water events. There was a drought related fish kill in July 2006, which coincided with the Smoky Hill River recorded flow of just 1 cfs. The second fish kill occurred in 2018 during high water when the Smoky Hill River overtopped the dike and flowed into Lakewood Lake. The long duration of flooding killed vegetation on the south side of the lake and is believed to be responsible for the fish kill.

Under the future without project conditions, the local habitat quality is expected to continue to decline, with the spread of invasive species and continued low water flows and sedimentation of the Old Channel. Most of the wildlife species in the area are adapted to disturbed habitat, but the Old Channel would remain inhospitable to aquatic life given the inconsistent flow and degraded and sedimented habitat.

2.2.5. Threatened and Endangered Species

2.2.5.1. Federally Listed Species

In accordance with Section 7(a)(2) of 16 U.S.C. §§ 1531-1544, Endangered Species Act (ESA), as amended, federally funded, constructed, permitted, or licensed projects must take into consideration impacts to federally listed and proposed threatened or endangered species. The USFWS was contacted via the USFWS Information for Planning and Consultation (IPaC) website for a list of federal threatened, endangered and candidate species that could potentially be present within the Project area (Table 2-1, full list included in Appendix J – Public and Agency Involvement).

Table 2-1. Federally Threatened and Endangered Species Potentially Present Within the Project Area

Common Name	Scientific Name	Listing Status	Habitat	Federal Critical Habitat within Project area?
Whooping Crane	*Grus americana*	Endangered	Inland marshes, lakes, open ponds, wet meadows and rivers, pastures and agricultural fields.	No
Monarch Butterfly	*Danaus plexippus*	Threatened (Proposed)	Open fields and meadows with milkweed and blooming native plants in the spring and summer.	No

2.2.5.2. State Listed Species

An online review of Kansas Department of Wildlife and Parks (KDWP) T&E species was conducted. In addition to the federally endangered Whooping Crane, KDWP identifies six additional T&E species that may be present in Saline County, Kansas (Table 2-2). There are no state designated Critical Habitats within Saline County.

Table 2-2. Threatened and Endangered Species Results for Saline County

Common Name	Scientific Name	State Listing Status	Habitat within Project Area	Critical Habitat within Project area?
Topeka Shiner	*Notropis topeka*	Threatened	No habitat currently within Project area – needs permanent streams with cold and clear water. Likely present in the Smoky Hill River but further east.	No
Whooping Crane	*Grus americana*	Endangered	Inland marshes, lakes, open ponds, wet meadows and rivers, pastures and agricultural fields.	No
Least Tern	*Sterna antillarum*	Endangered	No suitable habitat currently within Project area. As summer residents in Kansas, Least Terns need barren areas near water for nesting, like sandbars in riverbeds.	No
Piping Plover	*Charadrius melodus*	Threatened	Small area of suitable habitat in Project area. Rare migrant through Kansas, requires sparsely vegetated shallow wetlands, open beaches and sandbars within streams.	No

Common Name	Scientific Name	State Listing Status	Habitat within Project Area	Critical Habitat within Project area?
Snowy Plover	*Charadrius alexandrinus*	Threatened	Small area of suitable habitat in Project area. Regular but uncommon resident and migrant in Kansas, requires open salt flats, beaches and bars of rivers and wetlands.	No
Eastern Spotted Skunk	*Spilogale putorius*	Threatened	Unlikely to be in Project area, though suitable habitat is present. Utilizes forest edges and upland prairie grasslands, uses riparian corridors in western half of the state.	No
American Burying Beetle	*Nicrophorus americanus*	Endangered	Unlikely to be in Project area. Requires upland grasslands with sandy/clay loam soils. Historic records exist for this species in Saline County but now is presently only in the southeast corner of the state.	No

Under the future without project condition, the local habitat quality is expected to continue to decline, with the spread of invasive species and continued low water flows and sedimentation of the Old Channel. Continued development and spread of invasive species would be detrimental to the Monarch Butterfly with its habitat needs of open grassland with native milkweed species. Continuing limited water availability in the Old Channel reduces the habitat quality in the Project area for potential use by the Whooping Crane.

2.3. Physical Environment

2.3.1. Hydrology and Hydraulics

The Smoky Hill River flows approximately 575 miles from its headwaters in eastern Colorado before joining the Republican River to form the Kansas River in east-central Kansas. Historically, the Smoky Hill River meandered directly through Central Salina, with a contributing drainage area of 8,340 square miles.

There is a long history of flooding in the Salina area. Salina experienced large flood events periodically throughout the 1800's and early 1900's, particularly in 1903, during which 4/5ths of the city was inundated. In 1948, Kanopolis Reservoir was constructed about 30 miles upstream of Salina on the Smoky Hill River, with the primary authorized purpose of flood control. In the 1960's, a USACE project built a levee system around Salina and constructed a cutoff channel (Smoky Hill River) to the east of the city, so the main flow of the Smoky Hill River no longer ran through central Salina.

After the construction of the levee and cutoff channel, the interior channel was renamed the Old Smoky Hill River. The “Old” river extends roughly 6.8 miles from the levee entrance culvert water control structure to a levee exit culvert water control structure.

Since construction of the levee system, the Old Channel has been filling with sediment and urban debris. There is no longer a permanent baseflow and the channel no longer experiences the magnitude of flooding that historically shaped it. At South Ohio Street, where the 84-inch culvert is completely blocked with sediment, only about 1-2 cfs of water flows through the sediment and drains downstream. Figure 2-2 presents a typical channel section view of the Old Channel. It is heavily sediment laden with wooded vegetation adjacent to the channel.

Figure 2-2. Photo of wooded portion of the Old Channel taken in the winter of 2017

The Old Channel is currently the outlet for the municipal storm sewer system that drains approximately 4.6 mi^2 (2,944 acres) of urban, industrial, commercial, and residential development. There are 75 storm sewer outfalls that enter the channel before exiting through the levee outlet culvert. Impervious surface constitutes roughly 53% of drainage area, with the highest impervious areas located in the downtown region. Per the Center for Watershed Protection, a stream is considered non-supporting (little aquatic life or pollution tolerant aquatic life, poor water quality, no aquatic habitat, channel and bank erosion, etc.) when greater than 25 percent of a drainage area is impervious cover (Center for Watershed Protection, 2016).

The City of Salina experienced flooding events in 2007 from stormwater runoff. Low lying areas and streets in the interior of the levee system can be flooded from storm runoff that exceeds the stormwater system’s maximum capacity. The drainage area in

several locations is affected by surface runoff from adjacent watersheds. The most critical condition affecting the drainage problem is an extended period of above-normal rainfall with a high-intensity storm.

Additionally, H&H modeling indicates that most of the existing stream crossings of the Old Channel are undersized culverts that are fully or partially buried with sediment. These undersized crossings cause backwater conditions and prevent long reaches of the channel from flowing freely. The detained water eventually recedes resulting in sedimentation, vegetation mortality, and water quality issues. Lakewood Lake, near the downstream end, is used as a stormwater detention area during extreme events. Historically, a culvert connected the Old Channel and Lakewood Lake, but the two systems are currently isolated during normal flows. Flood waters can spill from the Old Channel over a pedestrian trail and into Lakewood Lake when stages are high enough. Since Lakewood Lake does not have a low-level pipe outlet, aquatic life and water entering the lake during extreme events can become isolated and the long duration of high water can cause vegetation mortality along the lake shore and backwater areas.

Under the future without project condition, the hydrology of the area is expected to change slightly, with an increase in predicted frequency and intensity of rainfall events. The hydraulics of the area may be slightly altered with increased development in the watershed increasing the area of impervious surfaces, leading to increased stormwater runoff and decreased stormwater absorption. The City of Salina is pursuing additional federal funding (through the Department of Transportation (DOT) RAISE grant program) to replace the undersized culverts on the Old Channel with appropriately sized culverts and pedestrian bridges over the channel. While independent of this Project, appropriately sized culverts would improve the hydraulics of the Old Channel and allow for the flow of stormwater throughout the Old Channel.

2.3.2. Floodplains

Executive Order (EO) 11988 Floodplain Management directs federal agencies to avoid, to the extent possible, the long and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct or indirect support of floodplain development wherever there is a practicable alternative. Engineering Regulation (ER) 1165-2-26 Implementation of Executive Order 11988 on Floodplain Management outlines the USACE policy for compliance with EO 11988. ER 1165-2-26 states it is the policy of USACE to formulate projects which, to the extent possible, avoid or minimize adverse impacts associated with use of the base floodplain and avoid inducing development in the base floodplain unless there is no applicable alternative. The base floodplain is defined as the area subject to a one percent chance of flooding in any given year.

Current Federal Emergency Management Agency (FEMA) flood maps (last updated in 2018) indicates that most of Salina is currently in the 0.2% Annual Chance Flood Hazard zone, which means this area is located in the 500-year floodplain or a 1/500 annual exceedance probability (AEP) flood event (see Figure 2-3). There are some portions of the city that are in the 1% Annual Chance Flood Hazard zone, which means these areas are in the 100-year flood zone (or the 1/100 AEP flood event) that EO 11988 discourages development in. The 1% areas include the Lakewood Lake area (not

permanently developed), an area of Salina southwest of the Old Channel (currently developed with residential housing) and some areas directly adjacent to the Smoky Hill River (the Bill Burke Sports Complex, developed as recreational fields). FEMA maps are mandated to be updated every five years, indicating that these 2018 maps are overdue for an update.

Under the future without project condition, it is likely that the area susceptible to the 1% Annual Chance Flood Hazard increases in Salina. Future climate projections indicate the potential for larger, more severe storms in the future, which would increase the area susceptible to flood events (see Appendix B for more detail). The city has no plans to develop the currently undeveloped areas in the 1% Flood Hazard Zone, and light use recreation is a good use for these flood-prone areas.

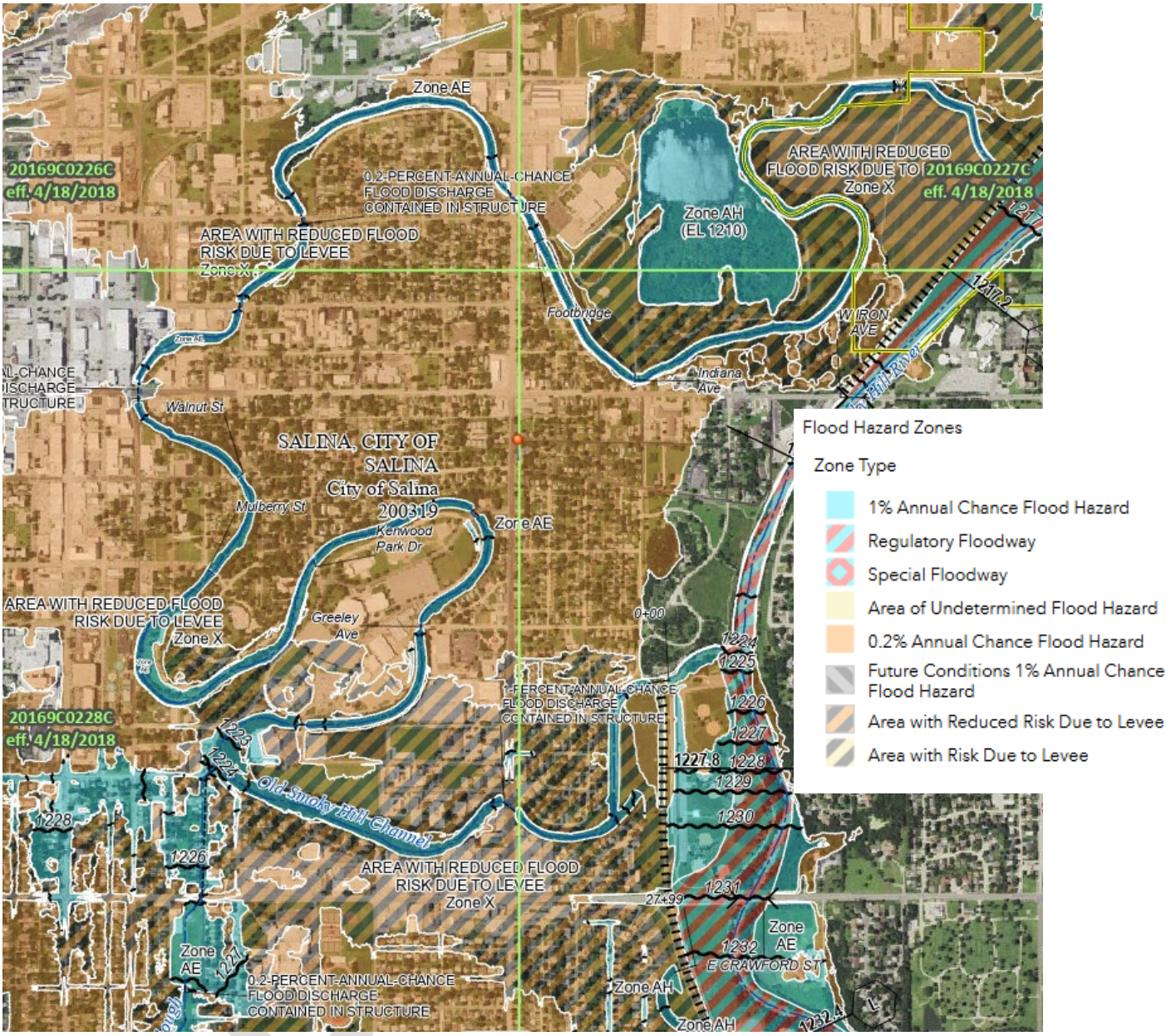
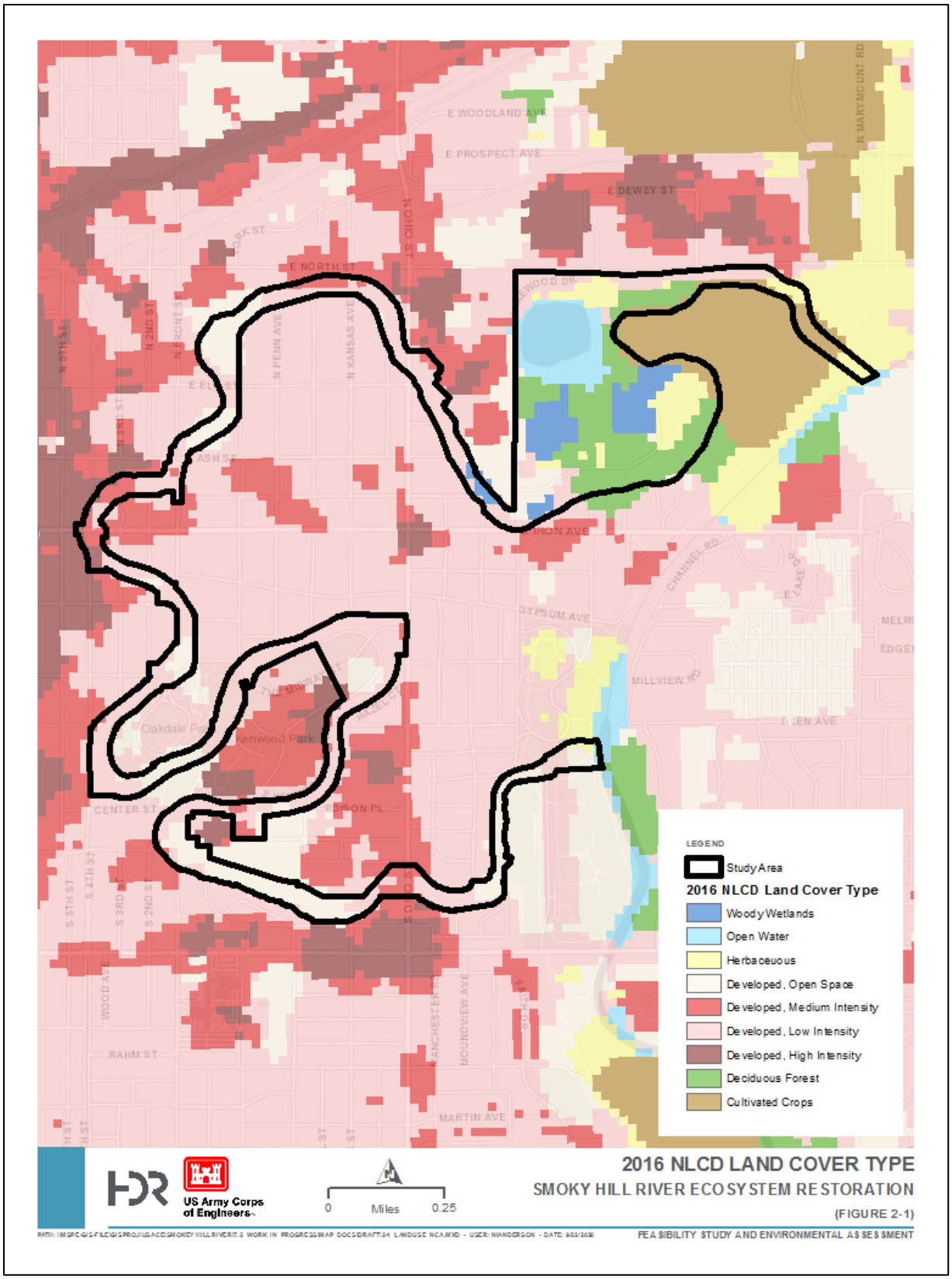


Figure 2-3. Federal Emergency Management Agency (FEMA) Flood Hazard Mapping for the Project Area

2.3.3. Land Use

The 2016 National Land Cover Data (NLCD) from the United States Geological Survey (USGS) Multi-Resolution Land Characteristics (MRLC) Consortium was used to review land use and land cover types within the Project area (MRLC 2019). The major land cover type within the Project area is developed land (open, low intensity, medium intensity, and high intensity) covering approximately 155 acres of the Project area. The remaining land cover types are concentrated in the northwest portion of the Project area and include approximately 31 acres of deciduous forest, 22 acres of herbaceous land,

21 acres of woody wetlands, 17 acres of open water, and 8 acres of cultivated crops (see Figure 2-4).



1 **Figure 2-4. 2016 National Land Cover Database (NCLD) Land Cover Type**

Under the future without project condition, no changes are expected to land use and land cover. The Project area is not experiencing major changes in population or development that would lead to substantially changing patterns in land use in the area.

2.3.4. Geology, Soils and Prime Farmland

Saline County lies within the Smoky Hills physiographic region, which encompasses north-central Kansas. Alluvium, Kiowa Shale, and Cheyenne Sandstone dominate the geology of Saline County, Kansas (USGS 2017). The Smoky Hills region is primarily characterized by sandstone, limestone, and chalk hills formed from sediment deposits during the Cretaceous Period. Much of the county was under water during the Cretaceous Period. Rivers and streams flowed through the region carving the rock layers into hills which created wide and flat river valleys (Buchanan 2010). Figure 2-5 shows the geology of Saline County and surrounding area.

A review of the surficial soils within the interior drainage area and within the Project area was conducted using the Natural Resource Conservation Service (NRCS) Web Soil Survey tool (NRCS 2019). Figure 2-6 depicts the soils within the Project area. The most dominant soil type found was McCook silt loam. This soil type is found in approximately 233 acres of the Project area. The remaining soil classifications include Orthents, clayey soil (26 acres) and Roxbury silt loam (8.9 acres), which have a silt loam and clayey parent material (NRCS 2019).

Within the USACE constructed Smoky Hill River cutoff channel, shale and limestone are present in the side walls. It is presumed that the cutoff channel cut through the Wellington Formation. According to the Kansas Geological Survey, the Permian-aged Wellington Formation consists primarily of gray and bluish-gray shale with beds of anhydrite, gypsum, and limestone.

Prime farmland, as defined by NRCS, is land that has the best combination of physical and chemical characteristics for producing food, feed and forage, fiber, and oilseed crops, and is also available for these uses. Soil data on the Project area obtained from Web Soil Survey shows that none of the soils within the Project area are classified as prime farmland. The majority of the Project area is a highly developed urban setting with no agricultural fields present.

Under the future without project condition, no changes are expected to geology, soils, and prime farmland within the study area.

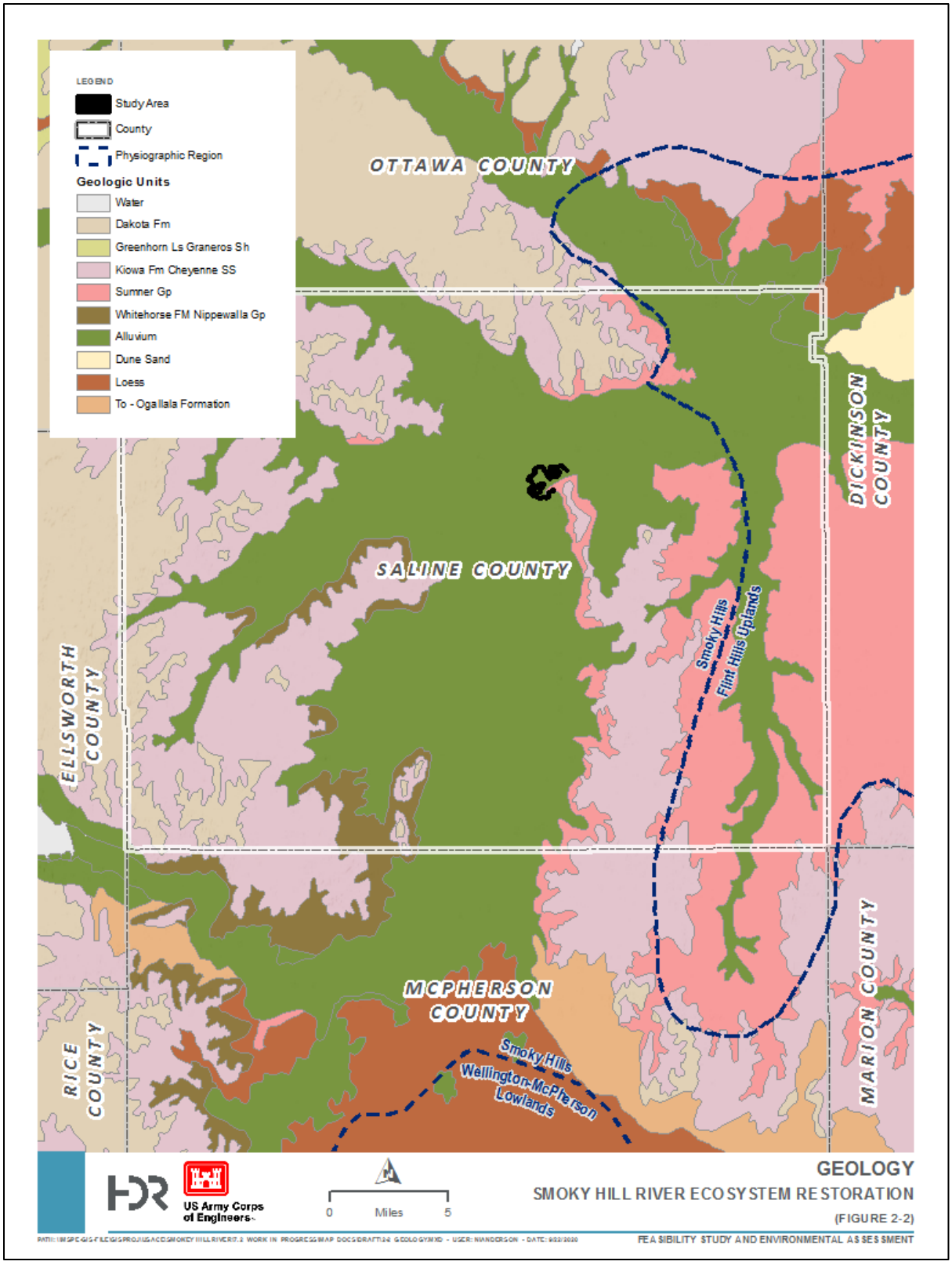


Figure 2-5. Geology of Saline County and Surrounding Areas

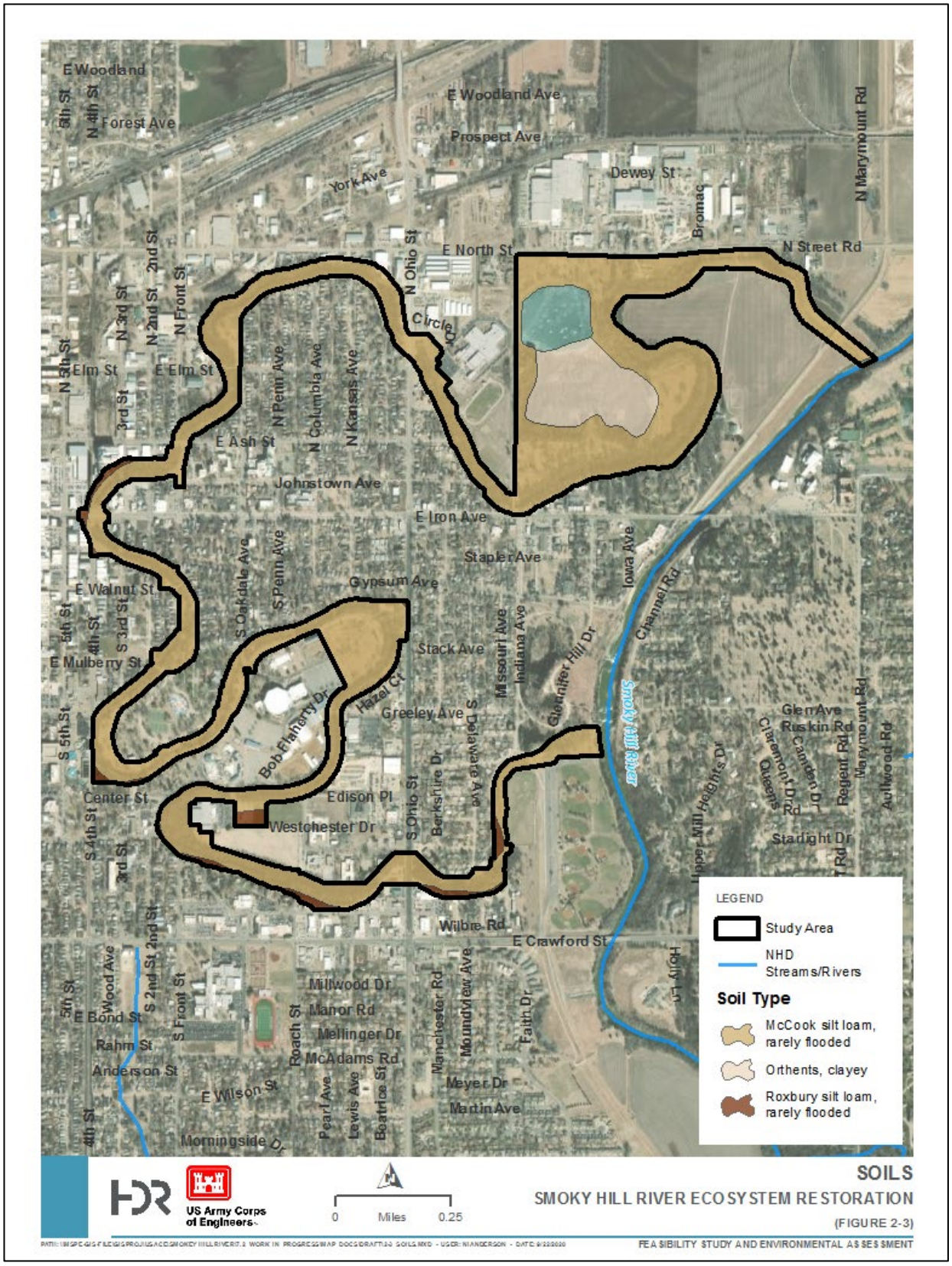


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Figure 2-6. Soils of the Study Area

2.3.5. Climate

The climate in Saline County is defined as a typical continental climate, which is characterized by very hot and dry summers and very cold winters. According to the National Climate Assessment, Kansas is part of the Southern Great Plains region, which includes the states of Kansas, Oklahoma, and Texas. This region is known to have extreme variation in weather including ice storms, high winds, heat waves, drought, severe storms and tornadoes. Precipitation occurs primarily from May to September with most of the rain accumulating during evening thunderstorms. The average annual precipitation is 32.23 inches. As a component of precipitation, the average snowfall is 20.2 inches. On average, 20 days a year have at least one inch of snow on the ground (USDA 1989) (Table 2-3). Climate Data for Salina, Kansas - 1961 to 1990 normals[1] lists the average minimum and maximum temperatures and precipitation for Saline County, Kansas. See Appendix B – Infrastructure and Installation Resilience for additional climate information.

Table 2-3. Climate Data for Salina, Kansas - 1961 to 1990 normals[1]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average high (°F)	39	46	56	67	76	87	93	91	82	70	54	42
Average low (°F)	19	24	34	43	53	64	69	68	58	46	33	23
Average precipitation (In)	0.79	1.06	2.64	3.07	5.12	4.13	4.33	3.5	2.52	2.56	1.57	0.94

[1]Source: U.S Climate Data https://www.usclimatedata.com/climate/salina/kansas/united-states/usks0523

In accordance with USACE Engineering Construction Bulletin (ECB) 2018-14, Guidance for Incorporating Climate Change Impacts to Inland Hydrology in Civil Works Studies, Designs and Projects (USACE, 2018), an infrastructure and installation resilience assessment was conducted for the study area (Appendix B – Infrastructure and Installation Resilience). The strongest consensus in the literature from the analysis supports a trend of increasing temperatures and precipitation in the region resulting in increased frequency in the occurrence of extreme storm events. Extremes in climate would also magnify periods of wet and dry weather resulting in longer more severe droughts and larger more extensive storms. The literature is conflicted as to projected peak magnitude, duration, and volume of extreme events with the uncertainty being largely attributed to the uncertainty of the climate models themselves.

Larger and more frequent storms may impact the Smoky Hill region by loading Project features more often, leading to higher costs to maintain them. Increased frequency of droughts can reduce the available water supply for aquatic and riparian restoration.

Under the future without project condition, the climate in the Project area is likely to follow the trends described above.

2.3.6. Air Quality and Noise

The Clean Air Act of 1963 requires the U.S. Environmental Protection Agency (EPA) to designate National Ambient Air Quality Standards (NAAQS). The EPA has identified standards for six pollutants: lead, sulfur dioxide, carbon monoxide, nitrogen dioxide, ozone, particulate matter (less than 10 microns and less than 2.5 microns in diameter), along with some heavy metals, nitrates, sulfates, volatile organic and toxic compounds (Table 2-4).

Table 2-4. U.S Environmental Protection Agency (EPA) Air Quality Standards

Pollutant	Averaging time	Criteria	Form
Carbon monoxide	8 hours	9 ppm	Not to be exceeded more than once per year
Carbon monoxide	1 hour	35 ppm	Not to be exceeded more than once per year
Lead	Rolling 3 month	0.15 µg/m^3	Not to be exceeded
Nitrogen dioxide	1 hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
Nitrogen dioxide	1 year	53 ppb	Annual Mean
Ozone	8 hours	0.070 ppm	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
Particle Pollution (PM2.5)	1 year	12.0 µg/m^3	Annual mean, averaged over 3 years
Particle Pollution (PM2.5)	1 year	15.0 µg/m^3	Annual mean, averaged over 3 years
Particle Pollution (PM2.5)	24 hours	35 µg/m^3	98th percentile, averaged over 3 years
Sulfur dioxide	1 hour	75 ppb	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
Sulfur dioxide	3 hours	0.5 ppm	Not to be exceeded more than once per year

The Kansas Department of Health and Environment (KDHE) Bureau of Air designated nonattainment for lead at the Exide Technologies lead acid battery manufacturing facility in Salina, which is approximately 6 miles south of the Project area. The remaining portions of Saline County are designated as attainment/unclassifiable (KDHE 2019). A lead air monitoring site is located approximately five miles south of the Project area, about 100 meters north of the Exide Technologies property boundary (see Figure 2-7).

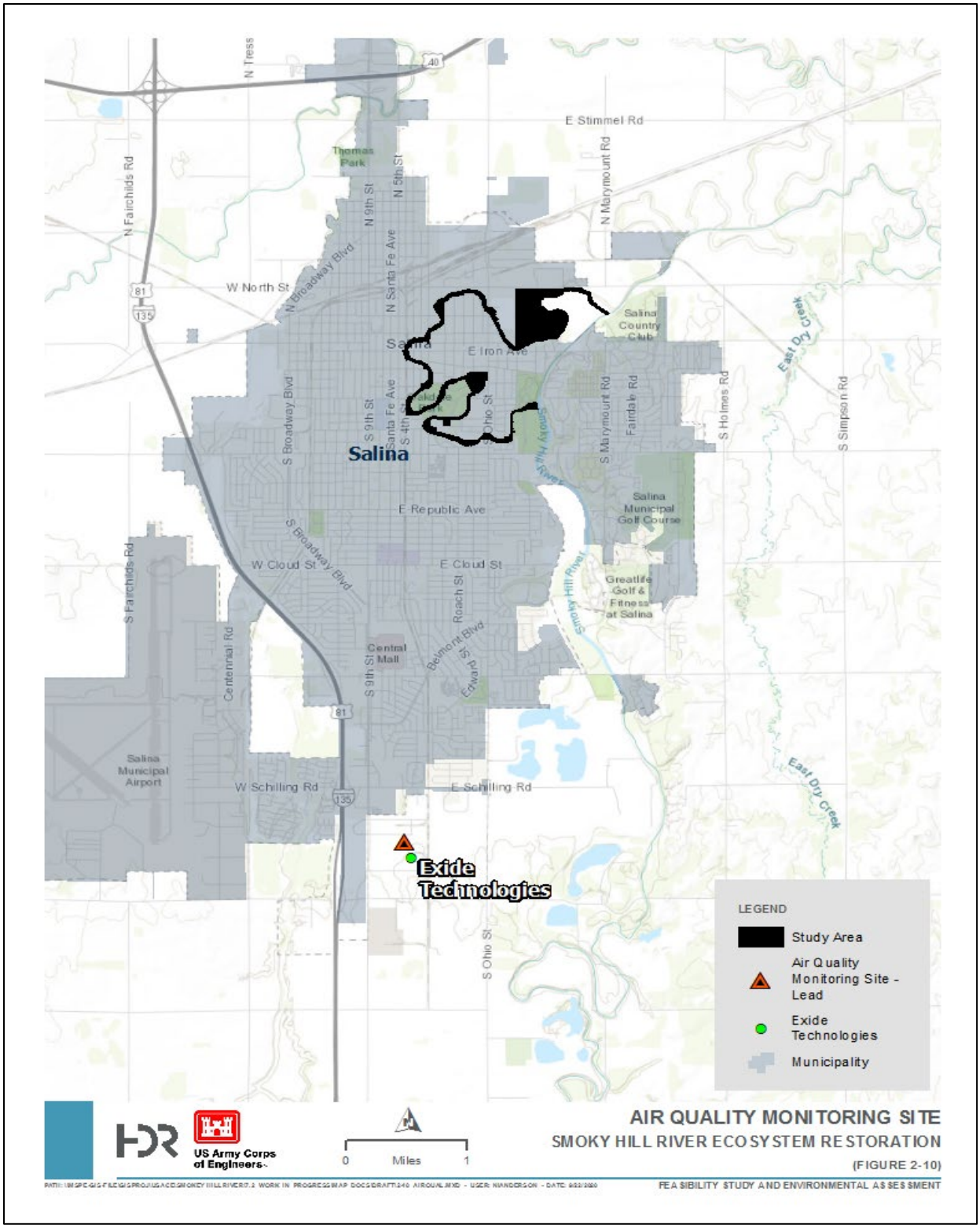


Figure 2-7. Location of Exide Technologies Air Quality Monitoring Site

The Noise Control Act of 1972 (42 USC 4901 et seq.) established a national policy to promote an environment free from noise pollution that jeopardizes public health and welfare. Sources of noise in the Project area result from the existing urban and industrial activities that take place within proximity to the Project area. Due to the heavily urbanized setting of the Project area, traffic is likely the primary contributor of year-round noise pollution.

Under the future without project condition, the air quality and noise in the Project area is expected to remain the same. According to US Census data, the City of Salina is slightly decreasing in population, so it is unlikely that there would be a notable increase in traffic in the Project area.

2.3.7. Water Quality

Under section 303(d) of the Clean Water Act, each state is required to identify waters that are not meeting water quality standards and for which adequate water pollution controls have not been required. The resulting 303(d) list helps the state keep track of impaired waters not addressed by normal water pollution control programs.

In KDHE's 2024 303(d) list, the Smoky Hill River near Salina is listed as impaired for aquatic life due to biology (medium priority), total phosphorus (high priority) and total suspended solids (low priority). Lakewood Lake is listed as impaired for aquatic life due to eutrophication.

Under the Clean Water Act, each state must develop Total Maximum Daily Loads (TMDLs) for all waters listed on the 303(d) list. A TMDL is the maximum amount of pollutant allowed to enter a waterbody so that the waterbody will meet and continue to meet water quality standards for that particular pollutant. For the Smoky Hill River near Salina, KDHE established TMDLs for Biology (measured in terms of macroinvertebrates living in the waterbody), E. Coli, Total Phosphorus and Total Suspended Solids.

KDHE has established a TMDL for Lakewood Lake its eutrophication problem. The current total phosphorus load is 9.3 lbs/year, and the TMDL is 1.4lbs/year, which represents an 85% reduction. The current Chlorophyll a load is 81 ug/L, and the TMDL is <12, another 85% reduction.

Qualitative reports of the water quality in the Old Channel (HDR, 2017) characterize the Old Channel as significantly degraded, with extensive sediment deposition, variable flow conditions dictated by urban runoff, and limited flushing capacity for debris and solid waste materials. City staff reported that the Old Channel is typically stagnant with algal growth in the hotter portions of the summer and fall, and sometimes foul smelling.

This urban stormwater runoff from the 75 outlets that discharge in the Old Channel carries a wide range of pollutants including sediments, solid waste, bacteria, heavy metals, fertilizers, pesticides, and oil and grease compounds. The City of Salina is considering various Best Management Practices (BMPs) independent of this study to address stormwater runoff quality.

Under the future without project condition, the water quality is expected to remain approximately the same or decrease slightly. The area is already impaired, and additional sedimentation added to the Old Channel would continue to decrease the

water quality. It is possible that BMPs implemented by the City of Salina improve the quality of runoff coming into the Old Channel.

2.3.8. Hazardous, Toxic and Radioactive Waste

Hazardous, Toxic, and Radioactive Waste (HTRW) and non-HTRW investigations were performed (Appendix G – Hazardous, Toxic and Radioactive Waste Investigation) to identify any potential HTRW sites, including soil, surface water, and groundwater contamination pathways that could be affected by Project construction. A records review and database search, map and aerial photo review, and site reconnaissance were conducted to determine if HTRW and non-HTRW environmental issues (recognized environmental conditions as defined by ASTM E1527-13) were present within the proposed Project area or adjacent to the Project area.

According to ER 1165-2-132, non-HTRW issues that do not comply with federal, state, and local regulations should be addressed in the HTRW evaluation along with HTRW issues. The purpose of the site reconnaissance was to examine the Project area for evidence of HTRW or indications of recognized environmental conditions (RECs) (see Figure 2-8). Sites identified during the historic records review and the EDR database review were investigated further to determine if activities from these or other facilities on or adjacent to the Project site may have impacted the Project area. Two REC sites were identified (418 E Ash Street and 616 E North Street) due to ongoing contamination or no closure documentation. The remaining sites were identified as Historical RECs, where contamination had occurred but was resolved.

The most relevant sites are summarized below, with a full list in Appendix G – Hazardous, Toxic and Radioactive Waste Investigation.

- **Central Garage (418 E Ash Street)**: This property partially overlaps the Project area and experienced a gasoline release from an underground storage tank in 1992, resulting in groundwater contamination with undetermined extent. The site status remains "monitor" with no closure documentation found, making it a REC.
- **616 E North Street**: This property is adjacent to and upgradient from the Project area, with tetrachloroethylene (PCE) contamination detected in groundwater during multiple investigations from 2014-2020. Recent 2020 monitoring found elevated PCE levels above EPA maximum contaminant levels in two wells, maintaining its status as a REC due to ongoing contamination.
- **Kenison, Inc (920 E North Street)**: This property partially overlaps the northern portion of the Project Area and had a transformer oil spill in 2013. Soil testing and remediation of impacted soils and waters was completed, classifying it as a Historical REC (HREC).
- **Land Pride S4/Turbine Specialties (1030 E North Street)**: This property is bisected by the Project area and experienced a leaking underground storage tank incident in 1990. No contaminants were found and no further action was required, making it an HREC.

- **ADM Milling Company (Ash & 3rd Street)**: This property is crossed by the Project area and had a 1990 leaking underground storage tank incident. No further action was deemed necessary, classifying it as an HREC.
- **Star A Insurance/Super Wash & Detail (156 N 5th Street)**: The southeastern corner of this property is crossed by the Project area, where an abandoned underground storage tank was discovered in 2006 with soil odor noted. No further action was required for the incident, making it an HREC.
- **City of Salina/Oakdale Park (730 Oakdale Park)**: This property is crossed by the Project area at multiple perimeters and had limited diesel and gasoline contamination around fill tubes during tank removal in 1992, with contamination not exceeding one foot in diameter. The case was closed with no further action required, and despite a historical sand and gravel mine record, this site is not considered a REC.

Under the future without project condition, no changes to the presence or effects of HTRW in the Project area are expected.

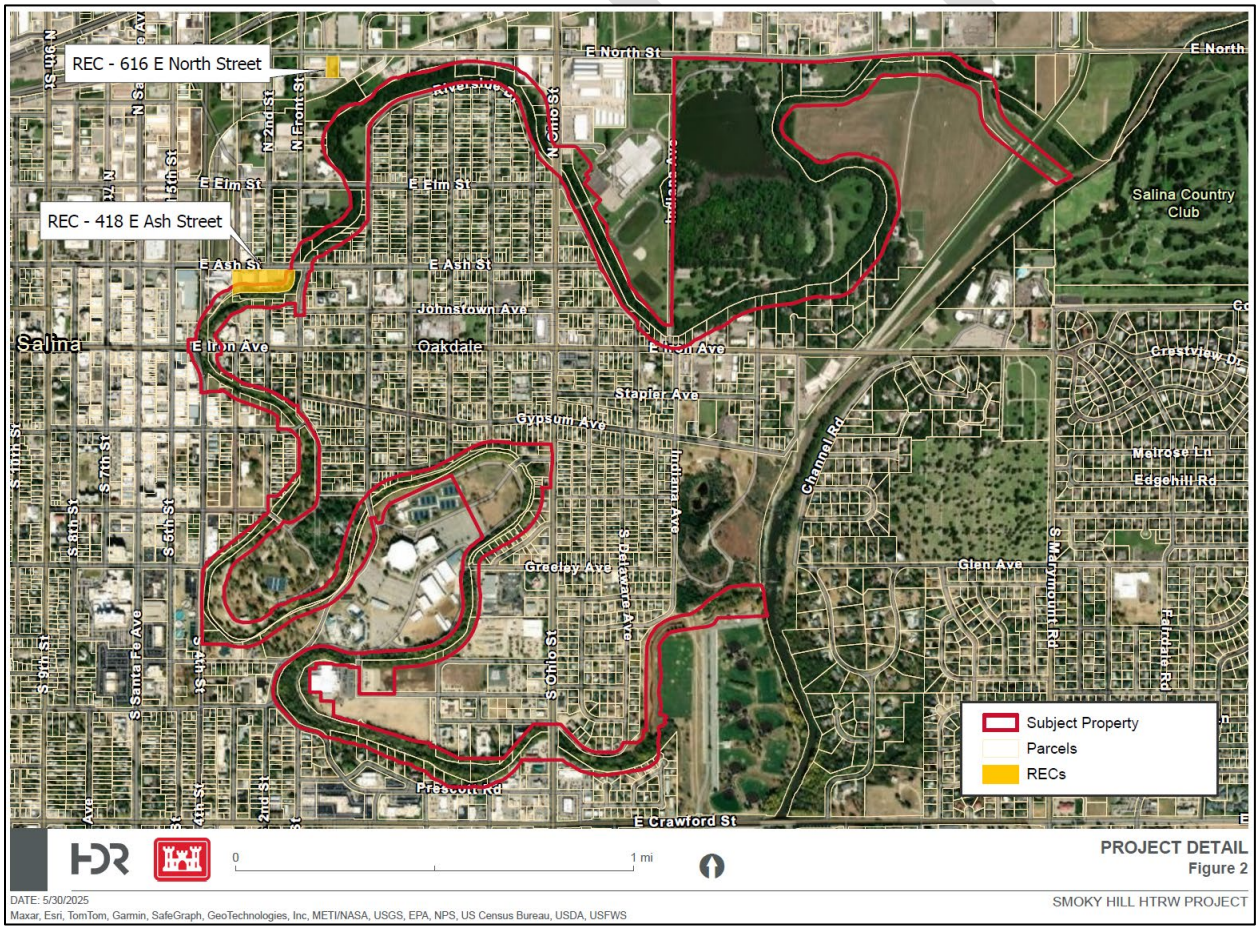


Figure 2-8. Recognized Environmental Conditions (RECs) within the Project Area.

2.3.9. Cultural and Historic Resources

A cultural resources background records search along with tribal and Kansas State Historic Preservation Office (SHPO) consultation is documented in Appendix J– Public and Agency Involvement and Appendix L-Cultural Resources.

Almost none of the Project area has been surveyed, save for two cell tower surveys (5383 and 7092), two surveys for pedestrian trails (5648 and 6795), and a small bank stabilization survey (5618). No sites were found during these surveys. Only one site is recorded near the Project area boundary of the Project. It is possible that there are cultural resources, both modern and ancient, along the Old Channel in relatively undisturbed places.

Lakewood Park Bridge

This is a National Register-listed Pratt Truss road bridge, located within the survey location of survey 5648, that was moved to this location from 0.3 mile to the southeast and re-purposed as a pedestrian bridge. It is listed on the Kansas Historic Resources Inventory (KHRI 169-4900-00320).

WPA Walls

The remains of a Works Progress Administration (WPA) wall is located at the end of 3rd Street where it dead ends into the Smoky Hill River and was photographed and entered into KHRI as #169-483. Research indicated that this and a similar wall at 2nd Street (and 8 others, now razed) were built by National Youth Administration, a division of the WPA in 1939.

Western Star Mill Weir

The Western Star Mill Weir is located on the Old Channel adjacent to Founder's Park, the place where the founders of Salina, William A. Phillips, Alexander M. Campbell, and James Muir, marked out the townsite and a ferry crossing in 1858. The park commemorates these events and the importance of milling to Salina's commercial development. Photographs of the weir were submitted to KHRI (KHRI.kansasgis.org #169-482). Due to the rarity of small concrete weirs in Kansas (only 10 others are recorded on KHRI), USACE has determined that the weir is NRHP eligible.

Cutler (1888) mentions several mills in Salina, but the grist mill built by C.R. Underwood in 1867 on the Smoky, which was operated by both steam and waterpower, is probably the Western Star Mill. Cutler goes on to say that C. R. Underwood & Co. erected another large, water-powered flouring mill in 1875, on the west bank of the Smoky Hill River, just north of the bridge that spans the river at Iron Avenue. These mills and most of the businesses of this era were spurred by the arrival of the Kansas Pacific Railroad. It was not until then that Kansas' copious hard wheat crop could be turned into flour and exported by rail. Appendix L – Cultural Resources show excerpts from the 1884 and 1917 Sanborn Fire Insurance maps showing the weir and mill. Appendix L – Cultural Resources is a historic photograph of the weir and mill dating to the 1920s.

In 1961, the USACE built a by-pass channel and flood control levee on the Smoky Hill River. This flood control project diverted the river flows away from the Western Star Mill

Weir and only stormwater drainage from approximately five square miles routinely flows through the site.

Archer-Daniels Milling Company (ADM) purchased the mill in 1970, and the City of Salina currently owns the weir. The water turbine shown in Appendix L – Cultural Resources have been replaced with sluice gates. In 1967, the Western Star Mill Weir was rehabilitated. The Smoky Hill River Weir plans are dated April 1965 and were completed by the City of Salina's City Engineer's office. The rehabilitation project improved the cutoff channel and consisted of installing new 5-foot tall by 5.5-foot-wide sluice gates, new operators, cross bracing, and a new vertical wall to mount the gates on. The face of the weir was also concrete surfaced; however, the plans do not include the details associated with this work.

In 2010, the Western Star Mill Weir was visually evaluated for structural soundness as part of the Master Plan development by Olsson Associates. In general, the weir was found to be competent, but the older (pre-1967) walls were in poor shape, with the 1967 rehabilitation work showing signs of corrosion (exposed rebar and rusted cross bracing) and a small sink hole had developed on the upstream side of the weir.

In June 2013, the City of Salina excavated the sinkhole area and patched a leak. During excavation, rotten wood timbers were exposed that appeared to be part of the upstream face of the weir. It is unclear if the timbers were used for temporary concrete form work in 1967 or if it was part of the older weir timber crib construction.

Future Without Project

Under the future without project condition, no changes are expected to the cultural and historic resources in the Project area. Any buried cultural or historic resources along the Old Channel would likely remain buried, with additional sediment accumulating on top. The condition of the Western Star Mill Weir would continue degrading, and it would remain an obstacle to aquatic organism passage in the Old Channel.

2.4. Built Environment

2.4.1. Infrastructure

The most notable water infrastructure in the Project area is the federal flood control project completed in the 1960s by USACE, which includes a diversion channel and associated levee system. This levee system, now owned and operated by the City of Salina, includes approximately 21 miles of levee, and protects approximately 14,000 acres in the City of Salina and Saline County from flooding. It also includes two storm water pumping plants, nine sandbag gaps and 25 interior drainage structures. The levee system has a design capacity to contain the 0.2% Annual Exceedance Probability (500-year) flood event and is currently in the USACE P.L. 84-99 levee program and is periodically evaluated by the USACE Kansas City District. The levee is FEMA accredited.

Transportation infrastructure crossing both the main Smoky Hill River and the Old Channel is extensive. Interstate Highway 70 traverses the northern portion of the watershed, while Interstate Highway 135 runs north-south on the west side of the city. Ohio Street is the main road in the Old Channel area, crossing the Old Channel on both

the north and south sides. Several other roads cross the Old Channel (running east-west) via bridges with culverts of varying age and condition. Several of these bridges were constructed during the 1950s-1960s and are approaching the end of their design life.

For rail, a major east-west line crosses on the north side of Salina. A smaller offshoot runs north-south through town along 4th street. Neither rail line interacts with the Old Channel area.

The level of urban development adjacent to the Old Channel varies considerably. Downtown Salina features dense commercial development directly abutting the channel banks in some locations, with minimal setbacks or riparian buffer. Residential development ranges from high-density multifamily units to single-family neighborhoods throughout the corridor. Several parks and recreational facilities have been developed along the old channel, including the Salina Family YMCA, Kenwood Cove Aquatic Park and Oakdale Park.

Under the future without project condition, the infrastructure of the Project area is expected to remain the same. Census data indicates a stable or slightly declining populating in the City of Salina, so there is not likely to be large scale development in the area. Independent of this study, the City of Salina has received a DOT RAISE grant to upgrade several bridges and culverts across the Old Channel. This construction is likely to begin in the next several years and would install appropriately sized culverts to limit floodwater backup in the Old Channel during larger runoff events.

2.4.2. Recreation and Aesthetics

The Old Channel through Salina offers both realized and unrealized recreational opportunities within an urban setting. Currently, recreational use of the Old Channel is limited due to water quality concerns, intermittent flow conditions, and access challenges. Despite these limitations, the City of Salina has developed several parks adjacent to the Old Channel, including Oakdale Park, Kenwood Park, Founders Park, Riverside Park and Lakewood Park, which provide recreational opportunities like picnicking, walking paths, playgrounds and nature observation areas near the Old Channel. Indian Rock State Park is located along the diversion channel.

The Salina Levee Trail, a multi-use path atop portions of the federal levee system, serves as the primary recreation corridor directly associated with the river system. About six miles of levee trail have been constructed, with trail extensions planned. This trail accommodates walking, jogging, cycling, and wildlife viewing activities, with interpretive signage describing the river's history and ecology at several locations. However, the trail's connectivity is interrupted in several places, limiting its utility as a comprehensive recreation corridor.

Unlike watersheds with major impoundments, the Smoky Hill River in Salina lacks reservoir-based recreation opportunities within the immediate Project area. The nearest significant water-based recreation occurs at Kanopolis Lake, approximately 25 miles upstream, which offers boating, fishing, camping, and swimming facilities managed by the U.S. Army Corps of Engineers.

Current fishing access to the Smoky Hill River is primarily limited to a few locations along the main channel outside the diversion. The Old Channel supports minimal game fish populations due to degraded habitat conditions and intermittent flows, resulting in little recreational fishing activity. Paddling sports like canoeing and kayaking are not feasible in the Old Channel due to low water levels, numerous barriers, and limited access points. The main channel outside the diversion offers some potential for these activities but lacks developed access points and water trails.

Aesthetically, the Smoky Hill River corridor presents varied conditions throughout the Project area. The Smoky Hill River maintains a semi-natural appearance with established riparian vegetation, though the channel has been modified from its historical condition. While the Old Channel through downtown Salina is degraded and clogged with sediment and debris, the riparian corridor has mature trees, and the riparian corridor provides a green and natural aesthetic through an urban area.

Under the future without project condition, recreational opportunities would likely remain limited along the Old Channel, with continued focus on adjacent parkland rather than water-based activities. The City of Salina would likely continue implementing updates included in the River Renewal Master Plan as funding allows, including replacing bridges and culverts and trail building. The Levee Trail would likely see modest expansions to improve connectivity and would eventually encompass the entire levee system around Salina.

Aesthetically, the Old Channel would be expected to continue deteriorating without intervention. Sediment accumulation would further reduce visible water surface area, while aging infrastructure and bank stability issues would detract from visual quality.

2.5. Socioeconomic Environment

2.5.1. Socioeconomics and Demographics

The Smoky Hill Project area is located entirely within the City of Salina, in Saline County, Kansas.

Per capita income is often used as a shorthand metric for the economic situation of an area. In March 2023, the Assistant Secretary of the Army for Civil Works adopted the definition of an economically disadvantaged community in its memorandum "Implementation Guidance for Section 160 of the Water Resources Development Act of 2020, Definition of Economically Disadvantaged Community." A disadvantaged community is a that meets one or more of the following:

- The area has a per capita income of 80 percent or less of the national average;
- The area has an unemployment rate that is, for the most recent 24-month period for which data are available, at least 1 percent greater than the national average unemployment rate; or
- Indian country as defined in 18 U.S.C. 1151 or in the proximity of an Alaska Native Village; U.S. Territories;
- Communities identified as disadvantaged by the Council on Environmental Quality's Climate and Economic Justice Screening Tool (no longer available.)

In 2023, the national per capita income was $43,289. The City of Salina, with a per capita income of $33,344 would be considered an economically disadvantaged community according to the above memorandum, as eighty percent of the national per capita income is $34,630.

The Old Channel flows through Census Tracts 1.01 (south) and 1.02 (north) in Saline County. Both tracts have lower per capita incomes than Salina as a whole: $27,928 for Tract 1.01 and $23,456 for Tract 1.02.

This income difference is also reflected in the poverty rates. While 13.1% of Salina's population lives below the poverty line, the rates in the census tracts around the Old Channel are much higher. In Tract 1.01, 29% of residents are below the poverty line, and in Tract 1.02, the figure rises to 42.7%.

Educational attainment also differs between the City as a whole and these individual census tracts. In Salina, 7.5% of the population aged 25 and older lacks a high school degree. This percentage increases to 11.7% in Tract 1.01 and further to 21.7% in Tract 1.02.

Salina has a population of 46,109, a figure that has slightly decreased from 47,132 between 2010 and 2020 (though note that COVID may have impacted the accuracy of 2020 numbers). Tracts 1.01 and 1.02 have populations of 2,686 and 2,344, respectively. It is important to note that data for the smaller populations at the individual census tract level have a larger margin of error than for the larger population of the City of Salina.

Under the future without project condition, the socioeconomics and demographics are expected to continue to follow their current trends.

2.6. Resources Not Evaluated in Detail

Mineral resources, energy resources and Wild and Scenic Reivers are not evaluated as these resources are not present in the Project area. Invasive species are discussed under Riparian Habitat. Traffic and Transportation is addressed under Infrastructure.

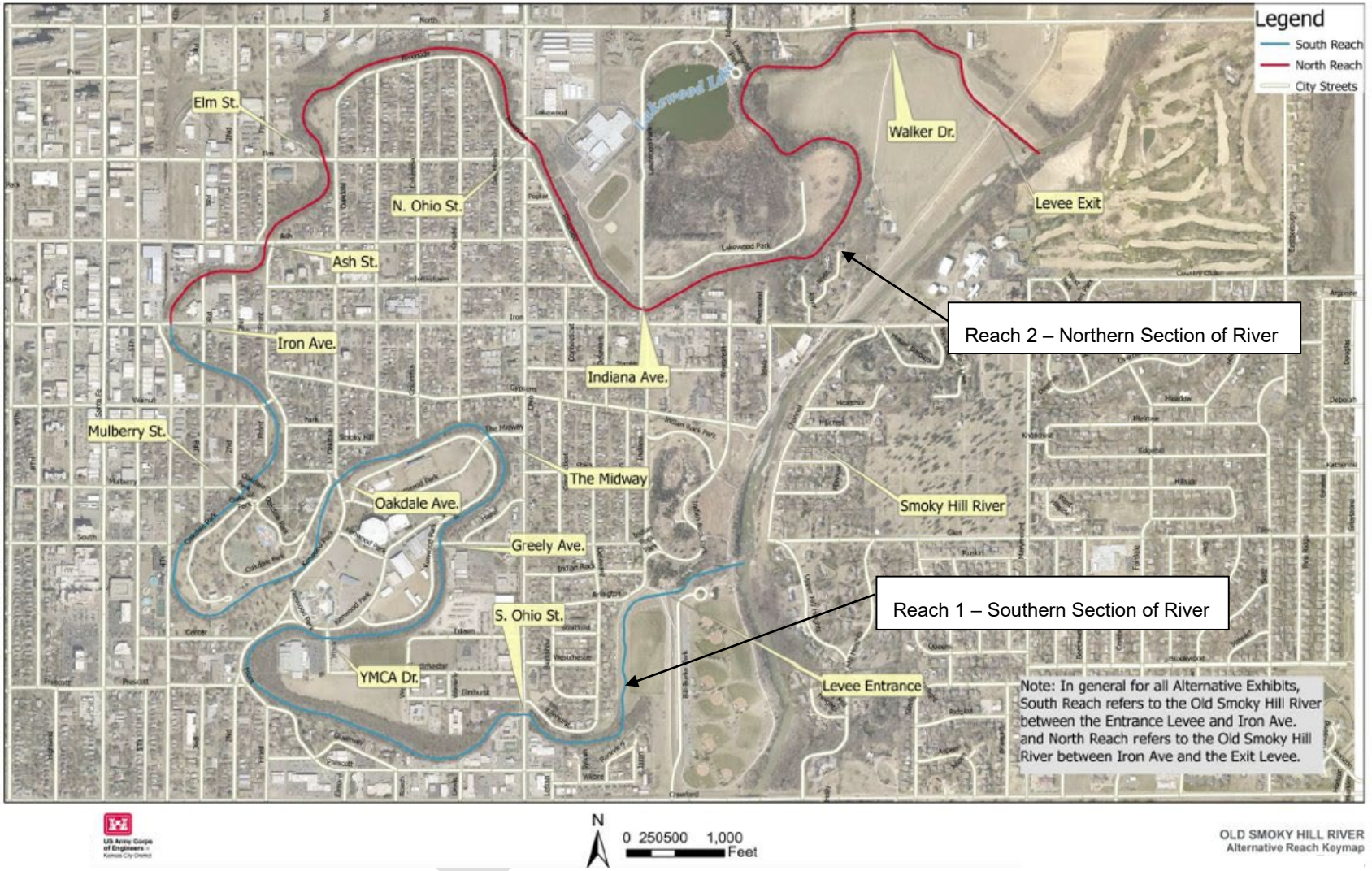
3.0 Plan Formulation and Evaluation

3.1. Planning Framework

The USACE follows a six-step planning process for feasibility studies, as detailed in Engineer Regulation (ER) 1105-2-103 “Policy for Conducting Civil Works Planning Studies”. While there are six-steps to the process, each step is iterative, allowing for the inclusion of more information and knowledge to inform plan formulation and selection at each stage. The Project began with identifying the problems and opportunities in the Project area, which is addressed in more detail in Chapter 1. Existing data and communication with other resource agencies and local stakeholders was used extensively to inform the problem and opportunity identification. The second step, and Chapter 2 of this report, focused on inventorying and forecasting conditions. Building on the existing data, strong relationships with other resource agencies, and local expertise from the first step. USACE engineers and biologists identified the relevant Existing Conditions in the Project area and then used hydraulic models and habitat models to extrapolate the Future Without Project (FWOP) Conditions from what is currently known about the area and what is expected to change over the next 50 years, from 2030 to 2080, if the proposed Project is not implemented.

Based on the current conditions in the Project area and expected FWOP Conditions, the Old Channel was divided into two reaches, Reach 1 (southern) and Reach 2 (northern) (see Figure 3-1). Reach 1 extends from the inlet to the Old Channel to the Western Star Mill Weir. Reach 2 begins at the Western Star Mill Weir and extends to the outlet of the Old Channel back into the Smoky Hill River. Using the information about current conditions and expected FWOP Conditions, a list of potential measures (features or activities that can be implemented at a specific location to address one or more planning objectives) was created. Measures are the building blocks of alternatives, and the team assessed individual measures and screened out those which technically, financially, environmentally, or some combination thereof did not meet Project goals and objectives. The team then combined the measures in different ways to formulate an initial array of alternatives for each reach. Measures could be implemented in either Reach 1, Reach 2, or in both reaches.

The initial array of alternatives was evaluated by looking at the estimated costs and benefits of each alternative; the Principles, Requirements and Guidelines for Federal Investments in Water Resources (PR&G) Criteria (Effectiveness, Efficiency, Acceptability, Completeness); and the total net benefits or comprehensive benefits (all addressed in Chapter 5). Four alternatives were formulated and analyzed as part of the Final Array of Alternatives. After analysis of the Final Array of Alternatives, the alternative that was the best balance of costs and benefits was selected as the Tentatively Selected Plan (TSP). After selection of the TSP, USACE engineers and scientists will refine the alternative further and add additional detail beyond the preliminary alternative development stage.



Feasibility Study and Environmental Assessment

Figure 3-1. Project River Reaches

3.2. Assumptions and Formulation Strategy

Plan formulation is the process of evaluating existing conditions, potential future conditions, and building alternative plans that meet planning objectives. Some assumptions were made to inform the decision-making process and to generate the measures and alternatives, which might improve conditions in and along the Old Channel.

Without any action, the Old Channel would remain at risk of continued sedimentation, reduced flow, and degraded and unavailable aquatic habitat. Consequently, populations of fish and macro-invertebrate species would be at increased risk due to the degraded habitat and biological limitations and stressors. Much of the impediment to flow is located in Reach 1 where the culvert at South Ohio Street is fully clogged and only allows 1 to 2 cfs to pass through. Additionally, the Western Star Mill Weir has a major impact on the hydraulics and fluvial geomorphic properties of the Old Channel, reducing flow and acting as an impediment to aquatic life movement.

An underlying assumption is that by removing the impediments to flow (clogged culvert and replacing Western Star Mill Weir with step-pool features) the Old Channel would support self-sustaining sediment transport and reestablish biological connectivity. It was assumed that Reach 2 would not have to undergo the same level of dredging as Reach 1 because flows would naturally help reestablish and maintain channel geomorphology. In addition, it is assumed that adding reliable base flow (10 – 100 cfs) is not a stand-alone restoration measure but is common to each measure discussed below. The City has secured the water rights needed to support a reliable base flow and therefore is considered an existing condition.

3.3. Management Measures

A management measure is a feature or activity that can be implemented at a specific geographic site to address one or more planning objectives. Measures are the building blocks of alternatives and can be mixed and matched in different ways, using the technical expertise of the team, to formulate potential alternatives for the Project area. The USACE planning team, the City, and other federal and state agency partners participated in several sessions in the planning process to identify potential management measures for ecosystem restoration within the Project area.

Measures generally fall into three categories: structural, nonstructural, and nature-based features. Structural measures are physically constructed features that can meet the planning objectives. A typical structural measure for an environmental restoration project would be constructing a wetland or notching a dike to create more habitat. Nonstructural measures are measures that alter behavior, policies, or procedures to meet planning objectives in the Project area. A typical nonstructural measure for ecosystem restoration would be increasing river flow in the spring to provide better spawning habitat or keeping water levels higher in a wetland during the fall to provide better duck habitat. Natural and nature-based features (NNBF) are landscape features that provide functions relevant to flood risk management or ecosystem restoration. A typical NNBF would be a coastal oyster reef providing some flood risk mitigation or

using tree plantings or riparian forest restoration to improve the ecosystem and reduce erosion.

The following measures were considered during the plan formulation process, but not necessarily included in the developed alternatives. Measures were considered at differing scales to allow additional combinations during alternative formulation and to screen and compare using PR&G criteria. Measure screening is discussed below in Section 3.4.

The channel dredging measures discussed are distinguished into two reaches in the 6.8-mile Old Channel due to marked differences in channel sediment deposition in the two reaches and related stream habitat modeling considerations.

The measures proposed are based on preliminary engineering and hydrology and hydraulics analysis conducted by the PDT. Combinations of these measures should effectively restore the Old Channel aquatic habitats and wetlands for meaningful ecosystem benefit.

3.3.1. Measure 1 – Channel Dredging Reach 1 – Uniform Trapezoidal Section and Profile

This restoration measure would involve dredging excess sediment from Reach 1 and establishing a uniformly dimensioned trapezoidal section and profile in the dredged portion. Dredging would occur upstream of the Western Star Mill Weir below the entrance levee outfall in Burke Sports Complex down to Mulberry Street where there is existing adequate conveyance capacity. The proposed dredging and channel formation would effectively restore consistent gravity-based flow conveyance upstream and downstream of the weir, create a positive downslope water gradient, increase water surface area, and add larger aquatic habitat for local plants and animals. This measure assumes removal and replacement of the sediment filled South Ohio Street culvert (replacement at City cost) to maintain positive downslope water gradient. The trapezoidal section has a channel bottom width of 5 feet, top water width of 30 – 50 feet at 80 cfs, and target water depth of 3.25 feet. Sediment removal is estimated at 42,000 cubic yards. See Figure 3-2.

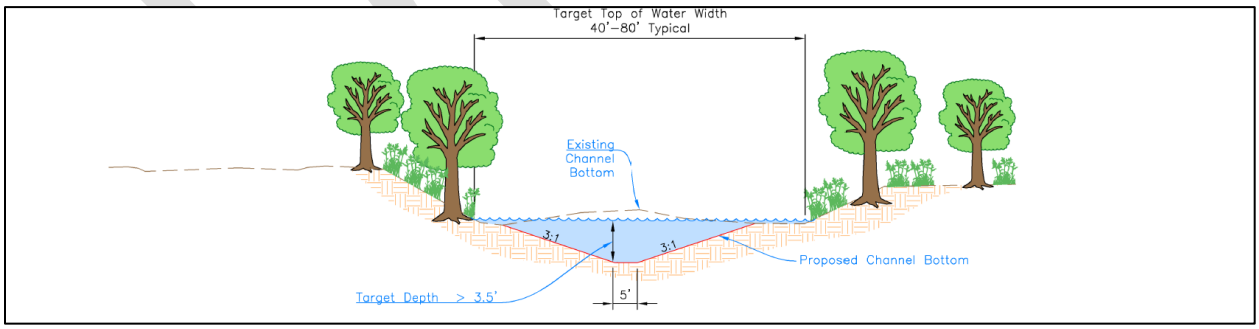


Figure 3-2. Measure 1 – Typical Channel Section

3.3.2. Measure 2 – Channel Dredging Reach 1 – Variable Depth Profile (Glide/Pool/Riffle/Run)

This restoration measure would involve dredging excess sediment from Reach 1 in the Old Channel and establishing a variable-depth channel profile consisting of glides,

pools, riffles, and run habitats (see Figure 3-3). Dredging would occur upstream of the Western Star Mill Weir below the entrance levee outfall in Burke Sports Complex down below Oakdale Avenue Bridge in Kenwood Park. Dredging and the variable depth profile would restore consistent gravity-based flow conveyance upstream and downstream of the weir and create a positive downslope water gradient, increased water surface area, and larger aquatic habitat for local plants and animals. This measure also assumes removal and replacement of the sediment filled South Ohio Street culvert (replacement at City cost) to maintain positive downslope water gradient. The variable depth profile has a channel bottom width of 8 – 20 feet, top water width of 30 – 50 feet at 80 cfs, target pool water depth of 4 – 6 feet, and target riffle depth of 3.25 feet. Sediment removal is estimated at 63,000 cubic yards.

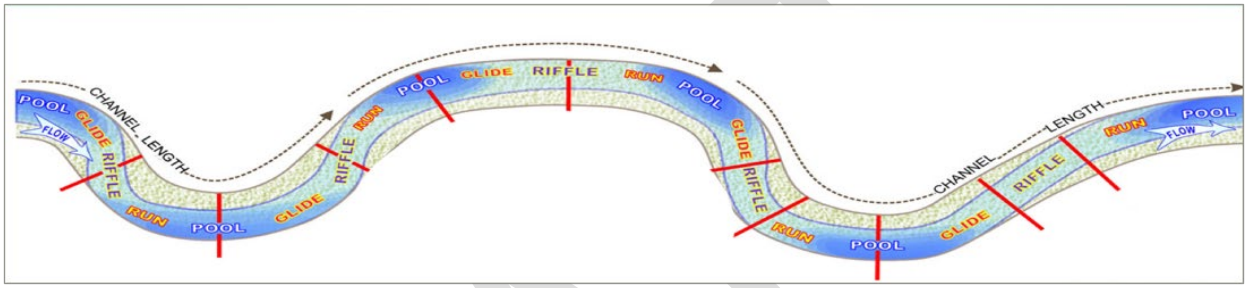


Figure 3-3. Measure 2 - Variable Depth Profile Habitats

3.3.3. Measure 3 – Channel Dredging Reaches 1 & 2 – Variable Depth Profile (Glide/Pool/Riffle/Run)

This restoration measure would involve dredging excess sediment from Reaches 1 and 2 in the Old Channel and establishing a variable-depth profile consisting of glides, pools, riffles, and run habitats (see Figure 3-3). Dredging in Reach 1 is upstream of the Western Star Mill Weir from below the entrance levee outfall in Burke Sports Complex down below Oakdale Avenue Bridge in Kenwood Park. Dredging in Reach 2 is downstream of Western Star Mill Weir to just downstream of Lakewood Lake. Dredging and the variable depth profile would effectively restore consistent gravity-based flow conveyance upstream and downstream of the weir and creates a positive downslope water gradient, increased water surface area, and larger aquatic habitat for local plants and animals. This measure also assumes removal and replacement of the sediment filled South Ohio Street culvert (replacement at City cost) to maintain positive downslope water gradient. In both Reaches 1 and 2, the variable depth profile has a channel bottom width of 8 – 20 feet, top water width of 30 – 50 feet at 80 cfs, target pool water depth of 4 – 6 feet, and target riffle depth of 3.25 feet. Sediment removal is estimated at 105,000 cubic yards.

3.3.4. Measure 4 – Channel Dredging Reaches 1 and 2 – Variable Depth Profile (Glide/Deeper Pool/Riffle/Run)

This restoration measure is nearly identical to Measure 3, except dredging of pools is approximately one foot deeper in Reach 1 only. Dredging Reaches 1 and 2 and establishing the variable-depth profile would effectively restore consistent gravity-based flow conveyance upstream and downstream of the weir, and create a positive

downslope water gradient, increased water surface area, and larger aquatic habitat for local plants and animals. Constructing additional pool habitat in Reach 1 would provide beneficial ecological functions and meet the Project's objective of providing in-stream aquatic habitat functions and features in the Old Channel. This measure also assumes removal of the sediment filled South Ohio Street culvert (replacement at City cost) to maintain positive downslope water gradient. In both Reaches 1 and 2, the variable depth profile has a channel bottom width of 8 – 20 feet, top water width of 30 – 50 feet at 80 cfs, target pool water depth of 5 – 7 feet, and target riffle depth of 3.25 feet. Sediment removal is estimated at 107,000 cubic yards.

3.3.5. Measure 5 – Channel Dredging in Reaches 1 and 2 – To Original Channel Depth

This restoration measure would involve dredging accumulated sediment to the original channel depth in both Reaches 1 and 2. The dredging depth would be approximated to match both the levee inlet culvert outfall invert elevation, and levee outlet culvert inlet invert elevation. Using these elevations which are assumed to represent the approximate depth of the historic Smoky Hill River channel pre-levee (FRM project) conditions, would represent a lowering in channel bed elevation of about 10 – 11 feet over 6.8 miles. Dredging width would be determined based on approximation of the historic condition and on slope stability geotechnical requirements. Significant channel bank slope grading would be required. This approach would effectively restore consistent base flow conveyance and consistent water connectivity upstream and downstream of the weir and increase water surface area and larger aquatic habitat for local plants and animals would result.

3.3.6. Measure 6 – Old Channel Substrate Enhancement

This restoration measure would add more diverse substrate habitat – sand, gravel, and potentially larger substrate in the Old Channel after dredging. Excess sediment within the Old Channel has degraded the quality and availability of aquatic habitat. The homogeneity of the channel bottom substrate, primarily composed of silts and clays, provides little cover, substrate for breeding and spawning, or foraging opportunities for aquatic life. Installation of larger substrate material along the Old Channel would act as niche habitat sanctuaries and reproductive sites for aquatic life.

3.3.7. Measure 7 – Additional Pool Habitat (Reach 2)

This restoration measure consists of constructing a habitat weir structure approximately two feet tall in the Old Channel to help create and maintain the pool habitat in Reach 2. The weir would be constructed to generally conform to the stream channel and allow water to flow and aquatic passage over the top. The weir would be designed to avoid impacts to stream connectivity. Constructing this weir in Reach 2 east of Lakewood Lake would provide beneficial ecological functions and meet the Project's objective of providing in-stream aquatic habitat functions and features in the Old Channel.

3.3.8. Measure 8 – Sediment Forebay (Inlet Area)

Measure 8 is a structural measure that involves construction of a sediment forebay at the current Old Channel inlet confluence with the Cut-off Channel. A forebay is a sediment settling basin system constructed at incoming discharge points of a

waterbody, such as a stream or reservoir. A forebay is usually constructed as an earthen berm(s), gabion wall(s), concrete wall(s), or riprap wall(s) surrounding the receiving water or along the outlet end of the receiving water. The Old Channel sediment forebay would consist of an artificial pool of water, located east of the levee intake water control structure. The structure would be designed to slow incoming water and facilitate gravity separation of coarse settleable solids prior to water entering the Old Channel, and contain sediment deposition to an accessible area, which facilitates maintenance and cleanout operations. Periodic cleanout would be required. The forebay would be designed to dissipate incoming energy flows and would be appropriately sized in relation to the elevation of the outlet structure to allow heavier, course-grained sediments and particulates to settle out of the runoff. The design would permit flow to exit the forebay at non-erosive velocities up to 100 cfs (maximum water right is 100 cfs) (see Figure 3-4). The forebay would prolong the design life and beneficial uses of the Old Channel by eliminating or reducing periodic sediment dredging downstream of the forebay. With proper maintenance of the forebay, the structure can be sustainable for 50 years.

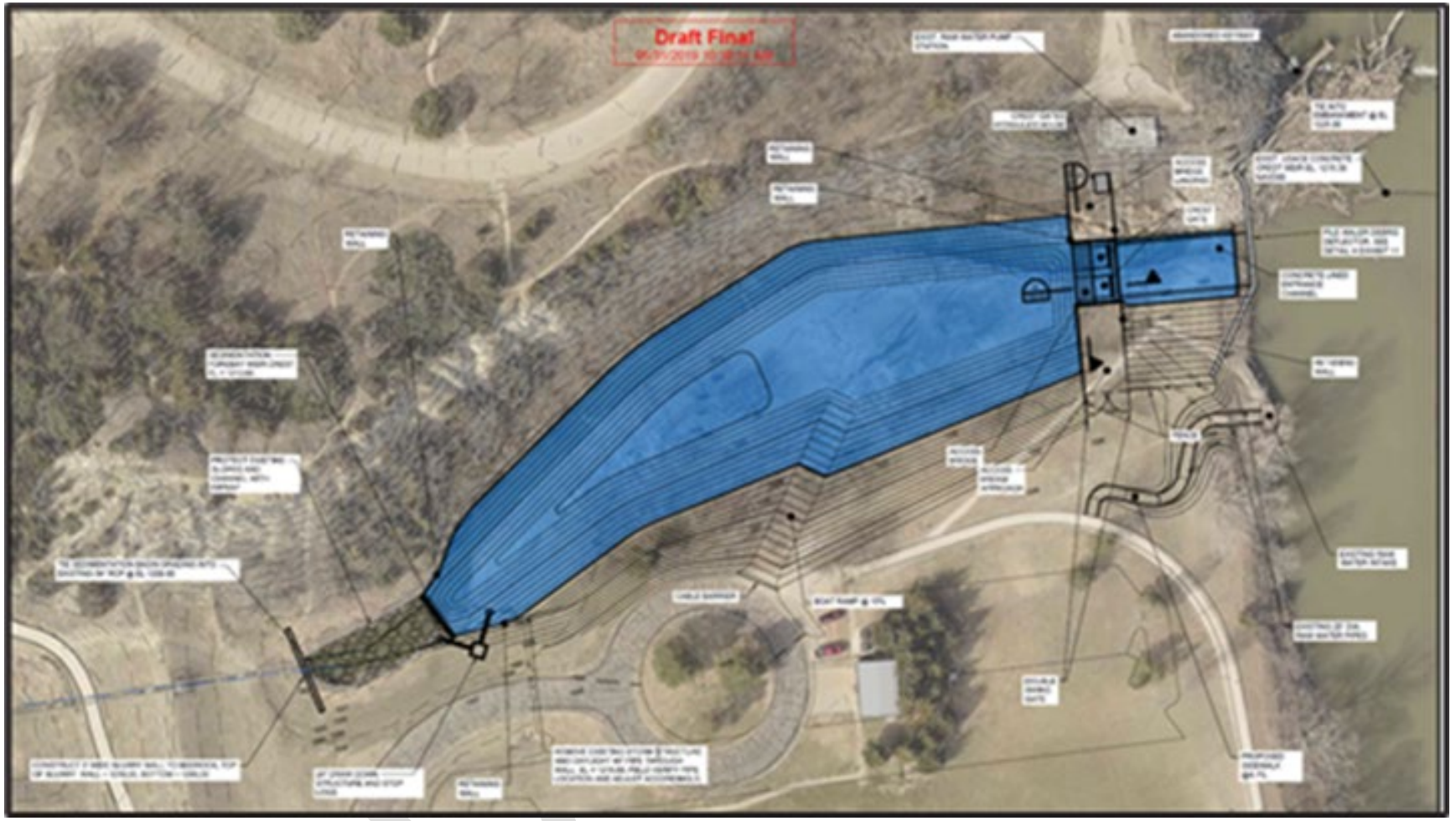


Figure 3-4. Sediment Forebay Design

3.3.9. Measure 9 – Old Channel Connected Wetlands

This restoration measures consists of creating 1.7 acres of connected wetland shelves within the Old Channel in Reach 1 for purposes of habitat creation. The measure would also provide ancillary benefits from phosphorus removal and improving water quality. The wetland shelves would be located downstream of the levee inlet culvert structure in an undeveloped open space. Wetland planting would be done on the shelves adjacent to the Old Channel. A habitat weir structure approximately two feet tall in the Old Channel would be constructed on the downstream portion of the connected wetland shelves to help create and maintain the wetland habitat in the Old Channel (see Figure 3-5). The weir would be constructed to generally conform to the stream channel and allow water to flow and aquatic passage over the top. The weir would be designed to avoid impacts to stream connectivity. Constructing this weir would provide beneficial ecological functions and meet the Project's objective of providing in-stream aquatic habitat functions and features in the Old Channel.

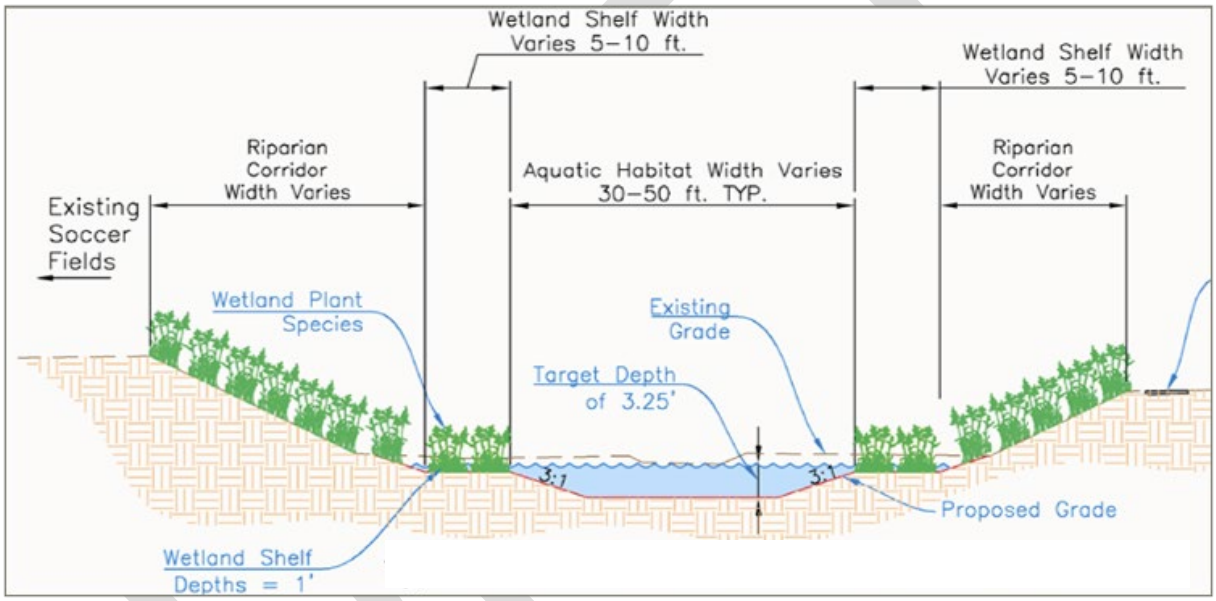


Figure 3-5. Typical Wetland Shelves Connection Section

3.3.10. Measure 10 – Renovate Western Star Mill Weir

The Western Star Mill Weir (see Figure 3-6) has been identified as a risk associated with the Project. The weir was constructed in the early 1900's and does not satisfy current national standards for weir infrastructure. Visual inspection of the weir indicates it is exhibiting declining conditions, which may compromise its structural integrity. The weir could fail prior to retrofitting or replacing, and cause damage to infrastructure as well as disrupt aquatic ecosystems. This measure involves renovating the existing structure. It is anticipated that renovating the weir would require either expensive repairs or the need to replace the entire structure within a decade. Either option would affect the Project when alternatives are formulated under the assumption the weir would remain throughout planning timeframe.

3.3.11. Measure 11 – Remove Western Star Mill Weir

This restoration measure would involve removing the Western Star Mill Weir. Removal of the weir would be sequenced to mitigate any risk of flooding or threat to public safety. The weir would not be replaced with a passage structure to account for the elevation differences upstream and downstream of the weir. Minor channel reshaping and rock placement at the removal location may be implemented to try to moderate the difference in elevations and abrupt increases in flow velocity from a steepened bed slope.

Figure 3-6. Western Star Mill Weir

3.3.12. Measure 12 – Remove and Replace Western Star Mill Weir with Step Pools

This restoration measure would involve removing the Western Star Mill Weir to restore aquatic life connectivity and passage to the Old Channel. The weir would be replaced with five step pools for aquatic life connectivity and passage that would address the elevation differences between the upper and lower Old Channel bottom profile (see Figure 3-7). The pools would be constructed in a stepwise fashion to allow for fish and other aquatic life to move upstream through a series of submerged pools. Step pools are composed of channel-spanning pools with boulder or cobble steps with small slots between the larger rocks to allow fish to move from one pool to the next while still being submerged. This method does not rely on the ability of fish or other aquatic life to jump from one pool to the next. The pools would be constructed to convey flow all year round to ensure fish can pass each pool structure submerged. Step pools would also allow safe public use of kayaks. Removal of the weir would be sequenced to mitigate any risk of flooding or threat to public safety.

Figure 3-7. Step Pools for Aquatic Habitat

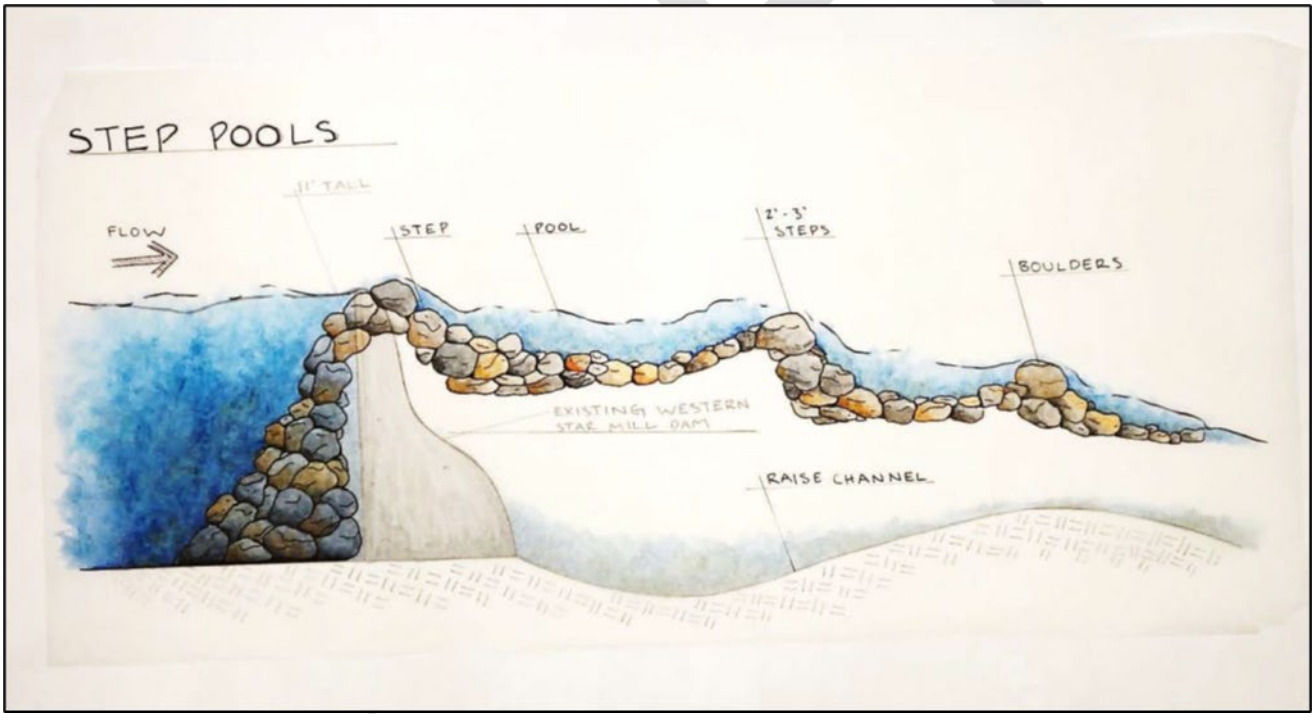


Figure 3-8. Conceptual Drawing of Step Pools

3.3.13. Measure 13 – New Main Channel Alignment

This restoration measure would forgo restoration of the Old Channel and instead create a new main channel alignment connected to the Cut-off Channel for purposes of aquatic connectivity and passage. The existing 6.8-mile Old Channel is tightly bound on both banks by urban development, leaving little room for a complete channel realignment within the City's boundaries. Realignment within the City would involve displacing businesses and homes to create a sufficient corridor for a new channel. This option

would likely receive substantial public dissent as it would drastically alter the current layout and organization of the City.

3.3.14. Measure 14 – Restore/Create Wetland Habitat in Lakewood Lake

This restoration measure would serve to restore and create wetlands by placing Old Channel dredged sediment into Lakewood Lake to create/restore 35.8 – 36.7 acres of emergent wetlands depending on a channel dredging measure. The expected increase in surface water overflow to the lake from the rehabilitation of the Old Channel and anticipated long term recovery of groundwater levels below the lake would likely increase the lake's water surface elevation by roughly six feet. Constructed wetlands would provide many ecological and societal benefits to the City including food sources and habitat for wildlife, flood storage, bank/shoreline erosion control, pollution filtration and enhanced water quality, and opportunities for recreation, education, and research.

Incidentally, the lake is currently documented at approximately six feet below historic levels and is isolated from the Old Channel by a small dike. This measure would reconnect the Old Channel to Lakewood Lake by removing a portion of the dike and allowing water to equalize between the Old Channel and Lakewood Lake. The lake has also suffered poor water quality. Additionally, public health advisories are often necessary for the lake during the late summer due to the presence of harmful blue-green algae. Restoring the lake to its former level would provide enhanced drought resiliency and increased fisheries and overall lentic habitat for aquatic species. Increasing the depth of the lake would improve the oxygen holding capacity of the lake; thereby reducing the occurrence or magnitude of blue-green algal blooms. Restoring the depth of Lakewood Lake via hydraulic connection with the Old Channel would support the goal of restoring and creating habitat functions supporting the Old Channel.

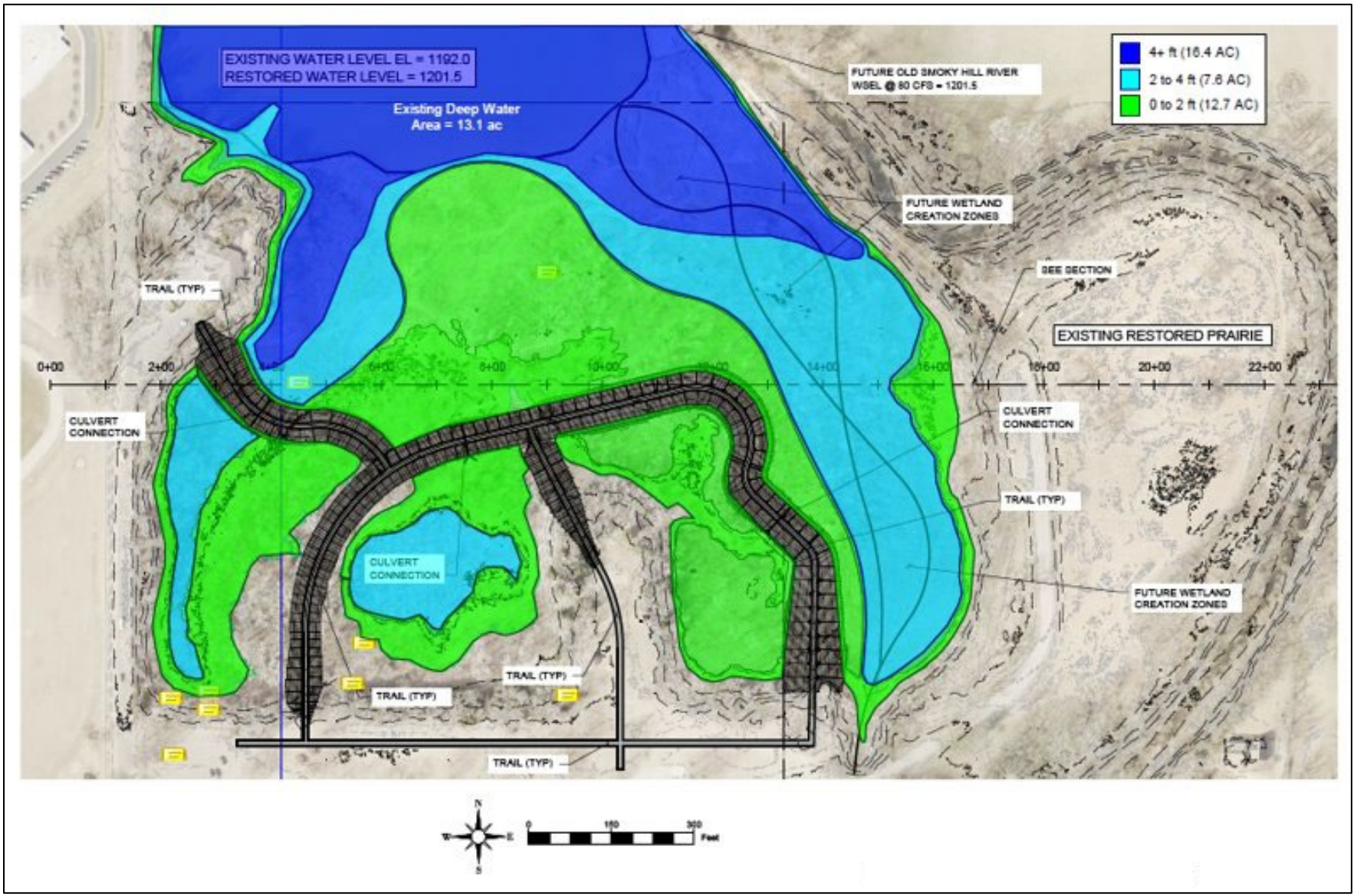


Figure 3-9. Lakewood Lake Wetlands

Low impact pedestrian trails would be enhanced in the wetlands to provide improved recreational opportunities.

3.3.15. Measure 15 – Riparian Habitat Restoration Along the Old Channel

This measure would involve rehabilitating the riparian corridor through invasive plant removal, native tree plantings, and management activities. Over the long term the riparian corridor would continue transitioning towards larger monoculture stands of honeysuckle, an aggressive invasive species, as old mature canopy trees die. The presence of honeysuckle suggests a low likelihood of success for rehabilitation as honeysuckle outcompetes and shades out establishment of new native tree and shrub seedlings. The City is interested in pursuing local riparian corridor restoration separately from the feasibility study.

3.3.16. Summary of Measures Considered but Not Retained

The following measures were not retained. Any measure that was eliminated was due to not meeting a Project objective or because it conflicts with a project consideration.

- Measure 5 – Channel Dredging in Reaches 1 and 2 – To Original Channel Depth – high amount of required ROW needed.
- Measure 6 – Old Channel Substrate Enhancement – Difficult to maintain, not sustainable.
- Measure 10 – Renovate Western Star Mill Weir – Not feasible, does not meet objective for connectivity and aquatic habitat objectives.
- Measure 11 – Remove Western Star Mill Weir – Unsafe for kayaks, does not meet objective for smooth transition of gravity flows resulting in safety concerns.
- Measure 13 – New Main Channel Alignment – Major community disruption.
- Measure 15 – Riparian Habitat Restoration Along the Old Channel – May be conducted as a separate action by the City.

3.3.17. Measures Carried Forward

The restoration measures shown below are carried forward based on using the objectives and constraints for screening criteria.

- Measure 1 – Channel Dredging Reach 1 – Uniform Trapezoidal Section and Profile
- Measure 2 – Channel Dredging Reach 1 – Variable Depth Profile (Glide/Pool/Riffle/Run).
- Measure 3 – Channel Dredging Reaches 1 & 2 – Variable Depth Profile (Glide/Pool/Riffle/Run)
- Measure 4 – Channel Dredging Reaches 1 & 2 – Variable Depth Profile (Glide/Deeper Pool/Riffle/Run)
- Measure 7 – Additional Pool Habitat (Reach 2)
- Measure 8 – Sediment Forebay (Inlet Area)

- Measure 9 – Old Channel Connected Wetlands
- Measure 12 – Remove and Replace Western Star Mill Weir with Step Pools
- Measure 14 – Restore/Create Wetland Habitat in Lakewood Lake

3.4. Screening of Management Measures

After the initial brainstorming sessions and development of a list of potential management measures for the Project, the measures were evaluated based on the planning objectives, considerations, and PR&G criteria. As defined in ER 1105-2-103, Policy for Conducting Civil Works Planning Studies, these four criteria are:

Completeness: Extent to which the measure provides and accounts for all necessary investments or actions to ensure realization of the planning objectives.

Effectiveness: Extent to which the measure contributes to achieving the planning objectives.

Efficiency: Extent to which the measure is the most cost-effective means of addressing the specified problems and realizing the specified opportunities, consistent with protecting the nation's environment.

Acceptability: Workability and viability of the alternative plan with respect to acceptance by federal and non-federal entities and the public, and compatibility with existing laws, regulations, and public policies.

Based on the Project objectives, engineering judgement and the PR&G criteria, some management measures were screened out and eliminated from future consideration. The management measures that contributed to the Project objectives and met the PR&G criteria were carried forward and used to formulate potential alternatives. Not all the measures that were retained for further evaluation ended up in the final array of alternatives, but they were considered in the formulation of alternatives. Table 3-1 shows the results of the measure screening; text in "red" denotes measures that were screened from further consideration in the plan formulation process.

Table 3-1. Measure Screening Summary

Measures	Meets Project objectives and PR&G Criteria	Retained for further evaluation	Description
Channel Dredging Reach 1- Uniform Trapezoid	Yes	Yes	Create **uniform trapezoidal section** and profile. Would restore gravity-based flow conveyance.
Channel Dredging Reach 1 –Variable Depth	Yes	Yes	Create a **variable depth profile** (Glide / Pool / Riffle /Run sequences). Would restore gravity-based flow conveyance.
Channel Dredging Reaches 1 & 2- Variable Depth	Yes	Yes	Create a **variable depth profile** (Glide/Pool/Riffle/Run sequences). Would restore gravity-based flow conveyance.

Measures	Meets Project objectives and PR&G Criteria	Retained for further evaluation	Description
Channel Dredging Reaches 1 & 2 - Variable Depth + Deeper Pools	Yes	Yes	Create a **variable depth profile** (Glide/Pool/Riffle/Run sequences), with **deeper pools in Reach 1**. Would restore gravity-based flow conveyance.
Channel Dredging in Reaches 1 & 2 to Original Channel Depth	Yes	No	Dredging to the **original channel depth**. Would **lower channel bed 10-11 feet** over 6.8 miles. Streambank grading would be required. Cost prohibitive, significant bank sloping to accommodate lower channel bottom would add real estate constraints
Old Channel Substrate Enhancement	Yes	No	Combine with a dredging measure. Adds more diverse substrate (gravel, cobbles, etc.) to enhance aquatic habitat. Difficult to maintain, not sustainable
Pool Habitat		Yes	Construct a **habitat weir (2 ft tall) in Reach 2** to create and maintain pool habitat (4' – 6').
New Main Channel Alignment	No	No	New channel alignment connected to the cut-off channel for aquatic connectivity and passage. Major community disruption, very high cost, no land available.
Sediment Forebay	Yes	Yes	Construct a **sediment forebay** near the intake structure in the old channel. Design to slow incoming water and settle sediments. Would need to be dredged.
Old Channel Connected Wetlands	Yes	Yes	Construct **1.7 acres of connected wetland shelves** within the Old Channel.
Restore/Create Wetland Habitat in Lakewood Lake	Yes	Yes	**Restore/create about 35-36 acres of wetlands**. Dredged sediment from Old Channel would be placed into Lakewood Lake and formed into emergent wetlands.
Riparian Habitat Restoration Along the Old Channel	No	Yes	Invasive species removal, tree plantings, forest management along the riparian corridor. Cost prohibitive; City will manage separately; not needed for a complete project
Renovate Western Star Mill Weir	No	Yes	Would repair weir (constructed early 1900's), which is in declining condition to prevent unexpected failure. Does not address connectivity or habitat restoration.

Measures	Meets Project objectives and PR&G Criteria	Retained for further evaluation	Description
Remove Western Star Mill Weir	No	Yes	Remove the weir; do some minor channel reshaping and rock placement to moderate the slope difference. Increases risk of stream instability, erosion and headcutting. The steep gradient with weir removal does not facilitate aquatic passage.
Remove and Replace Western Star Mill with Step Pools	Yes	Yes	Remove the weir and replace with 5 step pools that would moderate the slope difference and allow for aquatic and recreational passage.

3.5. Formulation Strategies

The measures that contributed to Project objectives and met the PR&G criteria were retained for future consideration and alternative formulation. A measure is a feature or activity that can be implemented at a specific site to address one or more planning objectives. Measures are the building blocks of alternatives and can be combined in different ways to form different alternatives. An alternative consists of a system of structural and/or non-structural measures formulated to meet, fully or partially, the identified Project planning objectives and avoid planning constraints.

To narrow the focus of all possible combinations of the remaining management measures, formulation strategies were developed to guide the creation of alternatives. The formulation strategies combine the management measure(s) together into alternatives based on the Project goals, objectives, planning criteria, and opportunities, while avoiding constraints. Ultimately, the PDT used professional judgement and several main themes to combine the potential management measures into alternatives. The main themes used to formulate the initial array of alternatives were:

Stream restoration: Restore flow to capacity to convey a base flow between 10 – 100 cfs. Through dredging and reconfiguring the channel depth profile it would be possible to maintain flow in this range, which is critical to ensuring sediment transport, habitat connectivity, and aquatic ecosystem functions and services. The stream system's natural low gradient, urbanized environment, and expected flow rate influence the depth profiles and the benefits that may be achieved from each alternative.

Sediment capture: Reduce or eliminate, if possible, sediment loading to the Old Channel from the Smoky Hill River and from urban overland flow. All alternatives include the construction of a sediment forebay to support a self-sustaining sediment transport flow in the Old Channel and minimize the need to perform any future in-channel dredging. The forebay also allows for efficient and effective operation and maintenance.

Habitat connectivity: Western Star Mill Weir presents the greatest obstacle to habitat connectivity. It effectively bisects the river into two separate reaches, preventing movement of most aquatic life from one reach to the other. Two options provide suitable approaches to reconnecting the 6.8 miles of the Old Channel. Only one of the options,

replacement of the dam with step pool features, presented a cost efficient, safe, long-term, and habitat friendly approach to reestablishing habitat connectivity.

Wetland and riparian habitat: The existing wetlands on the south side of Lakewood Lake present an opportunity to restore and create off-channel emergent wetland habitat and enhance deep water wetland habitat into the Project. This would provide both standalone habitat and establish hydrologic connectivity between the Old Channel and the wetland system. Additionally, dredge material from the Old Channel could be recycled and used as fill to create the variable depth profiles within the Lakewood Lake wetland area.

3.6. Array of Alternatives

All restoration measures retained for further evaluation in Table 3-1 were combined into a range of complete alternatives that could address Project goals and objectives and account for planning considerations. Complete alternatives were developed by combining stream restoration measures in the Old Channel and adjacent Lakewood Lake that could lead to a healthy, functioning, and restored stream and wetlands system. Complete alternatives were also developed for purposes of defining future with Project conditions to calculate aquatic habitat benefits associated with complete restoration plans.

The following four alternatives summarized in Table 3-2 were developed using the measure combinations. Following Table 3-2, each alternative is described in detail.

Table 3-2. Restoration Alternatives

Alternative No.	Restoration Measures Combination
A0 (No Action)	N/A
A1 (Base Alternative – Restores Base Flow)	• Channel Dredging Reach 1 – Uniform Trapezoidal Section and Profile • Pool Habitat Reach 2 weir • Sediment Forebay (Inlet Area) • Old Channel Connected Wetland Shelves[1] • Remove and Replace Western Star Mill Weir with Five Step Pools • Lake Wood Lake – Connected Wetland
A2 (A1 plus Variable Dredging Reach 1)	• Channel Dredging Reach 1 – Variable Section and Depth Profile (Glide/Pool/Riffle/Run) • Pool Habitat Reach 2 weir • Sediment Forebay (Inlet Area) • Old Channel Connected Wetland Shelves[1] • Remove and Replace Western Star Mill Weir with Five Step Pools • Lake Wood Lake – Connected Wetland
A3 (A2 plus Variable Dredging Reach 2)	• Channel Dredging Reaches 1 and 2 – Variable Depth Profile (Glide/Pool/Riffle/Run) • Pool Habitat Reach 2 weir plus dredging • Sediment Forebay (Inlet Area) • Old Channel Connected Wetland Shelves[1] • Remove and Replace Western Star Mill Weir with Five Step Pools • Lake Wood Lake – Connected Wetland
A4 (A3 plus Reach 1 Additional Dredging for Deeper Pools)	• Channel Dredging Reaches 1 and 2 – Variable Depth Profile (Glide/Deeper Pool Reach 1/Riffle/Run) • Pool Habitat Reach 2 weir plus dredging • Sediment Forebay (Inlet Area) • Old Channel Connected Wetland Shelves[1] • Remove and Replace Western Star Mill Weir with Five Step Pools • Lake Wood Lake – Connected Wetland

[1] Old Channel Connected Wetland Shelves cost considered part of stream riparian zone variable evaluated in QHEI; therefore, shelve costs are included with stream costs.

3.6.1. No-Action Alternative

Alternative A0 (No Action) – The National Environmental Policy Act (NEPA) requires federal agencies to consider the option of no action as one of the alternatives. The No Action Plan assumed no action is taken by the USACE to achieve the planning objectives and is synonymous with the future without project (FWOP) condition. As a result, flow would remain at roughly 1-2 cfs, sedimentation would continue, and habitat connectivity would not be achieved. The No Action Plan forms the basis against which all other alternative plans are measured.

3.6.2. Action Alternatives

Alternative A1 (Base Alternative – Restore Base Flow) – Alternative A1 is considered the base alternative from which all other alternatives are built and improved upon (see Figure 3-10 and Figure 3-11). Alternative A1 would involve dredging excess sediment from Reach 1 in the Old Channel and establishing a uniformly dimensioned trapezoidal section and profile of the Old Channel. Dredging would occur upstream of the Western Star Mill Weir, beginning below the entrance levee outfall in Burke Sports Complex down to Mulberry Street where there is existing adequate conveyance capacity. The dredging and construction of a uniform trapezoidal channel in Reach 1 would effectively restore consistent gravity-based flow conveyance upstream and downstream of the weir and would establish a positive downslope water gradient, increased water surface area, and larger aquatic habitat for local plants and animals. The trapezoidal section has a channel bottom width of 5 feet, top water width of 30 – 50 feet at 60 cfs, and target water depth of 3.25 feet. Sediment removal is estimated at 42,000 cubic yards. This measure also assumes removal and replacement of the sediment filled South Ohio Street culvert (replacement at City cost) to maintain positive downslope water gradient. Other measures in A1 include:

- Pool Habitat in Reach 2 created by a two-foot tall weir
- Sediment Forebay at the existing levee entrance culvert to remove coarse settleable sediment
- Connected Wetland Shelves in the Old Channel below the levee entrance culvert to create wetland habitat
- Remove and replace Western Star Mill Weir with Five Step Pools for aquatic life connectivity and passage
- Restore/create wetland at Lakewood Lake for supporting habitat functions such as increasing biodiversity
- Improvement of existing trails in the Lakewood Lake wetland creation area
- Habitat weir structure approximately two feet tall in the Old Channel to help create and maintain the pool habitat in Reach 2

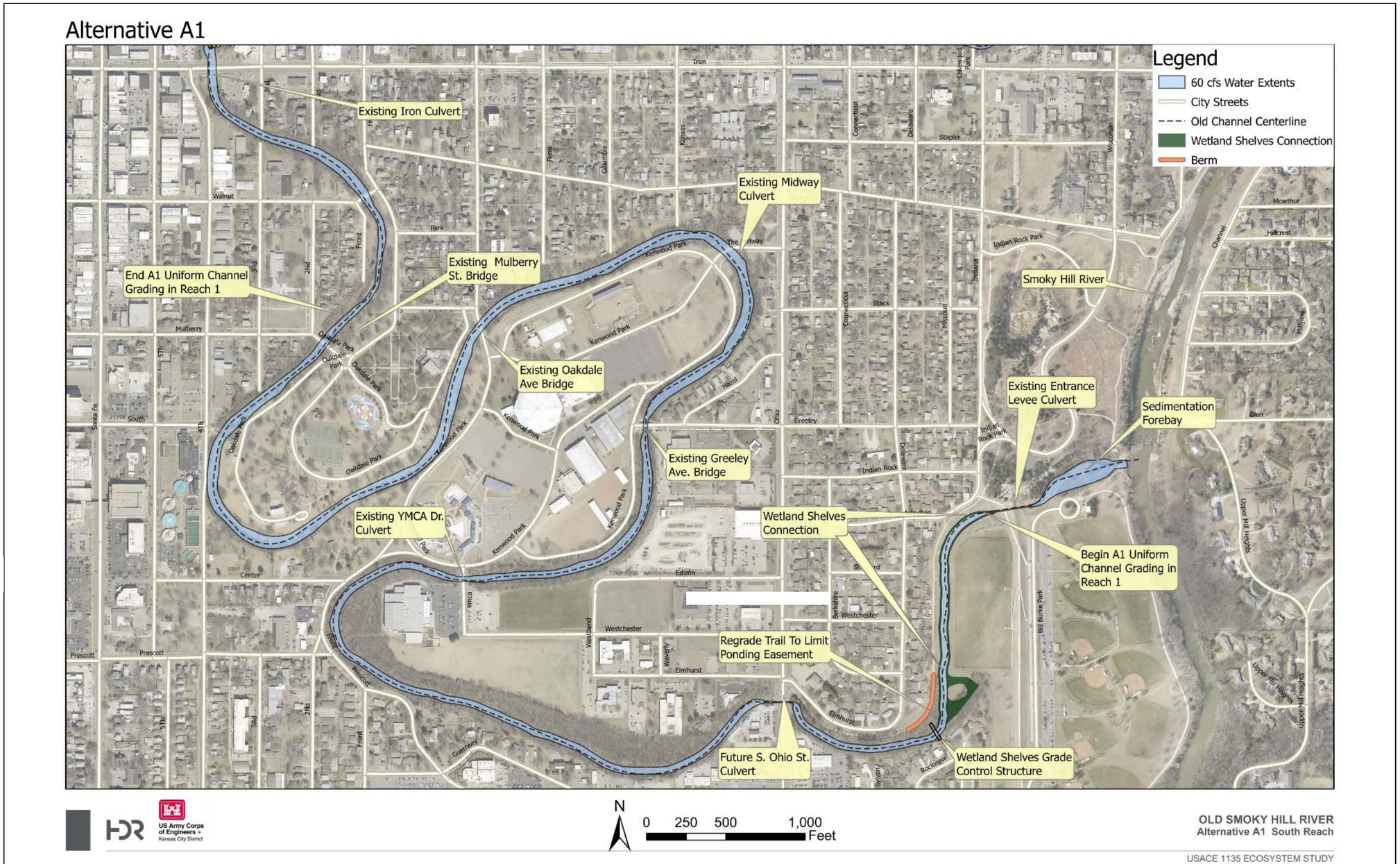


Figure 3-10. Alternative A1 - Reach 1

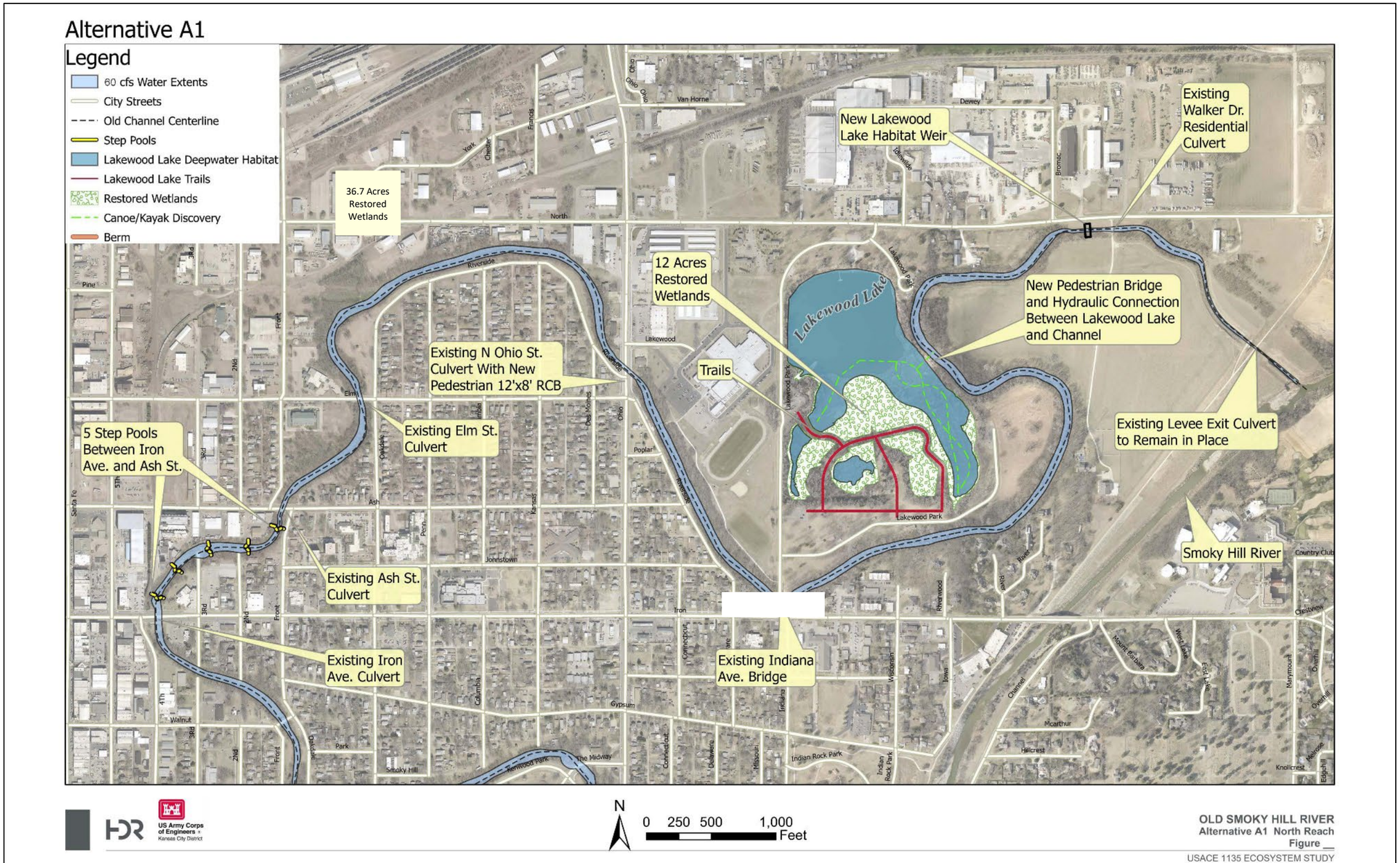


Figure 3-11. Alternative A1 - Reach 2

Alternative A2 – Alternative A2 would involve dredging excess sediment from Reach 1 in the Old Channel and establishing a variable-depth channel profile consisting of glides, pools, riffles and run habitats (see Figure 3-12 and Figure 3-13). Dredging would occur upstream of the Western Star Mill Weir, beginning below the entrance levee outfall in Burke Sports Complex down to Mulberry Street where there is existing adequate conveyance capacity. The dredging and construction of a variable depth channel in Reach 1 would effectively restore consistent gravity-based flow conveyance upstream and downstream of the weir, and create a positive downslope water gradient, increased water surface area, and larger, more diverse aquatic habitat for local plants and animals. The variable depth profile has a channel bottom width of 8 – 20 feet, top water width of 40 – 80 feet at 80 cfs, target pool water depth of 4 – 6 feet, and target riffle depth of 3.25 feet. Sediment removal is estimated at 63,000 cubic yards. This measure also assumes removal of the sediment filled South Ohio Street culvert (replacement at City cost) to maintain positive downslope water gradient. Other measures in A2 include:

- Pool Habitat in Reach 2 created by installation of a two-foot tall weir
- Sediment Forebay at the existing levee entrance culvert to remove coarse settleable sediment
- Connected Wetland Shelves in the Old Channel below the levee entrance culvert to create wetland habitat
- Habitat weir structure approximately two feet tall in the Old Channel would be constructed on the downstream portion of the connected wetland shelves to help create and maintain the wetland habitat in the Old Channel
- Removal and replacement of Western Star Mill Weir with Five Step Pools for aquatic life connectivity and passage
- Restore/create wetland at Lakewood Lake for supporting habitat functions such as increasing biodiversity
- Improvement of existing trails in the Lakewood Lake wetland creation area
- Habitat weir structure approximately two feet tall in the Old Channel to help create and maintain the pool habitat in Reach 2

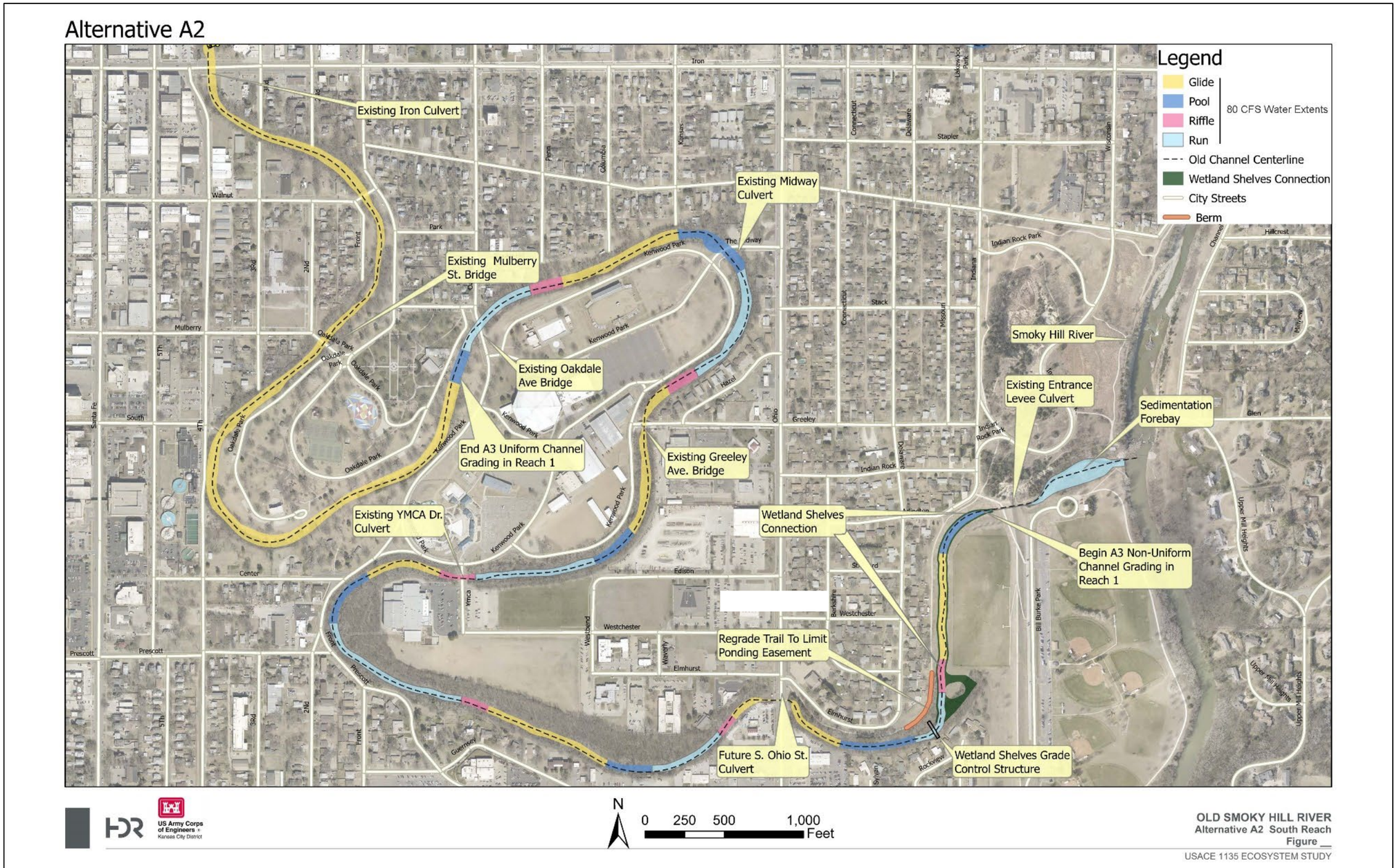


Figure 3-12. Alternative A2 - Reach 1

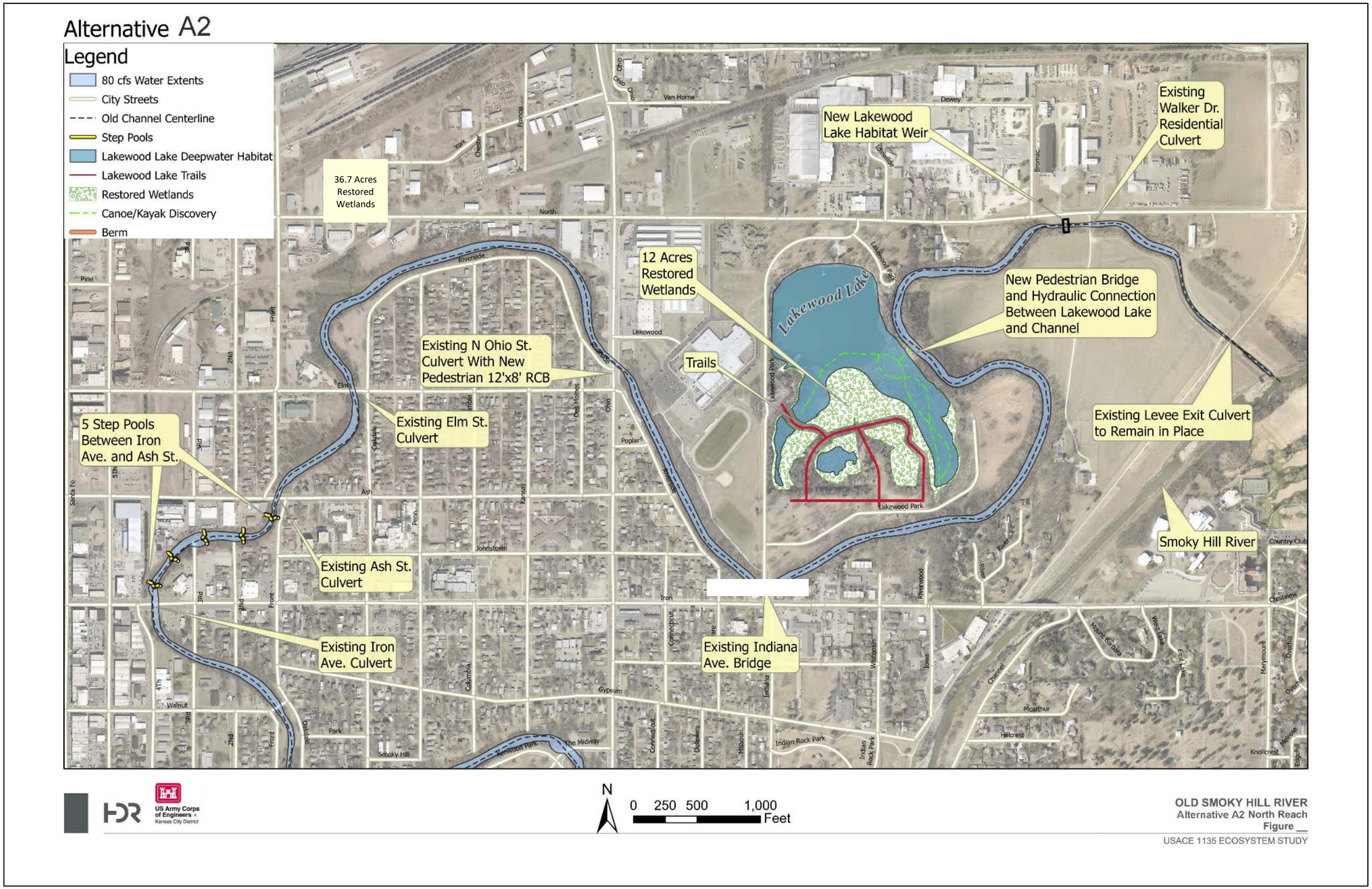


Figure 3-13. Alternative A2 - Reach 2

Alternative A3 – Alternative A3 would involve dredging excess sediment from Reaches 1 and 2, nearly the full 6.8 miles of the Old Channel, and restoring in both reaches a variable-depth channel profile consisting of glides, pools, riffles, and run habitats (see Figure 3-14 and Figure 3-15). Dredging in Reach 1 is upstream of the Western Star Mill Weir from below the entrance levee outfall in Burke Sports Complex down below Oakdale Avenue Bridge in Kenwood Park. Reach 2 dredging would occur from downstream of Western Star Mill Weir to just downstream of Lakewood Lake. The dredging in these reaches would effectively restore consistent gravity-based flow conveyance upstream and downstream of the weir and creates a positive downslope water gradient, increased water surface area, and larger, more diverse aquatic habitat for local plants and animals. In both Reaches 1 and 2, the variable depth profile has a channel bottom width of 8 – 20 feet, top water width of 30 – 50 feet at 80 cfs, target pool water depth of 4 – 6 feet, and target riffle depth of 3.25 feet. Sediment removal is estimated at 105,000 cubic yards. This measure also assumes removal of the sediment filled South Ohio Street culvert (replacement at City cost) to maintain positive downslope water gradient. Other measures in A3 include:

- Pool Habitat in Reach 2 created by installation of a two-foot tall weir
- Sediment Forebay at the existing levee entrance culvert to remove coarse settleable sediment
- Connected Wetland Shelves in the Old Channel below the levee entrance culvert to create wetland habitat
- Habitat weir structure approximately two feet tall in the Old Channel would be constructed on the downstream portion of the connected wetland shelves to help create and maintain the wetland habitat in the Old Channel
- Remove and replace Western Star Mill Weir with Five Step Pools for aquatic life connectivity and passage
- Restore/create wetland at Lakewood Lake for supporting habitat functions such as increasing biodiversity
- Improvement of existing trails in the Lakewood Lake wetland creation area
- Habitat weir structure approximately two feet tall in the Old Channel to help create and maintain the pool habitat in Reach 2

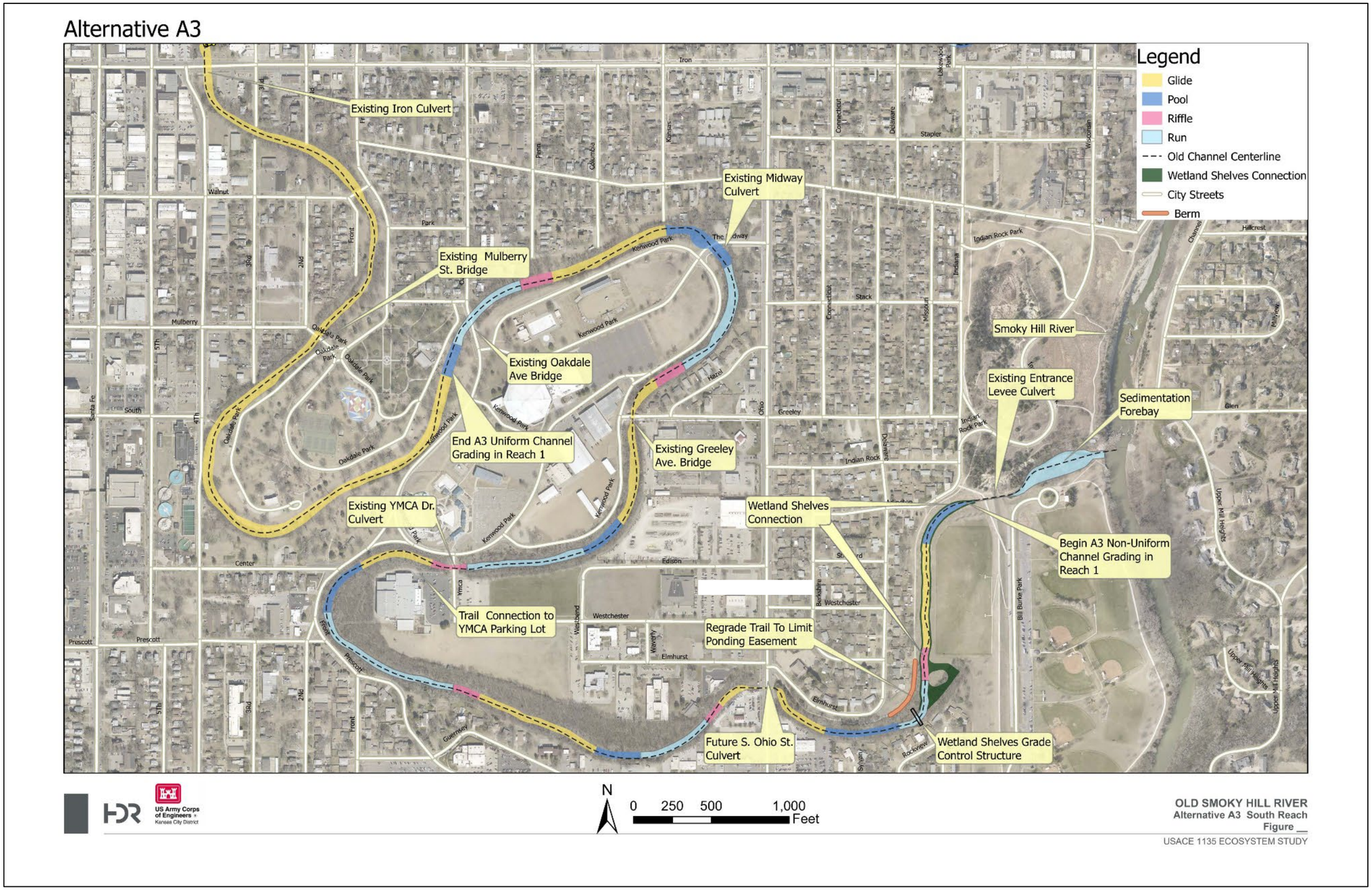


Figure 3-14. Alternative A3 - Reach 1

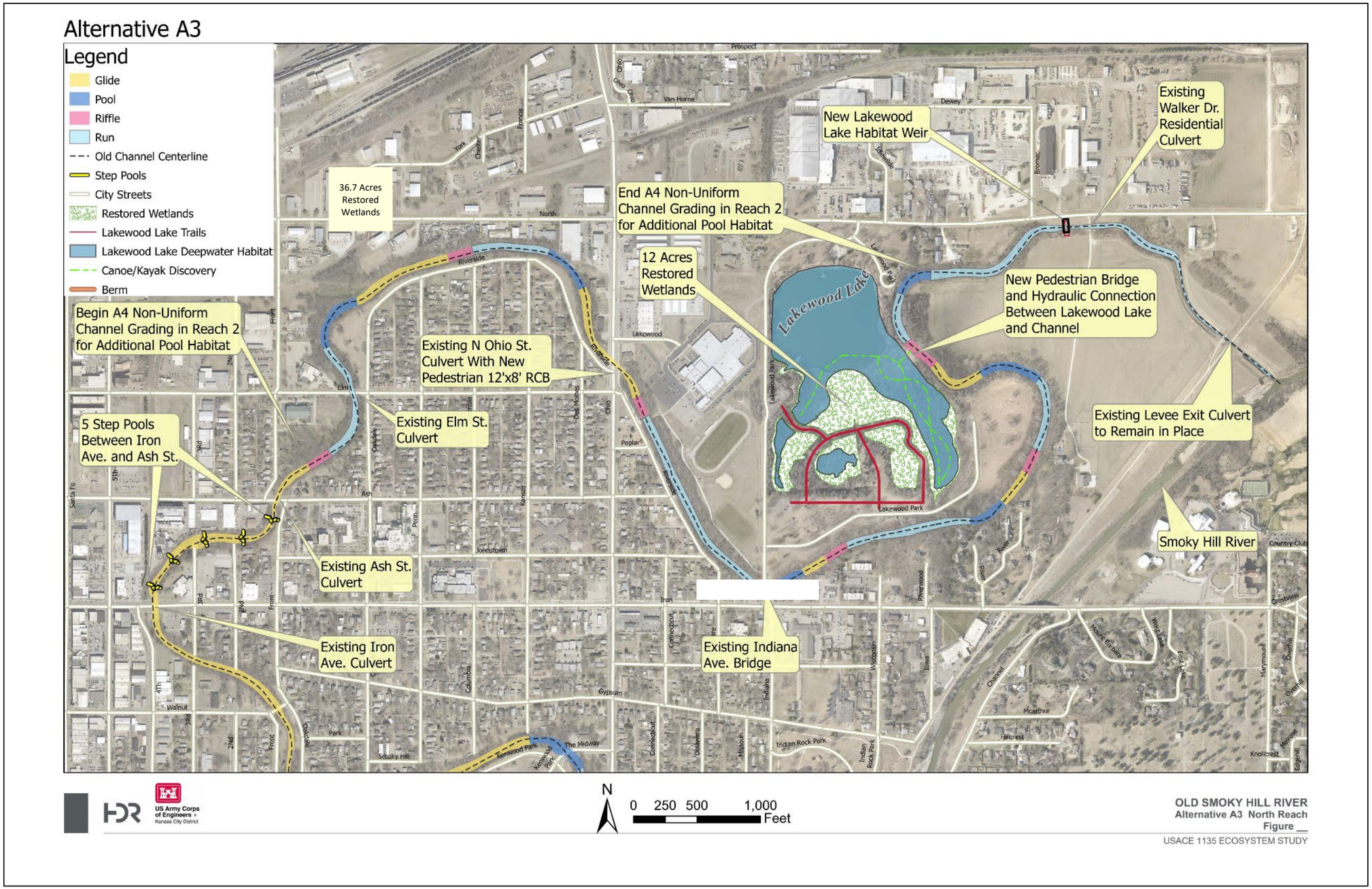


Figure 3-15. Alternative A3 - Reach 2

Alternative A4 – Alternative A4 is nearly identical to Alternative A3, except dredging of pools is approximately one foot deeper in Reach 1 only (see Figure 3-16 and Figure 3-17). Dredging Reaches 1 and 2 would effectively restore consistent gravity-based flow conveyance upstream and downstream of the weir, along with a variable-depth profile consisting of glides, pools, riffles, and run habitats. Dredging these reaches in this manner creates a positive downslope water gradient, increased water surface area, and larger, more diverse aquatic habitat for local plants and animals. In both Reaches 1 and 2, the variable depth profile has a channel bottom width of 8 – 20 feet, top water width of 30 – 50 feet at 80 cfs, target pool water depth of 5 – 7 feet, and target riffle depth of 3.25 feet. Sediment removal is estimated at 107,000 cubic yards. This measure also assumes removal of the sediment filled South Ohio Street culvert (replacement at City cost) to maintain positive downslope water gradient. Other measures in A4 include:

- Pool Habitat in Reach 2 created by installation of a two-foot tall weir
- Sediment Forebay at the existing levee entrance culvert to remove coarse settleable sediment
- Connected Wetland Shelves in the Old Channel below the levee entrance culvert to create wetland habitat
- Habitat weir structure approximately two feet tall in the Old Channel would be constructed on the downstream portion of the connected wetland shelves to help create and maintain the wetland habitat in the Old Channel
- Remove and replace Western Star Mill Weir with Five Step Pools for aquatic life connectivity and passage
- Restore/create wetland at Lakewood Lake for supporting habitat functions such as increasing biodiversity
- Improvement of existing trails and construction of new trails in the Lakewood Lake wetland creation area. This includes additional trail construction in comparison to those for A3 and construction of several new pedestrian bridges.

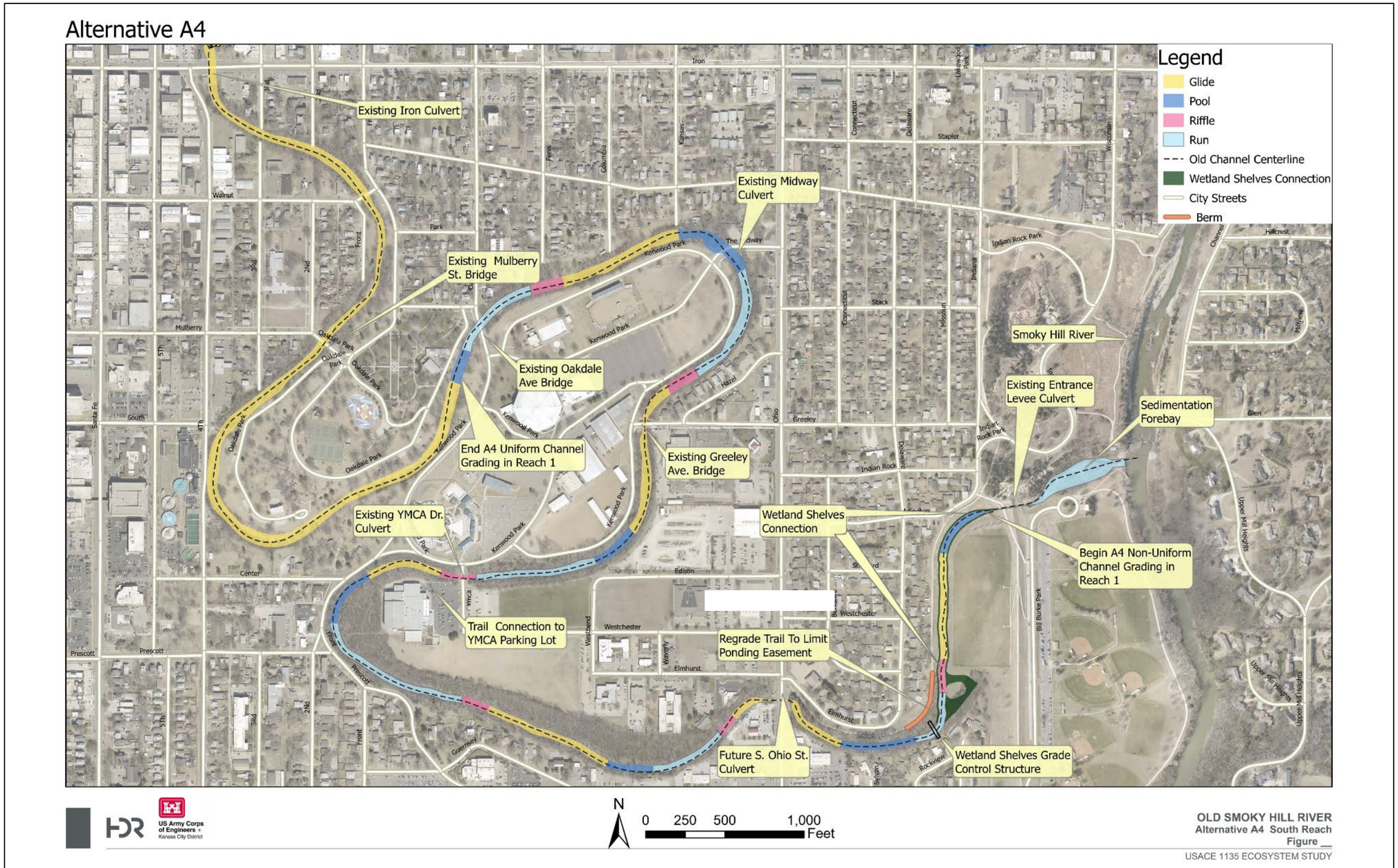


Figure 3-16. Alternative A4 - Reach 1

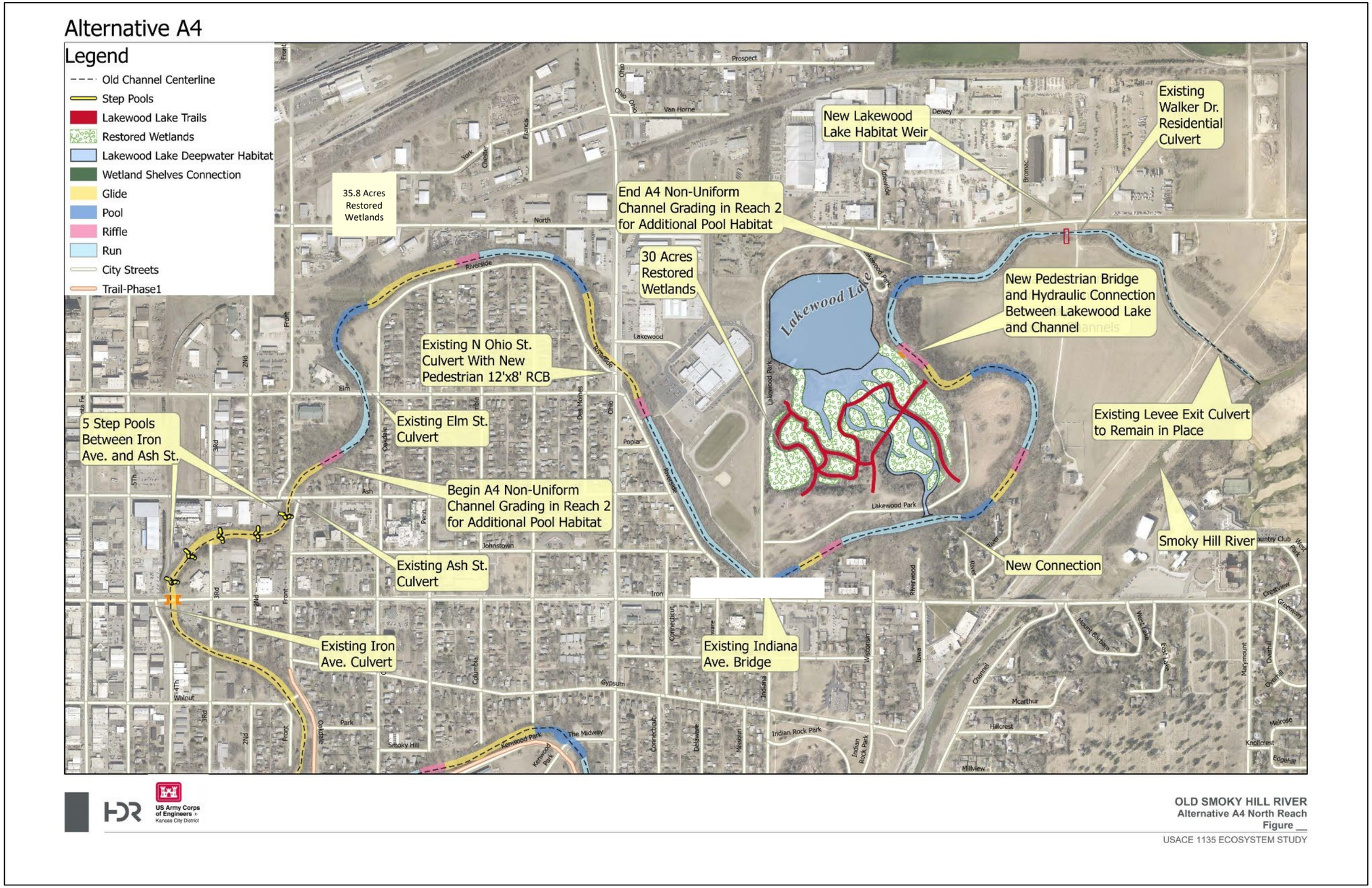


Figure 3-17. Alternative A4 - Reach 2

3.7. Habitat Modelling

Habitat modeling is used as an objective method to compare the existing condition to the future without project condition and the future with project condition.

The team identified two habitat models that would account for the conditions of the riparian and in-stream habitats in the Project area. The following models were used to establish a baseline condition, future without project conditions (FWOP), and future with project conditions (FWP) for alternative comparison.

3.7.1. Qualitative Habitat Evaluation Index Model

The Qualitative Habitat Evaluation Index (QHEI) is a model that quantifies the ecological value of in-stream habitat. This model was used to assess potential effects to in-stream habitat. The QHEI model was originally developed by the Ohio Environmental Protection Agency (OEPA) and subsequently updated as data was collected (Ohio EPA 2006). It is an index of macro-habitat quality of streams in Ohio and associated ecoregions. The QHEI is a rapid, index-based, community-focused, ecological assessment designed to provide a measure of the habitat that generally corresponds to those physical factors that affect fish communities, and which are generally important to other aquatic life (e.g., invertebrates). The model provides a macro-scale approach, used to measure emergent properties of habitat (e.g., sinuosity, pool/riffle development, bank erosion) rather than the individual factors which shape these characters (e.g., current velocity, depth). The QHEI methodology is applicable to stream restoration and restoration of fish passage for small- to medium watersheds and stream communities.

Calculation of the index is based on field observations and scoring of reach-scale habitat metrics, which describe attributes of the physical habitat that may be important in explaining composition of fish communities in streams, and the presence or absence of species (Ohio Environmental Protection Agency [Ohio EPA] 1989). The five metrics include:

- Substrate type and quality – points are awarded to locations with diverse, high quality substrate types. Includes: best substrate types, origin, quality, and embeddedness.
- Instream Cover – scores the presence of cover types and overall instream cover.
- Channel Morphology – emphasizes the quality of stream channel as it relates to the creation and stability of macrohabitats. Includes: sinuosity, development, channelization, and stability.
- Riparian Zone and Bank Erosion – emphasizes quality of the riparian buffer zone and floodplain vegetation. Each streambank is scored separately and then averaged to determine the component value (the average of each streambank). Includes: erosion, riparian width, and floodplain quality.
- Pool/Glide and Riffle-Run Quality – the quality of pool, glide, and riffle-run habitats is emphasized in this metric. Includes maximum depth (pools), channel width, current velocity, riffle depth, run depth, riffle/run substrate, and riffle/run embeddedness.

The metrics are individually scored and then summed to provide the total QHEI location score. The highest scores are assigned to the parameters that have been shown to be correlated with streams that have high biological diversity and integrity, with a maximum score of 90. Progressively lower scores are assigned to less desirable habitat features (Rankin 1989). A sample assessment field data sheet is included in Appendix F – Environmental.

In May of 2020, the USACE Ecosystem Restoration Center of Expertise (ECO-PCX) approved the QHEI model for regional use in Kansas and Nebraska streams in the High Plains, Southwestern Tablelands, Central Great Plains, Flint Hills, Cross Timbers, Ozark Highlands, and Western Corn Belt Plains Level III Ecoregions (USACE 2020). Appropriate modifications were made to the model metric scoring to better reflect general stream conditions in the States of Kansas and Nebraska.

Stream data from the Old Channel was collected from a combination of sources including a site visit in 2019. During the site visit, photographs were taken characterize in and along the Old Channel at representative sample points substrate, instream cover, channel morphology, pool/glide, riffle/run, and riparian corridor composition. Desktop GIS and engineering analysis was used (when needed) to characterize flow regime, channel morphology and riparian habitat width.

Scoring of QHEI habitat variables for alternatives was done by scoring Reach 1 separately from Reach 2. Environmental outputs, quantified as habitat units (HUs), were calculated by multiplying the acres of in-stream habitat in each alternative by the QHEI score as follows:

AREA x QHEI HABITAT SCORE = HABITAT UNIT (HU)

HUs were calculated for select time series years (0 year, 10 years, 25 years, 50 years) for the FWOP and FWP conditions, and annualized over the life of the Project (50 years) to derive average annual habitat units (AAHUs). Estimating HUs and AAHUs is essential for evaluating Project alternatives, and paired with costs, these metrics serve as the basis for selecting and justifying a Tentatively Selected Plan.

Table 3-3: QHEI Modeling Results by Alternative.

Alternative	Acres	Net AAHUs
FWOP – No Action	66.6	0
FWP – Alternative 1	66.6	19.8
FWP – Alternative 2	66.6	27.5
FWP – Alternative 3	66.6	35.6
FWP – Alternative 4	66.6	36.1

3.7.2. Dabbling Duck Model

To model the wetland ecological benefits at Lakewood Lake, the Dabbling Duck Migration Model for the Upper Mississippi River was used to assess potential changes in emergent wetland habitat, as well as changes in deepwater lentic habitat in Lakewood Lake. The model, which was originally reviewed and certified by USACE in 2013, was developed to evaluate the quality of fall migration habitat in large riverine areas and their associated backwaters for a wide variety of dabbling duck species. The model was originally developed for the Upper Mississippi River, but a range expansion

was recently approved, and the model is now certified for regional use in the Central Flyway.

The duck species represented in the model include mallard (*Anas platyrhynchosa*), gadwall (*Anas strepera*), pintail (*Anas acuta*), blue-winged teal (*Anas discors*), green-winged teal (*Anas crecca*), wigeon (*Anas Americana*), and wood duck (*Aix sponsa*). The Dabbling Duck model obtains a final habitat suitability index (HSI) score from 0.0 to 1.0 to determine the "quality" score for emergent wetland habitat based on a suite of variables that can be measured and assessed. The area of available habitat was assessed using design information and GIS aerial photography to determine proposed quantities (acres) of emergent wetland habitat. Model variables (V) for the Dabbling Duck Migration Model are included below. More information and full results of the Dabbling Duck model are in Appendix F - Environmental.

- Wetland Distance to Bottomland Hardwoods, Species Composition and Water Availability
- Distance of Wetlands to Cropland and Cropland Practices
- Percent of Wetland Habitat with Water Depth 4-18 inches in Fall
- Percent of Wetland Habitat with Water Depth < 4 inches in Fall
- Percent of Wetland Habitat with Open Water
- Plant Community Diversity
- Do Vegetative Beds Cover < 20% of the Evaluation Area
- Percent Coverage of Wetland Vegetative Beds with Important Food Plants
- Percent of the Wetland Area Containing Loafing Structures
- Percent of the Wetland Area with Structure to Provide Thermal Protection
- Disturbance in the Fall
- Presence of Visual Barriers

The metrics are individually scored and then combined to provide the total HSI score for the location. Environmental outputs, quantified as habitat units (HUs), were calculated by multiplying the acres of in-stream habitat in each alternative by the Dabbling Duck HSI score as follows:

AREA x Dabbling Duck HSI SCORE = HABITAT UNIT (HU)

HUs were calculated for select time series years (0 year, 10 years, 25 years, 50 years) for the FWOP and FWP conditions, and annualized over the life of the Project (50 years) to derive average annual habitat units (AAHUs). Estimating HUs and AAHUs is essential for evaluating Project alternatives, and paired with costs, these metrics serve as the basis for selecting and justifying a Tentatively Selected Plan.

Table 3-4: Dabbling Duck Modeling Results

	Acres	Net AAHUs
FWOP – No Action	14	0
FWP – Alternative A1	36.7	21.2
FWP – Alternative A2	36.7	21.2
FWP – Alternative A3	36.7	21.2
FWP – Alternative A4	35.8	22.3

3.8. Cost Effectiveness and Incremental Cost Analysis (CE/ICA)

3.8.1. Selection Process

Evaluation of the alternatives is based primarily on a comparison of the FWOP condition to each of the FWP alternative conditions. The benefits of the alternatives are measured as the net gain (change) in environmental outputs over the FWOP condition. The costs of implementing each of the alternatives are then compared with the benefits of each alternative, using both cost-effectiveness analysis and an incremental-cost analysis. Corps software program IWR Planning Suite version 2.0.9.35 (USACE certified on May 31, 2018) was used to help conduct the analyses. Costs and outputs for specific sets of measures were calculated and then inputted into the model. The model then evaluated all combinations of compatible alternatives and calculated the total cost and HUs of each permutation (i.e. combination of alternatives). The model also identified which alternatives and permutations were cost effective and which were “best buy” alternatives.

Analysis of cost effectiveness, in general, compares the relative costs and benefits of alternative plans. The most efficient plans that provide the greatest increase in output for the least increase in cost are called the best buys. The least expensive best buy plan, which also meets the restoration objective, is usually chosen as the NER.

Cost-effectiveness analysis compares the costs and expected environmental outputs among various alternative plans. If different alternative plans can produce the same level of output, only the least expensive (least-cost) choice makes economic sense for that level of output; economically *inefficient* alternative plans can be eliminated from further consideration. Similarly, if one alternative plan can produce a greater level of output for the same or less cost than others (cost-effective), only the greater output choice makes economic sense; economically *ineffective* alternative plans can be eliminated. After elimination of inefficient and ineffective alternative plans, there remain several least-cost, cost-effective alternative plans offering a range of output values from which to identify the means of meeting the ecosystem restoration objectives.

In addition to cost effective plans, best buy alternatives are defined as the lowest incremental cost per unit of benefit relative to other alternatives. In an array of all cost-effective alternatives, there can be multiple best buy alternatives. Incremental-cost analysis is conducted to show changes in costs (and especially cost per unit) for increasing levels of environmental outputs.

Incremental cost analysis measures the incremental or additional cost of the next additional level of environmental output. While cost-effective alternatives are economically effective in generating environmental outputs, best buy alternatives are the most efficient in benefit production.

The No Action Alternative, FWOP, represents the conditions in the Project area in the absence of a restoration project and serves as the basis for comparison with the alternatives serving to produce the “FWP” conditions.

The total implementation costs for the Project include the costs associated with the Project, including outlays for preconstruction engineering and design, supervision and administration, interest during construction, adaptive management and monitoring costs, and Operations, Maintenance, Repair, Rehabilitation, and Replacement (OMRR&R). To compare costs with average annual environmental outputs, it is necessary to convert implementation costs to average annual costs. The stream of costs associated with the Project occurs at various points in time.

Therefore, to develop equivalent average annual costs, all costs were amortized at the FY25 federal discount rate of 3.0 % over the Project life of 50 years. The costs that were developed during the CAP study were used for the screening of alternatives and escalated to the FY25 price level by using a 7.49% escalation rate. Costs related to Construction Contingency, Adaptive Management and Monitoring, and OMRR&R were re-evaluated and updated individually. This process eliminates non-cost-effective alternatives based on comparing average annual environmental outputs with the average annual costs.

3.8.2. CE/ICA Results

The preliminary cost estimate was used to estimate costs for construction, monitoring, adaptive management, and OMRR&R (see Table 3-5Table 3-5). This was paired with the anticipated schedule used to estimate annualized costs. Interest was calculated during the construction phase based on the construction schedule. The annualized economic cost of each alternative was also calculated using the 50-year period of analysis and FY 2025 discount rate of 3.0%.

These costs, along with the environmental benefits described above in Section 3.7 Habitat Modelling, were entered into the USACE software program, the Institute for Water Resources (IWR) Planning Suite II version 2.0.9.35 for CE/ICA. IWR Planning Suite was used to assist with the analysis, including generating graphs and charts that illustrate the alternative benefits and costs, aiding decision-makers by visually displaying the differences in output versus cost for each alternative.

Table 3-5. Preliminary Costs for Alternatives Used in CE/ICA

	Alt A0 (No Action)	Alt A1 (Restores Base Flow)	Alt A2 (Alt 1 Plus Variable Dredging in Reach 1)	Alt A3 (Alt 2 Plus Variable Dredging in Reach 2)	Alt A4 (Alt 3 Plus Additional Reach 1 Dredging)
Construction	$0	$6,046,652	$6,567,855	$7,815,134	$7,970,420
Planning, Engineering and Design	$0	$1,632,596	$1,773,321	$2,110,086	$2,152,013
*Real Estate (LERRDs for	$0	$2,000,000	$2,000,000	$2,000,000	$2,000,000

	Alt A0 (No Action)	Alt A1 (Restores Base Flow)	Alt A2 (Alt 1 Plus Variable Dredging in Reach 1)	Alt A3 (Alt 2 Plus Variable Dredging in Reach 2)	Alt A4 (Alt 3 Plus Additional Reach 1 Dredging)
Construction Easements)					
Construction Management	$0	$604,665	$656,785	$781,513	$797,042
Construction Contingency	$0	$1,511,663	$1,838,999	$2,578,994	$3,028,759
Project Costs With 7.49% Escalation	$0	$12,679,065	$13,798,449	$16,430,629	$17,142,757
Adaptive Management and Monitoring	$0	$490,000	$601,906	$837,812	$866,614
Total Project Costs	**$0**	**$13,169,065**	**$14,400,355**	**$17,268,441**	**$18,603,210**
Interest During Construction	$0	$487,000	$516,000	$585,000	$593,839
Total Investment Costs	**$0**	**$13,656,065**	**$14,916,355**	**$17,853,441**	**$18,603,210**
Total OMRR&R Costs	$0	$163,395	$168,992	$182,153	$185,714
Interest and Amortization	0.03887	0.03887	0.03887	0.03887	0.03887
Annualized Costs	**$0**	**$694,000**	**$749,000**	**$876,000**	**$909,000**
Total Net AAHUs	**0**	**41**	**48.7**	**56.8**	**58.4**

*Preliminary real estate costs were used for alternative comparison.

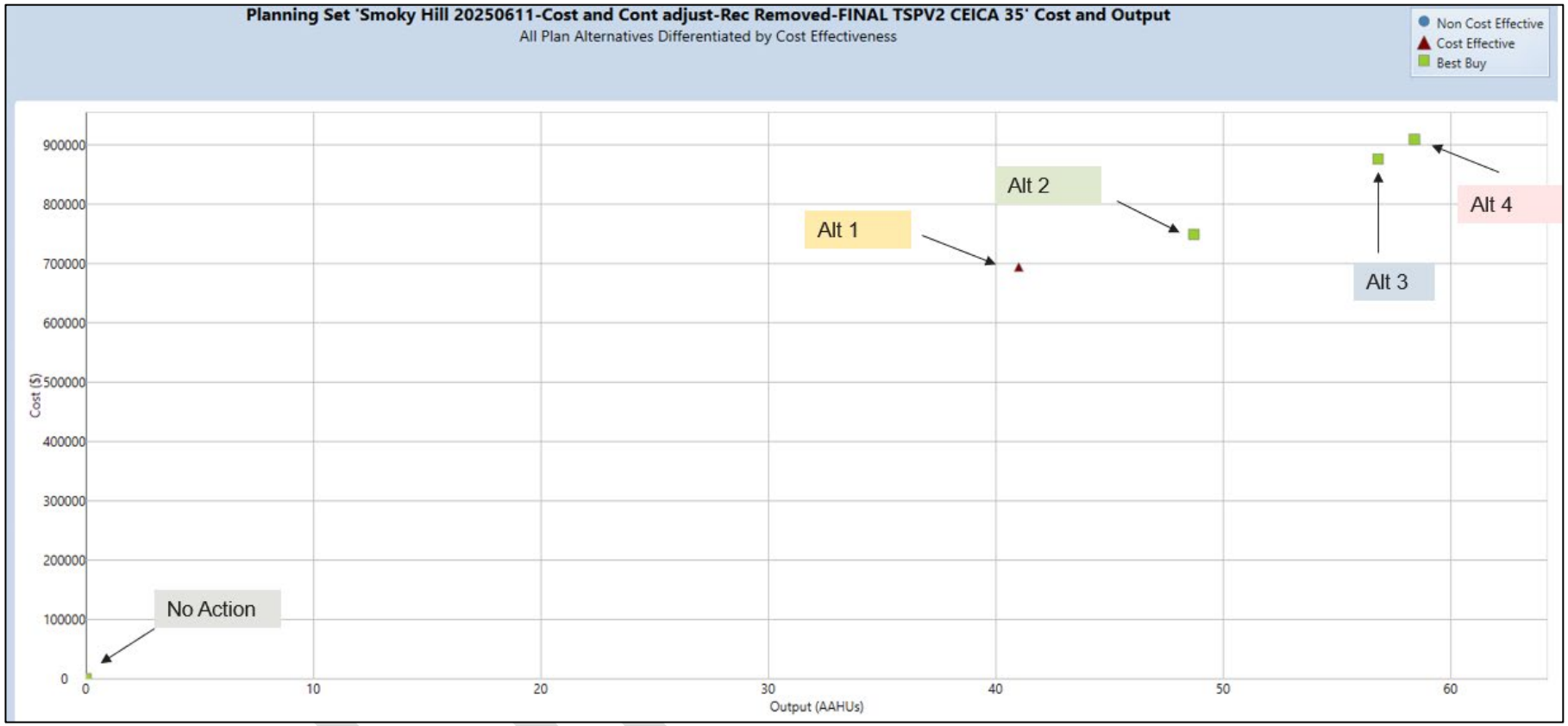
Within the IWR-Planning Suite, and once a planning study comprised of variables, outputs, and attributes has been defined with the plan editor, the plan generation module is used to populate a new planning set with plan alternatives. The IWR-Planning Suite displays generated planning sets with the information needed to assist planners to manage the plans and keep the plans in context. Based on the planning process for this Project, the plans were pre-generated by the PDT: A0, A1, A2, A3, and A4.

The cost effectiveness analysis uses the information in Table 3-5, above. There are 4 different action alternatives available. Each of the action alternatives represent a competing use for land compared to the other action alternatives and are thus non-combinable. Each action alternative is largely comprised of similar measures, with the notable distinction being the configuration of the redesigned Old Channel.

This analysis looks at the Net Average Annual Habitat Unit (AAHU) output as a desirable output of the ecosystem restoration efforts. The benefit stream for all the measures was calculated over a 50-year project life, summed, and then averaged over that period of analysis. Finally, where the existing condition is assigned a value for a given alternative, that measure's output score in the existing condition is removed from the output score with Project to compute only the marginal benefits of performing a specific alternative in the cost effectiveness analysis.

Using the nomenclature, Total Average Annual Costs and AAHUs from Table 3-5 were used to evaluate the cost-effectiveness of the alternatives. The analysis showed that Alternative 1 is deemed cost-effective. The No-Action, Alternative 2, Alternative 3, and Alternative 4 were identified as best buy plans. The cost-effective and best buy plans from the cost effectiveness analysis are presented in Table 3-6 and Figure 3-19.

Figure 3-18. Cost Effectiveness Scatter Plot



3.8.3. Final Alternative Array

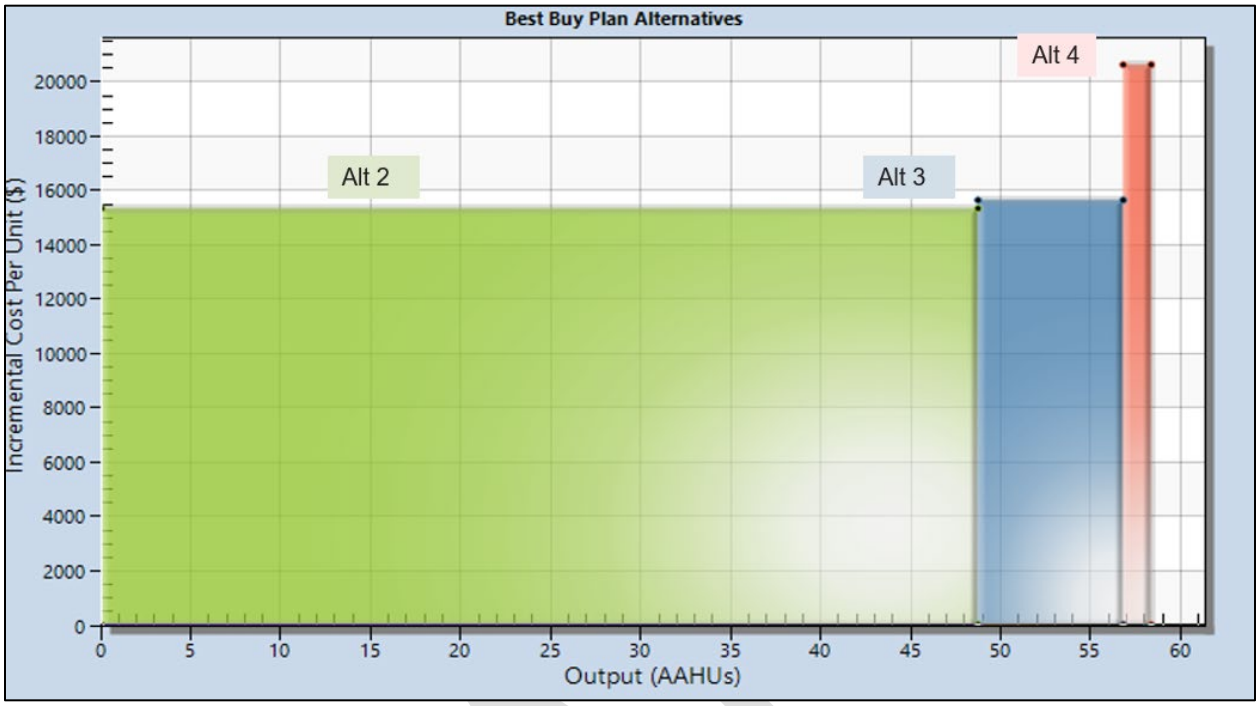
An incremental cost analysis was performed on the best buy alternatives to capture the marginal utility for each additional restoration feature. The most efficient plans that provide the greatest increase in output for the least increase in cost are called the best buys. The least expensive best buy, which meets the restoration objective, is usually chosen as the national ecosystem restoration (NER) plan depending on the scarcity of the resource. The No Action, Alternative 2, Alternative 3, and Alternative 4 are all considered best buy plans. Alternative 2 has an incremental output of 48.7 AAHUs and an incremental cost per unit of $15,380; Alternative 3 has an additional 8.1 AAHUs with an incremental cost per unit of $15,679; and Alternative 4 adds another 1.6 AAHU for an incremental cost per unit of $20,625. Based on the results of the CE/ICA analysis and assessment of the alternatives with the PR&G criteria, alternatives A0, A2, A3, and A4 were carried forward below, in Chapter 4 to assess potential environmental consequences, and in Chapter 5 for final alternative comparison and selection. The best buy plan cost and output details are summarized in Table 3-6 and depicted in the bar graph in Figure 3-19.

This final array was fully evaluated and compared, including an environmental affects analysis, using the PR&G Criteria and a Comprehensive Benefits analysis to determine the National Ecosystem Restoration (NER) plan (see Chapter 5.0 – Alternative Evaluation, Comparison and Selection).

Table 3-6. Final Alternatives Array CE/ICA Results

Alternative	Annual Cost	Net AAHUs	Incremental Cost Per Unit	Incremental AAHUs	Incremental Cost/Incremental Output	Cost Effective
No Action	$0	0	-	-		Best Buy
Alt A2	$749,000	48.7	$749,000	48.7	$15,380	Best Buy
Alt A3	$876,000	56.8	$127,000	8.1	$15,679	Best Buy
Alt A4	$909,000	58.4	$33,000	1.6	$20,625	Best Buy

Figure 3-19. Cost Effectiveness/Incremental Cost Analysis (CE/ICA) Best Buy Plans



3.9. Principles and Guidelines

Each alternative in the Final Array was independently evaluated by metrics for each of the USACE four screening criteria: Completeness, Effectiveness, Efficiency, and Acceptability. An evaluation for the alternatives is provided below.

3.9.1. Effectiveness

As defined in the PR&G, effectiveness is the extent to which an alternative plan alleviates the specified problems and achieves the specified objectives. The most effective alternatives make significant contributions to all the planning objectives. An ecosystem restoration plan must be effective in restoring degraded habitat and the NER Plan should be one of the most effective plans in restoring that habitat. The Project objectives identified included:

- Objective 1: Restore degraded in-stream aquatic and emergent wetland habitats within and surrounding the Old Channel during the 50-year period of analysis;
- Objective 2: Reestablish capacity in the Old Channel to convey appropriate flow rates throughout the year and during the 50-year period of analysis;
- Objective 3: Manage future Old Channel sedimentation during the 50-year period of analysis;
- Objective 4: Restore habitat connectivity for the 50-year period of analysis.

The No Action Alternative is not effective. It does not address the identified problems or meet the desired objectives. With flow remaining at 1-2 cfs sedimentation would continue and no habitat would be created or connected. The No Action Alternative is included in the Final Alternatives Array as the baseline upon which to compare all other alternatives. The No Action Alternative produces 0 Net AAHUs, Alternative A2 produces

48.7 Net AAHUs, Alternative A3 produces 56.8 Net AAHUs, and Alternatives A4 produces 58.4 Net AAHUs indicating that the plans are effective at creating habitat lift relative to the No Action Alternative.

Each of the three Action Alternatives include the same measures. The variable depth profile, instream habitat features, and sediment forebay produce beneficial aquatic habitat, create habitat connectivity, and reestablish channel capacity, meeting objective 1 and contributing to objectives 2 and 3. The alternatives are, however, differentiated by variations in the variable depth profiles and extent of channel that would be dredged. In Alternative A2 only Reach 1 would be dredged and reconfigured with a variable depth profile. Under Alternative A3, both Reaches 1 and 2 would be dredged and configured with variable depth profiles. Having these variable features in both reaches increases beneficial aquatic habitat. The primary distinction between Alternative A3 and A4 is that the Reach 1 pools in Alternative A4 would provide greater depth, on average than in Alternative A3, offering some additional habitat. The wetlands would also be configured differently under Alternative A4.

Construction of the sediment forebay would manage sediment loading over the life of the Project and address's objective 3 and contributes to maintaining channel capacity as outlined in objective 2. The sizing and operation of the forebay is the same across all alternatives. Similarly, the removal and replacement of the Western Star Western Mill Weir, under each action alternative, with five step-pool features, meets objective 4 by reconnecting the Old Channel.

3.9.2. Efficiency

Efficiency is the extent to which an alternative plan is the most cost-effective in alleviating the specified problems and realizing the specified opportunities, consistent with protecting the Nation's environment. An ecosystem restoration plan must represent an efficient means of habitat restoration, and a NER should produce restoration outputs that cannot be produced more efficiently by another plan.

Through CE/ICA, plans are identified as non-cost effective, cost-effective, or Best-Buy plans. Best-Buy plans have the least incremental increase in cost per unit of habitat output and were retained for consideration. The No Action Alternative, Alternative A2, Alternative A3, and Alternative A4 were identified as Best-Buy plans and fully analyzed. The No Action Alternative does not alleviate the specified problems, nor does it address the Project's objectives. It generates no costs and has no benefits (the 0 Net AAHUs produced by the No Action Alternative are used as a baseline to compare to the other alternatives). Alternative A2 generates 48.7 Net AAHUs and has a preliminary total first Project cost of $14,900,000. Alternative A3 generates 56.8 Net AAHUs and has a preliminary total first Project cost of $17,900,000 million. Alternative A4 generates 58.4 Net AAHUs for a preliminary total Project first cost of $18,600,000 million. Alternatives A2 and A3 were deemed the most efficient by the PDT and Alternative A4 was considered less efficient since the incremental output of 1.6 Net AAHUs cost an additional $20,625 per incremental unit.

Results of the CE/ICA inform selection of the NER. This cost analysis allows comparison of successive levels of output and the incremental costs between alternatives.

The CE/ICA (Appendix I - Economics) evaluated five possible alternative plan combinations presented in Sections 3.2.1 and 3.2.2. Of these, four plans were determined Best-Buy plans, including the No Action Alternative, and were retained for further evaluation (Table 3-7).

Table 3-7. Best Buy Alternative Plans Retained for Further Evaluation

Alternative	Annual Cost	Net AAHUs	Incremental Cost	Incremental AAHUs	Cost Effective
No Action	$0	0	-	-	Best Buy
Alt A2	$749,000	48.7	$749,000	48.7	Best Buy
Alt A3	$876,000	56.8	$127,000	8.1	Best Buy
Alt A4	$909,000	58.4	$33,000	1.6	Best Buy

3.9.3. Acceptability

Acceptability is the workability and viability of the alternative plan with respect to acceptance by state and local entities and the public and compatibility with existing laws, regulations, and public policies. Two primary dimensions to acceptability are implementability and satisfaction.

Implementability means that the alternative is feasible from technical, environmental, economic, financial, political, legal, institutional, and social perspectives. If the plan is not feasible due to any of these factors, then it cannot be implemented and, therefore, is not acceptable.

The second dimension to acceptability is the satisfaction that a particular plan brings to government entities and the public. This is a qualitative measure, but consideration of the degree of support of a plan is important to consider as part of the screening process.

An ecosystem restoration plan should be acceptable to state and federal resource agencies and local governments with evidence of broad-based public consensus and support for the plan.

The suite of habitat restoration measures and plans outlined within this report were developed, screened, and retained for further consideration with input from the City of Salina. The No Action Alternative is implementable, but provides no ecosystem improvements and is not satisfactory, as it does not meet the federal and City of Salina objectives. The action alternatives in the array of alternatives are all implementable, with each providing in-stream aquatic features, sediment management, and habitat connectivity. However, the alternatives differ slightly in their level of satisfaction specifically regarding in-stream aquatic features. Under Alternative A2 in-stream features are planned for Reach 1 only. Alternative A3 includes in-stream work for both Reaches 1 and 2. The distinction between Alternatives A3 and A4 is that the Reach 1 pools in A4 would be, on average, deeper and the wetlands would be configured differently.

3.9.4. Completeness

Completeness is the extent to which a given alternative plan provides and accounts for all necessary investments or other actions needed to ensure the realization of the planned benefits. This may require implementation of other types of public or private

plans if these plans are crucial to the outcome of the restoration objectives. Real estate, operations and maintenance, monitoring and adaptive management, and sponsorship factors must be considered. An adaptive management plan would be implemented as part of this Project to meet restoration goals and objectives, achieve a desired outcome, and ensure Project success.

The City is conducting RAISE Grant actions within the Old Channel to include bridge raises, recreational amenities, and culvert replacements that will increase flow conveyance from the existing Old Channel inlet to the existing Old Channel outlet through the federal levee. The City is required to conduct a Section 408 project to ensure the culvert work does not injure or harm the federal levee. In addition, the City is required to purchase an additional 2,711 acre-feet of access water from the Lower Smoky Hill Access District to support downstream Smoky Hill River flows for diversion into the Old Channel to maintain minimum 10 cfs flows during periods of extreme drought. The City culvert upgrade and water rights actions are required for all the USACE ecosystem restoration alternatives in the Final Array for the Project to be considered “complete”. The City has purchased the additional access water and would complete the levee upgrade during work for the RAISE Grant. If the levee upgrade work is not complete during the feasibility phase the Project Partnership Agreement will include this requirement.

The No Action Alternative does not restore degraded habitats; therefore, it is considered incomplete relative to realization of planned objectives. Alternatives A2, A3, and A4 all include implementation of habitat restoration measures that would benefit fish and other aquatic species, manage sediment, and establish connectivity. Consequently, each provides a complete plan for ecosystem restoration in the Old Channel and at Lakewood Lake and are consistent and compatible with Local Sponsor plans for ecosystem restoration.

Table 3-8: PR&G Criteria Results

	No Action	A2	A3	A4
Completeness	Complete	Complete	Complete	Complete
Efficiency	Efficient	Most Efficient	Efficient	Efficient
Effectiveness	Not Effective	Effective	Effective	Effective
Acceptability	Not Acceptable	Acceptable	Acceptable	Acceptable

4.0 Environmental Effects and Consequences

This chapter describes the anticipated impacts to the environment from implementation of the alternatives included in the final array. Impacts associated with the No Action Alternative, which serves as the baseline for comparison to Future with Project (FWP) actions, are also described. This chapter, like Chapter 2.0 Existing and Future Without Project Conditions, is organized by relevant resource topic.

The planning process considered potential environmental, social, and economic effects across resources in the natural, physical, built and socioeconomic environments; however, this section is not a comprehensive discussion of every resource within the Project area but rather focuses on those aspects of the environment identified as relevant during scoping or had the potential to affect or be affected by the considered alternatives. For each resource, the discussion began in Chapter 2.0 with the baseline (existing conditions), including reasonably foreseeable effects (effects that have a direct causal relationship to the considered action or are sufficiently likely to occur that they should be considered in the decision-making process) and planned actions in the affected area. This section continues the analysis with the environmental consequences of each reasonable alternative over the Project life from 2030 to 2080, including the No Action Alternative. The environmental consequences discussion forms the scientific and analytic basis for comparing the alternatives and their potential for impacts.

Potential Impacts are described using the following terms:

- Beneficial: A positive change to the appearance or state of a resource or a change that moves the resource toward a more beneficial state.
- Adverse: A change that moves the resource to a less desirable state, which can affect its appearance or state. Adverse impacts can be mitigated by different means such as through avoidance or minimization of adverse impacts.
- Short-Term: Impacts usually occur during the construction phase or a short-time after construction, which allows the resources to recover to their pre-construction state.
- Long-Term: Impacts continue after the construction phase, which creates a longer period of time for resources to return to their pre-construction state.
- Reasonably Foreseeable: Effects that are sufficiently likely that a person of ordinary prudence would take them into consideration when making a decision.

4.1. Resources Considered but not carried forward

Geology and Prime or Unique Farmland was considered in Chapter 3, but the geology of the Project Area would not be impacted by restoration efforts, and no soils within the Project Area are classified as Prime or Unique Farmland, this resource was not carried forward for further analysis.

4.2. Natural Environment

4.2.1. Aquatic Habitat and Resources

4.2.1.1. No Action

Under the No Action Alternative, continued degradation of aquatic habitat is anticipated, as discussed in Section 2.2.1.

4.2.1.2. Action Alternatives

For all action alternatives in the final array, a sediment forebay would be constructed at the entrance of the Old Channel, to settle sediment out from the Main Channel of the Smoky Hill River and reduce sediment inflow to the Old Channel. This would substantially reduce the sediment inflow from the Smoky Hill River and prevent excessive sedimentation from accumulating in the Old Channel over time, resulting in a long-term positive effect on the aquatic habitat in the Old Channel. However, sediment from the 75 stormwater outfalls would bypass the sediment forebay and would still add sediment into the Old Channel. Additionally, all action alternatives also remove the failing Western Star Mill Weir structure and replace it with step pools, restoring aquatic connectivity and facilitating aquatic organism passage throughout the channel. Both features would have a long-term, positive impact on aquatic habitat in the area, by reducing sedimentation and restoring connectivity.

Alternative A2 would dredge Reach 1 of the Old Channel and create a more natural river profile, including variable depths and configurations to create riffles, pools, glides and runs, all features of a healthy river channel. This increased diversity would improve the aquatic habitat in the Old Channel. The dredging would restore connectivity by removing excess sediment and allow water to flow through Reaches 1 and 2, substantially restoring the aquatic habitat of the Old Channel. Alternative A3 would dredge Reach 1 and Reach 2 to the variable depth configuration, restoring an additional 3 miles of river to higher quality aquatic habitat. Alternative A4 would dredge pools slightly deeper than Alternative A3, allowing for slightly more diversity and providing additional refugia at low flow conditions. All action alternatives would include the construction of two habitat weirs – one on the upstream end of the channel (to increase water levels for the wetland shelves) and one on the downstream end of the Old Channel to raise water levels to create pool habitat in Reach 2. Both weirs would be constructed to generally conform to the stream channel and would maintain aquatic passage and water flow across the top, avoiding impacts to stream connectivity with a low-profile design and rock rip-rap ramps. These weirs would provide a long-term positive benefit on aquatic habitat in the project area.

All action alternatives would cause temporary adverse effects to the aquatic habitat in the Project area due to disturbance from construction activities. Sediment excavation, heavy machinery, noise, and soil disturbance would all contribute to the temporary adverse effects, though the effects would be minor and temporary. Best Management Practices (BMPs) would be followed to reduce these impacts by minimizing the spread of invasive species, reducing erosion, and collecting runoff, etc. Dredged material from the Old Channel would be added to the Lakewood Lake area, resulting in a discharge of dredged material into waters of the United States. This project would be conducted in

accordance with Nationwide Permit 27 for aquatic ecosystem restoration projects. This is discussed further in Section 7.5. Clean Water Act.

Based on the habitat modeling results presented in Section 3.7 the implementation of any of the action alternatives would result in habitat lift compared to the future without project condition. For all the alternatives, restoring water flow to the Old Channel is the most important component for habitat lift, allowing the needed medium for aquatic organisms to live and survive. Variability in habitat lift is also provided by the action alternatives, which each produce slightly different amounts of habitat benefits, diversity, and complexity and then there are variations from the specifics of the alternatives. Alternative A2, with its more naturalized channel with riffle pool and run sequences, provides 27.5 AAHUs. Alternative A3 builds on Alternative A2 and creates a natural streambed in Reach 2 as well, generating 35.6 AAHUs. Alternative A3 and Alternative A4 are very similar, with the only difference being slightly deeps pools in Reach 1 in Alternative A4, and the habitat modeling reflects this, with Alternative A4 providing only a slight lift (36.1 AAHUs) over Alternative A3.

4.2.2. Wetlands

4.2.2.1. No Action

Under the No Action alternative increased sediment and invasive species expansion would continue to degrade the functionality of wetlands within the Project Area.

4.2.2.2. Action Alternatives

All action alternatives would build wetland shelves in Reach 1, increasing wetland habitat quantity and quality within the Project area. These wetland shelves are expected to benefit water quality by removing phosphorus in the water.

All action alternatives would also restore wetlands at Lakewood Lake, by reconnecting Lakewood Lake with the Old Channel through construction of an in-stream weir, raising water levels approximately six feet and increasing year-round water availability. All action alternatives would add sediment and reshape the topography of the area to create depth diversity. Alternatives A2 and A3 would restore and create a 36.7-acre wetland complex, with 16.4 acres of deepwater habitat, 7.6 acres of water with a 2-4ft depth, and 12.7 acres of shallow water habitat (less than 2 feet deep).

Alternative A4 would create a wetland complex with a very similar area (35.8 acres) but with different configurations of water depths. Alternative 4 would create 14.8 acres of deepwater habitat, 1.0 acre of water with a 2-4 foot depth, and 20 acres of shallow water habitat (less than 2 feet deep). All the action alternatives would have long-term, positive effects on wetlands in the Project area, through the restoration of water availability, reshaping topography to provide habitat diversity, and planting native wetland vegetation.

Temporary adverse effects on wetlands would occur from raising the water levels of Lakewood Lake as part of the wetland restoration alternatives. The water levels would be raised about 6 feet from the reconnection with the Old Channel. This would permanently inundate the area around Lakewood Lake, including portions of the identified wetland in the backwater of Lakewood Lake, killing vegetation. After the water levels are raised, the topography of the area would be altered with the application of

dredged material, and then native plantings established over a larger area of wetlands, resulting in a long-term positive effect on wetlands in the study area.

Adding the dredged material from the Old Channel to the Lakewood Lake area would be considered a discharge of dredged material into waters of the United States. This project would be conducted in accordance with Nationwide Permit 27 for aquatic ecosystem restoration projects. This is discussed further in Section 7.5. Clean Water Act.

Based on the habitat modeling results presented in Section 3.7. and Appendix F - Environmental, the implementation of any of the action alternatives would result in habitat lift for wetlands compared to the future without project condition. While the wetlands have different configurations of deep water, shallow water and emergent wetland habitat, the overall acres of wetland created is very similar, as are the results of the habitat modeling. Dabbling Ducks require a variety of water conditions for different behaviors, and while the wetland configurations are different between Alternatives A2, A3 and Alternative A4, the proposed wetlands provide nearly the same habitat benefit. Alternatives A2 and A3 would create 21.2 AAHUs over the future without project condition, while Alternative A4 creates 22.3. The biggest lift is water availability, which occurs with all wetland alternatives, as well as the availability of different water levels. Both wetland configurations provide a diversity of water levels that would create quality habitat for Dabbling Ducks. Short-term adverse impacts to wetlands would occur from construction activities, like dredging excess sediment in the Old Channel and the initial water level raise and reconstruction of wetlands at Lakewood Lake. There is currently a 9.93-acre wooded wetland identified in the Lakewood Lake area (see Section 2.2.2. for further detail). This wetland would be initially adversely impacted by the raising of the water level in the Lakewood Lake area and adding sediment into the area. Long-term, there would be a beneficial impact from the more reliable water supply. Reusing the sediment dredged from the Old Channel to raise the wetlands and reshape the topography of the area would initially have an adverse impact on the current 9.93-acre wetland area. After reestablishment of native plants and hydric soils, Alternatives A2 and A3 are expected to create 20.3 acres of wetland habitat in the Lakewood Lake area, with 16.4 acres consisting of deepwater habitat, greater than 4 feet deep.

4.2.3. Riparian Habitat

4.2.3.1. No Action

Under the No Action Alternative, riparian habitat along the Project Area would continue to degrade and allow invasive species to continue outcompeting native vegetation.

4.2.3.2. Action Alternatives

All action alternatives would have long-term beneficial impacts to riparian habitat from the habitat restoration implemented throughout the Project Area. The existing riparian corridor is highly degraded and primarily consists of invasive honeysuckle, with small pockets of native vegetation and narrow forested areas. The clearing of invasive species during restoration efforts would remove sunlight limitations and promote herbaceous and forest floor growth. Removing the understory of honeysuckle would encourage the reestablishment of a native overstory tree population by allowing native

saplings to sprout and grow without excessive shading from invasives. Alternative A2 only addresses the riparian corridor in Reach 1, while Alternatives A3 and A4 would restore the riparian corridor in both Reach 1 and Reach 2, doubling the riparian area improvements. Removing sediment and restoring water flow in the Old Channel would also improve the riparian corridor. More water present in the area would improve riparian corridor conditions for native species such as cottonwoods and willows that are adapted to wet and moist soil conditions.

While there would be an overall positive impact on the riparian corridor, there would be areas of riparian vegetation that would be adversely impacted. There would likely be small areas of tree clearing required for access points to the Old Channel for heavy equipment and sediment removal. Additionally, the vegetation currently in the park adjacent to Lakewood Lake would be adversely affected. Raising the water level of Lakewood Lake approximately 6 feet (in all action alternatives) would permanently inundate areas of vegetation along the lakeshore and in low-lying areas of Lakewood Park. The wetland restoration measures included in all action alternatives would add material to the Lakewood Park area to recontour the topography and create high quality wetlands in the area, through changing water levels and planting native wetland species.

4.2.4. Fish and Wildlife

4.2.4.1. No Action

Under the No Action Alternative, there would be long-term, adverse impacts to fish and wildlife from the lack of consistent flow, sedimentation, and urban stormwater inflows in the Old Channel. These conditions would continue to limit or prohibit healthy aquatic populations in the Old Channel. The narrow riparian corridor would continue to decline from the spread of invasive species, reducing the quality for wildlife in the area.

4.2.4.2. Action Alternatives

All action alternatives would result in long-term beneficial impacts to fish and wildlife in the Project area. All action alternatives would remove sediment from the Old Channel and restore consistent flow to the channel, substantially increasing habitat quantity and improving habitat quality available for aquatic species. Alternative A2 would dredge Reach 1 and create a varied river profile, providing a more natural environment, more habitat diversity, and areas of refuge for low water events, with a sequence of pools, riffles and runs. Alternative A3 and A4 would create that same varied river profile in both Reach 1 and Reach 2, doubling the area of channel that would have a restored profile. Alternative A4 would have slightly deeper pools, which would provide more refuge to aquatic species during potential low water events. The restoration of flow to the Old Channel would also have a long-term beneficial impact on wildlife, by creating feeding opportunities for raptors, waterfowl, shorebirds, and other wildlife in the area.

Restoration of the riparian corridor under all action alternatives would have a long-term beneficial impact on wildlife in the Project area. Reducing non-native species, increasing native species, and protecting the narrow riparian corridor from future development for wetland and riparian habitat restoration would increase travel corridors for common wildlife such White-tailed deer (*Odocoileus virginianus*), coyote (*Canis*

latrans), red fox (*Vulpes vulpes*), and eastern cottontail (*Sylvilagus floridanus*), and create nesting and roosting habitat for waterfowl, shorebirds, and songbirds.

While overall there would be long-term beneficial impacts to fish and wildlife in the Project area, there would be short-term adverse impacts during the construction period. Dredging would disrupt and disturb the current (limited) population of macroinvertebrates and fish currently in the channel and would likely increase turbidity during construction. Noise and activity from construction equipment could deter the use of the riparian corridor for other wildlife species.

4.2.5. Threatened and Endangered Species

4.2.5.1. No Action

The No Action Alternative would not have any impact on threatened and endangered species in the area. The existing degraded riparian and aquatic habitat would continue to decline under this alternative and would not provide adequate habitat for state or federally listed species.

4.2.5.2. Action Alternatives

It is unlikely that federally listed Threatened and Endangered species would be adversely affected under the implementation of any of the action alternatives, but presence of the species in the Project area is theoretically possible. The migratory habitat range for Whooping Crane overlaps the Project area. Whooping Cranes regularly utilize the Quivira National Wildlife Refuge (70 miles from Project area) and Cheyenne Bottoms National Wildlife Refuge (60 miles from Project area) on their fall and spring migrations. The Old Channel is not currently suitable habitat for use by the Whooping Crane, but it is possible that Lakewood Lake would be a suitable stopover site during the fall or spring migration. Long-term, the implementation of the alternatives would have a positive effect on Whooping Cranes, restoring aquatic habitat and restoring and expanding wetlands around Lakewood Lake. During construction, any potential Whooping Cranes utilizing the Project area may be disturbed by noise and activity in the Project area. If Whooping Cranes are spotted in the Project area, Construction would be halted and USACE will coordinate with USFWS on the appropriate course of action.

For monarch butterfly, there is currently very limited potential habitat (prairies and grasslands with native species, including milkweed) in the Project area. There are several small areas of native plantings in Lakewood Park and near the Lakewood Discovery Center. These native plantings would not be directly inundated by wetland construction or rise of Lakewood Lake, but construction activities in the area would create a temporary disturbance for monarch butterfly in the area. Long-term, the implementation of the alternatives would have a positive effect on monarch butterfly, with areas disturbed during construction replanted with native species.

KDWP indicated that there are no state Designated Critical Habitats within the Project Area and that no impacts would be anticipated to state listed species under the action alternatives.

This FR/EA represents the assessment and findings regarding the Project and serves as the Biological Assessment with a determination of “may affect but not likely to

adversely affect" for Whooping Crane and monarch butterfly. The USACE's coordination with the USFWS is ongoing, and ESA Section 7 Consultation would be completed with the final report.

4.3. Physical Environment

4.3.1. Hydrology and Hydraulics

4.3.1.1. No Action

Under the No Action alternative, no impacts to the surface water hydrology and hydraulics would be anticipated. Flowing water in the Old Channel would continue to be very limited.

4.3.1.2. Action Alternatives

Under all the action alternatives, a minimum baseflow of 10 cfs would be restored to the Old Channel. Large volumes of sediment removal (63,027 cubic yards for Alternative A2, 105,917 cubic yards for Alternative A3, and 107,390 cubic yards for Alternative A4) would restore channel capacity and allow for gravity-based flow through the Old Channel. All action alternatives would construct a sediment forebay at the inlet to the Old Channel from the Smoky Hill River. In the event of high-water levels in the Smoky Hill River, the City would have the ability to open and close the sediment forebay intake gate at the entrance to the Old Channel to manage flow levels within the Old Channel.

The flows from the Smoky Hill River (up to 80 cfs) that are diverted to the Old Channel would be returned to the Smoky Hill River after the 6.8-mile course through the Old Channel. Depending on the season and weather conditions, infiltration and evaporation might slightly reduce the volume of water returned to the Smoky Hill River.

A levee safety analysis was prepared (Appendix E – Levee Safety Considerations) to analyze any potential effects of the action alternatives on the federal levee system. There are two points (that are included in all action alternatives) that were considered. There is proposed channel grading in the Old Channel on the landward side of the federal levee where the Old Channel begins and travels under the levee in a culvert (on the north side of Bill Burke Park). The construction of the sediment forebay on the riverward side of this section of levee was another consideration. Seepage and stability analysis found that none of the action alternatives would affect the federal levee. USACE seepage and stability criteria would still be maintained. Additionally, the sediment forebay is located in an ineffective flow area behind a hill during major flood events that is not expected to affect riverside hydraulics.

All action alternatives for wetland restoration would raise the water levels of Lakewood Lake approximately six feet, back to historic levels. This would reduce the temporary stormwater storage capacity of the area. At the 1% AEP event, this would result in a higher tailwater condition for upstream culverts. To mitigate for this change in surface water elevation within the Lakewood Lake area and avoid any inducing flooding impacts on private property, an additional culvert structure would be added to the downstream levee outlet to allow greater stormwater flows back into the Smoky Hill River.

4.3.2. Floodplains

4.3.2.1. No Action

The No Action Alternative would have no impact on the floodplains in the Project area. It is likely given future climate predictions of more extreme storm events (see Appendix B – Infrastructure and Installation Resilience for more detail), that the areas of 1% Annual Chance Flood Hazard expand.

4.3.2.2. Action Alternatives

The implementation of any of the action alternatives would not impact development patterns within the floodplain. This is not a flood risk management project, and there are no effects from this Project that would reduce the flood risk of areas of Salina and encourage development in flood-prone areas.

Ecologically, there would be a long-term positive impact on the floodplain in the Project area, with the restoration of the aquatic habitat in the Old Channel and the restoration of the riparian corridor along the Old Channel.

4.3.3. Land Use and Land Cover

4.3.3.1. No Action

The No Action Alternative would have no impact on land use and land cover within the Project area.

4.3.3.2. Action Alternatives

Under all action alternatives, there would be minor changes to land use and land cover in the Project area. The restoration of the Old Channel and construction of multi-use trails would change some developed land to parkland. Under all action alternatives, increasing the water levels in Lakewood Lake, restoring the adjacent wetlands and adding recreational aquatic access and trails would increase the open water area and wetland area in the Project area and create new land use opportunities for recreational activities such as kayaking, bird watching, and fishing.

4.3.4. Air Quality and Noise

4.3.4.1. No Action

The No Action Alternative would have no impact on air quality or noise within the Project area.

4.3.4.2. Action Alternatives

For all action alternatives, construction activities during sediment dredging, Western Star Mill Weir removal, step pool construction, and wetland restoration would create short-term, minor adverse impacts within and adjacent to the Project area for noise. Construction activities that release dust would also have short-term, localized adverse impacts on air quality, though these impacts are not expected to change attainment status of the area. Alternative A2 only dredges Reach 1, so air quality and noise impacts would be limited to the Reach 1 and Lakewood Lake Area (approximately 35 acres for Reach 1 and 36 acres for the Lakewood Lake area). Alternatives A3 and A4 would address both Reach 1 and Reach 2 in addition to Lakewood Lake, so the impact

area would be larger for these alternatives (approximately 66 acres from Reach 1 and Reach 2, and 36 acres for the Lakewood Lake area).

BMPs would be followed to minimize the adverse impacts to air quality and noise, such as using fast growing ground cover on sediment storage areas, covering stockpiles, and minimizing vehicle idling. To avoid noise impacts to the surrounding residential communities, construction would occur at set times during working hours.

4.3.5. Water Quality

4.3.5.1. No Action

Under the No Action alternative, long-term adverse impacts would occur to water quality. Current 303(d) impaired waters in the Project area would be expected to remain impaired. Additional sedimentation in the Old Channel would continue to degrade water quality. Independently of this Project, the City of Salina is planning on implementing stormwater BMP's, including reducing the winter use of sand on city streets, which would reduce the sedimentation impacts of the 75 stormwater drains that drain into the Old Channel.

4.3.5.2. Action Alternatives

All action alternatives would create long-term beneficial impacts on water quality in the Project area. Removing sediment from the Old Channel and installing a sediment forebay (as all action alternatives would do) would substantially reduce the water quality issues in the Old Channel that result from excessive sedimentation. Restoring consistent flow through the entire 6.8-mile stretch would eliminate the stagnation issues that have caused low water quality, including low oxygen and algal blooms.

Additionally, there would be incidental water quality improvements from creating wetland shelves in Reach 1 (a measure that is included in all action alternatives). High levels of phosphorus are one of the reasons the Smoky Hill River is on the 303(d) impaired list, and wetlands provide an incidental water quality benefit by filtering water and reducing pollutants, excess nutrients, and sediments.

Reconnecting Lakewood Lake to the channel and restoring the adjacent wetlands would also have a positive impact on the water quality in the Project area. Functional wetlands (36.7 acres for Alternatives A2 and A3, 35.88 acres for Alternative A4) would trap sediment, remove nutrients, and help remove toxins to improve water quality in the Project area.

While there would be positive long-term impacts on water quality in the Project area from implementing any of the action alternatives, there would also likely be adverse short-term impacts from construction. Removing sediment from the Old Channel (63,027 cubic yards for Alternative A2, 105,917 cubic yards for Alternative A3, and 107,390 cubic yards for Alternative A4) would likely cause localized impacts to water quality from construction disturbance by increasing water turbidity within the Old Channel.

The Lakewood Lake wetland restoration would also have temporary adverse impacts. Raising the water levels approximately six feet back to historic levels would inundate areas that are currently vegetated. Previously in 2008, prolonged high-water levels in

Lakewood Lake killed vegetation, which caused a fish kill in the Lake, so care should be taken to increase the water level slowly or remove vegetation beforehand to reduce the risk of decomposing vegetation affecting oxygen levels in the lake. Increasing the water level in the winter, when there is less vegetation biomass present and microbial activity is lower would be another potential option.

The placement of sediment dredged from the Old Channel into the Lakewood Lake adjacent wetlands would also cause short-term adverse impacts. There would likely be some diffusion that would increase localized turbidity as sediment is placed, but this adverse effect is expected to be localized and settle out quickly. Establishing vegetation in the newly restored wetlands would keep sediment in place. The shallow water habitat area (0-2 ft depth) in the wetland design for Alternative A4 is larger (20 acres) than the shallow water habitat area in Alternative A2 and A3 (12 acres of shallow water habitat). Native wetland vegetation should establish more quickly in the shallow water habitat area, so the wetland design of Alternative A4 would likely establish more quickly to realize water quality benefits.

4.3.6. Hazardous, Toxic and Radioactive Waste

4.3.6.1. No Action

Under the No Action alternative, there would be no impacts to hazardous, toxic and radioactive waste sites in the Project area.

4.3.6.2. Action Alternatives

None of the action alternatives would impact the known sites of contamination listed in Section 2.3.8. While there are known sources of soil contamination in the Salina area, these are located outside of the Project area and restoration activities performed by any of the action alternatives would not impact or be impacted by these hazardous, toxic and radioactive waste sites.

4.3.7. Cultural and Historic Resources

4.3.7.1. No Action

Under the No Action alternative, there would be no impacts on cultural and historic resources in the Project area. Any current trends of degradation or exposure, as noted in Section 2.3.9 2.3.9. would continue.

4.3.7.2. Action Alternatives

All action alternatives would adversely impact the Western Star Mill Weir. All action alternatives would remove this historic structure and replace it with a series of five step pools. As such, any adverse impacts to the weir must be avoided, minimized, or mitigated through an agreement document such as a Memorandum of Agreement, per Section 106 of the National Historic Preservation Act (NHPA). Signatories would be USACE, the Kansas SHPO, and the City of Salina. At this time, other consulting parties would include the Smoky Hill Museum, the Friends of the River, and the Pawnee Nation. Mitigation measures have generally been discussed but not formalized yet. Mitigation could include historic signage and salvage and re-use of weir elements in monumentation placed at the existing mill site.

There are no other known cultural or historic sites that would be adversely impacted by the implementation of any of the action alternatives, but there is the potential for additional cultural resources to be discovered during site-specific surveys or during construction. Alternative A2 would involve sediment excavation in Reach 1, while Alternatives A3 and A4 would include Reach 2 as well, increasing the area of potential effect and the chance of cultural resources in the area.

There are other potential architecture resources, some listed on the NRHP, near the old channel listed on KHRI.org, especially on the western edge where the Project area abuts 5th Street. If affected, those resources would have to be coordinated with the Kansas SHPO's office. There are architectural resources within the channel known to local historians, such as the Overfelt Boat Livery, but their exact locations and conditions are unknown. Additional research at the Smoky Hill Museum is necessary and additional surveys might be required to locate them and evaluate their condition. If affected by the Project, they would also need to be coordinated with the Kansas SHPO's office and other interested parties. Ideally, once the locations are known they may be avoided by the Project.

Other known sites in the area would not be adversely impacted by the implementation of the action alternatives. Known sites in the area include the Indian Rock Battle Site, Lakewood Park Bridge, and WPA wall, none of which would be impacted by the action alternatives. It is possible that there are sites, both historic and prehistoric sites, along the old channel in relatively undisturbed places.

4.3.7.3. Consultation

Letters initiating consultation with several American Indian Tribes (Absentee Shawnee, Cheyenne-Arapaho Tribes, Delaware Nation, Eastern Shawnee, Iowa Tribe of Kansas and Nebraska, Kaw Nation, Osage Nation, Pawnee Nation, Prairie Band of the Pottawatomie, Sac and Fox Nation of Missouri in Kansas and Nebraska, and Wichita and Affiliated Tribes) were sent on October 25, 2019. Responses were received from the Iowa Tribe of Kansas and Nebraska and the Pawnee Nation expressing interest in the cultural resources of the area in general and the archeological site in particular. A letter initiating consultation with the Kansas State Historic Preservation was submitted on October 23, 2019, requesting an opinion about the eligibility of the Western Star Dam and the need for additional survey. A response asking for additional photographs of the dam was received on November 8, 2019, with concurrence regarding the need for additional survey, depending on the design of the project. Additional photographs and historic information about the dam were uploaded to KHRI.

In a meeting with the Kansas SHPO's office in May 2022, the NRHP eligibility of the weir was determined, and follow-up consultation letters about the Western Star Weir removal were sent in June 2022 to the same Tribes contacted in 2019. Responses were received from the Iowa Tribe of Kansas and Nebraska expressing no interest in the weir and from the Pawnee Nation expressing interest in the mitigation consultation of the weir. In June 2022, the Smoky Hill Museum, Pawnee Nation, Salina Certified Local Government, and the Friends of the River both agreed to be invited signatories for the Project. The consultation for the mitigation of the weir would result in a Memorandum of

Agreement (MOA), but the consultation has not yet begun beyond finding the interested parties.

USACE decided to execute a Programmatic Agreement (PA) that would comply with Section 106 once the areas of potential effects (ground disturbance) were determined in the design phase (described further in Section 7.3) (Appendix L). Pedestrian surveys would be conducted during the design phase to determine if any NHRP eligible cultural resources exist within the Project area. If cultural resources are found during the pedestrian survey or during restoration activities, consultation with the SHPO, federally recognized Native American Tribes, and other interested parties, would determine if the cultural resource was eligible for NRHP and efforts would be made to avoid the cultural resource and/or minimize impacts to the site. If avoidance is not possible, mitigation measures would be developed in consultation with SHPO and Native American Tribes.

4.4. Built Environment

4.4.1. Infrastructure

4.4.1.1. No Action

Under the No Action Alternative, there would be no impacts to infrastructure in the Project area.

4.4.1.2. Action Alternatives

Under all the action alternatives, the federal flood control project would be slightly altered. That project created the diversion channel to divert water away from downtown Salina, and all action alternatives would build a detention basin and water intake structure to restore flow to the Old Channel.

There would be no impacts to transportation infrastructure. Railroads and highways would not be adversely affected by the Project. There would likely be temporary adverse effects on local roads during construction, as areas would be temporarily closed off and traffic rerouted with detours around the construction area. This could increase travel times for local trips, as detours would be added, and several roads crossing over the Old Channel may be under construction at the same time.

The aging culverts and bridges would not be addressed through this Project, but the City of Salina is working with the Department of Transportation to replace and upsize these infrastructure features, which are part of the future with project condition for this Project.

4.4.2. Recreation and Aesthetics

4.4.2.1. No Action

The No Action Alternative would result in minor, long-term adverse aesthetic impacts due to continued degradation of the Old Channel and the riparian corridor due to sedimentation and invasive species. Under the No Action Alternative, recreational use of the Old Channel would remain infeasible, due to the lack of water and recreational access. Recreational opportunities in Salina may expand with the expansion of the Levee Trail system, which the City of Salina is pursing independently of this Project.

4.4.2.2. Action Alternatives

The implementation of any of the action alternatives would have a long-term, beneficial impact on the aesthetics of the Project area. Alternative A2 would dredge Reach 1 and create a more natural aesthetic than the current condition, with pool, riffle and run sequences. The riffle sequences included in Alternative A2 would be visible, and contribute to the natural aesthetic of a healthy, functioning stream. Alternatives A3 and A4 would restore Reach 2 in addition to Reach 1, increasing the area of improved aesthetics. There would be minor, short-term adverse impacts during the construction period for each action alternatives. The presence of construction equipment, sediment dredging, access routes and disturbed vegetation would all have a temporary adverse impact on the aesthetics. Alternatives A3 and A4, with the construction in Reach 2 as well as Reach 1, would have larger temporary aesthetic impacts than Alternative A2.

The restoration at Lakewood Lake would similarly have a long-term, beneficial impact on aesthetics.

All action alternatives would result in long-term, beneficial impacts to recreation by increasing recreational opportunities in the Project area. Removing sediment, restoring flow, restoring the riparian corridor and adding trails to the Old Channel would allow for the use of the Old Channel as a recreational attraction. Hiking, boating, and wildlife observation, and fishing, would all be examples of expanded recreational opportunities within the Old Channel and Lakewood Lake areas.

Similar to the Old Channel work, the restoration of the Lakewood Lake wetlands would have a long-term, beneficial impact on both recreation and aesthetics, as well as a short-term, adverse effect. Lakewood Lake and the surrounding lake is currently used for recreation, with trails crisscrossing the vegetated area alongside the Lake. Raising the water level of the Lake and adding sediment to the area would reshape this area. Currently used trails would be inundated, and a new trail system would be constructed on the new topography. Long-term, restoration of a healthy, functional wetland with sufficient water access would improve the aesthetics of the area. The restoration of the wetland includes boating access and kayaking trails in the current design, so long-term, recreation would be improved in the area. However, short-term effects would remove recreation opportunities during the construction period, and it would likely take several years for vegetation to reestablish into an aesthetically pleasing wetland community.

4.5. Socioeconomic Environment

4.5.1. Socioeconomics and Demographics

4.5.1.1. No Action

Under the No Action Alternative, there would be no impact to the socioeconomics and demographics of the Project area.

4.5.1.2. Action Alternatives

Implementing any of the action alternatives would likely have negligible adverse effects on the socioeconomics and demographics of the Project area. None of the action alternatives would impact Salina's per capita income. There would be temporary disruptions to the area directly around the Old Channel due to construction, such as

traffic disruptions and increased noise (all addressed in other sections). The renewal of the Old Channel corridor has potential for some renewal of the downtown business district and may help revitalize downtown Salina along with other City master planning actions, which would help increase commercial opportunities in the area. The renewal of the Old Channel corridor could lead to increased economic development, and quality of life for residents of Salina, with a more vibrant community and additional greenspace and recreation access. There would be potential for festivals, temporary dining options, boat rentals, etc. to establish new businesses and expand current downtown businesses. However, the impact of these beneficial changes is unlikely to reach a scale where it affects the socioeconomics of the Project area. Under the action alternatives, the socioeconomics and demographics are expected to continue to follow their current trends.

5.0 Plan Comparison and Selection

5.1. Evaluation and Comparison

Per ER 1105-2-103, Policy for Conducting Civil Works Planning Studies, 7 December 2023, the goal of the evaluation process is to provide a complete and comprehensive accounting of the benefits, costs, impacts, and risks expected from each alternative. A comprehensive accounting would illustrate whether and how economic, social, and environmental conditions are impacted relative to the no-action alternative. The evaluation includes the distribution of the Project effects geographically and among the population groups, including the benefits and impacts. USACE would compare whether the impacts to populations and communities are disproportionately high and adverse when aggregated with cumulative impacts to those same communities, and when compared to impacts on the general population. The traditional USACE economic evaluation procedures measure the national economic value of the primary USACE water resources purposes, but procedures are limited for measuring other aspects of value, such as non-monetary benefits.

Once plans are evaluated, this analysis is used to compare the alternatives, both against a baseline, future without project condition, and then against all the other action alternatives to identify differences in costs, benefits, risks and impacts among the choices that are available.

Evaluation and comparison of the final array of alternatives is integrated within this chapter, with an initial description and evaluation of criteria in every subsection followed by a comparison of the action plans to each other and the no action (future without project baseline) alternative.

5.2. Federal Objectives and Guiding Principles

Section 2031 of WRDA 2007 (Public Law 110-114) established the federal objectives for water resources investments. Federal water resources investments must reflect national priorities, encourage economic development, and protect the environment by:

- Seeking to maximize sustainable economic development
- Seeking to avoid the unwise use of floodplains and flood-prone areas and minimizing adverse impacts and vulnerabilities in any case in which a floodplain or flood-prone area must be used
- Protecting and restoring the functions of natural systems and mitigating any unavoidable damage to natural systems

With this Project's focus on environmental restoration, protecting and restoring the functions of the natural systems and mitigating any unavoidable damage to natural systems is the most applicable to the Project. Any of the action alternatives in the Final Array would protect and restore the function of a natural system along the "Old Channel" of the Smoky Hill River.

The guiding principles provide the overarching concepts that the USACE seeks to promote through investments in water resources. The guiding principles include:

- Healthy and resilient ecosystems

- Sustainable economic development
- Floodplains
- Public safety
- Watershed approach

The Project primarily focuses on the healthy and resilient ecosystems principle by restoring the Old Channel of the Smoky Hill River, but the principle of public safety is also applicable and was considered throughout the planning process.

5.3. Four Accounts

The four Principles and Guidelines for Water and Related Land Resources Implementation Studies (PR&G) accounts have consistently appeared in federal guidance in some form over the past 90 years; however, their roles and comparative importance have varied greatly. Economic, social, and environmental benefits, impacts, and costs are to be identified, measured, and/or qualitatively characterized using four accounts, which include:

- The National Economic Development (NED) account displays changes in the economic value of the national output of goods and services.
- The environmental quality (EQ) account displays non-monetary effects on ecological, cultural, and aesthetic resources including the positive and adverse effects of aquatic ecosystem restoration plans. Typically, also includes NER planning when the study purpose and objectives are specific to ecosystem restoration.
- The Regional Economic Development (RED) account displays changes in the distribution of regional economic activity (for example, income and employment).
- The Other Social Effects (OSE) account displays plan effects on social aspects such as community resilience, public health, life safety, displacement, energy conservation, and similar effects.

Taken together, the concepts behind the PR&G accounts contribute to a structured planning framework for evaluating and comparing alternatives, while also leaving sufficient flexibility to adapt water resource recommendations to federal priorities and the needs of Tribes, partners, stakeholders, and local communities.

5.3.1. National Economic Development (NED)

As defined in the Policy for Conducting Civil Works Planning Studies, ER-1105-2-103, NED contributions are increases in the net value of the national output of goods and services, expressed in monetary units. NED contributions are the direct net benefits that accrue in the Project area and the rest of the nation, including the net value of both marketed goods and services and goods and services that are not marketed. Traditionally, NED benefits are associated with flood risk management and navigation studies where the costs and benefits of implementing an alternative are assessed relative to flooding of property, emergency flood costs, and transport of commodities. Recreation benefits are also included in NED through the consideration of a new or

improved recreation benefit to the nation. This is an ecosystem restoration project, focused on nonmonetary ecosystem benefits, so the NED account was considered qualitatively. Construction expenditures in the local area would not be considered a net benefit to the nation and, thus, are addressed in the Regional Economic Development section.

All the action alternatives in the array contribute roughly the same amount to the NED account. Rehabilitation of the river would improve recreational experiences (active and passive) along the 6.8-mile Old Channel, though this improvement is not quantified as a part of this study. The restoration of the river would also complement the planned revitalization of the downtown area that is in progress. The implementation of any of the action alternatives is not expected to affect existing flood risk management.

5.3.2. National Ecosystem Restoration (NER) and Environmental Quality (EQ)

As defined in ER-1105-2-103, ecosystem restoration is one of the primary missions of the USACE Civil Works Program. For ecosystem restoration focused projects, like this Project, the USACE objective is to contribute to National Ecosystem Restoration (NER). This contribution is measured in increases to the net quantity or quality of desired resources and expressed quantitively in physical units or indexes (but not monetary units). The selection of a plan as the NER Plan indicates that the plan reasonably maximizes ecosystem restoration benefits compared to costs and is consistent with the federal objective of contributing to NER.

The Environmental Quality (EQ) account considers broader effects on significant natural and cultural resources, while the NER evaluation more narrowly measures non-monetary benefits to habitat resulting from ecosystem restoration. An effect on EQ resources occurs whenever estimates of future with and future without plan conditions of the resource are different.

Specifically, the EQ account encompasses:

- Ecological attributes, defined in the ER – 1105-2-103 as components of the environment and the interactions among all its living and nonliving components that sustain dynamic, diverse, and viable ecosystems.
- Cultural attributes, defined as evidence of past and present habitat that can be used to reconstruct or preserve human lifeways.
- Aesthetic attributes, defined as perceptual stimuli that provide diverse and pleasant surroundings for human enjoyment and appreciation.

For the NER evaluation, AAHUs were generated for each alternative, using the USACE approved Qualitative Habitat Evaluation Index (QHEI) model and the Dabbling Duck model. These models are discussed in more detail earlier in the report (Section 3.7 – Habitat Modeling and in Appendix F - Environmental – Habitat Modelling). The Smoky Hill Aquatic Ecosystem Restoration Project is a single purpose ecosystem restoration study, meaning that the plans were formulated and evaluated in terms of their net contributions to increase in ecosystem value (NER outputs).

Currently, the Old Channel is filled with sediment, to the point where any flows in the channel that are greatly reduced and inadequate to transport sediment. The lack of flow

and sediment has an adverse impact on the amount and quality of instream habitat. Additionally, the Western Star Mill Weir limits connectivity in the river for aquatic organisms. By establishing a more natural variable depth profile, removing the Western Star Mill Weir, minimizing future sedimentation, constructing a sediment forebay and restoring natural gravitational flow, the proposed measures would have a substantial positive impact on the habitat quality along the Old Channel.

The No Action Alternative does not improve the ecological resources in the Project area and allows the resources to continue to degrade. There would be no benefit to aquatic species, water quality, and no aesthetic benefits. This alternative generates 0 Net AAHUs that is used as a baseline against which all other alternatives are to be compared.

Alternative A2 would restore a variable depth pool profile (including pools, riffles, runs, and glides) to Reach 1 (from the intake at the Smoky Hill up to the Western Star Mill Weir) through dredging and construction of in-stream features. Flow capacity would be improved by the establishment of the more natural channel design along with the construction of a sediment forebay. The forebay would minimize continued sedimentation, contributing to maintaining appropriate flow rates. Replacing the Western Star Mill Weir with 5 step-pool features would provide habitat connectivity between Reaches 1 and 2 and create in-stream habitat that would be beneficial to aquatic organisms and wildlife. Installation of weirs near the downstream end of the Old Channel and at Walker Drive near the downstream end of Reach 2 would help manage and maintain beneficial depths in both Reach 1 and Reach 2. Alternative A2 generates 48.7 Net AAHUs.

In addition to the features of Alternative A2, Alternative A3 would include dredging and the establishment of a variable depth pool (including pools, riffles, runs, and glides) in Reach 2. This would add in-stream habitat along the full 6.8 miles of the Old Channel. The wetlands around Lakewood Like would be configured with slight differences to the depth and extent than those in Alternative A2. Alternative A3 generates 56.8 Net AAHUs.

Alternative A4 would be differentiated from Alternative A3 by having Reach 1 pools with overall greater average depths and a wetland complex around Lakewood Lake with a more extensive network of trails and marginally different configuration of wetland depths. Alternative A4 generates 58.4 Net AAHUs.

All three Action Alternatives are similar in their effects and would provide substantial benefits to aquatic habitat in the Old Channel, including increased habitat diversity, decreased channel sedimentation, and restored aquatic connectivity. Other benefits would be achieved by reestablishing hydraulic connectivity between the Old Channel and wetlands around Lakewood Lake along with creation of additional wetland habitat. The additional dredging and installation of in-stream features in Alternatives A3 and A4 would provide the most ecological benefits through increased depth refugia and diversity of habitats.

The removal of Western Star Mill Weir and its replacement with 5 step pool features is part of each action alternative. USACE is working with the City and appropriate stakeholders to develop a Memorandum of Agreement to mitigate for its removal.

Additionally, a Programmatic Agreement (PA) is being drafted pursuant to the National Historic Preservation Act. Should any cultural resources be found during surveys prior to construction, USACE will consult in accordance with the PA and all applicable law (Appendix L).

All the plans have similar outputs, as shown by the Net AAHUs generated. Alternative A2 has 48.7 Net AAHUs and Alternative A4 has the highest Net AAHUs with 58.4, a range of 9.7 AAHUs. The configuration of in-stream features, variable depth profile, and wetland habitat vary between alternatives, creating varying environmental benefits.

Overall, Alternative A3, which generates 56.8 Net AAHUs, was selected as the NER plan. The feasibility study team, with support from the Local Sponsor, agreed that Alternative A3 has the best balance of cost and ecosystem benefits of all the alternatives. Alternative A3 provides an incremental cost per incremental output of $15,380, which is reasonable for the additional amount of output. Buying up to Alternative A4 was deemed “not worth it” since the additional 1.6 AAHUs produced over Alternative 3 has an incremental cost of $33,000 and an incremental cost per incremental output of $20,625. Alternative A3 represents the best balance of maximizing ecosystem benefits by restoring in-stream habitat, connectivity, flows, and reducing channel sedimentation at a cost that is reasonable.

5.3.3. Regional Economic Development (RED)

The RED account includes a description and assessment of the changes in regional economic activity that would occur under the alternatives, including changes in jobs, income, economic output, and population (ER 1105-2-103).

Construction of the Project features would likely be awarded to a local contractor, generating more jobs and income in the local community that varies proportionally with the amount of construction work per alternative. The construction costs cited below are for construction of the Project only, they do not include other elements of the Total Project Cost because construction costs would have the most direct effect on the regional economy of the area. The No Action Alternative would not provide any construction benefits to the local economy. Alternative A2 has the lowest construction cost as it does not include any dredging or channel depth profile work in Reach 2. The more expensive Alternatives 3 and 4 with more constructed features would contribute slightly more to the regional economy during construction than Alternative A2. A Regional Economic System (RECONS) analysis was performed on the three action alternatives to find the regional impact of localized spending and jobs. The results of the RECONS analysis are shown in Table 5-1.

Table 5-1. RECONS Results

Metric	No Action	Alt A2	Alt A3	Alt A4
Local Capture	$0	$7,100,000	$8,800,000	$10,900,000
Local Jobs (in Full-Time Equivalence)	0	96.9	119.8	126.8

*FY2028 dollars

In addition to the benefits to the regional economy generated during construction, increases in recreational use could also benefit the local economy. All three action alternatives would provide passive and active recreation opportunities with improved habitat to fish and wildlife species, and increased access to the river and wetlands for kayaking and canoeing. This has been labeled as “RED 2: Tourism and Economic Opportunities”. The local economy would benefit through increased spending by recreationists on gas, hotels, and other goods and services provided in the downtown area leading to increased regional economic development in the immediate area. Any increase in tourism and recreation would be small and variable depending on the alternative. It would vary from moderate increases in tourism and economic opportunity to very high depending on actions taken within each alternative. Though it is clear the “No Action” alternative would not generate an increase local tourism nor regional spending.

5.3.4. Other Social Effects (OSE)

As defined in ER 1105-2-103, the Other Social Effects account includes plan effects on social aspects such as community impacts, public health and safety, access to critical infrastructure, displacement, energy conservation, and others social factors. The Institute for Water Resources publication Other Social Effects: A Primer (Section II, Table 1) further defines these categories as health, safety, social vulnerability, resilience, economic vitality, social connectedness, identity, recovery, participation, and leisure and recreation. All these categories help to understand the importance of their impacts within the local communities.

For this ecosystem restoration project, the categories that were focused on revolved around public health and safety, local recreation, and economic vitality, and social identity within the Project area. Each of these categories were relevant to this specific project. Each of these categories were incorporated since they were identified as important pillars in the local community’s culture and cohesion. Public health and life safety is important due to the existing flood risk system within the study area and the need to mitigate any potential inducing flooding from proposed alternatives. Since there were no changes to incremental risk with the federal levee system and only a minimal amount of water being reintroduced into the channel, none of the alternatives, including the “No Action” alternative would negatively impact life safety. Thus, life safety was not retained as an evaluation criterion. Local aesthetics and public recreation are important within the Old Channel corridor as noted by the number of parks, sporting fields, and access points to the Smoky Hill River. Community identify and support is important based on the City’s master planning actions to revitalize the Old Channel corridor and old downtown areas. The social identify of the City of Salina was historically tied to the Smoky Hill River for recreation, commerce, and industry; but was lost when the Old Channel was rerouted for flood risk management.

Of the Final Array of Alternatives, the “No Action” alternative does not lead to future improvements to the health and life safety of the Project area. The Old Channel would continue to have areas with steep eroded banks, the Western Star Mill Weir would continue to degrade, and seasonal pools of stagnant water would continue. This alternative does not increase aesthetics or recreational opportunities within the Project area. This alternative also does not reconnect the community with its historic connection

to the Smoky Hill River or provide synergy with other City master planning efforts to revitalize the area. It does not address current or future sedimentation of the Old Channel and provides no in-stream habitat improvement or connectivity for the local region.

Like the other accounts, all the proposed with project alternatives would provide variable benefits to the important OSE categories in the Old Channel corridor, with more extensive plans providing slightly more OSE benefits and opportunities. All the alternatives would address existing public health and life safety concerns, aesthetics and recreational opportunities, as well as community support and connection with the river by simply restoring more natural, consistent river flows to the Old Channel. Removal of sedimentation and degraded structures along the Old Channel would dramatically improve local aesthetics and recreational opportunities for a wide variety of recreational users and the surrounding community.

5.4. Comprehensive Benefits and Identification of Total Net Benefits Plan

Per the policy directive of the Assistant Secretary of the Army (Civil Works), ASA (CW), from January 5th, 2021, benefits to the regional economy not already accounted for in the NED assessment, both positive and negative that result from each alternative plan compared to the future without project condition, must be analyzed. The RED account should also be evaluated to the extent possible. Additionally, the ASA (CW) directs PDTs to assess the EQ and OSE of each plan. Together, along with the NED analysis, these accounts make up the Comprehensive Benefits associated with each plan. Table 5-2, below, qualitatively describes the benefits associated with the other accounts compared against a sub-set of the Best-Buy plans. Alternative A3 was also identified as the total net benefits plan because it generates substantial habitat lift for a reasonable cost (NER/EQ account); it creates additional revenue and jobs for the region, including tourism (RED); it creates enhanced visual aesthetics, recreational opportunities, improved public health and safety, as well as community support for restoration of the Old Channel (OSE).

Table 5-2. Comprehensive Benefits*

Alt	Description	NED 1: Recreation	NER :Project First Cost	NER1: Incremental Cost per Unit	NER 2: Net AAHUS / Incremental Output	NER 3: Incremental Cost / Incremental Output	EQ: Water Quality, Quantity, and Timing	RED 1: RECONS	RED 2: Tourism and Economics Opportunities	OSE 1: Visual Aesthetics and Local Recreation	OSE 2: Community Identity and Support
No Action			-	-	-		Does not provide any water quality, quantity, or timing benefits	Does not provide any increased benefits to the regional economy.	Does not provide any increased tourism or new economic opportunity.	No new or additional benefits provided.	No new or additional benefits provided.
Alt A2	Channel Dredging Reach 1 – Variable Depth Profile; Pool Habitat Reach 2; Lakewood Lake Wetlands; Remove Western Star Mill	Moderate amount of in-channel recreation benefits	$14.9M	$749,000	48.7 / 0	$15,380	High amounts of Benefits to Quality ++ Quantity ++ Timing ++	Local Capture: $7,107,716 Jobs (in full-time equivalance): 96.6	High number of benefits from tourism along with increases in Local Economic opportunity	Enhanced visual aesthetics + recreational opportunities.	Health Benefits + Increased Usage + Local engagement with shops + More Access for local community
Alt A3	Channel Dredging Reach 1 and 2 – Variable Depth Profile; Pool Habitat Reach 2; Lakewood Lake Wetlands; Remove Western Star Mill	High amount of in-channel benefits for recreation	$17.9M	$127,000	56.8 / 8.1	$15,679	Very High amounts of Benefits to Quality +++ Quantity +++ Timing +++	Local Capture: $8,787,890 Jobs (in full-time equivalance): 119.8	Very high number of benefits from tourism along with increases in Local Economic opportunity	Larger area for enhanced visual aesthetics and recreation opportunities.	Health Benefits + Increased Usage + Local engagement with shops + More Access for local community
Alt A4	Channel Dredging Reach 1 and 2 – Variable Depth Profile (Deeper Pools); Pool Habitat Reach 2; Lakewood Lake Wetlands; Remove Western Star Mill	High amount of in-channel benefits for recreation	$18.6M	$33,000	58.4 / 1.6	$20,625	Very High amounts of Benefits to Quality +++ Quantity +++ Timing +++	Local Capture: $9,299,441 Jobs (in full-time equivalance): 126.4	Very high number of benefits from tourism along with increases in Local Economic opportunity	Enhanced aesthetics + increased recreational opportunities. More expanded trail system at Lakewood Lake wetlands.	Health Benefits + Increased Usage + Local engagement with shops + More Access for local community

*Rating key (all alternatives are ranked as compared to the No Action alternative)

VERY LOW	Very low amount of identified benefits
LOW	Low amount of identified benefits
N/A	Not Applicable
MED	Moderate amount of identified benefits
HIGH	High amount of identified benefits
VERY HIGH	Very High amount of identified benefits

5.5. Identification of the NER Plan

A NER Plan is one that reasonably maximizes ecosystem restoration benefits compared to costs, and that is consistent with the federal objective of contributing to NER. Contributions to NER (outputs) are measured by the net quantity and/or quality of desired ecosystem resources. The Tentatively Selected Plan should be justified in achieving the desired level of outputs and be cost effective.

Alternative A3 was identified as the NER Plan since it is the plan that per 1105-2-103, "maximizes ecosystem restoration benefits compared to costs, consistent with the federal objective". Habitat modeling results and CE/ICA were used to inform plan selection. Preliminary restoration engineering plans are in Appendix C – Engineering. Alternative A3 provides a net benefit of 56.8 Net AAHUs and achieves the ecosystem restoration project purpose and need to restore degraded aquatic habitat functions and features within and near the Old Channel that were lost because of the previous FRM project. Without action, aquatic habitat would continue to degrade and remain unavailable to local, regional, and migratory species. The Project would result in restoration of approximately 63.7 total acres of in-stream aquatic habitat and 49.7 acres of wetland habitat.

5.6. Identification of the Tentatively Selected Plan

After evaluating and comparing the Final Array of Alternatives using the Principles & Guidelines Criteria and a comprehensive benefits analysis, Alternative A3 was also selected as the Tentatively Selected Plan (TSP), providing 56.8 Net AAHUs, and representing the best balance of maximizing ecosystem benefits by increasing flow, establishing in-stream habitat diversity, reconnecting the aquatic and wetland system, and minimizing future sedimentation at a reasonable cost, and restoring habitat connectivity while minimizing disruptions to local transportation systems and avoiding induced flooding.

Alternative A3 is considered an effective plan, fully meeting the Project objectives and restoring habitat quality to the Old Channel. It is the most efficient alternative, with the best balance of generating AAHUs, maximizing ecosystem benefits, and meeting the planning objectives at a reasonable cost out of all the alternatives in the Final Array. In addition to being technically feasible, Alternative A3 has the support of the City, stakeholders, and the local community. It does not require additional investment outside the federal investment and is consistent and compatible with future non-federal Sponsor plans for continued ecosystem restoration activities in the watershed.

Alternative A3 was also identified as the Total Net Benefits Plan or Comprehensive Benefits Plan, which is the plan that maximizes net benefits across all four PR&G accounts in comparison to costs. All the action alternatives in the final array have very similar impacts on all four accounts, however, Alternative A3 is the plan that best maximizes the benefits across all four account categories at the most reasonable cost.

Alternative A3 consists of restoration of multiple sites along the Old Channel by removing sediment from the stream channel, reestablishing in-stream aquatic features (e.g., riffles, pools, runs, and glides), reconnecting wetland and riverine habitat, and installing a sediment forebay to restore ecosystem services and functions of the in-

stream aquatic, riparian, and wetland habitats in the study areas. The benefits, design, costs, and other considerations of Alternative 3 are described in more detail in the following sections.

Under ER 1105-2-103, the Least Environmentally Damaging Practicable Alternative (LEDPA) is required to be identified during the comparison of alternative plans. Since this is an ecosystem restoration project, all the proposed plans could be considered the LEDPA. All plans would have minimal impact to existing habitats but result in significant restoration benefitting the human and natural environments. After analysis of proposed plans, the LEDPA was determined to be Alternative A3, as this is the alternative that provides the least amount of disturbance to existing environment and maximizes environmental benefits compared to costs.

6.0 Tentatively Selected Plan Accomplishments

Alternative A3, the TSP, would rehabilitate the full 6.8 miles of the Old Channel. The Project would:

- Establish in-stream aquatic features that would provide a range of habitat for aquatic organisms;
- Minimize future sedimentation of the Old Channel;
- Reconnect aquatic habitat in channel and with adjacent wetland areas; and
- Restore flows that would promote a self-sustaining system.

Appendix A – Hydrology and Hydraulics Assessment provides more information on flow and Appendix D – Sediment Transport Assessment details potential sediment loading and transport.

Dredging Reaches 1 and 2, in the 6.8 miles of the Old Channel, in combination with forming a variable depth profile with pools, riffles, runs, and glides would create a diversity of habitat beneficial to aquatic organisms and other wildlife. Reconfiguration of the stream channel would restore gravity flows and sediment transport functions within the Old Channel. Modeling suggests that the sediment forebay would capture coarse sediments and the finer sediments would be transported by the expected channel flow rates back into the Smoky Hill River.

Replacement of the Western Star Mill Weir with five step-pool features would help establish and maintain a more natural flow regime, provide habitat diversity, and reconnect the Old Channel hydraulically and hydrologically. Installation of weirs near the downstream and upstream ends of the Old Channel would help regulate flow and maintain sufficient water depth to support aquatic organisms and wetland shelves. Similarly, the plan would reconnect the wetlands around Lakewood Lake with the Old Channel, restoring hydrologic and ecological connections.

Alternative A3 generates 56.8 Net AAHUs of habitat benefit by reshaping the existing channel to create a variable depth profile with runs, riffles, pools, and glides and placing excess fill within the Lakewood Lake wetland area to create diverse wetland habitat.

Alternative A3 would have long-term benefits on the aesthetics of the Project area creating a more natural channel with a diversity of features. Recreation opportunities would improve with Alternative A3 by restoring flow to the Old Channel allowing for opportunities for kayaking, hiking, and wildlife observation. The restoration of the Lakewood Lake wetlands would provide more opportunities for recreation with the creation of additional trails and wetland habitat.

6.1. Tentatively Selected Plan Components

The TSP includes the features listed below. No features are considered separable elements. For a detailed plan view and more detailed descriptions of each proposed feature, refer to Appendix C – Engineering.

- Construct sediment forebay located at the confluence of the upstream end of the Old Channel and the Smoky Hill main channel. The forebay consists of the following major components:
    - A debris deflector wall at the confluence to reduce and protect against accumulation of debris;
    - A concrete lined entrance;
    - A stop log unit between the entrance channel and crest gates;
    - Two side by side crest gates for flow control;
    - An equipment bridge for maintenance, and;
    - One unlined sedimentation forebay to provide for removal of coarse sediment.
    - For additional detail refer to Appendix C – Engineering Entrance Works Memo
- Dredging of Reaches 1 and 2 removes channel sediment to a depth of approximately 7-feet, constituting 105,000 cubic yards.
- Reconstruct Reaches 1 and 2 with variable depth profile including riffles, pools, runs, and glides. Channel bottom width in both reaches would vary from 8 to 20 feet, top of water width would range between 30 to 50 feet, riffle depths would average 3.25 feet, and pool depths would be between 4 to 6 feet.
- Remove Western Star Mill Weir and replace with five step pools. The existing structure would be taken down to grade, fill added downstream, and appropriately sized rock placed to create pools. The first pool would be designed as an I-Wall with concrete and sheet pile to ensure that it would hold water.
- Constructed wetland shelves would create roughly 1.7 acres of wetlands for the purposes of habitat creation. The wetlands would also provide ancillary benefits from nutrient removal such as phosphorus, improving Old Channel water quality. The wetland shelves would be constructed towards the upstream levee inlet culvert structure in an undeveloped open space.
- Use of river dredge materials to construct variable depth wetland habitat around Lakewood Lake. An existing culvert would be excavated to hydrologically reconnect the Lakewood Lake wetlands with the Old Channel. This would help to reestablish wetland hydrology and support creation of approximately 35 acres of emergent wetland habitat. Existing trails in the wetland creation area would be improved by raising and widening them and applying wood mulch.
- Two habitat weir structures would be installed to support additional pool habitat. One would be located near the upstream end of the Old Channel and the other would be located near the downstream end of the Old Channel (at Walker Road). The weirs would be approximately 2-feet high and be comprised of a stoplog structure. Each weir would enable additional management of water depth in the channel to support pool habitat and water levels in Lakewood Lake.

During the planning, engineering, and design (PED) phase, USACE would complete detailed engineering and technical analysis needed to begin construction of the Project as recommended in this decision document. This includes engineering design documentation and the plans and specifications of the first significant construction contract. Further refinement, and any necessary changes to the TSP would occur during this time.

6.2. Cost Estimate

To develop equivalent average annual costs, all costs were amortized at the FY25 federal discount rate of 3.0% over the Project life of 50 years. The costs that were developed during the CAP study were used for the screening of alternatives and escalated to the FY25 price level by using a 7.49% escalation rate. Costs related to Construction Contingency, Adaptive Management and Monitoring, and OMRR&R were re-evaluated and updated individually. This process eliminates non-cost-effective alternatives based on comparing average annual environmental outputs with the average annual costs.

The preliminary cost estimate was used to estimate costs for construction, monitoring, adaptive management, and OMRR&R (see Table 3-5). This was paired with the anticipated schedule used to estimate annualized costs. Interest was calculated during the construction phase based on the construction schedule. The annualized economic cost of each alternative was also calculated using the 50-year period of analysis and FY 2025 discount rate of 3.0%.

A summary of the TSP implementation costs is provided in Table 6-1.

Table 6-1. Alternative A3 Implementation Costs

Item	Alt A3
Construction	$7,815,134
Planning, Engineering and Design	$2,110,086
Real Estate (LERRDs for Construction Easements)	$2,000,000
Construction Management	$781,513
Construction Contingency	$2,578,994
Project Costs With 7.49% Escalation	$16,430,629
Adaptive Management and Monitoring	$837,812
Total Project Costs	**$17,268,441**
Interest During Construction	$585,000
Total Investment Costs	$17,853,441
Total OMRR&R Costs	$182,153
Interest and Amortization	0.03887
Annualized Costs	$876,000

6.3. Lands, Easements, Rights-of-way, Relocations, and Disposal Areas (LERRDs)

The City of Salina is responsible for acquiring lands and easements necessary for construction and for OMRR&R of the constructed Project. The lands, easements, and rights-of-way required for the Project is 181.45 acres of publicly and privately owned

land. There would be three types of standard estates used to facilitate permanent features and construction of the Project. The first standard estate to be utilized is Fee. There is a total of 180.22 acres of Fee land required for the Project; of the 180.22 acres, 154.33 acres are owned by the City of Salina and are currently utilized as river channel and other public rights-of-way. The remaining required 25.89 acres are privately owned. All Fee lands for the Project would be used to facilitate the habitat and ecosystem restoration features of the Project. The second estate to be utilized is a Temporary Road Easement, which requires 0.15 acre of privately owned land. The road easement will permit access to the land being utilized for work area during construction. The third estate that will be utilized is a Temporary Work Area Easement, which requires 1.08 acres of land for the Project. The 1.08 acres are currently owned by the Sponsor and would be utilized as work areas for the duration of the Project construction. Approximately 115 parcels of varying size of the City of Salina's and privately owned land lie within the Recommended Plan footprint. Appendix H – Real Estate Plan shows the real estate boundaries for the TSP. Parcel identification numbers are included on the map for each private property acquisition.

The City of Salina would need to obtain title certifications of proof of ownership for all Project lands during design and provide documentation of ownership prior to advertising the construction contract. Once proof of ownership is received by USACE, a review would be completed to verify and determine the sufficiency for these lands to be made available for the Project.

Based on an appraisal completed by the USACE Kansas City District Certified General Review Appraiser in July 2025, the real estate acquisition values for the affected lands total approximately $8,415,447. Administrative costs associated with the land acquisition is estimated at $1,782,615. The total LERRD value including contingency, at the Project First Cost, is $10,198,062 with the creditable LERRD value being $9,907,112. A detailed discussion of LERRDs necessary for the construction and subsequent maintenance of the Project is presented in the real estate plan provided in Appendix H – Real Estate Plan.

The disposal for all in-stream dredging-grading material would be on-site in the south side of Lakewood Lake and re-used for wetlands restoration/creation. Soil would be spread out in areas demarcated on the construction plans.

Preliminary hydraulic modeling indicates that the project features will not cause increased water surface elevations. However, the NFS currently has funding through construction from the United States Department of Transportation's (USDOT), Rebuilding American Infrastructure with Sustainability and Equity (RAISE) grant for a separate project that will be completed prior to the construction of this project. Additional modeling will need to be conducted by Hydrology and Hydraulics with the outputs of those analyses used to determine whether increased water surface elevations will occur as a result of the completed RAISE grant project. If the modeling indicates an increase in water surface elevation, the necessary property interests will be identified for acquisition. The affected lands, as stated above, are subject to change based on the additional water surface modelling to be conducted prior to completion of this feasibility report.

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

The City of Salina would be responsible for all long-term OMRR&R activities following Project construction and any contractor warranty period. Management activities would include those necessary to manage inflows to the restored channel, facilitate water delivery through the project area, manage sediment transport through the system, maximize habitat quality, or to minimize project-related risks. Operational activities would include:

- Intake structure, bottom-hinged crest gate of the sediment forebay
    - periodic monitoring
    - control adjustments to optimize performance
    - manual gate operation when automated control systems are not in service
- Water level control adjustments along the Old Channel to optimize performance of the habitat restoration and baseflow water levels. This could be made by adjusting the in-stream weir structures.
- Periodical Inspections
    - Intake structure and gate at the upstream terminus of the Project
    - Water levels and flow conditions along the entire Project length
    - Water quality, debris, and suitable construction access along the entire Project length
    - Sediment conditions and restored channel substrate along the entire Project length
    - Stormwater outfall structures along the entire Project length
    - Water connectivity between Lakewood Lake and restored channel
    - Rock riffles, pools, and other habitat structures along the entire Project length
- Post-Flood Inspections – Items listed above, and general surrounding conditions should be inspected following significant flooding events to observe conditions, identify maintenance repairs, and potential changes to future flood operations and response.

Maintenance activities include activities required to maintain the intended habitat functionality and restored ecosystem. Maintenance activities can include repairs, replacement, and rehabilitation and could include:

- Sediment Forebay Dredging and Disposal
    - Anticipated clean-out interval is approximately once every 1.5 to 2 years.
    - Mechanical dredging and excavation.
    - Hydraulically pumped sediment into geotextile tubes on trailers

- Hauled or loaded into dump trucks for suitable disposal offsite.
- Not expected to be contaminated or require specialized handling.

- Vegetation Management
  - Control of invasive plant species
  - Management of woody growth
  - Selective use of approved herbicides
- Erosion Control – Periodic restoration with suitable rock materials and/or selective vegetation in localized areas.
- Reestablishment of Damaged/Deteriorated Structures
  - Periodic repairs of riffles, pools, and other channel stabilization measures
- Debris Cleaning
  - Required at entrance works and intake structure periodically following high flows on main channel
  - Periodic removal along Old Channel
- Sediment Removal Along the Old Channel
  - Expected to be minimal and acceptable for aquatic habitat. Could be performed at limited spot locations as needed.
  - See Appendix D – Sediment Transport Assessment and Appendix K – Operations and Maintenance.
  - The City no longer applies sand for winter street treatment; therefore, no inputs of settleable sand grains are expected during the life of the Project from stormwater outfalls.
- Lake Wood Lake Wetlands
  - Periodic inspections to check for and remove debris for water control and management structures
  - Manually operate water controls on a periodic basis to evaluate working condition
  - Inspect any riprap
  - Noxious and invasive plant species management, woody vegetation management, beaver and muskrat or other nuisance animal controls
  - Pedestrian trails inspection and maintenance
- Old Channel Wetland Shelves
  - Periodic inspections to check for and remove debris
  - Noxious and invasive plant species management, woody vegetation management, beaver and muskrat or other nuisance animal controls

The total annualized cost for OMRR&R of the TSP is estimated at $182,153.

Table 6-2. Estimated Annual O&M Costs

	Alternative A3
Initial Capital Construction Cost*	$7,815,134
Annual O&M Cost (0.5%)**	**$82,153**
Annual Sedimentation Basin O&M	$100,000
Total Annual O&M Cost	**$182,153**

*Costs obtained from Appendix M, Operations and Maintenance
**Rounded, Rough Order of Magnitude costs

A detailed Operational and Maintenance Manual (O&M Manual) for the constructed Project would be developed during the PED Phase of the Project and completed during construction. Refer to Appendix K – Operations and Maintenance for more detail on the draft O&M Manual.

6.5. Project Risks and Design Maturity

There would be risks and uncertainties associated with the TSP. These would be addressed through adaptive management, as described in Section 6.9 Monitoring and Adaptive Management. A risk register has been developed and maintained for this Project. Each risk identified the likelihood, consequence, and mitigation strategies.

Key risks include the following:

- Project Implementation Risks:
    - The project area is owned by the City and is private land. The City is responsible for acquiring lands and easements necessary for construction and for OMRR&R of the constructed Project. Delays in acquisition could cause delays in Project construction. The City has been actively engaging landowners along the Old Channel and adjacent to Lakewood Lake to implement the project.
    - Managing implementation workflow – Feasibility, design, and construction phases need to be coordinated with the City's RAISE grant work to avoid or minimize timing issues with Project funding as well as construction of both the GI and RAISE grant project features.
    - Managing sediment transport – Given the low gradient of the "Old Channel" and potential for seasonal flow restrictions, sediment transport may be limited, and sedimentation could continue within the channel. If measures are not successful at reducing the rate of sedimentation, the Project could incur additional long-term OMRR&R costs to maintain performance requirements. It is acknowledged that the Old Channel features will evolve after construction and that changes will likely occur over a range of timeframes based on flows and sediment transport conditions. The design approach and detailed design will result in an

appropriately designed system with redundancies to complement the dynamic nature of the Old Channel while also including structures that will persist to sustain design intent of the restoration measures.

- Managing flows – The "Old Channel" is restricted by the State of Kansas (Water Appropriation #47,510) to a maximum of 100 cfs and may be further reduced when flows in the Smoky River are 40 cfs or less. Habitat features have been developed to provide benefits over a range of seasonal flows, including during droughts. The Sponsor and public need to understand that fluctuations in flows are likely, resulting in variable recreational use, aesthetics, and seasonal habitat availability within the Old Channel.
- Hazardous runoff potential – As an urbanized area, the presence of hazardous waste could contribute to water quality impairment and have an adverse impact on establishment of sustainable aquatic ecosystems.
- Erosion potential – Several banks around the area have steep slopes and disturbance during construction may make sections more susceptible to erosion.
- Construction considerations – The nature of land use and infrastructure along the Old Channel present logistical challenges for the construction phase of the habitat restoration effort. Existing transportation corridors consist of relatively narrow two-lane roads with substantial urban and residential traffic. Furthermore, the narrow river corridor in locations limit available access corridors and staging areas. Nevertheless, the logistical challenges can be planned in developing detailed restoration strategies.

- Feasibility Study Risks:
  - Budget and schedule – Continued execution of the feasibility study schedule is contingent upon timely receipt of federal funds in FY2026. non-federal Sponsor funds to match federal funds received in FY2024 have been received. If Federal funds are not received by FY2026 Quarter 1, the current schedule would be delayed resulting in a delayed Chief's Report and inclusion of construction authorization in the 2026.
  - WRDA authorization – The non-federal Sponsor downtown revitalization actions (i.e., bridge work, culvert work, etc.) are expected to be complete by 2028 followed by USACE restoration actions to restore flows within the Old Channel. The synchronization of Sponsor and USACE construction actions is critical to avoid potential overlap and conflicts between USACE and Sponsor construction actions. Delays in WRDA authorization and USACE construction would result in poor public perception, the ability for public recreational opportunities, and further degradation of the Old Channel.
  - Induced flooding risk – The TSP was assessed for potential induced flooding by comparing peak water surface elevations (WSE) between the

FWOP and FWP conditions. See Appendix A2 – Future Without Project Condition for additional details related to induced flooding.

Under the FWP condition with the increase in filled storage area of Lakewood Lake for wetland creation there would be an increase in WSE in areas adjacent to the Old Channel and on the fringes of Lakewood Lake from the end of the step pools to the downstream federal levee outlet. A sensitivity analysis was conducted and determined that the culvert at Walker Drive at the downstream portion of the Project Area acts as a hydraulic control. A design feature to increase the size of this culvert was added and would substantially mitigate the increase in WSE under the FWP with only a minor decrease in WSE from Walker Drive to the downstream federal levee outlet. Much of the land in this area is currently owned by the City.

If there is any remaining increase in WSE under the FWP for lands not currently owned by the City, flowage easements or fee property acquisition would be used to acquire and mitigate any induced flooding and documented in the Final Feasibility Report. Any future changes to proposed construction features during PED and construction should be re-assessed to avoid or mitigate the potential for induced flooding.

- Design Maturity – Proper scoping, engineering, and design maturity during the Feasibility phase would help decrease risks of scope and cost increase during the PED and Construction phases. Adequate design maturity would reduce risk of cost increases and schedule delays during PED and construction. The PDT will continue to work to refine design details and any associated risks related to specific project features to obtain an adequate level of confidence (e.g., 80%). Past projects can also help inform design details and areas where there are gaps or low levels of confidence that create increased budget and schedule risk.

The PDT discussed risks and uncertainty and developed construction contingencies based on engineering, costs, economics, and other aspects of the Project into the plan formulation process. This information generated the contingency amount used for developing the Total Project Cost, as well as a more robust risk register. This contingency covers certain unknowns, and unanticipated conditions that are not possible to evaluate from the data used in this Project but must be accounted for to cover identified risks.

Design maturity for the Project was assessed for Hydraulic, River Engineering, Geotechnical, and survey as the main disciplines involved. At the Feasibility phase of the Project, the USACE is required to produce a product that is sufficient to support a Class 3 cost estimate, which requires a design maturity of 35%. During the design phase, the Project would be developed to a final 100% design maturity. The key items that would increase design maturity during feasibility include:

- More detailed H&H modeling
- Additional sediment transport assessment

- Validate boring samples in the relative location to the project features to ensure adequate assumptions to the structural foundations of the sediment forebay, weirs and step pools.
- Identify existing utility locations through survey and utility information request to identify construction impacts

6.6. Project Cost Sharing

A non-federal Sponsor must support all phases of the Project. Feasibility Study costs are cost-shared 50% federal and 50% non-federal. Design and implementation phases are also cost-shared, with the non-federal Sponsor providing a maximum of 35% of the fully funded cost estimate. Currently, the cost estimate is under refinement. As a result, the cost estimate for construction, real estate, and associated contingencies would be further developed. The resulting cost estimate for cost sharing is very likely to exceed the current estimate of $17.5 M and is expected to be more than $25 M. Additionally, the non-federal Sponsor must provide all the LERRDs and may receive a credit toward their cost share through creditable work in-kind and LERRDs. All detailed design and construction would be in accordance with USACE's regulations and standards. Once a project has been implemented, OMRR&R of the Project is 100% the non-federal Sponsor's responsibility.

6.7. Project Design and Construction Phases

The Final Feasibility Report, Environmental Assessment, Finding of No Significant Impact, and accompanying Chief's Report, once approved, would be offered to Congress for authorization of the Recommended Plan. Construction activities would not commence until such authorization is received, typically within a Water Resources Development Act (WRDA). The estimated schedule for preconstruction engineering and design (PED) assumes that the feasibility report is approved by USACE Headquarters (HQ) in FY26, and the Project Partnership Agreement (PPA) is signed by the USACE and City of Salina prior to construction in FY27. Additional refinements to the Project schedule would be made as authorization and program guidance is received. The development of this schedule assumes federal and non-federal funding is available in the years required and the real estate actions are completed on schedule.

Following construction authorization and near the completion of the PED phase (and prior to the acquisition of any required Project lands) USACE and the Sponsor would execute a PPA. The Design Documentation Report prepared during PED would guide development of the PPA. For Project areas that require lands, the Sponsor would acquire easements, rights-of-way, and any necessary disposal areas prior to advertisement and award of a construction contract. The technical scope and magnitude of the Project, combined with reasonable assumptions of future funding availability, indicate that one construction contract would be needed for the Recommended Plan. Further construction details would be developed during PED, following completion of the feasibility study and execution of a Design Agreement. A preliminary schedule for design and implementation of the Project is shown in Table 6-4.

Table 6-3. Preliminary Design and Implementation Schedule

Milestone	Schedule
Final Feasibility Report	APR 2026
Signed Chiefs Report	AUG 2026
Design Agreement Execution	SEP 2026
Begin PED	2027
Earliest Congressional Authorization	2026
PPA Execution	2027
Complete PED	2028
Begin Construction	2028
Complete Construction	2030
Construction Warranty Period	XXXX
Adaptive Management & Monitoring Period Complete	2040
Complete Project and Close Out	2041

Potential schedule constraints related to construction include:

- In-stream construction work would need to be coordinated with the City's RAISE grant work, to avoid potential construction conflicts between City infrastructure work and USACE actions.
- Rock used in the Project features should not be quarried from October 15th to April 15th due to freeze thaw cycles during these months, which could affect the durability of the stone.
- Vegetative plantings for site restoration (native grasses) would ideally be conducted between March 1 through May 15. Seeding for temporary erosion control would ideally be planted as soon as possible to minimize potential erosion/loss of soil.

6.8. Levee Safety Considerations

A detailed draft Levee Safety Considerations report is provided in Appendix E – Levee Safety Considerations. The report describes the assessment of the levee conditions and outlines any potential issues associated with seepage, stability, settlement, erosion potential, and interior drainage storage.

Based on investigation of vertical exit gradients at the levee toe under steady state conditions for base flood elevation, seepage would be less than the maximum allowable value of 0.5. This satisfies the design requirements for the USACE condition for both existing and proposed conditions.

Similarly, geotechnical modeling indicates that levee slope stability Factor of Safety results are at or above recommended minimum values for all cases analyzed.

As no new loads would be added to the levee under Alternative A3 (TSP), no settlement is expected at the Project site. In addition, no significant changes to erosion or interior drainage storage capacity are expected.

Based on these findings, proposed channel grading landward of the levee and the proposed sediment basin riverward of the levee would meet USACE seepage and stability criteria.

6.9. Monitoring and Adaptive Management

Per Section 2039 of Water Resources Development Act (WRDA) 2007, monitoring for ecosystem restoration studies will be conducted to determine Project success and is defined as: The systematic collection and analysis of data that provides information useful for assessment of Project performance, determining whether ecological success has been achieved, or whether adaptive management may be needed to attain Project benefits.

The implementation guidance for Section 1161 of WRDA 2016, which amends Section 2039 of WRDA 2007, in the form of a CECW-P Memorandum dated 19 October 2017, requires that “the recommended project includes a plan for monitoring the success of the ecosystem restoration” and requires that an adaptive management plan be developed for all ecosystem restoration projects. Monitoring for ecosystem restoration studies is defined as: The systematic collection and analysis of data that provides information useful for assessment of project performance, determining whether ecological success has been achieved, or whether adaptive management may be needed to attain project benefits.

The primary purpose for implementing an adaptive management plan is to increase the likelihood of achieving desired project outcomes given the identified uncertainties, which may include incomplete description and understanding of relevant ecosystem structure and function, imprecise relationships among project management actions and corresponding outcomes, engineering challenges in implementing project alternative and ambiguous management and decision-making processes. The Monitoring and Adaptive Management Plan in Appendix F – Environmental provides the framework for adaptive management triggers and responsibilities of monitoring and data collection. Per Section 1161 guidance, monitoring costs (not to exceed 10 years after project construction) were considered as part of project costs and developed.

6.9.1. Monitoring

In the Planning Guidance Notebook, Engineering Regulation (ER) 1105-2-100, the prepublication version of Appendix C: Environmental Evaluation and Compliance, the components required in a monitoring plan are defined as follows:

- The rationale for monitoring, including key Project specific parameters to be measured
- How the parameters relate to achieving the desired outcomes or making a decision about ecological success

- The intended use(s) of the information obtained
- The nature of the monitoring, including duration and/or periodicity, the disposition of the information and analysis
- The disposition of the information and analysis
- The cost of the monitoring plan
- The party responsible for carrying out the monitoring plan
- A project closeout plan

Table 6-5 summarizes the monitoring objectives, actions, timeline, and estimated costs of the monitoring plan.

Table 6-4. Monitoring Activities & Costs Summary

Objective	Monitoring Actions	Years	Cost Estimate
Restore degraded in-stream aquatic habitat	Install and monitor flow gages in the Old Channel Photo documentation and site surveys at select riffle/pool/run features Aquatic organism survey at select riffle/pool/run features	Preconstruction Year 1 Year 3 Year 5 Year 7 Year 9	$165,000
Restore degraded wetland habitat	Install and monitor piezometers for seasonal and long-term water levels in the wetland Establish vegetation monitoring sites, survey for hydric characteristics,	Preconstruction Year 1 Year 3 Year 5 Year 7 Year 9	$250,000
Manage Old Channel Sedimentation	Monitor sediment levels in sediment forebay Perform settleable solids tests at sampling locations in the Old Channel Establish and monitor permanent sediment deposition benchmarks at several locations in the Old Channel	Preconstruction Year 1 Year 3 Year 5 Year 7 Year 9	$100,000
Restore habitat connectivity	Site survey at step pool structures, habitat weirs, and Lakewood Lake inlet and outlet.	Preconstruction Year 1 Year 3 Year 5 Year 7 Year 9	$50,000

Monitoring costs (not to exceed 10 years after project construction) were considered as part of project costs. Any monitoring conducted after 10 years would not be part of the total project cost and would be a 100% non-federal responsibility.

6.9.2. Adaptive Management

To address potential problems with ecosystem restoration features, the USACE has developed an Adaptive Management plan (see Appendix F - Environmental). This plan identifies some contingency measures that can be implemented if it appears that restoration activities are in danger of not meeting ecological success criteria. Table 6-6 summarizes the adaptive management plan by providing a description of potential contingency measures, under what circumstances they would be implemented, an estimated cost for implementation, and the responsible organization.

Table 6-5. Summary of Potential Adaptive Management Contingency Measures

Contingency Measure	Decision Trigger	Cost Estimate
Increase flows through the sediment forebay to maximize available flow in the Old Channel and riffle, pool and run habitat depths. Adjust habitat weirs to increase depth with available water.	Recreational and non-recreational seasonal flows not as projected Less than 10 cfs baseflow in the Old Channel under normal flow conditions during the recreation season for more than 10 consecutive days or more than 30 days per season.	$5,000
Modify step pool structures – add or remove riprap, adjust gradients.	Step pool structures not working as intended, steep gradient preventing aquatic passage.	25% of Construction Cost, one time
Adjust riffle, pool, run features. Dredge out pools, add more rock to riffle features. Coordinate with NFS for additional stormwater sedimentation measures.	Riffle, pool run features are not functioning as intended. Excessive sedimentation is filling in pools, erosion or high flows modified the riffle pool runs so they are not defined aquatic habitats.	10% of Construction cost, one time
Reshape and slope eroding banks, add additional protection features – woody debris, rock at the most vulnerable spots.	Increased flow in Old Channel causes excessive erosion. Riffle, pool, run features cause excessive bank erosion.	$100,000
Adjust wetland topography, additional plantings (additional or different wetland plants) at wetland shelves or Lakewood Lake wetlands. Perform invasive species control.	Wetlands are not maintaining at least 50% hydrophytic species (OBL, FACW or FAC), wetlands not maintaining hydric indicators.	20% of wetland planting cost

6.10. Environmental Operating Principles

The USACE Environmental Operating Principles (EOPs) were developed to ensure that USACE missions include totally integrated sustainable environmental practices. The EOPs provided corporate direction to ensure the workforce recognizes USACE's role in, and responsibility for, sustainable use, stewardship, and restoration of natural resources

across the nation and, through the international reach of its support missions. The EOPs include:

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

As a single purpose ecosystem restoration project, the Smoky Hill River Aquatic Ecosystem Restoration Project aligned with the EOPs at every step of the study process. Environmental consequences for all potential USACE actions were considered, along with the impacts on both the human and natural environments for both action and no action alternatives. Collaborative efforts with other partners in the area (USFWS, City of Salina) helped to leverage scientific, economic, and social knowledge to understand the larger context around the Project and the Project area. An open and transparent process was followed, with multiple public meetings and a public notice period, where the public was notified of the planned activities and input was solicited.

6.11. Views of the Non-Federal Sponsor

The City of Salina has a strong interest in restoring aquatic habitat in and adjacent to the Old Channel. They have been actively involved throughout the Project and participated in the identification of the objectives and identification of alternative plans. They are supportive of the results of the analysis and findings presented in the draft report.

The public is in support of an environmental restoration project along the Old Channel. In 2010, the City of Salina, Kansas approved the Smoky Hill River Master Plan after soliciting public input. The intent of the Smoky Hill River Master Plan is to “identify appropriate planning, design, and preliminary engineering responses to the specific opportunities associated with the restoration and redevelopment of the Old Channel area of the Smoky Hill River” (City of Salina, Kansas, 2010). This effort indicated that the Sponsor and general public strongly support restoring the Old Channel. The rehabilitation of the River is generally seen by the City, public, and stakeholders as a critical piece of the ongoing efforts to revitalize the downtown area of Salina.

7.0 Environmental Compliance*

Table 7-1 summarizes federal environmental laws and Project compliance for this Project.

Table 7-1: Environmental Compliance Summary Table

Federal Law & Policy	Compliance*
Archeological Resources Protection Act, 16 U.S.C. 470aa-470mm	Not Applicable
Bald and Golden Eagle Protection Act, 16 U.S.C. 668-668d	Full Compliance
Clean Air Act, as amended, 42 U.S. C. 7401, et seq.	Full Compliance
Clean Water Act (Federal Water Pollution Control Act), 33 U.S.C. 1251, et seq.	Full Compliance
Coastal Zone Management Act, 16 U.S.C. 1451, et seq.	Not Applicable
Endangered Species Act, 16 U.S.C. 1531, et seq.	Ongoing
Estuary Protection Act, 16 U.S.C. 1221, et seq.	Not Applicable
Farmland Protection Policy Act, 7 U.S.C. 4201, et. seq.	Not Applicable
Federal Water Project Recreation Act, 16 U.S.C. 460*l*-12, et seq.	Full Compliance
Fish and Wildlife Coordination Act, 16 U.S.C. 661, et seq.	Ongoing
Floodplain Management (Executive Order 11988)	Full Compliance
Invasive Species (Executive Order 13122)	Full Compliance
Marine Protection Research and Sanctuary Act, 33 U.S.C. 1401, et seq.	Not Applicable
Migratory Bird Treaty Act, as amended, 16 U.S.C. 703-712	Full Compliance
National Environmental Policy Act, 42 U.S.C. 4321, et seq.	Ongoing
National Historic Preservation Act, as amended, 54 U.S.C. 300101, et seq.	Ongoing
Archeological and Historic Preservation Act, 54 U.S.C. 312501, et seq.	Ongoing
Protection & Enhancement of the Cultural Environment (Executive Order 11593)	Full Compliance
Protection of Wetlands (Executive Order 11990)	Full Compliance
Rivers and Harbors Act of 1899, section 10 (33 U.S.C. 403)	Not Applicable
Wild and Scenic River Act, 16 U.S.C. 1271, et seq.	Not Applicable

7.1. Scoping

This Project was originally initiated as a CAP 1135 project in 2018 and then converted to a larger GI study in 2024. Public involvement in the concept of Old Channel and Lakewood Lake Restoration began early.

- Between 2017 and 2018, the City of Salina held multiple public involvement activities to gather input for updating the 2010 Smoky Hill River Renewal Master Plan.

- The Local Sponsor, USACE, and study contractor met on August 22, 2019, and again on October 11, 2019, to discuss and review technical elements and issues associated with the proposed project. (See Appendix J for additional detail)
- On January 31, 2018, the Local Sponsor and USACE met for a Smoky Hill River Renewal Project informational meeting. This meeting highlighted the general scope of the Old Channel renewal vision and how the 1135 Ecosystem Restoration Project could integrate within that vision. This meeting also highlighted expectations held by the Local Sponsor and USACE in terms of support and processes. Additionally, Project design elements and restoration features were also discussed.
- On 7 July 2022, USACE met with the Salina City Council to describe the existing Section 1135 Ecosystem Restoration Project and request support for conversion to a GI study. The City of Salina City Council voted unanimously for conversion to the GI study process.

7.2. Public Involvement

- During the CAP feasibility study 3 public meetings were held in Salina, KS to present the details and status of the project. The initial meeting was conducted on October 8, 2021, with a second meeting held on November 1, 2021. The third presentation was given to the City Board in Salina, KS on November 7, 2022, to explain options for the CAP study, including transition to a GI study. Members of the public were present for the presentation.
- The Environmental Assessment (EA) and draft Finding of No Significant Impact (FONSI) were posted on the USACE Planning Public Notices webpage for public review on 22 September 2025, with a 30-day comment period ending on 22 October 2025.
- One public meeting will be held in Salina in October during the public notice period. Written public comments could be submitted by email, mail, or on comment cards provided at the public meetings.
- Public comments received during the public notice period will be included and addressed in Appendix J – Public and Agency Correspondence in the Final Report.

7.3. Agency Coordination

An interagency meeting was hosted by USACE in October 2024 and was attended by representatives from EPA Region 7, KDHE, KDWP, and the Kansas SHPO office to discuss the Project and allow agencies to express any questions and provide recommendations at an early project stage.

A USFWS IPaC query was conducted on 04 June 2025 with a Corps determination of may affect but not likely to adversely affect for the Whooping Crane and Monarch Butterfly. The USFWS concurred with this determination on 31 January 2025. Coordination with the USFWS under the Fish and Wildlife Coordination Act (FWCA) is ongoing. FWCA consultation was first initiated in 2020 during the CAP study, with the USFWS responding at that time with no concerns about the project and encouragement

for restoration projects that would improve watersheds for native fish communities. This letter is included in Appendix J - Public and Agency Correspondence.

Additional agency coordination and comments received from the public will be included in Appendix J – Public and Agency Correspondence of the Final Report.

A letter initiating consultation with the Kansas State Historic Preservation Office (SHPO) was submitted on October 23, 2019, and continued into 2025 as the Programmatic Agreement (PA) for the Project was developed. Signories for the PA will be the Kansas SHPO, the City of Salina, and USACE. Invited signatories will be Friends of the River, the Smoky Hill Museum, and the Salina Certified Local Government. (See Appendix L for additional information, including communication between SHPO and USACE during the CAP study).

7.4. Tribal Consultation

Letters initiating consultation with several American Indian Tribes (Absentee Shawnee, Cheyenne-Arapaho Tribes, Delaware Nation, Eastern Shawnee, Iowa Tribe of Kansas and Nebraska, Kaw Nation, Osage Nation, Pawnee Nation, Prairie Band of the Pottawatomie, Sac and Fox Nation of Missouri in Kansas and Nebraska, and Wichita and Affiliated Tribes) were sent on October 25, 2019 (example letter included Appendix J – Public and Agency Correspondence). Responses were received from the Iowa Tribe of Kansas and Nebraska and the Pawnee Nation expressing interest in the cultural resources of the area in general and on one site in particular. The Pawnee Nation has agreed to be an invited signatory on the PA.

7.5. Clean Water Act

Under Section 404 of the Clean Water Act (CWA), a permit is required for the discharge of dredged or fill material into waters of the United States.

This Project meets the requirements of Nationwide Permit 27 (NWP 27), which allows aquatic habitat restoration, establishment or enhancement projects involving the discharge of dredged or fill material into waters of the U.S. based on certain conditions.

Kansas has issued 401 Water Quality Certifications for all nationwide permits, including NWP 27. This certification is valid through March 2026. Kansas applies several general conditions to all nationwide permits (including guidance on stream crossings, suitable materials, Indian County and T&E Species waters). Kansas does not apply any specific regional conditions to NWP 27.

Additionally, the USACE would need to acquire a National Pollutant Discharge Elimination System (NPDES) permit from KDHE to fully comply with the Clean Water Act. This permit would outline further commitments, such as best management practices that would need to be used. Such practices would likely include silt fencing around construction activities to minimize siltation, and include other provisions, like discharge methods and limits.

Coordination with the KDHE is ongoing, and a letter from KDHE listing any project concerns and concurring with the likely use of NWP 27 and the issuance of a future NPDES permit will be obtained by the Final Report.

8.0 District Engineer Recommendation

Viable plans have been identified that meet the federal interest of restoring aquatic habitat, reconnecting aquatic habitat, and restoring species life movement functions. These plans were validated against national and Project planning objectives to ensure the most efficient investment for the nation. All alternatives would involve stream restoration measures in the Old Channel, Lakewood Lake wetland restoration with compatible recreational amenities, removal and placement of the Western Star Mill Weir with five step pools for aquatic life connectivity and passage, completion of two weir features to maintain habitat flows and depths within Reaches 1 and 2, and implementation of a sediment forebay to provide in-flows and remove excess sediment from the Old Channel. All plans would involve channel dredging to remove excess sediment and reestablish capacity in the Old Channel to convey appropriate flow rates throughout the year; manage sedimentation in the Old Channel, restore habitat connectivity; and restore degraded in-stream aquatic and emergent wetland habitats. Differences among alternatives include the complexity of in-stream restoration and largely the overall acreage footprint based on whether, and to what extent, reaches are incorporated into the restoration. All alternatives were developed with the consideration of avoiding adverse flooding effects while aiming to restore in-stream aquatic habitats and connectivity along with restoring in-stream and wetland habitats along and adjacent to the Old Channel.

Alternative A3, the TSP, would rehabilitate the full 6.8 miles of the Old Channel. The Project would establish in-stream aquatic features that would provide a range of habitat for aquatic organisms; minimize future sedimentation of the Old Channel; reconnect aquatic habitat within the Old Channel and within adjacent wetland areas; and restore flows that would promote a self-sustaining system. Alternative A3 generates 56.8 Net AAHUs of habitat benefit compared to the No Action Plan. Alternative A3 would reshape the channel to create a variable depth profile with aquatic habitat types including runs, riffles, pools, and glides providing more habitat than currently exists in the existing sediment laden channel. In addition to habitat, the reconfiguration of the stream channel would foster self-sustaining gravity water flows. The gravitational flows created by the variable depth profile, along with construction of the sediment forebay would minimize the potential for future sedimentation and enable sediment transport that would efficiently and effectively maintain adequate flows throughout the Old Channel.

Replacing the Western Star Mill Weir with five step-pool features would help establish and maintain a more natural flow regime, provide habitat diversity, and reconnect the Old Channel hydraulically and hydrologically. Installation of adjustable weirs near the downstream and upstream ends of the Old Channel would help regulate flows and maintain sufficient water depth to support aquatic organisms and wetland habitats. Similarly, the TSP would reconnect the wetlands around Lakewood Lake with the Old Channel, restoring hydrologic and ecological connections.

The estimated total project first cost for the TSP is approximately $17,900,000 (FY25 price levels). Average annual costs are estimated at $878,000, resulting in 56.8 Net Average Annual Habitat Units and an average annual cost per average annual habitat unit (AAC/AAHU) of $15,425. The TSP represents a significant investment nationally, regionally, and locally and provides an excellent opportunity for the USACE to partner

with a proactive and committed non-federal sponsor to restore habitat degraded by a previously constructed federal flood risk management project.

The information and conclusions within this Feasibility Study have considered all significant aspects in the overall public interest, including environmental, social, and economic effects; engineering feasibility and maturity; the interests and capacity of the City of Salina to perform the required items of cooperation and to operate and maintain the Project; and views of federal, Tribal, and State agencies, stakeholders, and the public. As the NWK District Engineer, I recommend that the TSP for aquatic ecosystem restoration in the Smoky Hill River, as fully detailed in this Draft Feasibility Report and Integrated Environmental Assessment, be approved as a federal project, with any discretion of the Commander, HQUSACE, which may be advisable.

My recommendation is subject to cost sharing and other applicable requirements of federal laws, regulations, and policies. Federal implementation of the Project for ecosystem restoration includes, but is not limited to, the following required items of local cooperation to be undertaken by the non-federal Sponsor in accordance with applicable federal laws, regulations, and policies:

- Provide the non-federal share of project costs as further specified below;
- Provide, 35 percent of design and construction costs in accordance with the terms of a project partnership agreement entered into prior to commencement of construction work for the Project;
- Provide all lands, easements, relocations, rights-of-way, and disposal areas required to implement the Project;
- Prevent obstructions or encroachments on the Project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) that might reduce the outputs produced by the Project, hinder operation and maintenance of the Project, or interfere with the Project's proper function;
- Ensure that the Project or lands, easements, relocations, rights-of-way, and disposal areas required for the Project shall not be used as a mitigation banks or crediting associated with any other project;
- Operate, maintain, repair, rehabilitate, and replace the Project or functional portion thereof at no cost to the federal Government, in a manner compatible with the Project's authorized purposes and in accordance with applicable federal laws and regulations and any specific directions prescribed by the federal Government;
- Hold and save the federal Government free from all damages arising from design, construction, operation, maintenance, repair, rehabilitation, and replacement of the Project, except for damages due to the fault or negligence of the federal Government or its contractors;
- Perform, or ensure performance of, any investigations for hazardous toxic, and radioactive wastes (HTRW) that are determined necessary to identify the existence and extent of any HTRW regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C.

§ 9601 et seq., and any other applicable law, that may exist in, on, or under real property interests that the federal Government determines to be necessary for construction, operation, and maintenance of the Project;

- Agree, as between the federal Government and the non-federal sponsor, to be solely responsible for the performance and costs of cleanup and response of any HTRW regulated under applicable law that are located in, on, or under real property interests required for construction, operation, and maintenance of the Project, including the costs of any studies and investigations necessary to determine an appropriate response to the contamination, without reimbursement or credit by the federal Government;
- Agree, as between the federal Government and the non-federal sponsor, that the non-federal sponsor shall be considered the owner and operator of the Project for the purpose of CERCLA liability or other applicable law, and to the maximum extent practicable shall carry out its responsibilities in a manner that will not cause HTRW liability to arise under applicable law; and
- Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended, (42 U.S.C. §§ 4630, 4655) and the Uniform Regulations contained in 49 C.F.R. § 24, in acquiring real property interests necessary for construction, operation, and maintenance of the Project including those necessary for relocations, and placement area improvements; and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act.

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

_____ _____

Date

Andrew T. Niewohner

Colonel, Corps of Engineers

District Commander

9.0 List of Preparers

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