

Sears Dam



Steel Dam



Prepared for:



Sears & Steel Dams

Rock River near Milan, IL

Hanson Professional Services Inc.

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FINAL

Prepared by:



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Acronym	Definition
ACS	American Community Survey
AEP	Annual Exceedance Probability
AJD	Approved Jurisdictional Determination
ASCE	American Society of Civil Engineers
ASDSO	Association of State Dam Safety Officials
ASTM	ASTM International / formerly American Society for Testing and Materials
AUID	Assessment Unit ID
BL	Bureau of Land
BMPs	Best Management Practices
BOW	Bureau of Water
BW	Bureau of Water
CCDD	Clean Construction and Demolition Debris
CERP	Comprehensive Environmental Review Process
CFD	Computational Fluid Dynamics
cfs	cubic feet per second
CWA	Clean Water Act
CY	cubic yards
DEM	Digital Elevation Model
DOR	Depth of Refusal
DTW	David T. Williams & Associates

DWRM	Division of Water Resource Management
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FHWA	Federal Highway Administration
FIS	Flood Insurance Study
GIS	Geographic Information System
GLO	General Land Office
HARGIS	Historic Architectural Resources Geographic Information System
HEC-RAS	Hydrologic Engineering Center River Analysis System
HEC-SSP	Hydrologic Engineering Center Statistical Software Package
HHPD	High Hazard Potential Dam
HUC	Hydrologic Unit Code
IAC	Illinois Administrative Code
IBEW	International Brotherhood of Electrical Workers
IDNR	Illinois Department of Natural Resources
IDNR-OWR / OWR	Illinois Department of Natural Resources – Office of Water Resources
IDOT	Illinois Department of Transportation
IEPA	Illinois Environmental Protection Agency
ILEPA	Illinois Environmental Protection Agency
ILP-25 / PLP-25	IEPA Assessment Unit ID for the Rock River
IPaC	Information for Planning and Consultation
ISHPO	Illinois State Historic Preservation Office
ISWS	Illinois State Water Survey
LiDAR	Light Detection and Ranging
LHDI	National Inventory of Low-head Dams
MAC	Maximum Allowable Concentration
MBTA	Migratory Bird Treaty Act
mg/L	milligrams per liter
MSA	Metropolitan Statistical Area
ND	Not Detected
NID	National Inventory of Dams
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
NS	No Standard is Published

NWI	National Wetlands Inventory
NWP	Nationwide Permit
OHWM	Ordinary High Water Mark
PCBs	Polychlorinated Biphenyls
PEC	Probable Effects Concentration
RRD	Rock River Dam / Rock River sediment sample identifier
S.U.	Standard Units
SQRT	Screening Quick Reference Tables
SWE-EM	Shallow Water Equation – Eulerian-Lagrangian Method
TACO	Tiered Approach to Corrective Action Objectives
T&E	Threatened and Endangered
TEC	Threshold Effects Concentration
TMDL	Total Maximum Daily Load
UIUC	University of Illinois at Urbana-Champaign
USACE	United States Army Corps of Engineers
USCB	United States Census Bureau
USEPA	United States Environmental Protection Agency
USFO	Uncontaminated Soil Fill Operation
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
USBR	United States Bureau of Reclamation
WOTUS	Waters of the United States
WQC	Water Quality Certification
YR	Year

Executive Summary

The Illinois Department of Natural Resources – Office of Water Resources (IDNR–OWR) commissioned this planning-level feasibility study to identify a technically sound, cost-effective, and permissible solution to address public safety hazards associated with the Sears and Steel Dams on the Rock River near Milan, Illinois. Following the decommissioning of the hydropower facility in 2020, the dams no longer serve their original purpose, allowing for a comprehensive evaluation of dam modification or removal alternatives. The study emphasizes improvement of public safety as the primary goal, supported by secondary objectives including reduction of long-term maintenance and cost-effective implementation, ecological enhancement, regulatory compliance, and consideration of recreational uses.

This report evaluates existing conditions, river geomorphology, sediment dynamics, and hydraulic behavior to inform a comparative assessment of six dam alternatives. Analyses were performed using field investigations, geomorphic reconnaissance, sediment sampling, and 1D/2D hydraulic modeling to assess impacts to river processes, infrastructure, ecology, and recreation. All findings are presented at a feasibility level; detailed design, structural assessments, and final permitting are beyond the scope of this study. Evaluation of the Sears powerhouse structure was explicitly excluded.

Existing Conditions

The Sears and Steel Dams are low-head, run-of-the-river structures that create dangerous hydraulic rollers capable of trapping swimmers and boaters. At least six fatalities (at Steel Dam) and multiple near-miss incidents (at both Sears and Steel Dams) have occurred in the past 20 years alone. Hydraulic modeling confirms that hazardous conditions exist across nearly all river flow conditions, including common recreational flow conditions. The existing conditions present a persistent public safety risk.

Field investigations and hydraulic modeling determined that the dams impound nearly 20 miles of river. The aging infrastructure no longer supports its original purpose to generate electricity, and the continued operational benefits are impacted by safety risks and maintenance costs.

A reach-based geomorphic assessment indicates the river system is generally stable under current impounded conditions, with banks stabilized by a combination of bedrock, vegetation, and artificial armoring. Approximately 75% of the shoreline remains in natural riparian condition, while developed areas are partially hardened.

From an ecological perspective, the dams block fish migration between the Rock River and Mississippi River. They raise water temperatures and lower dissolved oxygen levels in the river while also decreasing habitat for native species, including state-listed fish and mussels. By impeding river continuity, the dams inhibit biodiversity and alter sediment transport. It has been estimated that approximately 4.3 million cubic yards of sediment are impounded upstream of the structures. The sediment composition is predominantly sand with ~25% fines. Sediment deposition patterns reflect the influence of the dams, with thicker fine-grained deposits near Sears Dam and predominantly sand-dominated material farther upstream. Sediment quality testing indicates generally low contamination levels, supporting the feasibility of passive sediment management but further testing will be required during the permitting process. The geomorphic setting suggests that removal of hydraulic controls

would restore natural processes but initiate a period of channel adjustment, including incision, bar formation, and redistribution of flow between channels.

Recommended Plan of Action

Six alternatives were evaluated, ranging from full dam removal to various modification strategies intended to reduce hydraulic hazard while maintaining portions of the impoundment. Alternatives were assessed using a structured evaluation matrix considering public safety, cost, maintenance, ecological benefit, recreation, constructability, and regulatory feasibility. Structural modification alternatives (e.g., stepped spillways, rock ramps, bypass channels) were found to reduce hazardous hydraulic conditions. These options retain long-term maintenance requirements and continue to limit ecological connectivity. Partial removal alternatives provide incremental benefits but maintain elements of the existing hazard and system disruption. The following six alternatives were fully evaluated:

1. Alternative 1 - Remove Both Dams
2. Alternative 2 - Remove Sears, modify Steel Steps
3. Alternative 3 - Remove Sears, modify Steel Rock Ramp
4. Alternative 4 - Remove Sears, modify Steel Steps, add Riffles.
5. Alternative 5 - Remove Sears, modify Steel Steps with Bypass
6. Alternative 6 – No Change to Sears, Modify Steel Steps

Implementation of any alternative will require coordination with IDNR–OWR, Illinois Environmental Protection Agency (IEPA), and the U.S. Army Corps of Engineers (USACE), among others. Key regulatory drivers include compliance with the Clean Water Act (Sections 401 and 404), floodplain management, endangered species consultation, and cultural resource protection. Dam removal alternatives will require mitigation for impacts to wetlands, stream channels, and temporary disruptions to aquatic habitat. While these impacts are more extensive under the full removal scenario, they are balanced by long-term restoration of river processes, reduced cost and provide the strongest alignment with the primary goal for public safety.

The project team in collaboration with IDNR-OWR has determined the recommended plan as Alternative 1 – Removal of Both Dams. Per IDNR-OWR direction, Sears Dam removal was limited to the spillway with the powerhouse remaining in place. Steel Dam is fully removed. This alternative most effectively satisfies the primary project goal by completely eliminating the hydraulic roller hazard and associated public safety risk. It is the only alternative that removes, rather than mitigates, the hazard. Typical river safety hazards will remain; however, but an assessment of such additional safety hazards is outside the scope of this report.

In addition to safety, Alternative 1 provides the strongest overall performance relative to secondary goals. It eliminates long-term maintenance obligations, offers the lowest lifecycle cost, restores approximately 70 miles of river connectivity, and fully reestablishes natural geomorphic and sediment processes. Ecological benefits include improved fish passage, enhanced habitat diversity, and long-term recovery of aquatic systems.

However, the selected alternative does not fully satisfy all project objectives. The transition from an impounded system to a free-flowing river results in the loss of flatwater recreation (e.g., boating and

water skiing) but increases other recreational pursuits such as paddling activities (i.e., canoeing and kayaking). There are also changes to shoreline conditions adjacent to private property. Short-term impacts include sediment release, elevated turbidity, and the potential need for wetland and habitat mitigation. Additionally, changes in water surface elevation and velocity may affect local recreational preferences and require adaptation by river users. There may be significant economic impacts to local river-based businesses and private shoreline residences that warrant consideration. Economic quantification was not considered within the scope of this study.

No single plan can fully achieve all desired goals for this study. The pros and cons of each alternative were evaluated and scored within the alternative evaluation matrix to provide a comprehensive visual comparison. Alternative 1 is recommended as the most balanced solution, providing the greatest overall benefit while directly addressing the primary safety objective. Its advantages in hazard elimination, ecological restoration, and long-term sustainability outweigh the identified tradeoffs. Successful implementation will require careful management of sediment release, coordination with regulatory agencies, and consideration of stakeholder concerns during subsequent design and permitting phases.

1. Purpose & Scope

This study was initiated by IDNR-OWR to evaluate potential safety improvements for the Sears and Steel Dams on the Rock River near Milan, Illinois. The existing low-head dams present documented public safety hazards and functional limitations. Following the decommissioning of the Sears Powerhouse in 2020, the structures no longer provide hydroelectric function and are evaluated for modification or removal. The study is guided by the project goals defined in the Executive Summary, emphasizing public safety as the primary objective, with supporting considerations for cost, maintenance, ecological function, recreation, constructability and regulatory feasibility. Feedback from public outreach leans heavily in favor of preserving the existing pool. All of these goals are addressed within this report.

The IDNR-OWR retained Hanson to complete a dam safety feasibility study to evaluate safety improvement modifications for both Sears and Steel dams. Hanson has teamed with Inter-Fluve Inc. (Inter-Fluve), Prairie Engineers (Prairie), and David T. Williams & Associates (DTW) to assist with evaluating dam removal and dam modification feasibility considerations. Hanson's primary role was to develop hydrologic and hydraulic modeling, concept plans and cost estimates. Inter-Fluve performed geomorphic site assessment, evaluated impounded sediment management and assisted in evaluation of the alternatives. Prairie, and their partner EnviroScience, performed environmental and cultural resource investigations, sediment sampling and laboratory analysis and alternative impacts. DTW served in the quality assurance role for all phases of the study. The team also collaborated with IDNR-OWR who led public outreach, performed bathymetric survey for the study reach and traditional surveys of the dams, and depth-of-refusal surveys of the sediment upstream of the structures. This report documents feasibility findings and characterizes existing river conditions, including geomorphology, sediment dynamics, and ecological resources.

The purpose of this study is to evaluate dam safety and river function in the project reach, considering ecological conditions, sediment dynamics, and recreational use. Evaluation of existing hydraulic conditions and the potential impacts of dam modification or removal are central components of the study described in detail in Sections 7 and 8.

The project scope includes the formulation of evaluation criteria to thoughtfully analyze alternatives, development of hydraulic models to assess impacts under varying conditions, and surveying to acquire bathymetric data. Field investigations and data collection support characterization of existing conditions and evaluation of alternative impacts.

This report supports IDNR-OWR in evaluating feasible options to improve public safety and river function through dam modification or removal. The evaluation considers regulatory compliance requirements while assessing implications for public safety and environmental resources.

1.1 Hazard Definition

Run-of-the-river low head dams are known to be a public safety drowning hazard because they often appear harmless while also concealing a strong underlying current that prevents escape. The potential drowning hazard is increased by the ogee spillway shape associated with increased hydraulic efficiency and stronger currents. As water flows over the steep face of the dam, it plunges downward with high velocity, striking the downstream surface and creating intense turbulence (see [Figure 1](#)). This impact

forms what is known as a hydraulic jump, where fast-moving water meets slower water downstream. At certain downstream levels, the tailwater submerges the hydraulic jump, forming a powerful recirculating current called a roller. This roller pushes water—and anything caught in it—back toward the dam’s face, where it gets pulled into the high-velocity jet again. Swimmers, boaters, or even rescuers caught in this cycle can be held underwater or pushed repeatedly into the dam, making escape nearly impossible without specialized equipment or intervention. According to a study on low-head dams by Brigham Young University and the US Department of Homeland Security, across the United States, more than 1,000 deaths have resulted from people unknowingly or accidentally entering the area below the spillway and becoming trapped.

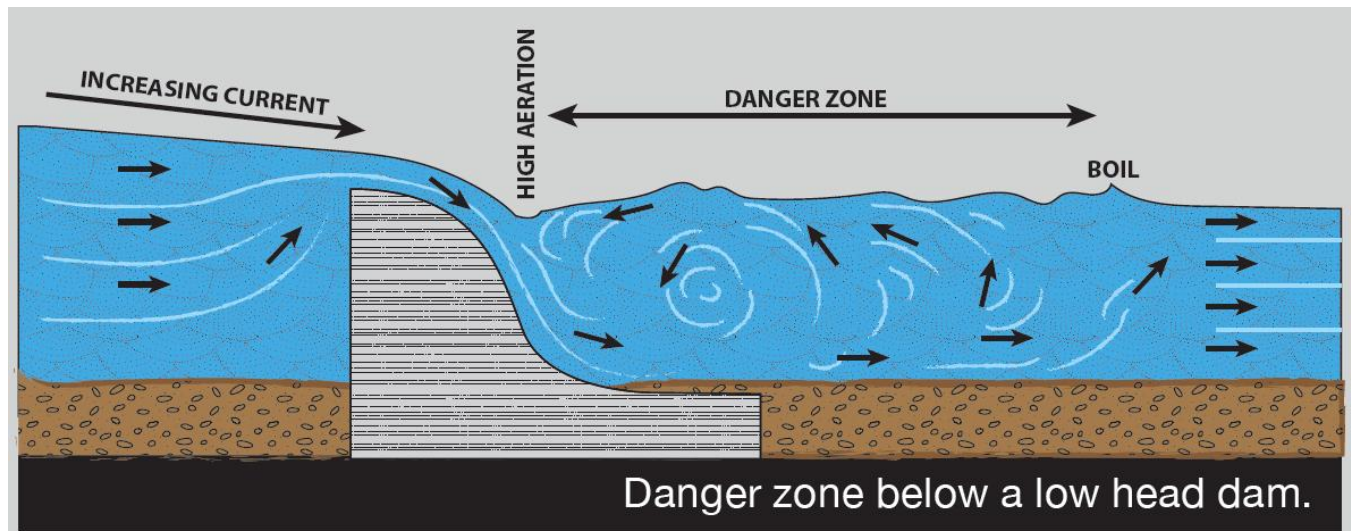


Figure 1 - Hydraulic Roller (image source: americanrivers.org)

The nature of low-head dams often leads to their inauspicious hazard. When tailwater elevations rise, the dams become nearly invisible to the upstream boater’s perspective with no obvious drop and little to no white water. During low tailwater conditions the low dam height presents a minor vertical drop viewed as inviting to wading anglers or swimmers unaware of the submerged conditions. Under some water discharges no visible hazard may be present leading people to view the area as safe. But when conditions change, like after a rainfall, and the roller forms, what was a safe area becomes deadly. These dams can lull people into a false sense of security. For these reasons posting adequate warning signs is recommended to alert those recreating in the area. With tens of thousands of low-heads across the country, the Association of State Dam Safety Officials (ASDSO) Public Safety Around Dams Committee has formed a Task Force to create a National Inventory of Low-head Dams (LHDI). ASCE estimates that nationwide 50 people drown each year at low-head dams (Landers, 2021).

While warning signs and buoys are installed upstream of the Sears and Steel dams per IDNR policy, accidents have occurred. In 2020, a 21-year-old and 16-year-old were both killed when their boat lost power and went over the Steel Dam. In 2018, a 5-year-old drowned after a boating accident at the dam. In 2013, two jet skiers went over the dam and a 40-year-old died in the incident. Prior deaths were also reported in 2008 (20-year-old) and 2007 (70-year-old). Most recently, in 2023, four boaters (no fatalities) were rescued from a boating incident near Sears Dam.

2. Data Collection and Limitation of Study

This section presents the data sources, collection methods, and study limitations that supported the Sears and Steel Dams Feasibility Study. An understanding of existing site conditions was developed through a combination of hydrographic surveys (bathymetric and depth of refusal), limited sediment sampling, Light Detection and Ranging (LiDAR) data, background data, and computational hydraulic modeling. These datasets provided the foundation for evaluating dam safety, sediment dynamics, ecological impacts, and potential alternatives. However, since this is a planning-level study, it was conducted without certain elements typically included in design-phase investigations—such as river borings, dam corings, structural conditions, and finalized design plans. Additionally, response to public outreach and permitting activities were deferred to future phases. The Illinois Environmental Protection Agency (IEPA) and the Illinois Department of Natural Resources – Office of Water Resources (IDNR-OWR) have regulatory authority over dam removal projects in Illinois in cooperation with the United States Army Corps of Engineers (USACE). Permitting and regulatory input were sought with some limited direction documented in this study.

During this study phase, the following limitations were recognized:

- Design and permitting were not performed. The feasibility study was limited to concept level.
- No river borings or dam corings were performed.
- No dam structure condition assessment was performed.
- One chemical background level result was attained – additional samples will likely need to be performed to meet the level required for design and permitting.
- Sediment sampling scope was limited to that of a feasibility assessment. Additional assessment will likely be required for design and permitting.
- No design plans were available for Sears Dam.
- Per IDNR-OWR direction, the powerhouse and all facilities will remain in place with no alterations.

2.1 Data Collection

- Hydrographic surveys were collected by IDNR-OWR in June and August 2024.
- Depth of Refusal (DOR) surveys were collected August 2023, June 2024, and September 2024 by IDNR-OWR.
- 2020 LiDAR data was obtained from the Illinois Geospatial Data Clearing House with a nominal pulse spacing of 0.5-meters. The LiDAR data was post-processed into Digital Elevation Model (DEM) format at a 1-m resolution.
- HEC-RAS 1D hydraulic models were developed for the Rock River by Illinois State Water Survey (ISWS) in 2011 based on surveyed channel cross-sections. The model serves as the regulatory basis for the FEMA floodplain on Rock River. The 1D model was provided by ISWS and amended by Hanson to reflect newly collected LiDAR and bathymetric survey. The model was used for definition of river geometry outside of the newly collected areas associated with this study.
- River supernatant samples were collected by EnviroScience (subcontractor to Prairie) in 2024 for chemical analysis.
- River sediment samples were also collected by EnviroScience for particle size determination and select chemical testing.

- Geomorphic assessment was completed by Inter-Fluve on June 13-14, 2024.
- 2D HEC-RAS hydraulic models were developed by Hanson from bathymetric survey for the area immediately adjacent to the dams, including both channels around Vandruff Island.

2.2 IEPA's Illinois Integrated Water Quality Report and Section 303(d) List

Illinois sets water quality standards against which water bodies are assessed for impairment. State standards for impairment must be as strict, or stricter than the national standards. Water bodies that are rated impaired by pollutants and do not meet the water quality standards for their designated use and are required by the Clean Water Act (CWA) to have Total Maximum Daily Loads (TMDLs) of pollutants that are causing the impairment; the TMDL is the maximum amount of a given pollutant that may be present for the water body to still meet water quality standards. The Environmental Protection Agency (EPA) sets national standards for TMDLs of pollutants in waterbodies. If a water body does not meet the established standards, it is listed on the 303(d) list of impaired waters and the CWA requires the development of a restoration plan (also known as a TMDL).

IEPA develops an Illinois Integrated Water Quality Report every two years to describe the water quality of waterbodies within the State, as required by CWA. IEPA designates water bodies into one of five categories based on waterbody assessments. For this assessment, each waterbody in the State is assigned a use(s) designation. The Illinois use designations including Aesthetic Quality, Aquatic Life, Indigenous Aquatic Life, Primary Contact, Public Food and Processing Water Supply and Fish Consumption. The latest report is the Illinois Integrated Water Quality Report and Section 303(d) List, 2024 Draft (IEPA, 2024). The Rock River segment from the Sears and Steel dams to its confluence with the Mississippi River is within the Lower Rock Watershed (HUC10 070900005) and is identified by IEPA as unit AUID IL_P-25 (this is the assessment unit code given to this water body segment by the IEPA for use in tracking water quality status of waterbodies in the state). This assessment unit is depicted in [Figure 2](#) below in teal.

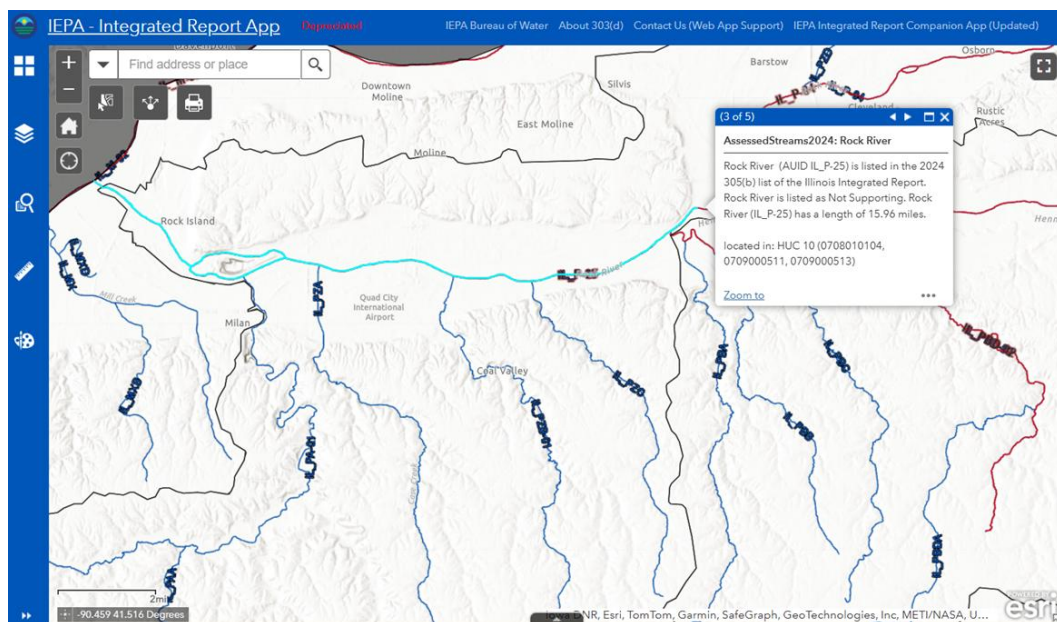


Figure 2 - IEPA Assessment Unit ID PL_P-25 (source: <https://illinois-epa.maps.arcgis.com/apps/webappviewer/index.html?id=773c1711e0e9417ea7cd6cad8afb66ea>)

2.2.1 IEPA Water Quality Assessments and TMDLs

Current water quality conditions in the Rock River were reviewed through IEPA (IEPA, 2025) and U.S. Environmental Protection Agency (USEPA, 2025) resources. According to the IEPA, the Rock River AUID IL_P-25 (see [Figure 2](#) above), as it flows through the Project Area, is impaired for Fish Consumption. Causes of impairment were determined to be from various chemicals including aldrin, dieldrin, endrin, heptachlor, mercury, mirex PCBs and toxaphene. The USEPA further specified that the water quality in this section is impaired for Fish and Shellfish Consumption. Identified issues leading to these impairments include the presence of Mercury, PCBs, and Pesticides.

This section of the Rock River, as it flows through the Project Area (IL_P-25), while on the 303(d) list as an impaired water, does not yet have a TMDL plan developed for restoration of water quality. In Illinois, the development of TMDLs for waterbodies are prioritized by the watershed within which they are located. There are 52 watersheds and three priority rankings for TMDL development in Illinois. High priority is assigned to waters for which public water supply use is impaired by atrazine, simazine or nitrate. TMDLs for these waters will be developed for the entire watershed. Medium priority is assigned to watersheds with no approved or ongoing TMDL. 'Medium' ranking waters are further categorized in priority based on the number of impairment causes identified for the waterbody. Low priority is assigned to watershed that have an approved or ongoing TMDL, although TMDL implementation is ongoing and unaffected by the prioritization process. The state TMDL development schedule calls for initiation of TMDL development in six TMDL watersheds each year (IEPA, 2024). The Lower Rock Watershed is ranked as a medium priority for TMDL development due to the total number of potential causes of impairment (IEPA, 2024). The current IEPA forecast for watershed TMDL development lists the next six watersheds, higher in priority, for development within the next two years and does not include the Lower Rock Watershed. As a medium priority watershed for TMDL development, it could be sometime before a TMDL is developed for Lower Rock Watershed. Implementing the dam removal option may accelerate the need for TMDL plan development.

3. Existing Conditions / Facility (Background)

This section provides a detailed overview of the Sears and Steel Dams, including their physical characteristics, historical significance, and current condition. The information presented here establishes the baseline conditions necessary for evaluating potential modification or removal alternatives in subsequent sections.

3.1 Area Overview

3.1.1 Location

Sears Dam and Steel Dam are located on the Rock River in Rock Island County, Illinois, near Milan and the City of Rock Island (see [Figure 3](#)). The Sears Dam spans the North Channel of the Rock River along the north side of Vandruff Island, immediately upstream of the U.S. Highway 67/11th Street bridge. Together with Steel Dam on the South Channel, they impound a portion of the Lower Rock River upstream of Vandruff Island, several miles above the Rock River's confluence with the Mississippi River. The upstream impoundment also includes the City of Moline and Village of Coal Valley. The dams lie within a developed river corridor that includes public transportation infrastructure, former hydroelectric facilities, private riverfront properties, quarry lands, and natural riparian areas.

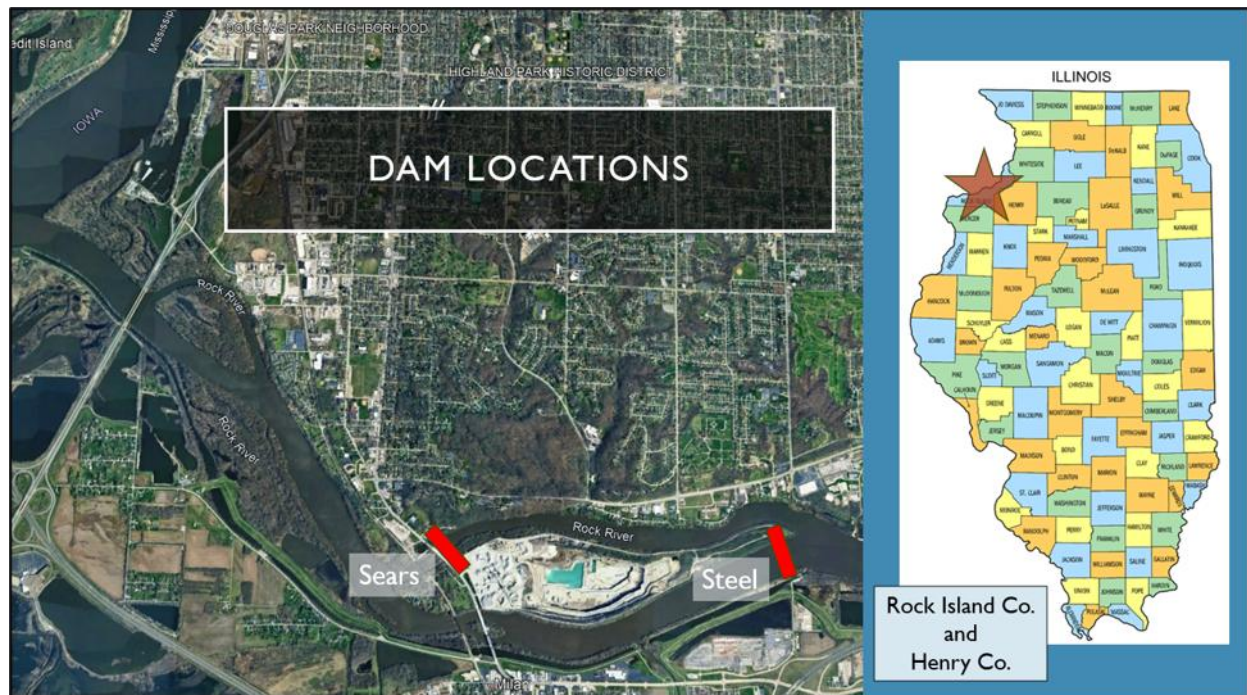


Figure 3 - Location Map

These low-head, run-of-the-river dams were originally constructed more than one hundred years ago to support hydroelectric power generation but have since been decommissioned. Currently, the dams impound nearly 20 miles of the Lower Rock River providing a recreational pool but also limiting fish passage from the Mississippi River to the upper Rock River watershed. Run-of-the-river, low-head dams also create a public safety hazard. In recent years there have been multiple drowning deaths associated with the dams. These types of dams have a record of facilitating drowning deaths across the nation and many states have created programs to remove the hazard – often by removing the dams.

3.1.2 Geology

The geology of the Lower Rock River has been described in detail by several researchers (Alden 1918, Anderson 1967, Anderson 2005, Carman 1909, Leverett 1899, and Savage and Udden 1921). The Rock Island-Milan area geology is dominated by Devonian limestone deposits overlain by glacial Mississippi alluvial deposits. See Figure 4 showing rivers as of 1839 prior to dam construction (GLO 1839). The modern river has incised into these deposits, and Vandruff Island is a good example of limestone bedrock exposed through quarrying. The current Vandruff Island was once two islands, Vandruff Island to the west and



Figure 4 - General Land Office Map of Survey Plat T17N, R2W, 4th Principal Meridian (GLO 1839)

Carr Island to the east. Historic maps show that these islands were separated, but the gap was later filled as part of the quarrying and damming operations.

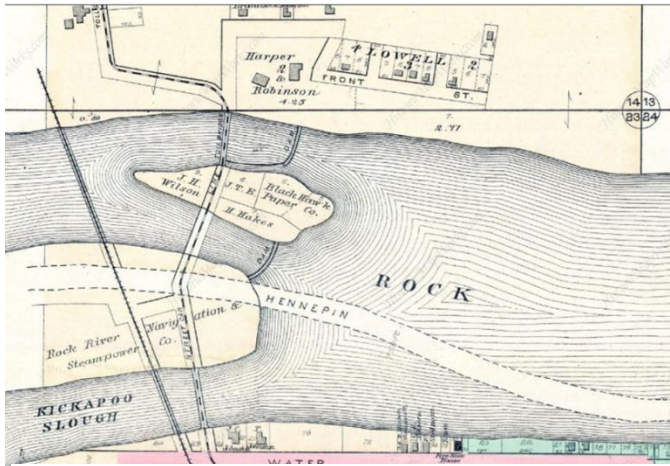


Figure 5 - Sanborn Fire Insurance Map from 1888 showing former dam location on the south side of Vandruff Island providing power for the Black Hawk Paper Company (Sandborn 1888).

slough and surrounding wetlands were filled.

The Hennepin Canal is a concrete and earthen berm canal constructed to facilitate barge traffic from the Illinois River to the Mississippi. Construction of the canal began in 1890, and the boat traffic started in 1907, reducing the distance from Chicago to Rock Island by 419 miles. A portion of this historic channel runs along the left bank (looking downstream) of the Rock River adjacent to the project reach, with a former lock/entrance at the Steel Dam location. Widening of locks on the Illinois and Mississippi Rivers made the Hennepin Canal obsolete shortly after it opened, and by the 1930s, the canal was used primarily for recreational activities. The Hennepin canal was closed to boat traffic in 1951 (Armstrong 1961, Yeater 1979). Portions of Hennepin Canal are listed on the National Register of Historic Places, which may have an impact on site access and permitting requirements for construction at the adjacent Steel Dam.

3.1.3 History

Prior to the current Sears Dam, a previous stone dam was built in the North Channel in 1846 to power the Island Mills operated by D.B. Sears and Sons (see 1888 map in [Figure 5](#)).

Prior to the Steel Dam being built, a dam once spanned the Rock River across the South Channel near the current County 67 crossing south of Vandruff Island. This dam (the Black Hawk dam) provided power for the Black Hawk Paper Company and diverted water into the Kickapoo Slough ([Figure 5](#)). The Black Hawk dam is no longer in place. By 1900, the Steel Dam was constructed at the head of Carr Island to control water flow into the Hennepin Canal ([Figure 6](#)). In the early 20th century, much of the Kickapoo



Figure 6 - Looking south along the Steel Dam from Vandruff Island, July 26, 1904

3.2 Dam Details

3.2.1 Sears Dam

The current Sears Dam and abutments are owned by the State of Illinois, as well as the adjacent US Highway 67 right-of-way (Figure 7). The surrounding land north of the river is owned by the City of Rock Island (hydroelectric plant), and private parcels including Fraternal Order of Eagles and the Cotton Mill Senior Living Center. The land south of the river is owned by Allied Stone Quarry who maintains active quarry mining operations.



Figure 7 - Sears Dam Looking Upstream from Highway 67 Bridge (Prairie 2024).

The National Inventory of Dams (NID) lists the current Sears Dam as having a height of 16-feet (spillway 14-feet and apron 2 feet) and a hydraulic head of roughly 18 feet. While as-built plans are not available, based on available bathymetry, survey and projections, it is estimated that the actual dam height is **13.1 feet**. This height aligns well with a head of impoundment topset delta (depositional area) just downstream of the Hwy 80 crossing (near TPC Deere Run Golf Club). In low gradient alluvial rivers, topset beds are typically composed of coarser grained material, with finer sediment fractions transporting closer to the dams, as is the case with Sears and Steel Dams.

3.2.2 Steel Dam



Figure 8 - Steel Dam Looking North from Southern Bank at Park (Prairie 2024).

The current Steel Dam and abutments are also owned by the State of Illinois. The surrounding lands north of the river are owned by Allied Stone Quarry and south of the river are publicly owned by State of Illinois and Village of Milan (Figure 8).

The National Inventory of Dams (NID) lists the current Steel Dam as having a height of 11.0 feet. The NID shows the Steel Dam being built in 1912, but photos show the dam in place in summer of 1904, and plat maps from 1905 also show the dam in place. As-built plan drawings are available for the Steel Dam and define a height of **6.0 feet**.

3.2.3 Dam Safety Features

IDNR-OWR installs safety features including buoys and signage at all state-owned dams. Buoys are placed approximately 300' upstream of the dam at 50' intervals across the width of the river. The buoys are marked in accordance with Coast Guard Regulations and say, "DANGER DAM". Buoys are 9" in diameter and a Solar Marine Light is placed on the middle buoy that flashes white at a rate of 60 flashes per minute and is visible for a minimum of 1 nautical mile. At dams that are owned by the State of Illinois, signs are also placed and maintained at the dams. This signage is usually affixed to the dam abutment or placed on property that is owned by the State of Illinois. The Department has no authority to place and maintain signage at locations where it does not own the property.

3.3 Cultural Resources

The information in this summary provides a general review of the potential cultural impacts assessed based on readily available online databases, including an archaeological/historic review of existing Historic and Architectural Resources Geographic Information System (HARGIS, accessed 2025) and Illinois Archaeological Survey / Illinois State Archaeological Survey records (accessed 2025), and a summary of the findings from a Phase I Literature Review. No new Phase I archaeological or onsite investigation was completed as part of this effort.

3.3.1. Previously Recorded Archaeological Sites and Surveys

A Comprehensive Environmental Review Process (CERP) was approved in July 2024 under CERP code: 2417158. Final reviews will be completed once final plans are developed and submitted.

3.3.1.1. Sears Dam

Two archaeological sites and four previous surveys were documented within 1,000-foot (laterally) of the dam (Figure 9). For the two archaeological sites, one is the location of the historic Native American Sauk Village of Saukenauk and the other site is known as the Sauk Cemetery. The exact boundaries of either site are not known and neither site has been evaluated for inclusion in the National Register of Historic Places (NRHP). The four previous surveys included portions mapped within 1,000-feet of the dam, which were completed in 1976, 1981, 2016, and 2017. No evidence of these sites was found inside of the search radius of the dam.

3.3.1.2. Steel Dam

Two archaeological sites and one previous survey were documented within 1,000-feet of the dam (Figure 10). For the two archaeological sites, one was a shell midden that had been excavated around 1960. The other

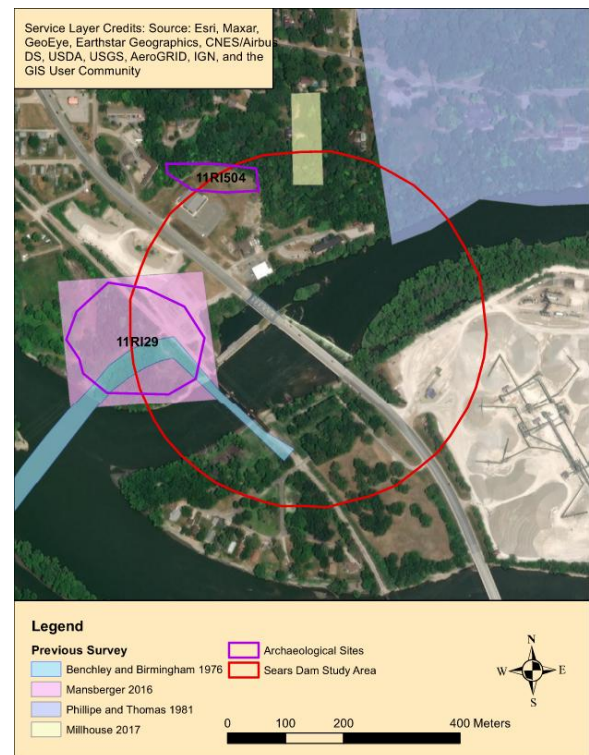


Figure 9 - Sears Dam Archaeological Sites

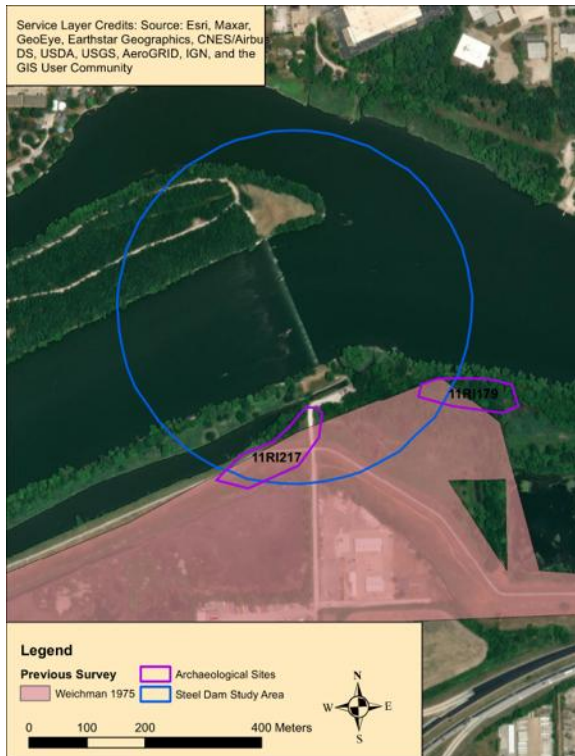


Figure 10 - Steel Dam Archaeological Sites

site was a precontact lithic scatter consisting of flakes and projectile points recovered in 1973. The one previous survey conducted in 1975 identified one precontact site recommended for further investigation.

3.3.2. Historic Map Data

The existence on historic maps (Figure 11) of nonextant structures indicates areas of high probability to contain archaeological sites.

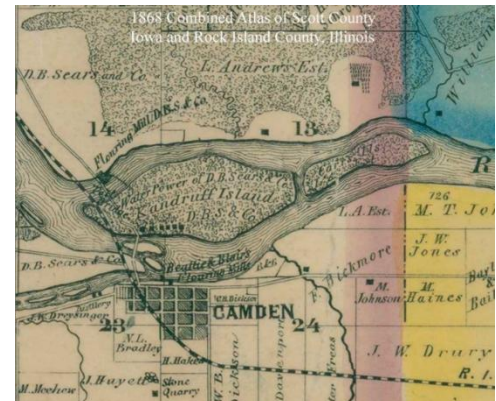


Figure 11 - Atlas of Rock Island County, Illinois (Thompson and Everts 1868).

3.3.2.1. Sears Dam

Historic maps from the 1800's and 1900's show nonextant structures within the search radius of the dam including a ferry, Vandruff's House, the D.B Sears and Company flour mill, a historic dam and mill race, a toll bridge, railroad tracks over the river, an additional mill, three small structures, Graham's Cotton Mill, residential structures, and another cotton mill that had occurred prior to the construction of the dam.

3.3.2.2. Steel Dam

Historic maps from the 1800's and 1900's show nonextant structures within the search radius of the dam including a lock for the Hennepin Canal, the Hennepin Canal (now the Illinois and Mississippi Canal) and a single other structure that had occurred prior to the construction of the dam.

3.3.3. Historic Architectural Resources and NRHP Properties

There are no historic architectural resources or recommended eligible or listed NRHP resources in the 1,000-foot study area. Sauk Cemetery and Hennepin Canal are not listed in NRHP and are not in the state's archaeological or architectural databases. These are "potential resources" in the area that would need to be evaluated for the NRHP if they could be impacted by the project.

3.3.4. Cemeteries

The only cemetery within the study area was the previously mentioned Sauk Cemetery (boundary limits unknown).

3.3.5. Conclusions

Given the above findings, there is a high potential for undiscovered archaeological resources on undisturbed grounds within the study area. Design considerations should be given to the four previously recorded archaeological sites with further archaeological investigations to determine NRHP eligibility. It is recommended that a Phase I Archaeological Survey be conducted for areas involving ground disturbance. While most of the disturbed areas will be within the channel, additional disturbance will occur along the abutments, adjacent banks and access points. The Illinois Historic Preservation Agency should be consulted, in accordance with the Illinois State Agency Historic Resources Preservation Act, if state actions are required for the project, including permits, licenses, funding or approvals.

3.4 Existing Aquatic and Riparian Wildlife

Inter-Fluve performed a desktop analysis to review the existing aquatic organisms and obtained local species information during an initial consultation with IDNR-Office of Resource Conservation (ORC). The Rock River aquatic ecosystem in Rock Island County has a rich diversity of fish and native mussel species. This region has been the focus of extensive documentation by IDNR. The river supports a thriving fishery with at least nine sport fish species and over twenty-three extant native mussel species, some of which are state endangered.

Dams have been shown to disrupt the upstream migration of fish and negatively impact fish community composition and genetics in warmwater Midwestern rivers (Kanehl et al. 1997, Smith et al. 2016, Smith et al. 2019). Likewise, many studies have shown that dam removal improves riverine habitat diversity, fish passage, mussel diversity, water quality, geomorphology and sediment and nutrient transport (Baxter 1977, Bednarek 2001, Bushaw-Newton 2002, Cordone and Kelly 1961, Ligon et al. 1995, Petts 1984, Stanley and Doyle 2003, Ward and Stanford 1979).

3.4.1 Fish

The Rock River has a successful and diverse fishery. At least nine species of sport fish can be found in the Rock River: Green Sunfish, Largemouth Bass, Northern Pike, Channel Catfish, Sauger, Smallmouth Bass, Walleye, White Bass, and Flathead Catfish. In efforts to support fishery, each year IDNR stocks over 70,000 walleyes annually (Illinois Department of Natural Resources, n.d.). IDNR has noted that both Lake Sturgeon and Paddlefish were encountered downstream of the dams and have not been recorded upstream of the dams, suggesting that the dams are a barrier to their movement.

The inventory of fish species present in the Lower Rock River have been documented by the IDNR (personal communication with Brian Metzke, IDNR) and are presented in [Appendix C](#). Four state endangered species are included in the Rock River fish inventory: Western Sand Darter (*Ammocrypta clara*), Pallid Shiner (*Hybopsis amnis*), Weed Shiner (*Notropis texanus*), and Lake Sturgeon (*Acipenser fulvescens*). No federally listed fish species or state threatened fish species are known to be present in the project area.

3.4.2 Native Mussels

Forty-five species of mussels have been historically reported in the Rock River basin (Bales et al., 2012). A survey conducted on the Rock River mainstem and tributaries in 2009 found 23 freshwater mussel species to be extant in the mainstem river (Bales et al., 2012) with an additional 10 species encountered and recorded by the Illinois Department of Natural Resources, Division of Natural

Heritage in the lower Rock River of Rock Island County inventory list from 1924 — 2022 (personal communication with Brain Metzke, IDNR). All species documented between these two efforts are summarized in [Appendix C](#). Two of the 33 extant mussel species are state-listed and no species found are federally threatened or endangered.

While no federally endangered species have been recently observed or recorded in the Rock River, the United States Fish and Wildlife Service IPaC (Information for Planning and Consultation; <https://ipac.ecosphere.fws.gov/>) analysis shows three federally endangered mussel species have known ranges encompassing this project area: Higgins eye (*Lampsilis higgensii*), Sheepnose (*Plethobasus cyphus*), and Spectaclecase (*Cumberlandia monodonta*). Based on recent surveys, these three species are likely extirpated from the area.

3.4.3 Riparian Species of Interest

During an assessment of threatened and endangered species, Inter-Fluve identified four other listed species have known or expected ranges within the project area. These species, the Indiana bat (*Myotis sodalists*), northern long-eared bat (*Myotis septentrionalis*), and the rusty patched bumble bee (*Bombus affinis*) are federally endangered, and the eastern prairie fringed orchid (*Platanthera leucophaea*) is federally threatened, see [Appendix C](#) for more discussion.

Considering the habitat observations from the geomorphic assessment (see Section 5) and the habitat requirements of the species listed above, it is unlikely that these species would be found in the immediate project riparian or wetted areas. However, further investigation may be necessary once any specific activities and areas with potential for habitat disturbance are identified.

3.4.4 Summary of Key Wildlife Findings

- The Rock River supports a successful fish inventory of a recorded ninety-four fish species, including nine sport fish species, as described by IDNR-ORC.
- Four state endangered fish are documented (Western Sand Darter, Pallid Shiner, Weed Shiner, and Lake Sturgeon) and no federally listed fish species are known to occur in the Rock River.
- Twenty-three of the historical forty-five species of native freshwater mussels were encountered in the most recent (2012) extensive survey.
- Three federally endangered native freshwater mussel species are known to have ranges in the Rock River (Higgins eye, Sheepnose, Spectaclecase), however, these species have not been encountered in recent surveys and are likely locally extirpated.
- Four federally listed species of riparian fauna (Indiana bat, northern long eared bat, rusty patched bumble bee, eastern prairie fringed orchid) are known to have ranges in the project area and unlikely to be found in the wetted areas of the river.

3.5 Existing Wetlands

A desktop review of the National Wetlands Inventory (NWI) including a review of wetlands using the NWI, hydric soil mapping and aerial photography was performed within a 1,000-foot radius of each dam in preparation for a field investigation of wetlands ([Figure 12](#)). Delineations were performed for three potential wetlands identified from this review ([Figure 13](#)). These three wetlands totaled 2.5 acres and included two emergent and one forested wetland. Several other areas were identified that exhibited wetland characteristics but were not delineated as they fell

below the Ordinary High Water Mark (OHWM). Refer to [Appendix G](#) for the detailed wetland assessment report.

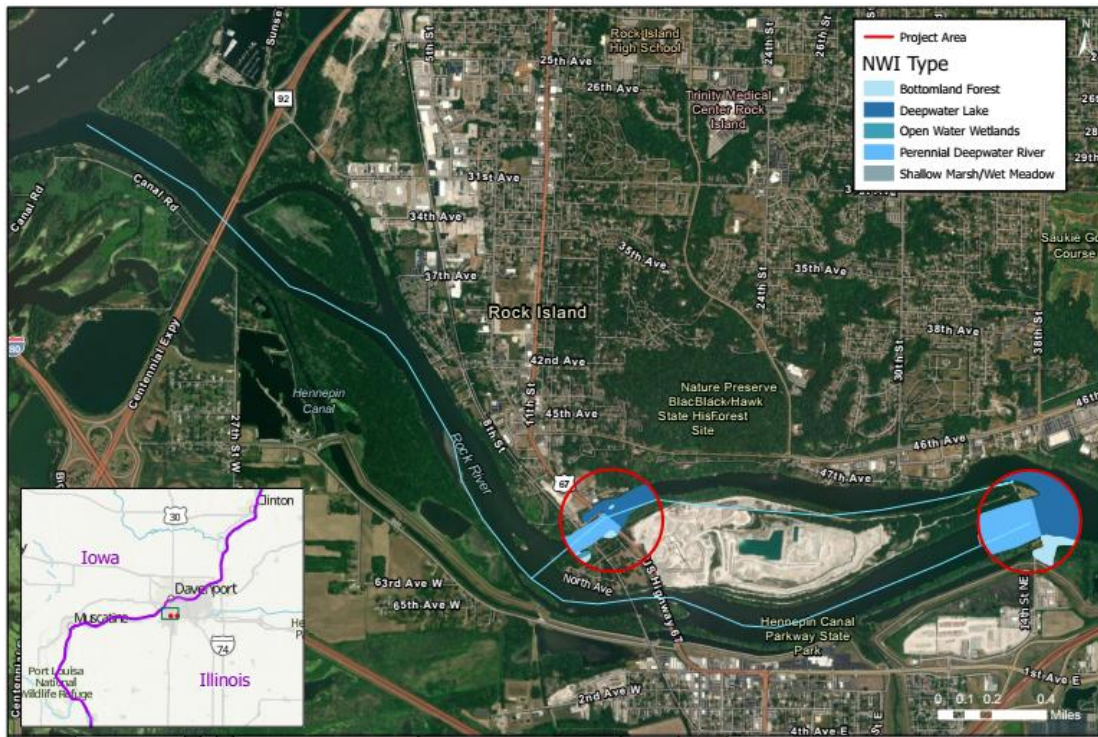


Figure 12 - National Wetlands Inventory (NWI) Wetlands within a 1,000-foot radius of each dam.

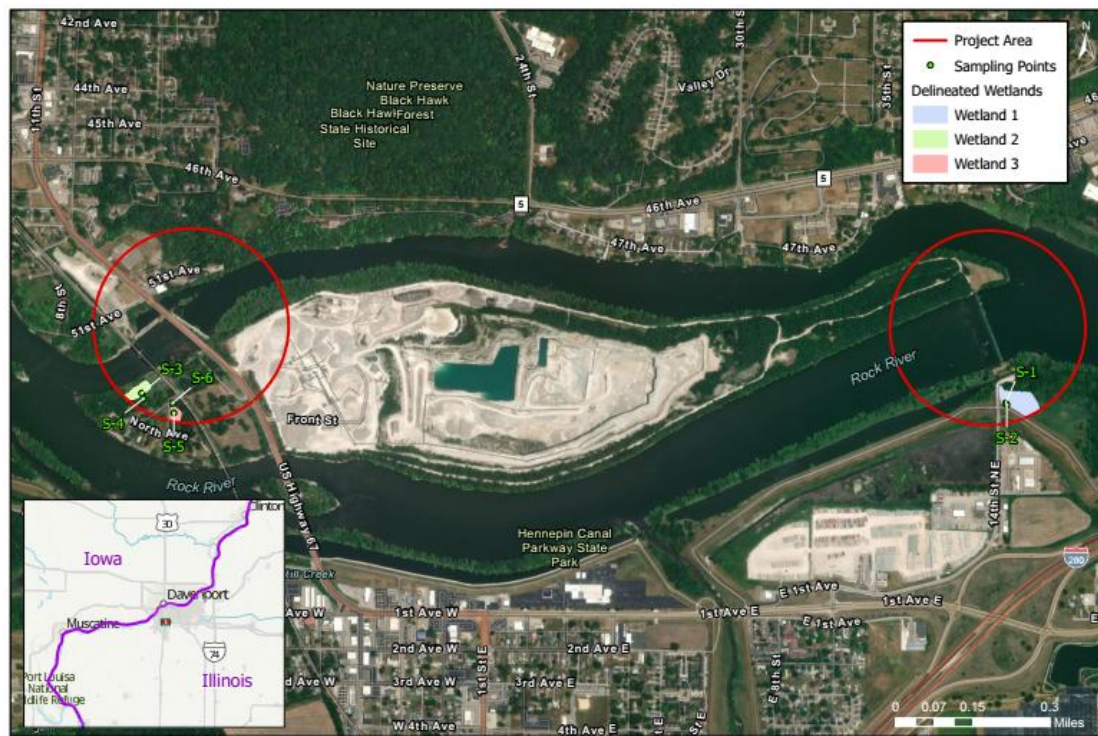


Figure 13 - Wetlands Delineated within a 1,000-foot radius of each dam.

The OHWM within 1,000-feet of the dams was also delineated (Figure 14 and Figure 15). The OHWM was typically well defined by changes in bank slope or vegetation, or by lines impressed on concrete structures. Data points were collected using GPS equipment along the OHWM in areas that were accessible. Some areas were inaccessible due to safety and lack of landowner permission. In these areas, the OHWM was estimated via desktop analysis of Light Detection and Ranging (LiDAR) and other publicly available data.

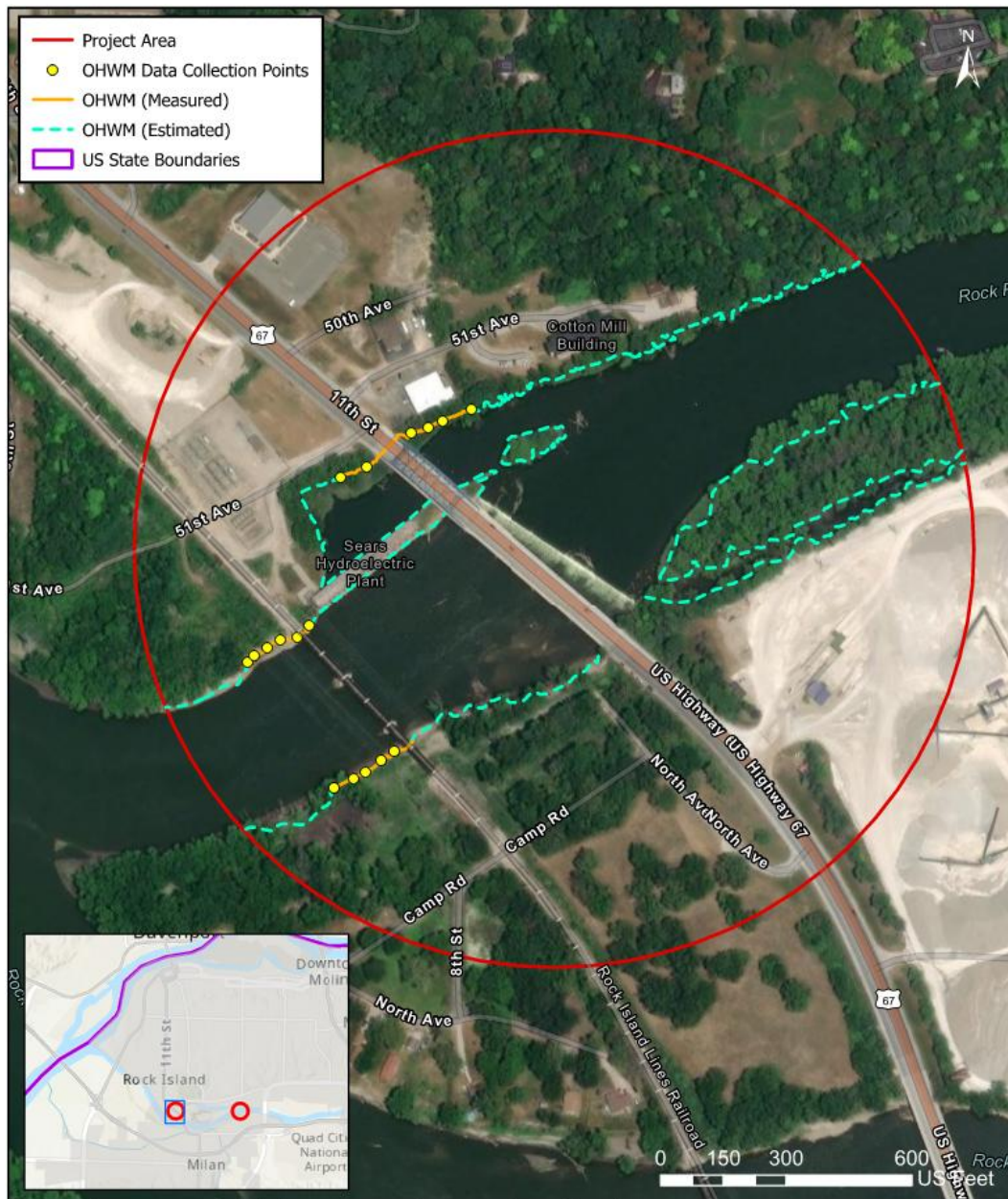


Figure 14 - Ordinary High Water Mark (OHWM) Delineated within a 1,000-foot radius of the Sears Dam.

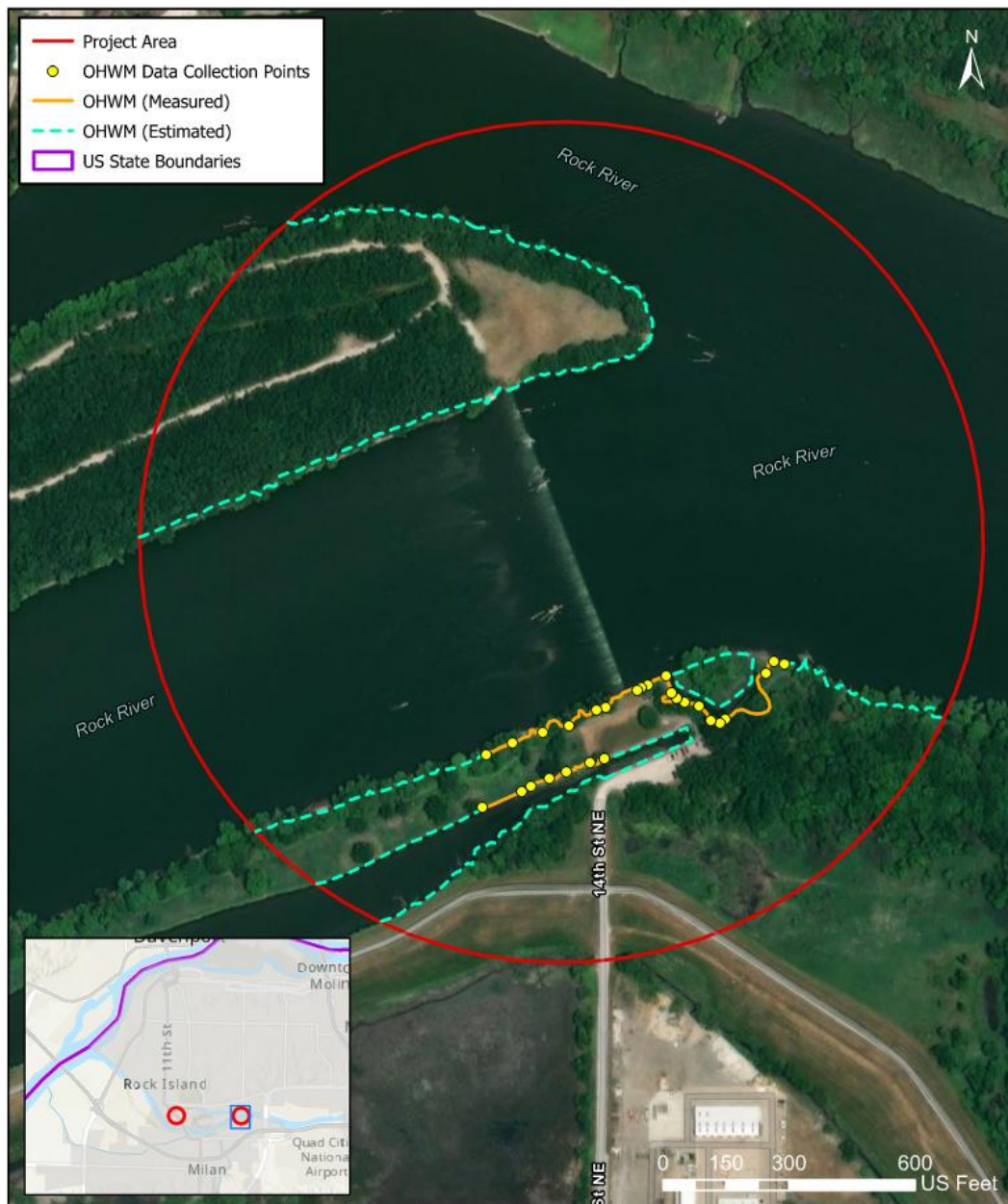


Figure 15 - Ordinary High Water Mark (OHWM) Delineated within a 1,000-foot radius of the Steel Dam.

A desktop review was performed for potential wetlands downstream of the dams to the confluence with the Mississippi River and within 1,000-feet of the Rock River (Figure 16). This review of wetlands that could be impacted by removal of the dams identified 706 acres of wetlands and included lake, riverine, bottomland forest, shallow marsh/wet meadow, open water and shrub-scrub wetlands.

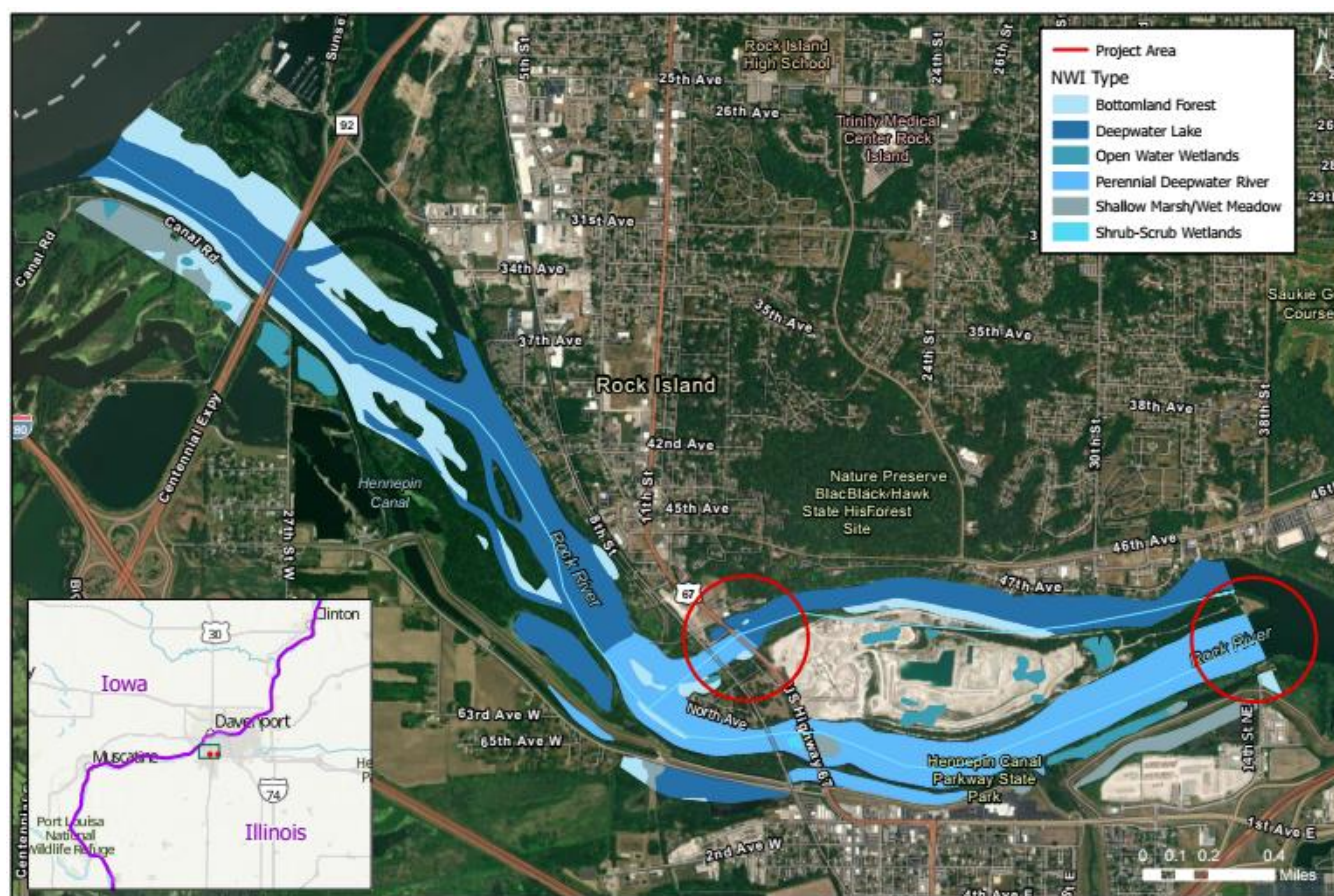


Figure 16 - National Wetlands Inventory (NWI) Wetlands downstream of each dam and to the confluence with the Mississippi River.

Many of these wetlands are likely jurisdictional and would require permitting under Section 404 of the Clean Water Act (CWA) if they will be disturbed. The United States Army Corps of Engineers (USACE) and United States Environmental Protection Agency (USEPA) have the final authority to determine which features are jurisdictional and would need to be consulted prior to any disturbance taking place.

4. Previous Studies

In 2007, the State of Illinois commissioned a report which evaluated the public safety at 25 run-of-river dams across the state, including several on the Fox River and the Sears and Steel dams. The study identified significant hazards posed by these dams, particularly the dangerous hydraulic conditions downstream that can trap even experienced swimmers. It proposed a range of safety improvements, including enhanced signage, public awareness campaigns, and both temporary (e.g., rock fill) and permanent structural modifications (e.g., dam removal, riffle pools, bypass channels). Dam removal was highlighted as the most effective long-term solution for eliminating safety risks, though it was noted to come with high costs and environmental considerations. The report included cost estimates for each proposed intervention and emphasized the need for site-specific planning and stakeholder engagement.

At Sears Dam, the following recommendations were made:

1. Signage Improvements: Installation of warning and informational signage was proposed to enhance public safety. The estimated cost for signage ranged from \$77,000 to \$86,000 [YR 2026: \$143k-\$163k], depending on whether optional signs were included.
2. Temporary Structural Option: Placement of rock fill downstream of the dam was suggested to reduce the formation of dangerous hydraulic conditions (like reverse rollers). This option was estimated to cost \$3.79 million [YR 2026: \$7.20m].
3. Permanent Structural Option: A stepped face modification of the dam was considered the most viable permanent solution, with an estimated cost of \$5.69 million [YR 2026: \$10.8m]. Other options like full bypass channels or instream bypasses were deemed infeasible due to the presence of hydropower operations and lack of available routes.

Dam removal was not considered for Sears Dam, likely due to its role in hydropower generation at the time. With the decommissioning of the Sears Powerhouse Plant in 2020, the primary function of the dams no longer exists and the opportunity to provide modifications for improved safety are being pursued.

For Steel Dam, the 2007 Illinois Dam Safety Report recommended the following public safety measures:

1. Signage Improvements: The report proposed installing warning and informational signage to alert river users of the dangers near the dam. The estimated cost for signage ranged from \$242,000 to \$320,000 [YR 2026: \$460k-\$608k].
2. Temporary Structural Option: Place rock fill downstream of the dam to reduce the formation of dangerous hydraulic rollers. This option was estimated at \$1.67 million [YR 2026: \$3.17m].
3. Permanent Structural Options:
 - a. A minimal canoe chute was considered to allow boaters to bypass both Steel and Sears Dams. A full bypass channel through the adjacent state park canal was deemed infeasible due to hydropower constraints.
 - b. A riffle pool rock ramp was estimated to cost \$4.77 million [YR 2026: \$9.06m].
 - c. Instream bypass and dam face modification options were not considered viable, primarily due to their impact on upstream pool levels and hydropower operations at the time.

These recommendations reflect a balance between improving public safety and maintaining existing hydropower functionality. Safety signage is currently present at the dams, but structural modifications were not pursued.

5. Geomorphic Assessment

This section presents the results of a semi-quantitative geomorphic reconnaissance assessment conducted by Inter-Fluve to evaluate the physical characteristics and stability of the Rock River channel within the project area surrounding the Sears and Steel Dams. Details are available in [Appendix C](#).

Reconnaissance was completed on foot and via small boat, and included observations of bank stability, channel bed material, depositional and scour features, habitat, and riparian vegetation. The assessment was conducted on June 13-14th, 2024. This assessment divides the Rock River within the project area general limits of impoundment into five sub-reaches ([Figure 17](#)):

- Reach 1 extends from the Sears dam to the eastern end of Vandruff Island. This reach is composed of Rock River branch north of Vandruff Island. (Station 24+00N to 115+00N)
- Reach 2 extends from the Highway 67 bridge to the Steel Dam is composed of the Rock River branch on the south side of Vandruff Island. (Station 154+00 to 231+00)
- Reach 3 extends from the upstream end of Vandruff Island to the Milan Beltway bridge. (Station 231+00 to 263+00)
- Reach 4 extends from the Milan Beltway Bridge to the I-74 bridge. (Station 263+00 to 380+00)
- Reach 5 (beyond project area) extends from the I-74 bridge to the I-80 bridge. (Station 380+00 to 909+40)

Note: Stationing (STA) terminology refers to the distance from the downstream confluence in 100' increments, e.g., 12+00N means 1,200 feet away from the confluence.

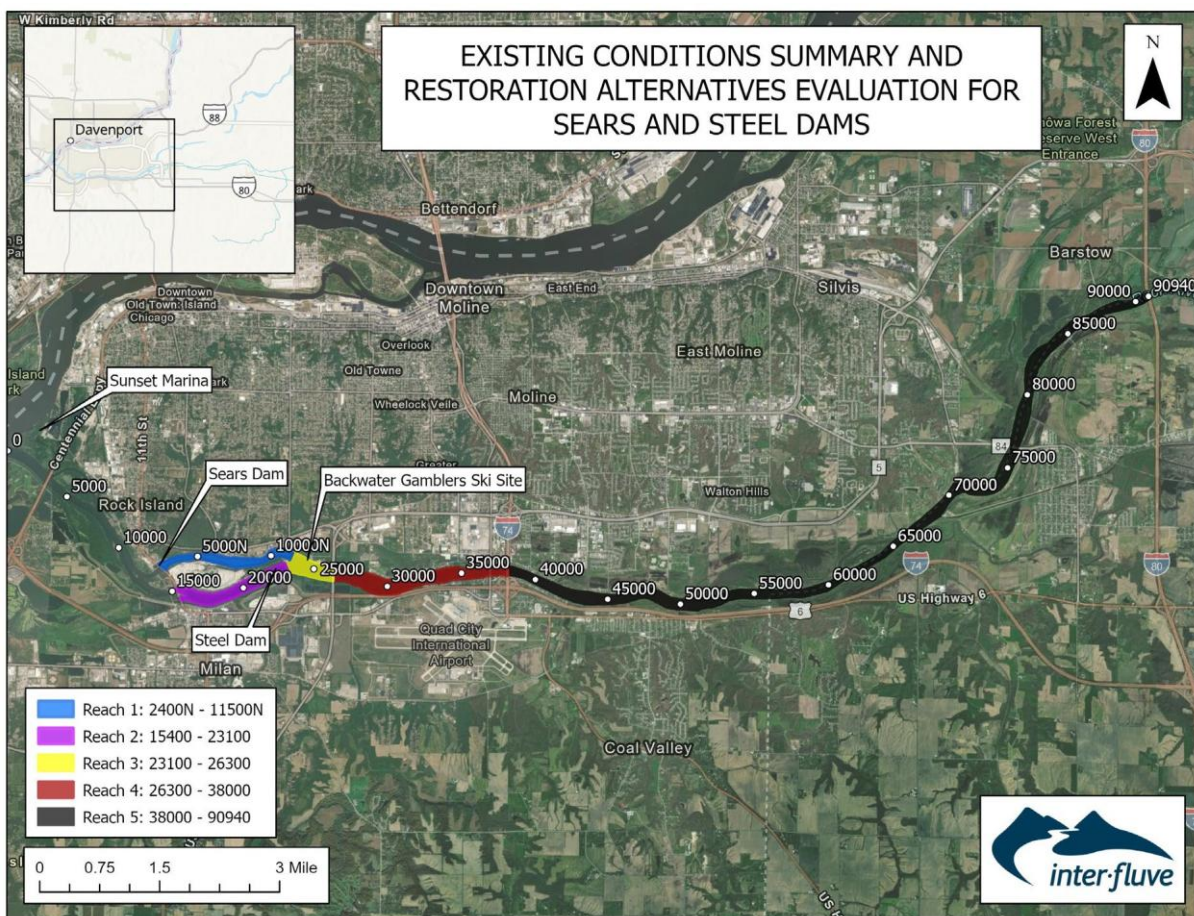


Figure 17. The five reach sections of the Rock River used for the geomorphic assessment.

The Inter-Fluve team accessed the Rock River at Ben Williamson Park launch and conducted a boat reconnaissance of the channel from Sears Dam to just upstream of the I-74 Bridge. The area within 1,000-feet of the Steel Dam was not traversed for safety reasons. Flow at the time of survey was approximately 12,300 cubic feet per second (cfs), roughly 1.5-feet above median flow for June 13th (based on the 24-year period of record) and 5-feet higher than on the same date in 2023 (Byron USGS gauge 05440700).

The Sears Dam ([Figure 18](#)) was viewed from the Fraternal Order of Eagles parking lot on 51st Avenue, as well as from the Hwy 67 (11th Street) Bridge. The Sears Dam, including the mill building remnant and bridge abutment, spans 934 feet, with the spillway spanning 457 feet. The Steel Dam ([Figure 20](#)) was viewed from the left dam abutment. The Steel Dam spillway spans 776 feet. The upstream impoundment is held back by the two dams and Vandruff Island.

Reconnaissance was conducted by car and on foot for areas downstream of the dam spillways to the confluence with the Mississippi. Flow velocities downstream of Steel and Sears Dams were too high to allow for safe access via boat.

Periodic probing of depths and sediment thickness/composition was completed using flexible depth of refusal rod at selected sites. This probing was performed to inform the geomorphic assessment, but full depth of refusal (DOR) measurements were completed by the IDNR-OWR on August 29-30, 2023, and June 11-13, 2024, and September 11, 2024. The IDNR-OWR DOR data was used in the analysis and quantification of moveable bed material. Observations were made regarding stabilized banks (e.g. riprap), bank stability, vegetation, and channel bed features.

5.1 Reach 1

Highway 67 bridge is located immediately downstream of Sears Dam. The dam is located between river left and a multipurpose mill building (circa 1838) parallel to the river right bank. Large wood accumulations were present along the top rim of the dam, and photographs suggest the large wood was present in greater abundance than in past years. The channel on the northern side of Vandruff Island has widths ranging from 600-feet at the dam to 284-feet at bedrock outcrops on river right 2,200-feet upstream of Sears Dam. Water depths range from approximately 5-feet to 12 feet. The dam is situated at the base of a moderately steep riffle section of the North Channel. This riffle had a pre-dam slope of approximately 0.28% with its crest roughly 5,000-feet upstream of the dam, midway along Vandruff Island ([Figure 19](#), FEMA 2010). The upper half of the North Channel flattens out to a plateau-like riffle feature with its crest at roughly the same elevation as the base of the adjacent Steel Dam (553 feet.)



Figure 18: Sears Dam, looking from river right on Highway 67. June 13, 2024. 41.461637, -90.578965.

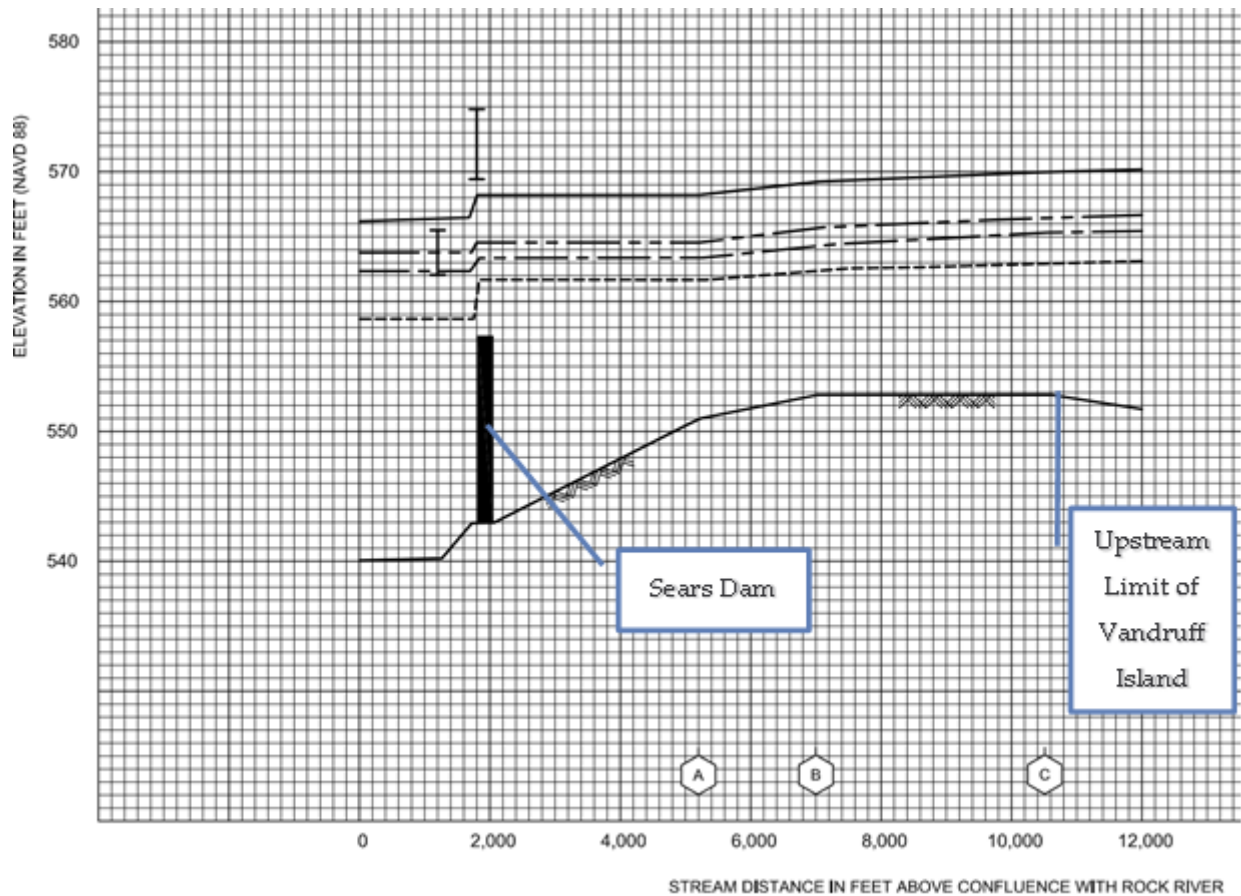


Figure 19. Flood Insurance Study profile (FEMA 2010) showing the elevation of channel bed features and the Sears Dam in the vicinity of Vandruff Island.

Fine sediment such as sand and clay travels further in impoundments and is often concentrated closer to the dam spillway. Inter-Fluve probing and IDNR-OWR DOR surveys revealed sediments within 1,000-feet of the Sears Dam are primarily silt from 4- to 8-feet in thickness above a pre-dam gravel bed. Upstream of STA 35+00N to the upstream end of Reach 4, the river bottom is predominantly sand, varying in thickness from 1-3 feet.

Reach 1 sediment deposition varies, with the deepest fine sediment deposits from STA 25+00N to 45+00N (upstream of Sears Dam), and in the backwater channel near the mill building. Sand deposits of 1- to 4-feet in thickness are present along the channel center and right bank from the tributary outlet delta at 60+00N to the upstream head of the island. Sand bars are identifiable from aerial photos by the location of large wood deposits lodged in the sand.

The river right shoreline between the Sears dam and 38th Street (STA 25+00N to 105+00N) is bounded by a 100-foot-tall bluff area sloping steeply toward the south and terminating in the river, sometimes with vertical limestone outcrops. A floodplain bench is present along the base of the bluff, with a small housing development along 47th Avenue east of 24th Street (STA 60+00N). The riparian area is forested between the dam and 24th Street, dominated by large silver maple, red oak, and catalpa overstory trees and an understory of reed canary grass and shrubs.

The Vandruff Island north bank varies from 8- to 15-feet in height. The island riparian area is naturally vegetated but includes invasive shrubs such as bush honeysuckle and buckthorn. The upper canopy is mature with overstory trees similar to the right bank of the channel. Woody debris is present in low density along the island's bank.

Banks are stable throughout the reach. Island side banks have mature trees with thick root systems, whereas the right banks are stabilized with vegetation, bedrock outcrops, and artificial toe stabilization such as riprap and seawalls. Approximately 63% of the Rock River in Reach 1 is developed, primarily with residential housing. A few properties contain no artificial armoring.

5.2 Reach 2

Due to high water, the river channel on the south side of Vandruff Island between the Sears and Steel dams was accessible only by foot along the Hennepin millrace canal. The river left bank is stable and naturally vegetated with cottonwood, black walnut, white oak, and hawthorn as the dominant canopy trees.

Understory vegetation includes dogwood, sumac, and service berry, sedges, poison ivy, milkweed, Canada thistle, goldenrod, and invasive buckthorn. Banks are 7- to 10-feet high, with steep upper banks that taper at the toe. Cottonwood, black willow, and other trees provide stabilizing root systems. The right bank (north) of the channel appears to be stable, but high water prevented inspection of the channel toe.

Mill Creek (STA 217+00) enters this reach from the south, midway between Hwy 67 and the Steel Dam. The historic Hennepin Canal runs along the left floodplain but is interrupted by the Mill Creek crossing and confluence. The Hennepin Canal Trail berm runs south of the canal from the Rock Island-Milan Parkway to 27th Street West. (DOR readings in this Reach were delayed due to the high-water conditions.) The banks in Reach 2 are undeveloped with natural cover along the quarry bounding to the north and Hennipen Canal to the south.

5.3 Reach 3



*Figure 20. Steel Dam, looking from river left across towards Vandruff Island.
June 13, 2024. Location: 41.459772, -90.547531*

The Steel Dam (STA 231+00) is situated on the mainstem of the rock river, just downstream of the head of Vandruff Island at the crest of a riffle ([Figure 21](#), FEMA 2010). At the eastern (upstream) head of Vandruff Island, starting upstream from Steel Dam to the Rock Island-Milan Beltway bridge (STA 234+10), the channel widens to approximately 900- to 1200-feet as this area starts the split flow around Vandruff Island. Bed sediments are approximately 1-3 inches of sand, fines, with mud and gravel mix on top of refusal. Sediment depths increase upstream toward the Milan Beltway

bridge. A relic side channel remains open on river right from Station 255+00 at the Backwater Gamblers Waterski area to 285+00 in Reach 4.

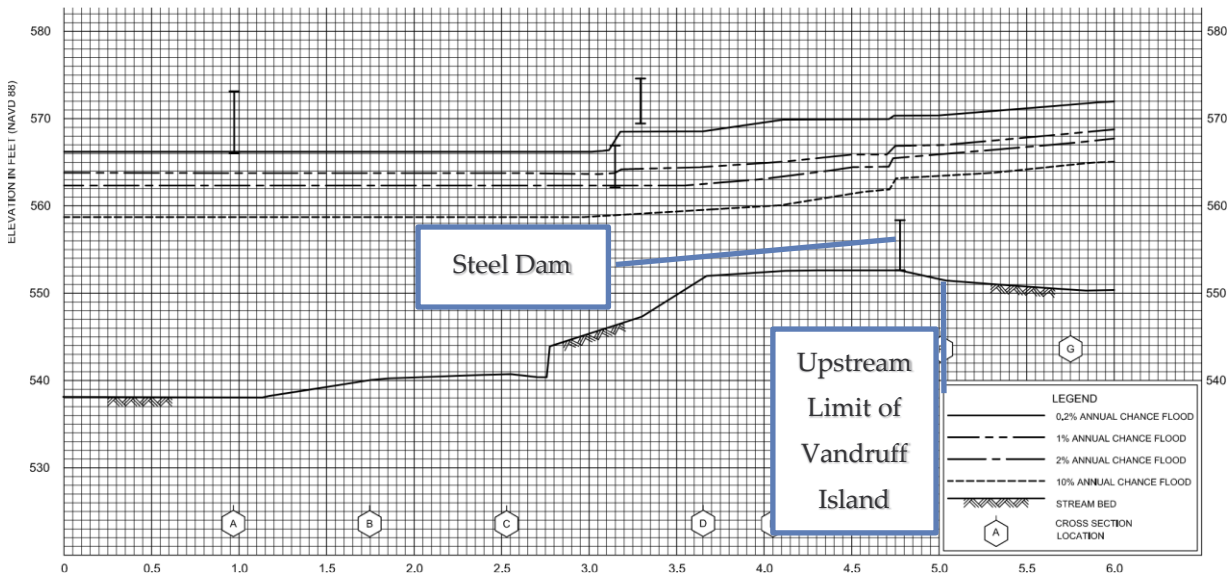


Figure 21 - FEMA Flood Insurance Study profile showing the elevation of channel bed features and the Steel Dam in the vicinity of Vandruff Island.

Apart from the waterski facility area, river left (south) and right (north) banks are swamp (forested wetland) dominated, with a silver maple dominated canopy over invasive reed canary grass understory. Ben Williamson Park covers approximately a 900-foot stretch in this reach with heavy foot traffic and a boat launch. The riverbank in the park/waterski area is low and armored by concrete and riprap.

A natural gas pipeline crossing is visible on the right bank shoreline at Station 245+00. Power lines cross the river at Station 112+50N at the head of Vandruff Island – neither are expected to impact construction. Reach 3 is undeveloped along the river outside of Ben Williamson Park.

Probing corroborates OWR depth of refusal data, and Inter-Fluve found a thin veneer of sand between 0-4-feet in thickness. No significant large wood accumulations were noted.

5.4 Reach 4

The reach between Rock Island-Milan Beltway bridge upstream to the I-74 bridge (STA 379+00) becomes narrower than the downstream reaches. Channel width varies from 600 – 1000 feet. River right upstream from the Milan Beltway bridge for approximately 2,000-feet has stable but slightly undercut banks with mature forested wetland dominated by silver maple canopy and an understory monoculture of reed canary grass. Large wood is present along the right bank shoreline.

A relic side channel remains open on river right from Station 255+00 at the Backwater Gamblers Waterski area to 285+00 in Reach 4. This small side channel is part of a larger relic meander still present as wetlands north of North Shore Drive to 16th Street.

Probing corroborates IDNR-OWR depth of refusal data throughout the reach, and Inter-Fluve found a thin veneer of sand between 0- to 2-feet in thickness. Water depths at the time of survey ranged from 6.0 to 8.0 feet.

Approximately 65% of the Rock River in Reach 4 is developed, primarily with residential housing. Banks are riprap or sea walls, most with lawns maintained to the shoreline and few canopy trees. Banks vary up to 12-feet from top of bank to toe of slope, with top of bank typically 4-5 feet above impoundment water level.

5.5 Reach 5

This reach is 7.3 miles long, extending from I-74 to the I-80 bridge (STA 379+00 to 909+40). From I-74 to Green River Park (STA 424+00), the channel is mostly armored with riprap or concrete sea walls to protect homes and roads. Upstream of Green River Park, the channel is bounded by primarily natural, but stable shoreline. The post-glacial valley bottom is over a mile wide and is encroached partially by Highway 5 to the north and I-280 to the south.

Sediment input from upstream and the Green River have created a wide, low floodplain that is frequently inundated. This floodplain area contains relic channel segments, sloughs, and an active side channel. The Green River (STA 666+20) enters the Rock River just downstream of the Illinois & Mississippi/Hennepin Canal terminus, across the Rock River from TPC Deere Run Golf Club. Sediment movement through this reach is likely impacted by the backwater from the Sears and Steel dam complex, which has a normal pool elevation near Elevation 560. This elevation corresponds to the FEMA FIS study channel bottom elevation found in the I-80 area.

Banks are sand and sand loam and stable but vary in width from 580 feet to as wide as 900 feet. Bank morphology, riparian vegetation and channel bed material are consistent with Reach 4, with the bed being predominantly sand with some fines and gravel present. Sediment depths measured by IDNR-OWR (2024) between Bowles Slough and the Green River confluence average 1.5-feet, with a maximum measurement of 4.3-feet. This reflects both a potential topset delta of the dam impoundment as well as deposited sediment from the Green River. The deposited sediment would have a fraction that originates from the upstream Rock River reaches, but clearly the Green River has a strong influence on deposition in this area. If the dam complex was not present, sediment depths would likely be reduced as more Green River sediment would mobilize downstream.

5.6 Summary of Key Geomorphic Findings

Key findings of the geomorphic assessment are summarized as follows:

- Sand bars are present near tributary confluences and on the inside of meander bends. Large wood accumulations are common in these areas, but ephemeral. There is currently more wood in the channel than is visible in aerial photos since 2000.
- Desktop and field geomorphic assessment suggests that the banks are stable, with little or no change observed in the past 30 years. Stability is due to artificial stabilization (riprap and sea walls), bedrock outcrops, and native stabilizing vegetation.
- Residential areas are armored with riprap and sea wall treatments of varying materials and quality. These areas have no riparian habitat value and limited green canopy.

- Reaches 1-4 have a total of 13 miles of shoreline, roughly 3 miles is developed shoreline (25%). The rest is riparian forest varying in width from 20 feet along Hwy 280 to 1800 feet in Ben Williamson Park. Reach 5 has 14.6 miles of shoreline, with roughly 23% developed, including the TPC Deere Run property shoreline (6,000 ft).
- Roughly 75% of the shoreline in the study reach has a natural riparian area, dominated by cottonwood and silver maple overstory, shrub understory and in the case of lowland areas, reed canarygrass marsh/swamp.
- Banks vary in height and morphology, but in natural areas are well vegetated and root stabilized. Some areas had stabilized toes, but high water prevented us from seeing down to the actual river toe.

6. Impounded Sediment Assessment

Impounded sediment can be a significant cost and schedule driver for dam removal projects, particularly where fine-grained material is stored behind a structure and permitting requires evaluation of sediment quality and potential downstream effects. This chapter summarizes the estimated quantity, distribution, and quality of sediment impounded upstream of the Sears and Steel Dams, and highlights considerations for sediment management and permitting. Detailed methods, datasets, and laboratory results are provided in [Appendix C](#) and the supporting technical documentation referenced therein [Appendix D](#).

6.1 Impounded Sediment Quantity

IDNR-OWR completed DOR probing (2023–2024) and associated bathymetric surveying (June 2024) within the impoundment upstream of the Sears and Steel Dams to the I-80 bridge. DOR measurements estimate sediment thickness by comparing the surveyed channel bed elevation to the elevation of a deeper “refusal” surface (interpreted as a more competent pre-dam substrate such as gravel/cobble/bedrock). These data were used to (1) develop a reach-scale estimate of sediment thickness and volume and (2) inform sediment sampling locations. Detailed methods and assumptions are summarized in the appendices.

Using GIS-based surface comparisons of bathymetry and DOR-derived refusal elevations, the volume of impounded sediment in the surveyed reach (dams to I-80 bridge) is estimated at ~4,300,000 cubic yards. The average fines fraction is 25% establishing ~1,100,000 cubic yards of fine material. This is a planning-level estimate: it reflects interpolation between discrete survey points, excludes potential overbank/vegetated deposits and any material upstream of the survey limits, and is sensitive to areas where refusal could not be reached within the probe length.

DOR and probe results indicate that sediment texture and thickness vary along the impoundment ([Figure 22](#)). The deepest fine-grained deposits are concentrated nearest the Sears Dam, transitioning upstream to generally thinner, sand-dominated deposits (e.g., a sand “veneer” upstream to approximately Veteran’s Memorial Park). Sand deposits of up to about 8 feet were measured in portions of the reach between Veteran’s Memorial Park and Hwy 84. At a reach scale, the dams create low-flow backwater conditions that can extend several miles upstream, but separating dam-related deposition from naturally depositional river segments is uncertain; historic mapping and geomorphic indicators suggest parts of the reach have long been depositional.

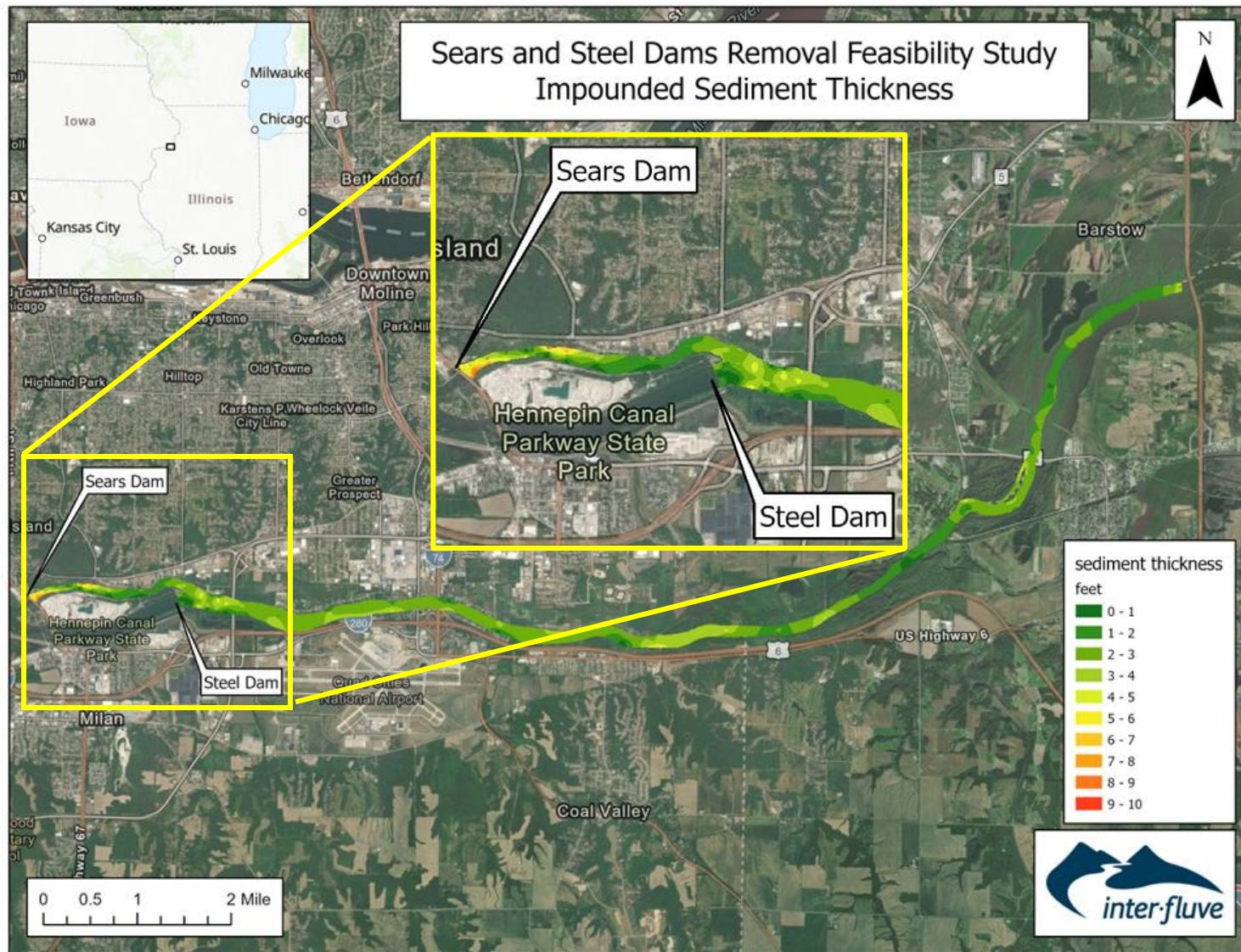


Figure 22. Sediment Thickness Map for Sears and Steel Dam impoundments to the I-80 bridge.

Using the bathymetric and DOR survey data, Inter-Fluve created cross-sections and longitudinal profiles of the existing river channel and underlying refusal surfaces. The longitudinal profile is broken into two sections, the North Channel (impoundment upstream of the Sears Dam) and the South Channel profile (upstream and downstream from the Steel Dam). These two longitudinal profiles are shown in [Figure 23](#) and [Figure 24](#).

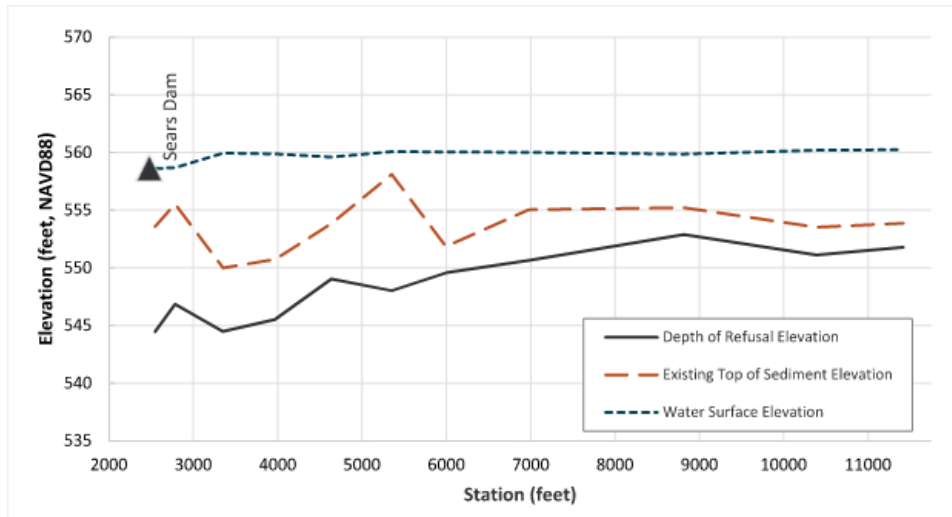


Figure 23. North Channel Rock River Longitudinal Profile.

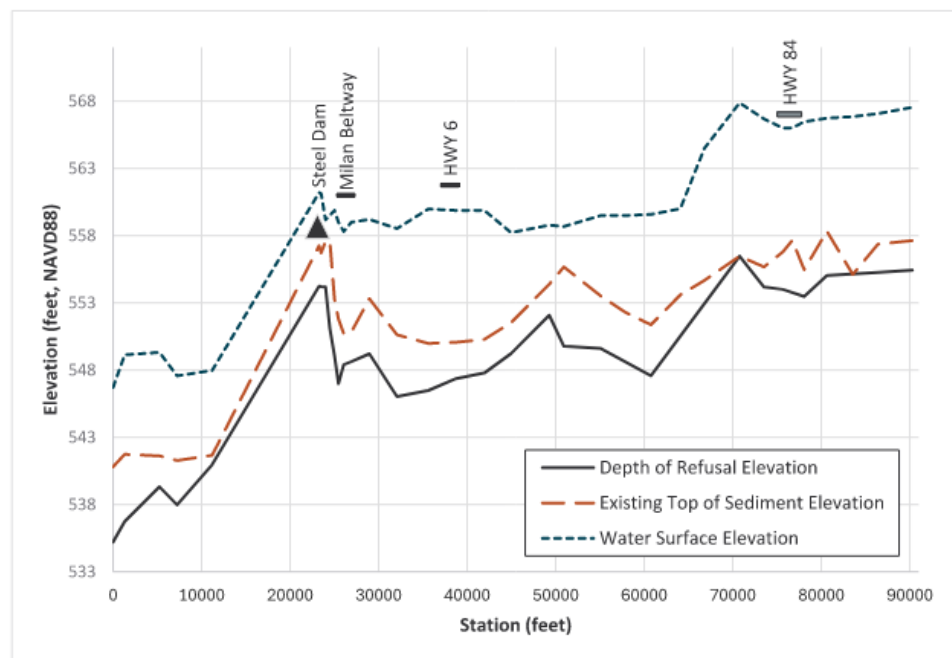


Figure 24. South Channel Rock River Longitudinal Profile.

Longitudinal profiles show the thickest accumulation in the North Channel within roughly the first mile upstream of Sears Dam (commonly exceeding 5 feet), with more consistent 2–3 foot thickness farther upstream. Along the main channel, sediment thickness is generally on the order of 2–5 feet through much of the lower impoundment, with more variable and locally thin deposits in the upstream third of

the evaluated reach. Downstream of Steel Dam there is little sediment accumulation due to high velocities resulting in exposed refusal surface.

Four representative cross sections are shown in [Figure 25](#) to highlight the range in channel and sediment accumulation characteristics at different sections of the impoundment. Cross sections (XS) indicate that accumulation patterns vary laterally and by reach:

- XS 27+84: the area immediately upstream of Sears Dam represents a higher-accommodation zone for greater sediment storage.
- XS 232+71: the reach near Steel Dam shows localized accumulation in the deeper channel portion with thinner deposits elsewhere.
- XS 289+51: wide portions of the lower impoundment commonly have 2–4 feet of sediment across much of the channel bottom.
- XS 668+00: displays a thin sediment layer representing transitional load in the upper impoundment.

For sediment management, these patterns suggest that (1) fine/thick deposits nearest Sears Dam warrant the greatest attention for turbidity control and potential handling, while (2) much of the remaining reach is dominated by sandier, more evenly distributed material.

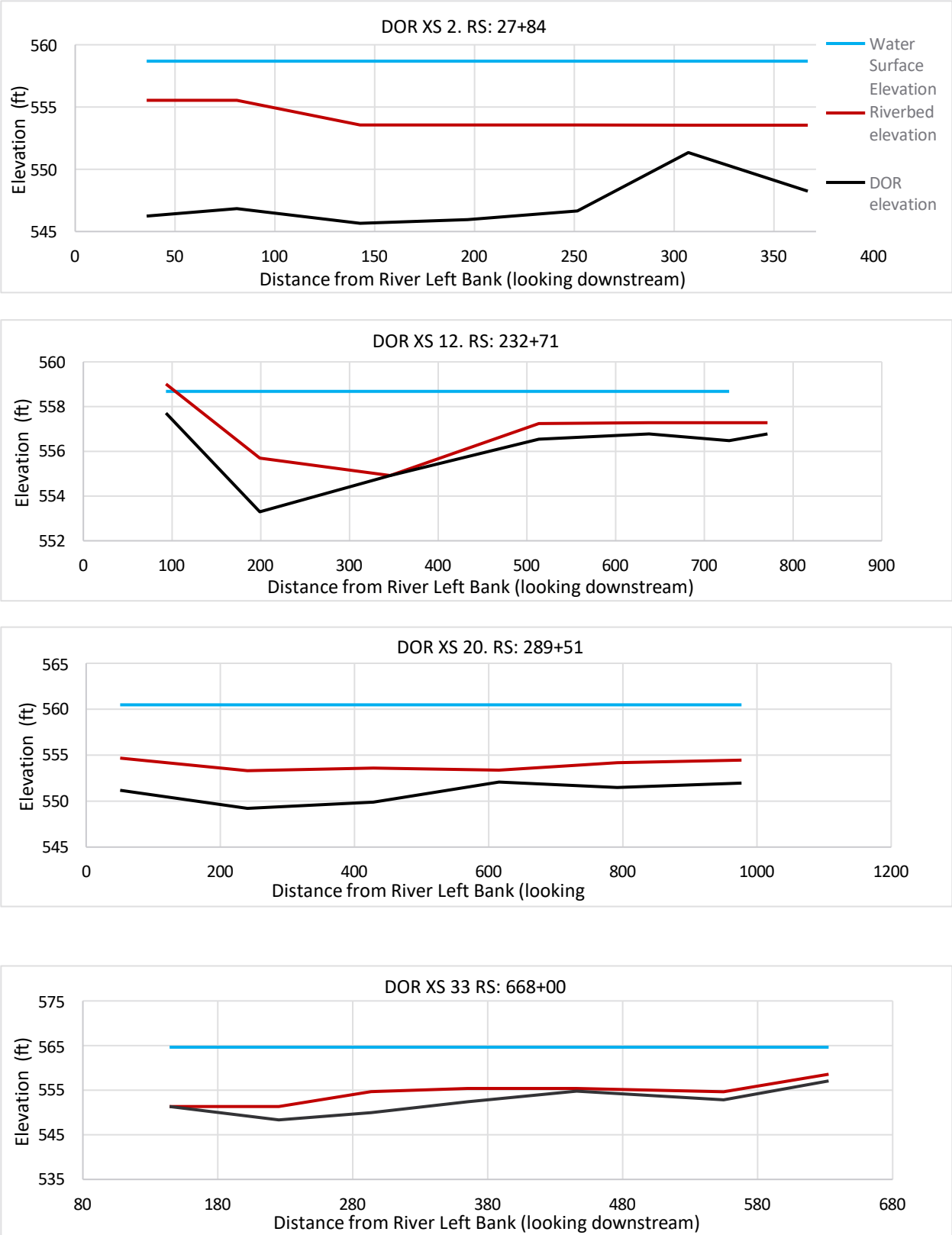


Figure 25 - Select cross section profiles of the Rock River within the project area showing water surface elevation, riverbed elevation, and DOR elevation.

6.2 Impounded Sediment Quality

6.2.1 Sediment Sampling

Sediment contaminant sampling was conducted by EnviroScience in spring of 2025, with methods detailed in the Sediment Sampling and Analysis Plan (Enviroscience 2025) and results were summarized in a draft report prepared for IDNR-OWR (Enviroscience 2025, see [Appendix D](#)). On March 11-13, 2025, EnviroScience conducted vibracore sediment sampling, supernatant, and water sampling at ten sampling locations on the Rock River ([Figure 26](#)). Nine of the ten sample locations were collected upstream of the Sears and Steel dams, with one sample location located directly downstream of the dams. [Table 1](#) shows the results of the testing and comparison to the relevant standard. Refer to [Appendix D](#) for details of sediment sampling, laboratory testing and detailed results.

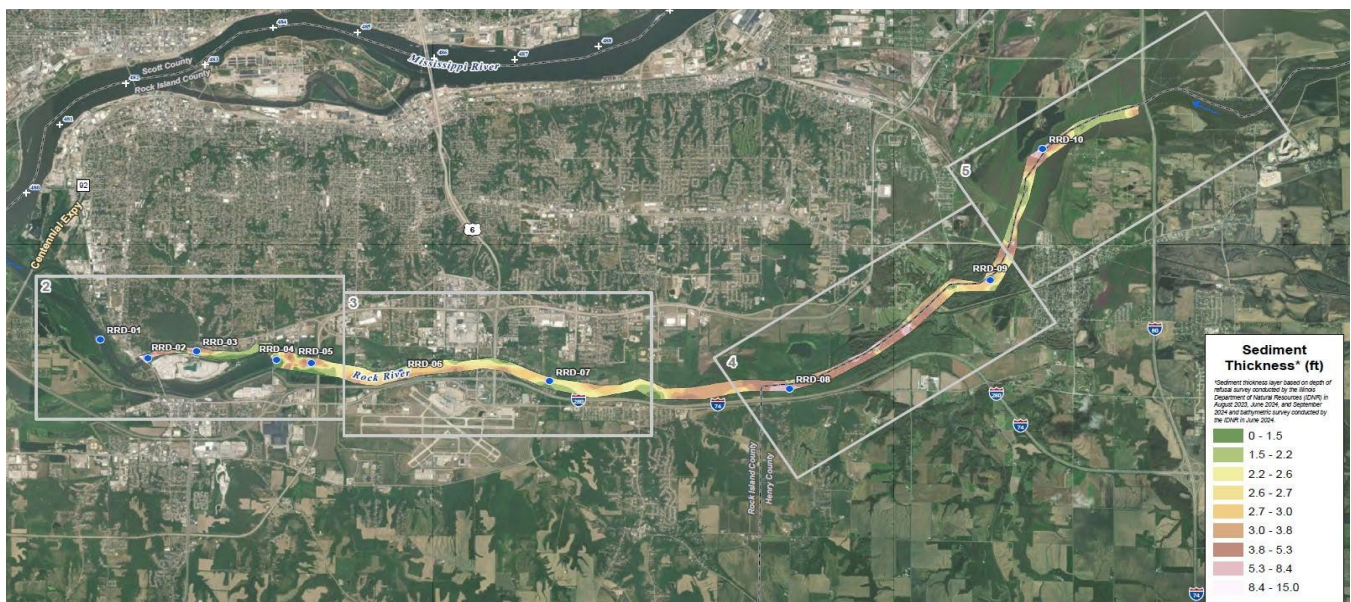


Figure 26 - Excerpt from Enviroscience (2025) report showing sediment core locations (blue dots) within the project reach. See EnviroScience (2025) for detailed maps.

- Nine sediment cores, RRD-02 through RRD-10, were retrieved from the Rock River upstream of the Sears and Steel Dams.
- Samples RRD-10, RRD-09, RRD-08, RRD-07, RRD-06, RRD-05, and RRD-03 were collected as supernatant samples with both sediment cores and five gallons of site water being collected from each site location.
- Samples RRD-04 and RRD-02 were collected as sediment samples with no water samples being collected.
- Sample RRD-01 was originally proposed as a supernatant sample with additional receiving water samples. However, no sediment was found at the sample site. Receiving water samples were collected.

6.2.2 Analytical Testing

Sediment samples underwent grain size determination and chemical analysis. Grain size distribution, hydrometer, and Atterberg limits analyses were completed under ASTM D422, C136, and D4318 specifications and characterized by sieve analyses to determine coarse fractions and percent fines. Grain size distribution analyses were performed by Terracon of Parma, Ohio. Sand/fine split analysis were completed under ISW SOP No. Sed. 4 method and were performed by the University of Illinois. Sediment chemical analysis was compared to the Maximum Allowable Concentration (MAC) Standards. This is the maximum concentration of a chemical constituent permitted in soil (or fill material) for it to be considered uncontaminated and eligible for use in regulated fill operations.

Supernatant parameters that were analyzed included those detailed in *Appendix A* of the Illinois Environmental Protection Agency, Bureau of Water Section 401 Water Quality Certification circular entitled *Material Analysis for Dredge and Fill Activities* as well as those added through personal communication with IEPA staff (Gove 2025 pers. comm). Analytes included metals (As, Ba, Cd, Cr, Cu, Fe, Pb, Mn, Ni, Se, Ag, Zn), hexavalent chromium, mercury, ammonia, fluoride, oil and grease, phenols, PCBs, Total Volatile Solids, and the 303(d) listed pesticides Aldrin, Dieldrin, Endrin, Heptachlor, Mirex and Toxaphene. Additional parameters for water and supernatant samples included pH, hardness (Ca and Mg calculation), and Total Suspended Solids. Chemical analysis was performed by Eurofins of Pittsburgh, Pennsylvania. In addition to comparing to the *Appendix A* thresholds, the supernatant results were also compared to the recommended IEPA 401 Water Quality Certification (WQC) values for aquatic life standards.

6.2.3 Analytical Results Summary

Sediment Grain Size:

Grain size distribution analysis performed on the nine sample cores revealed that all samples were predominantly composed of silty sand or clayey sand. The Sand/Fine Split Report from the University of Illinois is included in EnviroScience's 2025 report entitled "Rock River Sediment Analysis" (see [Appendix D](#)). Based on the average sand fraction (74%), average fines fraction (25%), and average gravel fraction (1%) from the 9 samples tested for sieve analysis, it could be approximately estimated that of the 4.3 million cubic yards of impounded sediment, approximately 1.1 million cubic yards are fines. However, it should be noted that this estimate is based on a limited number of samples and that results are extrapolated to a much larger volume than sampled.

Sediment Chemical Analysis:

The sediment chemical testing results were compared to the Maximum Allowable Concentration (MAC) Standards as directed by IEPA. There was only one chemical MAC exceedance - total Iron in sample RRD-02. Illinois DOT Specifications for Road and Bridge Construction (adopted January 1, 2022) Article 669.05 describes how regulated substances are to be handled for disposal. Hanson believes that there are insufficient sediment samples to make a statistical evaluation of background concentrations to show that the Iron exceedance at RRD-02 falls within the 99% confidence limit to prove its concentration is within the sediment background range of concentrations (Article 669.05(a)(1)). Additional sediment background samples may not indicate Iron contamination.

However, based on the limited data available the Iron concentration does lie above the maximum concentration for location within a Metropolitan Statistical Area (MSA) and for locations outside an

MSA. This means the sediments removed during construction activities could not be used as IDOT right-of-way fill or other backfill or cannot be disposed at a clean construction and demolition debris (CCDD) facility. (Article 669.05(a)(2) and (3)). Without the additional sediment samples to evaluate the background concentration of Iron, the only disposal alternative is to dispose of the sediments as a non-special waste or special waste (depending on its characteristics) at a landfill (Article 669.05(a)(5) or (6)). It is understood that Illinois MAC standards (per Illinois EPA 35 Ill. Adm. Code 1100 SubpartF) will be used to determine whether any material removed during construction qualifies as CCDD or requires special handling or disposal.

Supernatant:

When compared to the water quality thresholds from ILEPA 401 WQC - *Appendix A*, the supernatant exceeded levels for a variety of parameters as follows:

- RRD 03, 05, 06, 07, 08, 09, and 10 for Fluoride, Iron, Manganese and Mercury
- RRD 06, 07, 09, and 10 for Copper
- RRD 03, 05, 06, 07, 08, and 09 for Oil and Grease
- RRD 06, 09, and 10 for Zinc
- Ammonia Nitrogen (as N) for all supernatant samples.

For additional comparison, the Illinois Environmental Protection Agency (EPA) 401 WQC values are the minimum concentration that must be met in testing and the 35 Illinois Administrative Code (IAC) 302 acute and chronic are the general water quality standards for aquatic life. The supernatant results only had three samples, RRD-07, RRD-06, and RRD-03, that exceeded the 35 IAC 302 chronic standard for Ammonia, but did not exceed the maximum allowable Ammonia concentration of 15 mg/L.

Conclusions:

This round of testing was performed to better inform what additional testing, if any, is required to satisfy the IEPA 401 water quality certification requirements if this project is pursued. Testing areas will be further refined using a combination of sediment transport modeling, the DOR results, and further grain size testing to better define areas of potential erosion in the riverbed. IEPA is only concerned about the material where particle or grain size analysis shows 20% or greater passage of material through a #230 US sieve (i.e., fines). In future sampling, only those locations where that finer material and erosion occur will require additional chemical analysis.

Key results of the contaminant analysis are summarized as follows from [Appendix D](#):

Sediment

- Sediment cores RRD-2 and RRD-4 did not exceed the lowest ILEPA MAC thresholds for any of the analytes tested except for a slight Iron exceedance.

Supernatant

- Supernatant water quality thresholds from ILEPA 401 WQC - *Appendix A* were exceeded in various samples for: Fluoride, Iron, Manganese and Mercury, Copper, Oil and Grease, Zinc and Ammonia Nitrogen (as N).
- The Supernatant water sample concentrations did not exceed any of the available listed EPA SQRT thresholds for Freshwater surface water acute exposure for any of the analytes.
- The EPA SQRT threshold for groundwater was exceeded by iron in Supernatant samples RRD 03, 05, 06, 07, 08, 09, and 10.

- Organochlorine pesticides were not detected in any supernatant samples.
- PCBs **were not detected** in any supernatant samples.

Table 1. Supernatant and Sediment Sampling and Analytical Plan

Media	Supernatant										Sediment			
Applicable Standard	IEPA 401 WQC (1)	35 IAC 302 (acute)	35 IAC 302 (chronic)								TACO Residential (3)	MAC Standards		
unit	mg/L (4)	mg/L	mg/L	RRD-10	RRD-09	RRD-08	RRD-07	RRD-06	RRD-05	RRD-03	mg/kg	mg/kg	RRD-04	RRD-02
Arsenic	0.05		0.05	0.0029	0.0036	0.0015	0.0051	0.0058	0.0034	0.0047	11.3(5)	11.3	4	5.7
Barium	0.5		1	0.19	0.24	0.16	0.23	0.21	0.22	0.23	5500	1500	100	120
Cadmium	0.001		0.01	0.00022	0.00024	0.00025	0.00016	0.00048	ND	0.00015	78	5.2	0.16	0.43
Chromium (hexavalent, grab)	0.01			ND	ND	ND	ND	ND	ND	ND	230	NS	ND	ND
Chromium (total)	0.05	1.254	0.149	0.0058	0.0053	0.0023	0.0023	0.0013	0.003	0.0019	230	21	17	20
Copper	0.005	0.044	0.027	0.0059	0.0057	0.002	0.005	0.0063	0.0038	0.0041	2900	2900	8.5	12
Cyanide (total)	0.005	22	5.2								1600	40		
Fluoride	0.1	17.330	8.715	0.15	0.11	0.18	0.12	0.11	0.12	0.13	4700	80	1.7	2.2
Iron (total)	0.5			6.5	6.2	2.9	4.7	6.5	3.2	3.6	NS	15000	14000	16000
Iron (Dissolved)	0.5		0.3								NA	NS		
Lead	0.05	0.013	0.013	0.0058	0.0065	0.0018	0.005	0.0068	0.0034	0.0049	400	107	8.7	12
Manganese	0.5	8.882	3.777	2.2	2.2	1.5	0.9	0.75	1.1	0.91	3700	630	470	610
Mercury	1.0 ng/L	2210.0	1105.0	33	42	7.3	22	33	18	12	23	0.1	0.041	0.064
Nickel	0.005	0.193	0.012	0.0061	0.0044	0.0024	0.0028	0.003	0.0028	0.0035	1600	100	12	15
Oil & Grease	5		0.1	4.5	6.8	7.3	7.8	7.6	8.2	7.8	NS	NS	170	200
Phenols	0.005		0.1								47000	100		
Selenium	0.005	1	0.00097	0.00061	0.00073	0.00051	0.00043	0.00051	0.00047	0.00047	390	1.3	0.22	0.22
Silver (total)	0.003		5	ND	ND	ND	ND	ND	ND	ND	390	4.4	ND	0.067
Zinc	0.025			0.026	0.026	0.011	0.015	0.027	0.013	0.019	23000	5100	43	68
Polychlorinated Biphenyls (PCBs)	1.0 ng/L			ND	ND	ND	ND	ND	ND	ND	1	1		
Ammonia-Nitrogen (as N)	0.02	15.000	6.848	1.2	5.2	0.72	11	13	4.9	13	NA	NS	120	220
Total Suspended Solids (TSS)	1			390	210	77	160	240	120	150	NA	NS		
Total Volatile Solids (TVS)	1			650	480	630	410	800	600	390	NA	NS	2.8	2.5
pH	0.1 S.U.										NS	NS		
Hardness (as CaCO3)	1			320	270	310	260	260	260	240	NA	NS	ND	ND
aldrin	NS			ND	ND	ND	ND	ND	ND	ND	0.04	0.94	ND	ND
dieldrin	NS			ND	ND	ND	ND	ND	ND	ND	0.04	0.603	ND	ND
endrin	NS			ND	ND	ND	ND	ND	ND	ND	23	1	ND	ND
heptachlor	NS			ND	ND	ND	ND	ND	ND	ND	0.1	0.871	ND	ND
mirex	NS			ND	ND	ND	ND	ND	ND	ND	NS	NS	ND	ND
toxaphene	NS			ND	ND	ND	ND	ND	ND	ND	0.6	0.6	ND	ND
35 IAC 302 chronic aquatic life standard														
000 Maximum Allowable Concentration														
Water Quality Certification - Appendix A														

Applicable Standard exceedance

Notes:

- Standards as indicated in *Appendix A* of the Illinois Environmental Protection Agency, Bureau of Water Section 401 Water Quality Certification circular entitled Material Analysis for Dredge and Fill Activities.
- Standards as applied to Class I Groundwater from the Illinois Environmental Protection Agency's Tiered Approach to Corrective Action Objectives (TACO), specifically *Appendix B*, Table E: Tier 1 Groundwater Remediation Objectives for the Groundwater Component of the Groundwater Ingestion Route.
- Standards as applied to the Ingestion Exposure Pathway from the Illinois Environmental Protection Agency's Tiered Approach to Corrective Action Objectives (TACO), specifically *Appendix B*, Table A: Tier 1 Soil Remediation Objectives for Residential Properties.
- Concentrations in mg/L unless otherwise noted.
- Lowest Applicable Standard as indicated by Illinois Environmental Protection Agency's Tiered Approach to Corrective Action Objectives (TACO), specifically *Appendix A*, Table G: Concentrations of Inorganic Chemicals in Background Soils.
- Abbreviations:

"NA" - Not Applicable

"ND" - Not Detected

"NS" - No Standard is Published

"mg/L" - milligram per liter

"ng/L" - nanogram per liter

"S.U." - Standard Units

When interpreting sediment results, it is important to note that supernatant water can be influenced by the water throughflow from upstream and above the sample as well as groundwater from adjacent soils. It is not possible to discern whether or not the materials found in supernatant water come directly from leaching of the soils in the core, or from adjacent sources. Additional background samples are required to fully interpret this data in proper context.

6.3 Sediment Management Evaluation

This section evaluates sediment management strategies for the approximately 4.3 million cubic yards of material impounded upstream of the Sears and Steel Dams. Managed sediment release is a critical component of dam removal planning, influencing project cost, ecological outcomes, and regulatory compliance. Typical sediment management evaluation encompasses a range of approaches—from passive release to active excavation—based on sediment volume, grain size, contamination levels, and transport dynamics. Active excavation and pilot channel considerations were not explored due to favorable chemical results for passive release, concerns for increased costs, and general owner preference to allow the channel to reform in a natural manner. This section also assesses the likely fate of mobilized sediment, potential downstream impacts, and construction-phase considerations. The findings support the selection of a sediment management strategy that balances environmental protection, feasibility, and alignment with IDNR–OWR’s project goals.

The degree to which impounded sediments are excavated and managed will have substantial effects on flood hydraulics, habitat suitability, and project cost. Impounded sediment management for dam removals falls somewhere on a spectrum between passive and active management and restoration.

Passive restoration of an impoundment entails removing the major impediment to natural river function (i.e., Sears and/or Steel dams) and allowing the river to evacuate sediments and restore itself over time. The channel within the former impoundment freely adjusts its slope and form via incision, widening, and meandering, and eroded sediment is transported downstream unimpeded. These adjustments continue until the channel develops a form appropriate for its flow and sediment regime. Exposed sediment that is not flushed downstream will develop to form floodplains, and existing seedbanks within those soils may contribute to vegetation that stabilizes surfaces. The advantage of passive restoration approaches is the low cost, as it requires little work in the impoundment to control sediment or create the channel and floodplain characteristics. Low cost comes at the expense of time, as the river will evolve through a process of erosion and migration that may take years or decades following dam removal. It can also have a negative short-term impact on downstream reaches if large volumes of sediment, including any contaminated materials, are delivered to reaches downstream of the dam.

Active sediment management, on the other hand, involves some degree of mechanical excavation of sediment from the impoundment to control and shape channel form and adjustment. When localized sediment contamination is encountered, active management may also include capping or excavation and replacement of sediment along the channel margins that are expected to become future floodplain areas. Active restoration results in reduced sediment loading to downstream reaches, immediately stable channel form, and a higher degree of ecological function in a shorter time. These advantages are realized at a higher project cost. Property rights, access agreements and costs are far more extensive with active sediment management versus passive release.

Sediment management strategies may also include hybrid approaches that combine elements of passive and active strategies. Successful approaches used on dam removals of a similar scale elsewhere include, but are not limited to the following:

- Pilot channels, which partially excavate impounded sediments to reduce the volume mobilized downstream during and immediately after dam demolition.
- Floodplain benching, which constructs a stable channel but does not fully remove sediment from floodplain areas.
- Sediment trapping, which uses constructed and maintained depositional traps to remove mobilized sediment from the river before it is allowed to transport downstream.

6.3.1 Sediment Management Recommendations

Hanson reviewed potential sediment management strategies with IDNR-OWR in the period following DOR surveys and sediment coring/contamination analysis. Given the impounded sediment volume, distribution of sediment, low degree of contamination, and anticipated construction budget, IDNR-OWR prefers a passive approach to sediment management without additional active or hybrid (e.g., pilot channel) management options. The following sections discuss outcomes (evacuation and fate) associated with the recommended passive sediment management approach.

6.3.2 Sediment Evacuation and Fate

6.3.2.1 Grain Size

Grain size analysis was performed on the nine cores collected upstream of the dams by EnviroScience on March 11-13, 2025, and shows that impounded sediments are predominantly composed of silty sand or clayey sand with about 25% average fines fraction (Table 2). Impounded materials in the downstream reach of the project generally have larger fractions of silt and clay compared to reaches further upstream, a finding that is consistent with typical depositional patterns in impounded river reaches.

Table 2. Grain size analysis for the nine cores collected on March 11-13, 2025.

Sample Name	% Cobble	% Gravel	% Sand	% Silt	% Clay	Description
RRD-02	0.0	0.0	54.1	23.7	22.1	Clayey Sand
RRD-03	0.0	6.3	70.7	14.4	8.6	Silty Sand
RRD-04	0.0	0.5	68.1	13.4	17.9	Clayey Sand
RRD-05	0.0	0.8	83.5	7.5	8.3	Silty Sand
RRD-06	0.0	0.4	59.5	18.9	21.2	Clayey Sand
RRD-07	0.0	1.8	81.4	8.1	8.7	Silty Sand
RRD-08	0.0	0.0	84.8	8.3	6.9	Silty Sand
RRD-09	0.0	0.0	90.2	5.1	4.7	Poorly Graded Sand with Silt
RRD-10	0.0	0.1	70.0	17	12.9	Silty Sand

6.3.2.2 Sediment Transport Characteristics

Sediment transport estimates within the Rock River are available from Graf (1983) and estimates for the upper Mississippi River are available from Bhowmik et al. (1986). Graf (1983) analyzed bedload data

from the Rock River near Joslin, IL, located approximately 30 miles upstream of the Steel and Sears Dams. Bhowmik et al. (1986) analyzed three gages along the Mississippi River: East Dubuque, IA (100 miles upstream of the Rock River confluence), Burlington, IA (75 miles downstream), and Keokuk, IA (115 miles downstream). Estimates of sediment transport in both studies are based on rating curves developed using stream gaging records, with the Rock River estimates developed over a period of 3.7 years (5/1980-9/1983), and the Mississippi River estimates developed over a 14-year period between 1967 and 1981. Average annual sediment loads shown in Table 3 are based on published data in Bhowmik et al. (1986) and indicate that the Mississippi River carries a larger sediment load 2 to 13 times that of the Rock River, depending on the location. The volume of impounded sediment upstream of Sears and Steel Dams at 4.3 million CY represents a value that is approximately 6.5 times the estimated average annual sediment load of the Rock River and is approximately equal to the annual transport rate of the upper Mississippi River. As such, sediment transport and average sediment deposition associated with dam removal is minimal and not expected to significantly impact the Mississippi River.

Table 3. Average annual sediment load for the Rock River and the upper Mississippi River as estimated by Graf (1983) and Bhowmik et al. (1986).

Gage	Approximate Distance from Steel and Sears Dams (mi)	Average Annual Sediment Load (CY)
Rock River at Joslin, IL	30 (upstream)	656,376
Mississippi River at East Dubuque, IL	100 (upstream)	2,390,386
Mississippi River at Burlington, IA	75 (downstream)	8,644,169
Mississippi River at Keokuk, IA	115 (downstream)	5,080,103

6.3.2.3 Sediment Evacuation

Inter-Fluve evaluated expected sediment transport characteristics of the impoundment under dam-removal conditions and downstream reaches of the Rock and Mississippi Rivers to evaluate likely outcomes of the recommended passive sediment management strategy. Following dam removal, the majority of impounded sediments are expected to readily mobilize and transport downstream. The evolution of impoundments under a passive sediment management strategy typically occurs in two phases (Collins et al., 2017). Initially, following the dam removal, sediment is eroded from the channel in a ‘process-driven’ phase as a result of base level lowering and increase in the energy gradient, incising the channel until a stable channel slope and cross-section are formed (Pearson et al., 2011). During this phase, in the initial months, a large percentage of sediment will be mobilized and transported downstream. Deposition will occur in downstream reaches, and sediment may be stored within depositional areas such as the Rock River with a lower transport capacity, such as point bars, midchannel bars, and pools. Following the ‘process-driven’ phase, channel evolution enters an ‘event-driven’ phase in which larger flood events contribute to the majority of sediment transport (Collins et al., 2017).

Predicting precise rates of sediment transport and evacuation during drawdown and post-removal is extremely difficult because driving variables—such as flow magnitude, surface bed sediment composition, water depth, local flow velocity, rate of excavation, and channel size—are subject to

simultaneous change and may not be predictable in advance. Nevertheless, predictions of potential sediment transport characteristics over intermediate time scales are possible based on sediment grain size characteristics and approximate channel hydraulic conditions obtained from 1-D model results of post-removal hydraulics (e.g., Sumaiya et al., 2021).

Model results indicate that following dam removal, materials smaller than fine to medium gravel, which is understood to be the majority of the impoundment, will be readily mobile in reaches upstream of the dams during nearly all flow events. Therefore, it is expected that the process-driven phase of sediment transport will include rapid evacuation of the thick sediment deposits upstream of Sears Dam and a portion of the uniform sand deposits upstream of Vandruff Island. Material finer than medium sand (0.25 mm) is expected to transport as suspended load, while coarser sand will transport as bedload. Suspended load consists of very fine particles such as silt and clay (25% of the sediment composition) that are light enough to be carried within the water column by turbulence. These particles remain in the flow for long distances and are not confined to the riverbed. Bedload, in contrast, consists of coarser particles such as sand and gravel (75% of the sediment) that move along the riverbed. These materials transport depending on local flow velocity and energy conditions, meaning that these sediments tend to deposit relatively quickly when flow velocities decrease, such as in pools, behind bars, or in wider channel sections. Some degree of sediment may be stored within floodplains, bars, and pools within the former impoundment, but over time, over the course of years, a substantial fraction (potentially one third) of the impounded sediment volume is expected to evacuate the impoundment during the process driven phase. Over the event-driven phase, much of the remainder of impounded material would evacuate the impoundment, with deposits remaining as floodplain or bar deposits with the degree of mobility determined by how quickly stabilizing vegetation establishes.

Analysis suggests that under a passive release scenario, the volume of released sediment will be greater than the estimated annual sediment transport capacity, making the Rock River system transport-limited. In transport-limited systems, the ability of the channel to mobilize bed material is the determining factor, as opposed to a supply-limited system where the amount of material is the constraint. Therefore, in the time period immediately following dam demolition, the Rock River will be actively transporting its maximum amount of sediment, and it is during this period that the greatest degree of deposition is anticipated (see [Figure 27](#)). As time progresses, river flows will re-mobilize those deposits, transporting those materials further downstream to the Mississippi River.

6.3.2.4 Sediment Fate

A sediment fate analysis was conducted to assess the ability of the Rock River and Mississippi River channels to accommodate the downstream release of impounded sediment following dam removal under a passive sediment management approach. This analysis considered the volume and characteristics of impounded sediment, the sediment transport capacity of the Rock River and the Mississippi River, and identification of potential depositional areas downstream where released impounded sediment may accumulate.

Once within the Mississippi River, mobilized sediments will move downstream and deposit within the pool above Mississippi Lock and Dam number 16 (Lock and Dam no. 16), a 34-foot-tall dam owned and operated by the USACE (U.S. Army Corps of Engineers Rock Island District, 2012). To evaluate impacts to the navigational pool, Inter-Fluve digitized the areal extent of potential deposition (hashed

areas illustrated in Figure 27). The average depth of sediment deposition for fractions of material that may evacuate the Sears and Steel Dam impoundments (Table 4) was estimated considering this area.

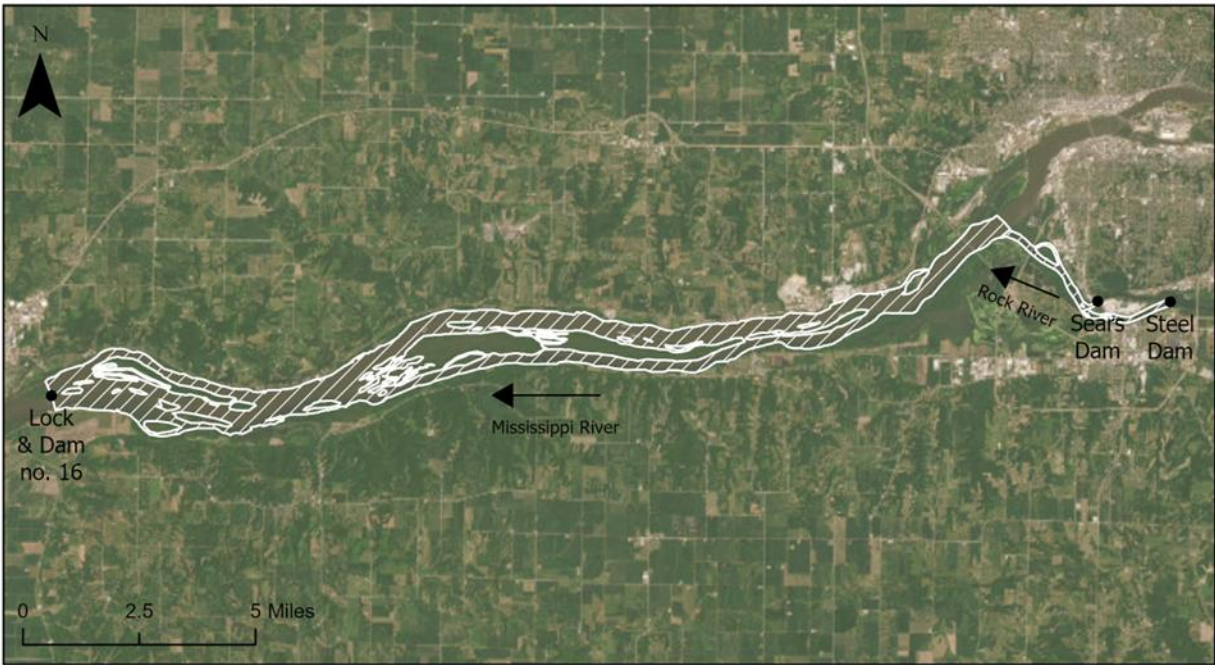


Figure 27. Potential depositional areas in the navigational pool above Lock and Dam no 16.

Table 4. Average depths of potential sediment deposits in reaches of the Rock and Mississippi Rivers downstream of Steel and Sears Dams for given fractions of the total impounded sediment volume.

Percentage of Total Impounded Sediment (%)	Volume of Sediment (CY)	Depth of Deposition (inches)
100	4,300,000	3.4
75	3,225,000	2.6
50	2,150,000	1.7
25	1,075,000	0.9

The Upper Mississippi River is subject to routine dredging by the USACE to maintain a navigation channel to a depth of 9 feet (USACE, 2024). Annually, the Rock Island District of the Upper Mississippi dredges approximately 500,000 CY over its 314 river miles (USACE, 2024). Given the volume of impounded sediment and the extent of the assumed depositional area, the average anticipated depth of deposition is less than four inches, assuming complete evacuation of the Sears and Steel Dam impoundment. In actuality, the depth of sediment deposition will vary over time and space given flow magnitude, local slope, bedforms, islands, side channels, and other influences on local transport capacity. It should be noted that due to the lower sediment transport capacity of the Rock River (due to

its smaller size) as compared to the Mississippi, it is anticipated that deeper depths of sediment may occur within the Rock River in the years immediately following sediment release.

6.3.2.5 Sediment Management During Construction

Sediment management and erosion control during construction are required to minimize turbidity caused by in-river work and erosion from upland areas of the project site. Given dam conditions and demolition plans, a staged drawdown approach will be adopted. It is anticipated that dam demolition will occur at a maximum rate of up to one foot per day. A staged drawdown results in gradual changes in energy within the impoundment and results in less immediately mobilized sediment compared to a rapid drawdown.

Turbidity may be managed during drawdown, but it is important to note that all dam removal projects result in some degree of turbidity released to downstream waters. Turbidity controls, such as turbidity curtains, cofferdams, or temporary grade control may be adopted to limit turbidity, and thresholds for work stoppage could be adopted if desired. Additionally, construction site erosion and sedimentation control best management practices (BMPs) would be employed to minimize erosion from upland areas. Measures will include sediment control logs or silt fence around the perimeter of spoils piles and along access routes, and stabilized construction entrances.

If IEPA determines there are areas of potential contamination, full mechanical dredging, dewatering, and disposal operation for the 4.3 million cubic yards of impounded sediment—including 1.1 million CY of fine silts—would impose an excessive cost premium estimated over \$100 million. However, additional modeling and testing would reduce the quantities requiring potential removal/disposal. In addition, several significantly less expensive alternatives could be pursued to satisfy regulatory objectives. These include engineering solutions such as a targeted "fines-only" extraction coupled with a passive sand bypass (~\$30M), in-place geomorphic stabilization to terrace and isolate the sediment within a new floodplain (~\$20M), or an incrementally managed high-flow notched drawdown (~\$5M) release over multiple years designed to dilute chemicals naturally.

7. River Hydraulics

This section provides a comprehensive assessment of the Rock River watershed as it relates to the Sears and Steel Dams project area. Understanding the broader watershed context is essential for evaluating the hydrologic and hydraulic behavior of the river system, sediment transport dynamics, and potential impacts of dam modification or removal. This section outlines key watershed characteristics, including land use, topography, and drainage patterns, and presents hydrologic data to inform modeling scenarios. It also details the development and results of both 1D and 2D hydraulic models used to simulate existing conditions and evaluate the performance of proposed alternatives. This analysis supports informed decision-making by identifying how changes to the dams may influence upstream and downstream flow conditions, infrastructure, and ecological systems.

7.1 Watershed Characteristics

The Rock River drains 10,800 square miles from Wisconsin to Steel Dam just upstream of the confluence with the Mississippi River. The watershed is primarily agricultural with pockets of urban development including cities of Watertown, Jefferson, Fort Atkinson, Janesville, and Beloit in Wisconsin and past Rockford, Dixon, Sterling, Rock Malls, and Moline in Illinois.

The area containing the Sears and Steel Dams lies within the Case Creek – Rock River Watershed (HUC12: 070900051302) within the Mill Creek Watershed (HUC10: 0709000513) within the Lower Rock Watershed (HUC8: 07090005) within the larger Rock River Watershed (HUC6: 070900) in Illinois and Wisconsin. See Figure 28 for a map of these watersheds around the project area.

From Rockford, the river flows generally southwest, entering the Mississippi River at Rock Island. The Rock River flows approximately 300 miles from headwaters to its mouth. River elevation declines more than 300 feet over this distance, from an elevation of 857 feet above mean sea level at Horicon Marsh to 553 feet at Steel Dam with an average watershed slope at 0.021%.

7.2 Hydrology

Hanson has reviewed the published FEMA discharges, USGS gage data (05446500 Rock River near Joslin, IL, 05447800 Rock River near Moline, IL), and discharges published by ISWS (Singh et al., 1988) for locations in the study reach to develop a range of design discharges for the hydraulic model. The discharges used to evaluate both existing conditions and proposed alternatives are presented in Table 5 through Table 7.

Annual exceedance flows for the 10%, 4%, 2%, 1% and 0.2% (10-, 25-, 50-, 100-, and 500-year) events were acquired from the US Army Corps of Engineers (USACE) Rock Island District hydraulic model, see Table 5.

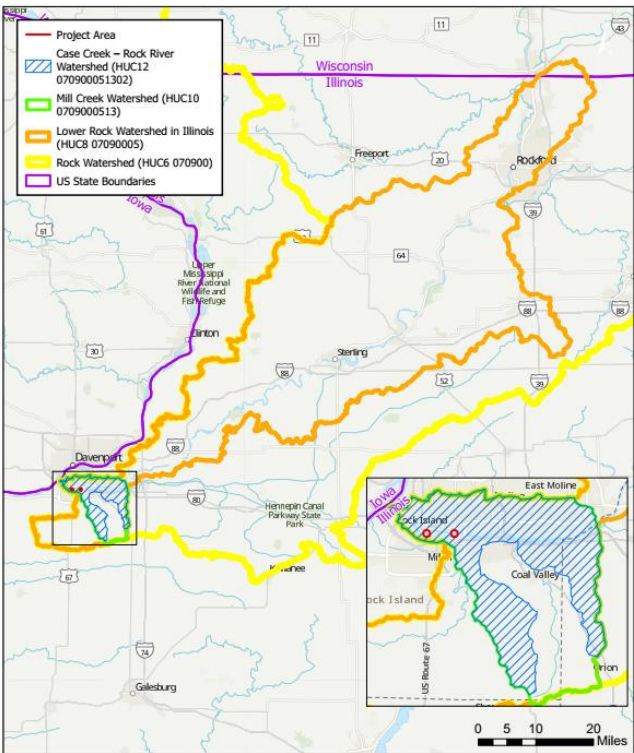


Figure 28 - Map of Successive Watersheds Including the Project Area (HUC 6 through 12).

Table 5 – Flood flows

AEP (%)	Recurrence Interval (years)	Flow (cfs)
10.0	10	47,400
4.0	25	49,800
2.0	50	50,900
1.0	100	51,900
0.2	500	54,900

A 7Q10 discharge value, which represents the lowest 7-day average discharge with a recurrence interval of 10-years, was determined to be 1,520 cfs using publications provided by ISWS. On the day that the field survey was completed to capture bathymetry, the flow in the river was 15,500 cfs according to gage readings. This flow was used to help calibrate the models to ensure model accuracy. Recreational

and fish passage flows were evaluated by Inter-Fluve as a part of this dam removal study and are provided in this section and [Appendix C](#).

7.2.1 Fish Passage Analysis Flows

Inter-Fluve investigated flow conditions to support hydraulic modeling in design of aquatic organism passage. They researched the local fish species and recreational use of the Lower Rock River and determined suggested flow considerations for hydraulic modeling and alternatives evaluation. The Lower Rock River extent covers the portion of the Rock River within the Lower Rock River watershed (HUC: 07090005) stretching from its confluence with the Mississippi River, continuing upstream to the Illinois-Wisconsin border.

Low head dams, like the Sears and Steel dams, can negatively influence the populations of riverine fish by limiting migration of fish and their food sources, pulsing of nutrients, raising water temperatures, lowering dissolved oxygen, and interrupting normal sediment transport (Bednarek 2010, Cumming, 2004, Porto et al., 1999, J. Tiemann et al. 2004). Understanding dam hydraulics before and after removal, with a special focus on migration periods, is important in determining the conditions for removal and restoration. Hydraulic analysis for fish passage is thus completed during common migration periods for fish in the project reach. Data for fish flow considerations was obtained from the United States Geological Survey (USGS) gage ID 05446500, near Joslin, IL. This is the closest gage to the project site with sufficient available data. Flow exceedances, detailed in [Table 6](#), were determined based on the typical migration periods (April through June) of the migratory fish traveling upstream for spawning habitat.

HEC-SSP (Hydrologic Engineering Center’s Statistical Software Package, Version 2.3) was used to perform a flow duration analysis by analyzing streamflow data from USGS gage 05446500 to determine the frequency with which certain flow magnitudes are equaled or exceeded over the period of 1993 to 2023. This process involves sorting the flow data in descending order, ranking each value, and calculating the exceedance probability for each ranked flow. These probabilities are used to create a flow duration curve table, which represents the percentage of time that specific flow rates are met or exceeded. The values of the flow duration curve for April, May, and June of 1993 – 2023 (three total values) were averaged together to obtain the final average flow values, shown in [Table 6](#).

Table 6 – Fish passage flows (April, May, and June)

Percent of Time Exceeded	Average Flow (cfs)
95	4,410
90	5,510
80	6,860
70	8,200
60	9,360
50	10,900
40	12,300
30	14,400
20	17,100

1021,800

7.2.2 Recreational Flows

Inter-Fluve reached out to several local groups to gather information about recreational uses of the Rock River. At that time, no responses were received from the Backwater Gamblers, a water ski group that holds regular shows just upstream of the dams, or Sunset Marina, a large marina (approximately one-hundred slips) located on the Mississippi River near the Rock River confluence. However, Inter-Fluve did receive communication via email with the owner of Quad Cities Kayak River Adventures, a local outfitter that provides kayak guiding, rental, and shuttle services on the Rock River. This individual stated that they paddle the river almost daily during the warmer months and noted that the optimal flow for kayaking is approximately 10,000- to 11,500-cfs, or around a stage of 9 feet at the Moline USGS gage. When the stage drops closer to 6 feet, beaches appear, and other recreational use of the river increases. It was also stated that that common river users include flat-bottom fisherman, pontoon boats, jet skiers, and tubers, with recreational boats and water skiers in the lower reach around Moline. Potential high flows for recreational use were estimated using gage data from the dates when Backwater Gamblers shows were canceled. Using this information, Inter-Fluve determined suggested recreational analysis flows, presented in Table 7.

Table 7. Suggested recreational passage flow considerations for the Rock River, Rock Island County, Illinois.

Flow Description	Flow (cfs)
Low Recreational Flow (September 90% Exceedance Flow)	2,700
Average Recreational Flow (Average 50% Exceedance Flow for April-October)	7,900
High Recreational Flow (reported high “easy” flow for paddling from Quad Cities Kayak)	11,500
Potential Maximum Recreational Flow (2024 Waterski Show cancellations occurred in July with flows exceeded approximately this value)	16,000

Using these ranges of flows, modeling efforts and comparisons were made using selected flows that best represented the typical or worst case in various situations. For example, when comparing water surface profiles, the periods of most interest by the public would be during the lowest drought case or the average recreational flow so those were used to best illustrate what the river might look like during those river flow ranges. Table 8 provides a summary of which flows were used for each model or comparison.

Table 8 - Summary of Model Flows

Model or Comparison	Flow (cfs)
1D Model (Steady)	7Q10 (1,520), Fish Passage (Spring 95%=4,409 thru Spring 10%=21,757)
1D Model (Unsteady)	Flood (10yr/10%=47,400 thru 500yr/0.2%=54,900)
2D Model	7Q10 (1,520), Fish Passage (Spring 95%=4,409 thru 10%=21,757), Calibration (15,500), Flood (10yr/10%=47,400 thru 500yr/0.2%=54,900)
CFD Model	Low (2,700) and High Recreation (16,000)
River Profile Comparison	7Q10 (1,520) and Avg. Recreation (7,900)
Flow Distribution Comparison	Low (2,700), Avg (7,900), High (11,500), Max (16,000) Recreation and 100yr/1% (51,900)
Velocity Comparison	Max Recreation (16,000)
Bridge Scour Analysis	100yr/1% (51,900)

7.3 Hydraulics

7.3.1 Literature Review and Roller Formation

Low-head ogee-crest run-of-the-river dams have a long history of forming dangerous hydraulic rollers at the downstream portion of the spillway. The U.S. Bureau of Reclamation (USBR) developed a spreadsheet tool to define dangerous flow ranges for low-head dams. This tool was used to determine the range of discharges that result in the formation of dangerous rollers under existing site conditions. Flows ranging from the 7Q10 to the 0.2% (500-year) flood were analyzed using the spreadsheet procedure. The tool computes the hydraulic jump formation downstream of the dam and categorizes it into four cases (A, B, C, and D) shown in [Figure 29](#). **Case C** corresponds to dangerous roller conditions, which occur when the tailwater depth downstream of the dam exceeds the conjugate depth of the hydraulic jump, pushing the jump to the face of the dam and forming a roller with recirculating currents. The spreadsheet also establishes "keeper velocities," which are the velocities at the roller surface that push objects back towards the dam face, trapping them in the roller.

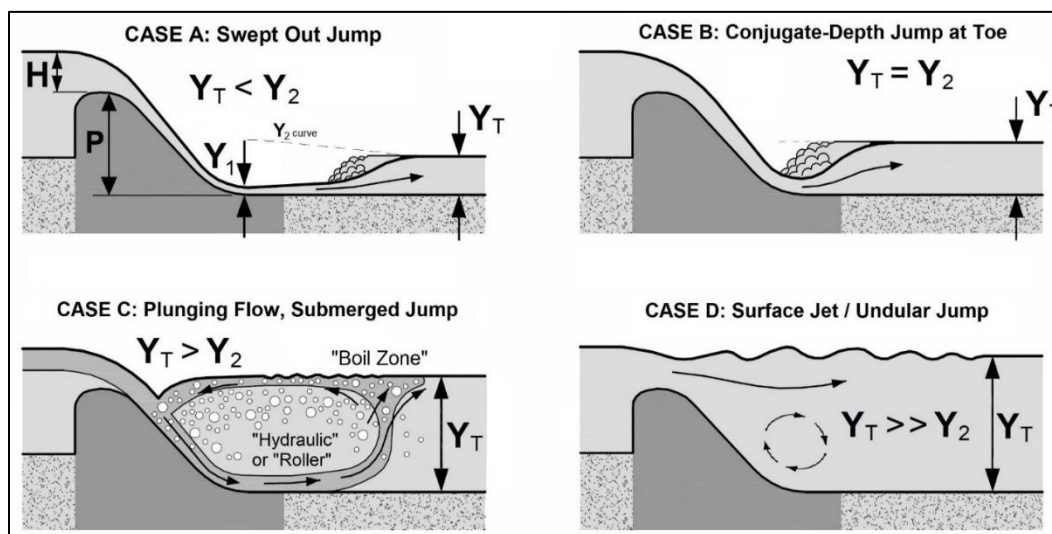


Figure 29: Hydraulic Jump Case (USBR Wahl, T.L., & Svoboda, C.D. (2023))

Based on results of spreadsheet calculations, a roller forms at Steel Dam across the full range of low to normal flows (7Q10 through 10% (10-year) annual exceedance fish passage flow) which **encompasses all recreational flows**. The “keeper velocity” ranges from 3.31-ft/s to 4.64-ft/s which exceeds an average person’s swimming ability, indicating they cannot swim out of the roller.

A more severe roller forms at Sears Dam for the full range of analyzed flows (7Q10 through 1% (100-year) AEP) which also **encompasses all recreational flows**. The confluence of the North and South Channel is in close proximity to Sears Dam and creates increased tailwater conditions that promote the formation of rollers across the full range of flows. The “keeper velocity” ranges from 4.47-ft/s to 7.15-ft/s. Detailed spreadsheet calculations and documentation can be found in [Appendix F](#).

7.3.2 Existing Conditions Model Development

Sears Dam and Steel Dam are low head run-of-the-river ogee crest dams. Steel Dam has a height of 6.0 feet, measured from the crest of the dam to the toe of the apron, and a weir length of 772.5 feet. Sears Dam has a height of 13.1 feet, measured from the crest of the dam to the toe of the apron, and a weir length of 443 feet. Both structures are classified as low hazard dams; however, this classification system only considers the risk of impacts due to dam failure and does not account for the risk to public safety caused by the formation of adverse hydraulic conditions known to occur at run-of-the-river dams or the risk to watercraft by the dam structure. Both 1D and 2D hydraulic models were developed to establish baseline conditions for evaluating the risk of adverse hydraulic conditions and to assess impacts to the existing upstream pool under proposed alternative conditions.

The HEC-RAS 2D v.6.6 existing conditions model geometry was developed using a combination of LiDAR elevation data collected by the USGS (USGS, 2023), bathymetric data collected by IDNR-OWR in late 2023 and 2024, and cross-section data taken from a 1D unsteady hydraulic model developed by the USACE Rock Island District in 2014 (USACE, 2014). Land cover was defined by visual observation of site orthophoto datasets. Manning’s *n* values in the 2D domain were divided into nine categories. The model domain ([Appendix F](#)) used an average grid cell size of 50-feet by 50-feet. Breaklines were used to capture key hydraulic elements such as levees, roadway embankments, bridge piers, and abutments. Breakline spacing varied from 2- to 50-feet to ensure high ground was captured and to maintain cell orientation orthogonal to flow where feasible. The 2D shallow water equation solver (SWE-EM) was used for all model simulations. This method is well suited for simulating 2D free-surface flow allowing the model to represent flow splits, velocity gradients, water-surface variation, and hydraulic conditions near the dams.

The USACE Rock Island District 1D HEC-RAS model was used as a supplement to extend the limits of computed bed shear and velocities upstream of the detailed 2D domain in support of the sediment fate analysis (performed by Inter-Fluve). The geometry of the 1D model developed by USACE was updated using the 2024 IDNR-OWR bathymetric survey from cross-section 0.19 to 17. The 1D model was developed by the USACE Rock Island District on behalf of IDNR-OWR to develop (10, 4, 2, 1, and 0.2 AEP) water-surface elevations for the Lower Rock River (USACE, 2014). Using RAS Mapper, a 1D interpolation surface was created from the survey cross sections. The channel subsections of the model cross sections were updated from the surface.

Results of the 1D model were validated using the flows reported by the USACE gage at Moline, Illinois, on the dates of the observed water surface survey. The profiles were computed with 1D steady HEC-RAS plans. The split flow optimization option for the computation of flow around Vandruff Island was enabled in the HEC-RAS steady flow plan. A comparison of flows over the Sears and Steel Dams for the 1D and 2D plans produced identical flow splits between the two structures. Computed water-surface elevation profiles for the 1D and 2D plans showed reasonable agreement. Documentation of existing conditions boundaries, calibration, and model results are further discussed in the [Appendix F](#) Existing Conditions Hydrology and Hydraulics Memo.

7.3.3 Computational Fluid Dynamics (CFD)

A cursory computational fluid dynamics (CFD) analysis was conducted within Flow 3D to verify and provide visualization of roller formation on the downstream crest of the Steel Dam and to demonstrate preliminary viability of two of the six proposed remediation options. Similar CFD models were also developed for the existing Steel Dam, Steel Dam remediated with steps, and Steel Dam with a crest reduction of -2-ft. The models are intended to provide insight into the existing roller formation and determine if potential alternatives such as a spillway steps or reduction in crest height properly mitigate roller formation for all recreation flows (2,700 cfs to 16,000 cfs). These were selected as representing the range most commonly utilized by boaters and typical river users. The CFD model covers a 100-ft section of Steel Dam. The CFD geometry is limited to the Steel Dam structure. Upstream and downstream channel geometry is not incorporated into the model, and the upstream and downstream channel are represented as a wide flat bottom at the approximate thalweg elevation of the Rock River. The model does not incorporate the scour pool formed downstream of Steel Dam. The CFD model has an average vertical and horizontal mesh spacing of 0.125-ft to ensure adequate coverage of the flow field as flow enters the supercritical flow regime over the crest of the dam. The upstream boundary was set as the maximum recreation unit discharge over Steel Dam and a starting water surface elevation informed by the 1D and 2D models. The downstream water surface elevation was informed by the 1D and 2D models. Air entrainment (2 phase flow) was not considered as part of the evaluation to reduce simulation time and file size.

[Figure 30](#) provides results of the CFD modeling for the maximum recreation flow over Steel Dam. As shown in the image with water transparency, the surface turbulence is low and a boater upstream of the dam may not be able to visually identify the hazard. The view with velocity coloration demonstrates the dangerous roller with more prominent visualization. Velocities over the crest of the dam exceed 10-ft/s with “keeper” velocities in the upper water column at the surface exceeding 4-ft/s. A low recreation flow was also analyzed in the CFD to verify the results of the spreadsheet analysis that a roller forms across the full range of recreation flows. [Figure 31](#) depicts the formation of the roller at low recreation flows, validating the results of the USBR spreadsheet (Wahl 2023). “Keeper” velocities in the upper water column exceed 4-ft/s even at the lower discharge.

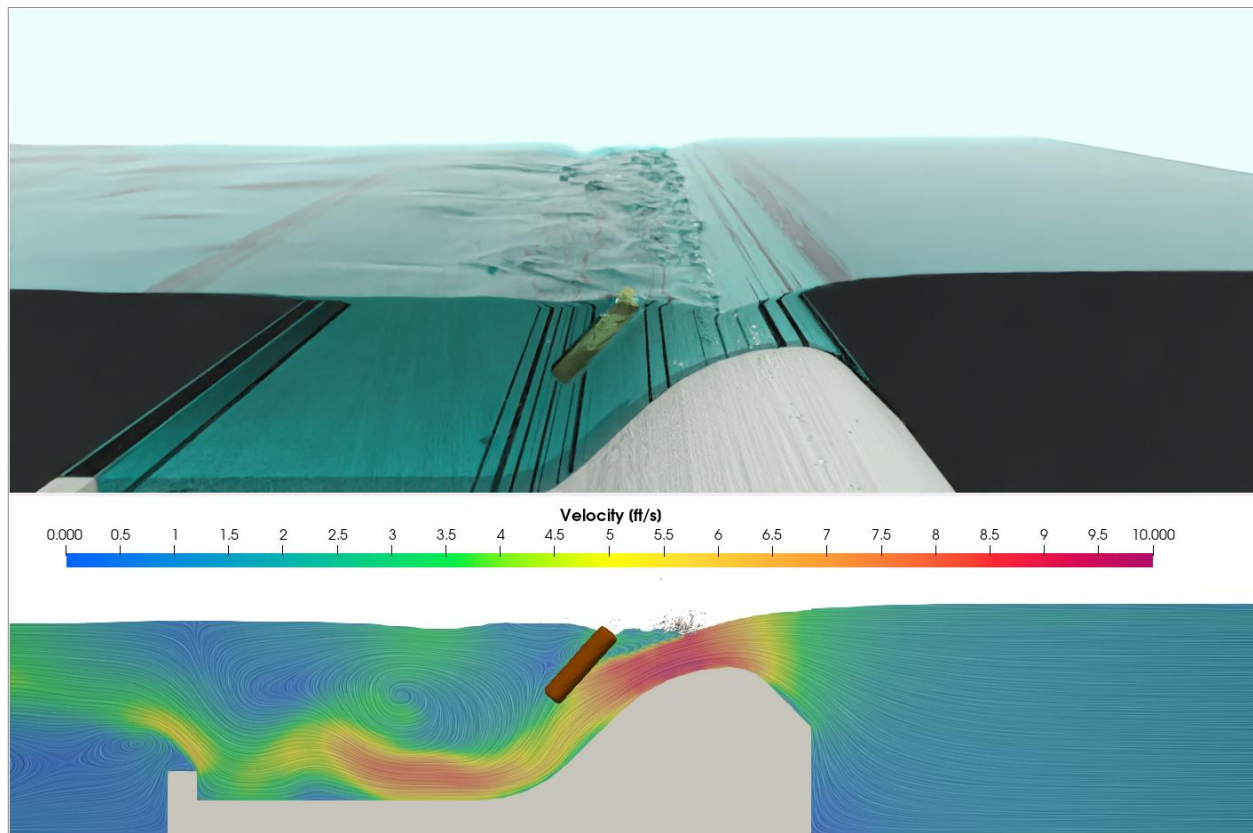


Figure 30: CFD Roller on Existing Steel Dam at Max Recreation flow.

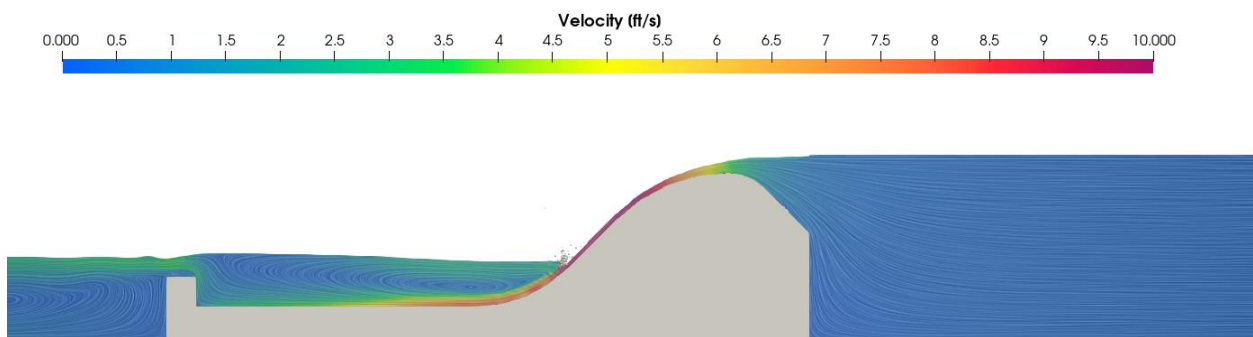


Figure 31: CFD Roller on Existing Steel Dam at Low Recreation flow.

8. Dam Alternatives

There are a variety of structural alternatives that can be implemented to address the public safety hazards at low-head dams. The alternatives evaluated include full removal, partial removal, and structural modification approaches. Alternatives are evaluated based on their ability to meet project goals, with emphasis on public safety and supporting criteria defined in Section 1. This section summarizes the alternatives considered and provides the basis for comparative evaluation.

Non-structural measures, including signage, public education, and restricted access, can improve awareness but do not eliminate the hydraulic hazard. Alerting the public to the hazard or preventing access to it are common approaches, as well as conducting educational campaigns. On-river safety buoy lines, ropes, ladders and warning systems can also provide safety benefits. These safety features are considered “soft” additions to alert the public to the hazard, but they do not change the safety issues at the dams.

8.1 *Typical Dam Rehabilitation Options*

IDNR-OWR is exploring options to modify the dams so they do not continue to pose a public safety hazard [REF: Section 1.1 Hazard Definition]. Structural modifications can reduce hazardous hydraulic conditions but do not fully eliminate all risks at dams. The following practices are known options for modification. These common practices were considered during evaluation and selection of alternatives. These structural practices focus on improved hydraulics with roller removal. They do not remove the general hazard of boater or swimmer strikes and general river hazards.

8.1.1 *Concrete Steps*

Concrete steps are a structural modification to the spillway face that incorporate a series of uniformly spaced vertical drops, typically around one foot vertically and 5 feet horizontally. Concrete steps modify the spillway face to incrementally dissipate energy, reducing hydraulic intensity and improving downstream conditions. Additionally, they offer long-term durability and low maintenance, making them a reliable solution for spillway retrofits.

8.1.2 *Rock Ramps*

Rock ramps are conducive to nature-based engineering solutions that facilitate gradual water descent over a dam using strategically placed rocks and boulders to simulate a natural streambed. Specific design considerations for nature enhancement should be performed during final design. Rock ramps provide a gradual transition over the structure, reducing energy and supporting fish passage. While rock ramps are considered more cost-effective than structural alternatives, they require a significantly larger footprint due to their extended slope length and could require more long-term costs due to maintenance requirements.

8.1.3 *Bypass Channels*

Bypass channels are engineered pathways designed to redirect flow around a dam structure, thereby reducing the frequency with which hazardous hydraulic conditions occur at the primary spillway. While they do not completely eliminate the formation of turbulent or high-energy flow zones, they help mitigate these effects by offering an alternative route during dam-flow events. Additionally, nature-like bypass channels can serve as effective fish passage solutions, replicating more natural stream conditions and improving ecological connectivity for aquatic species.

8.1.4 *Height Reductions*

Height reductions lower the potential energy of the falling water, thereby decreasing the kinetic energy transferred to the river below. A higher vertical drop introduces greater energy into the flow, which intensifies hydraulic forces such as turbulence, scour, and downstream velocities—conditions that can

pose safety risks and structural challenges. By reducing dam height, the energy is reduced, resulting in less aggressive hydraulic behavior and improved safety and stability in the receiving channel.

This concept was tested for Steel Dam in a CFD model simulation. A crest reduction of -2-ft was analyzed to determine if a roller still forms for average recreation flows. As shown in Figure 32 the high velocity jet forms on the ogee crest and remains in place leading to the formation of a roller downstream of the dam. The “keeper” velocities in the roller continue to exceed 4-ft/s. As such, height reductions were not pursued for this study.

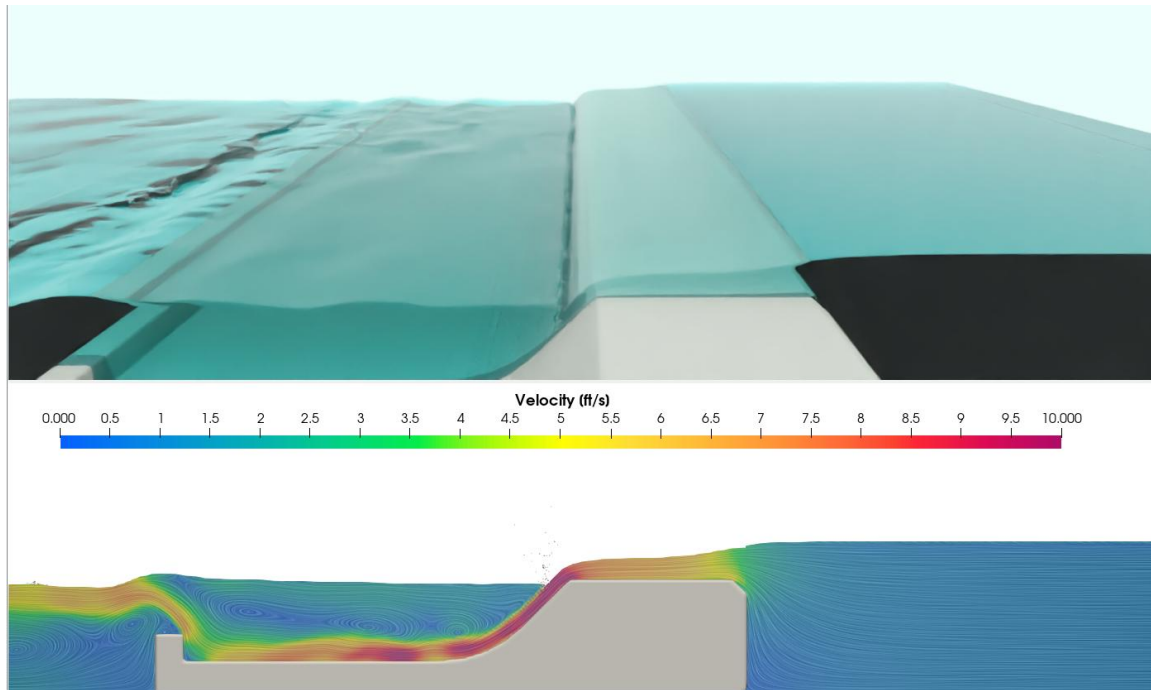


Figure 32: Steel Dam Crest Reduction of -2-ft at average recreation flows.

8.2 Dam Removal Considerations

Dam removal eliminates the hydraulic hazard and directly addresses the primary project goal for public safety.

8.2.1 Environmental Restoration

Nationwide, dam removals are playing a critical role in restoring natural river ecosystems. It allows rivers to reestablish their natural hydrology, which supports the recovery of aquatic and riparian habitats. Natural sediment transport processes resume, contributing to the regeneration of downstream features such as wetlands, floodplains, and estuaries. This enhances habitat complexity and promotes biodiversity. Dam removal restores natural flow, sediment transport, and ecological connectivity [REF: Section 3.4 and Section 5].

8.2.2 Sediment Management and Ecosystem Recovery

Sediment implications of dam removal, including passive release and downstream transport, are described in Section 6.

8.2.3 Recreational Activities

Rivers, dams, and the created pools support a wide range of recreational activities. River-based recreation includes canoeing, kayaking, motorboating, pontoon boating, water skiing, tubing, fishing from boats or shore, swimming, wading, paddleboarding, wildlife viewing, birding, shoreline walking, picnicking, and other informal access activities. Some of these uses benefit from the deeper, slower water created by a dam and its impoundment, while others are limited by the dam as a barrier to navigation and river continuity. Transitioning recreational conditions from impoundment-based uses to riverine conditions represents a tradeoff depending on user type. For that reason, the overall recreational impact of dam removal cannot be characterized as objectively positive or negative.

8.2.4 Longterm Costs and Maintenance

Dam removal eliminates long-term structural maintenance (inspections, debris removal, structural repairs, erosion and scour repairs) and associated liability. Longterm costs and associated dam maintenance are factors in this study and will be part of the evaluation consideration.

8.3 Studied Alternatives

Six studied alternatives were included in the feasibility study. They are listed here and discussed in depth with concept-level drawings later in this section.

1. Alternative 1 - Remove Both Dams
2. Alternative 2 - Remove Sears, modify Steel Steps
Alternative 2a - Modify Sears Steps, modify Steel Steps
3. Alternative 3 - Remove Sears, modify Steel Rock Ramp
4. Alternative 4 - Remove Sears, modify Steel Steps, add Riffles
5. Alternative 5 - Remove Sears, modify Steel Steps with Bypass
6. Alternative 6 – No Change to Sears, modify Steel Steps

Potential remediation alternatives were evaluated through a combination of 1D and 2D hydraulic evaluations. The existing conditions 1D and 2D hydraulic models served as the baseline models for development of the proposed alternatives. The 1D HEC-RAS model was used to identify impacts of the proposed alternatives to the upstream pool and determine how far the water surface impacts propagated upstream. The 2D hydraulic model further evaluated impacts to both bed shear and velocity in the vicinity of the dams. The 2D hydraulic model evaluated impacts with dam removals and the channel degraded to the approximate depth of refusal measured in the upstream pool. The DOR terrain was developed by first creating a DOR channel terrain through interpolation of the DOR survey data using the HEC-RAS RASMapper tool. This interpolated channel terrain was used to generate the final DOR surface which extended to the upstream boundary of the 2D hydraulic model.

Sensitivity testing models were performed in HEC-RAS by modeling and comparing four basic options:

- (1) Existing conditions with both dams in place,
- (2) Removal of Sears Dam with Steel in place,
- (3) Removal of Steel Dam with Sears in place, and
- (4) Removal of both dams.

The following profiles summarize river impacts for each condition under average recreational (7,900 cfs) flows (Figure 33, Figure 34) and severe low flow condition represented by 7Q10 (1,520 cfs) flows (Figure 35, Figure 36). The figures demonstrate impacts within the South Channel and the North Channel to understand impacts to all adjacent reaches. The profiles show the change (in feet) in water surface elevations between the existing conditions (green line) and the three removal options. Negative numbers indicate the amount of decrease (in feet) below today's water levels with both dams in place. Detailed discussion and hydraulic analysis of each alternative is available in [Appendix F](#).

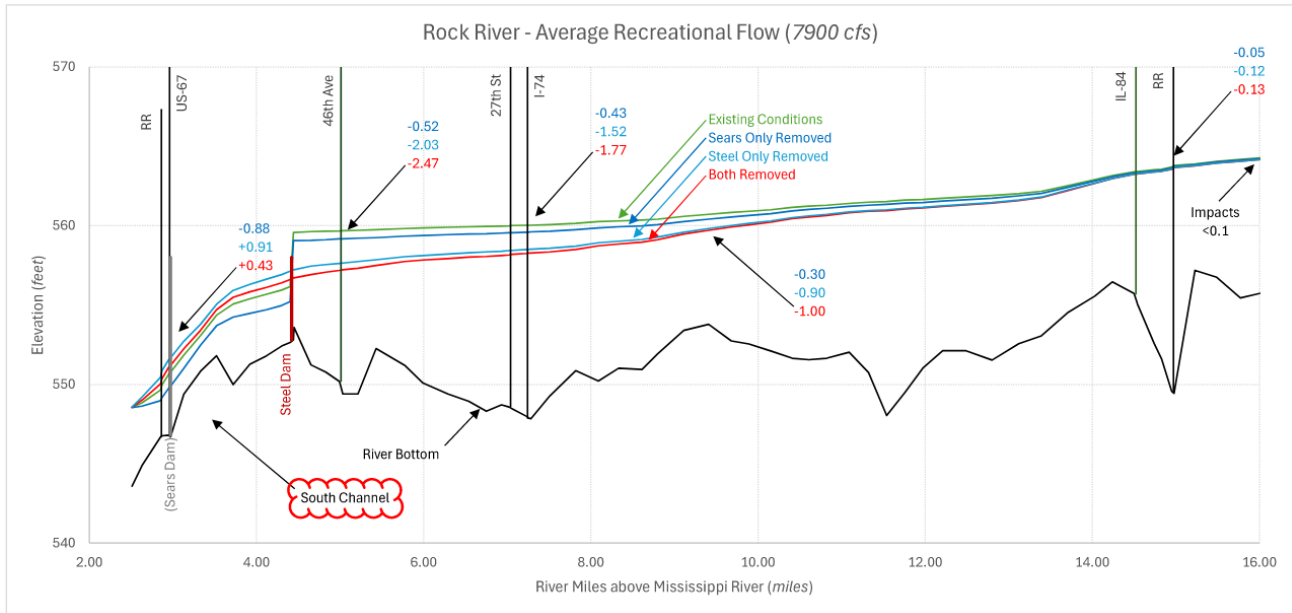


Figure 33 - River Impacts under Varying Dam Removal Conditions (Rec Flows, South Channel)

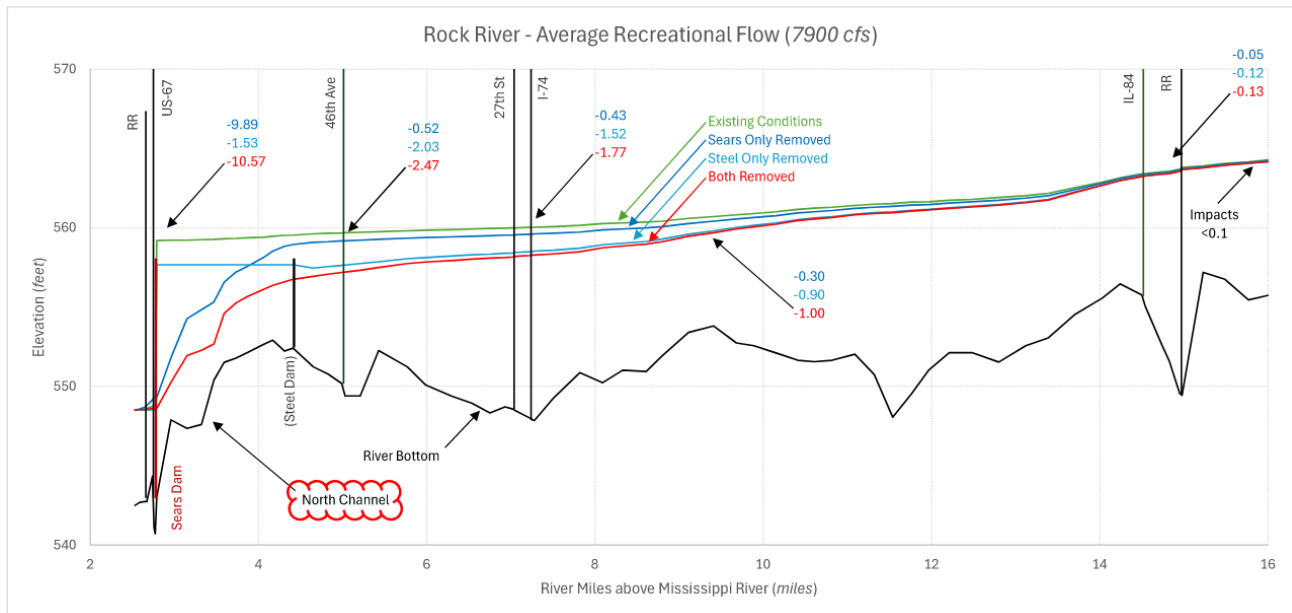


Figure 34 - River Impacts under Varying Dam Removal Conditions (Rec Flows, North Channel)

The existing pool is primarily located between Steel Dam and the I-74 bridge. Water level changes are labeled at the major bridge crossings as well as the location where all scenarios are below -1.0-ft of impact. Impacts are most dramatic when flows are low as demonstrated by the low flow profiles in Figure 35 and Figure 36. As flows enter high flow, flood conditions, the impacts become minimal. As expected, the greatest pool impact occurs when both dams are removed. In all cases, the impacts become negligible just upstream of IL-84.

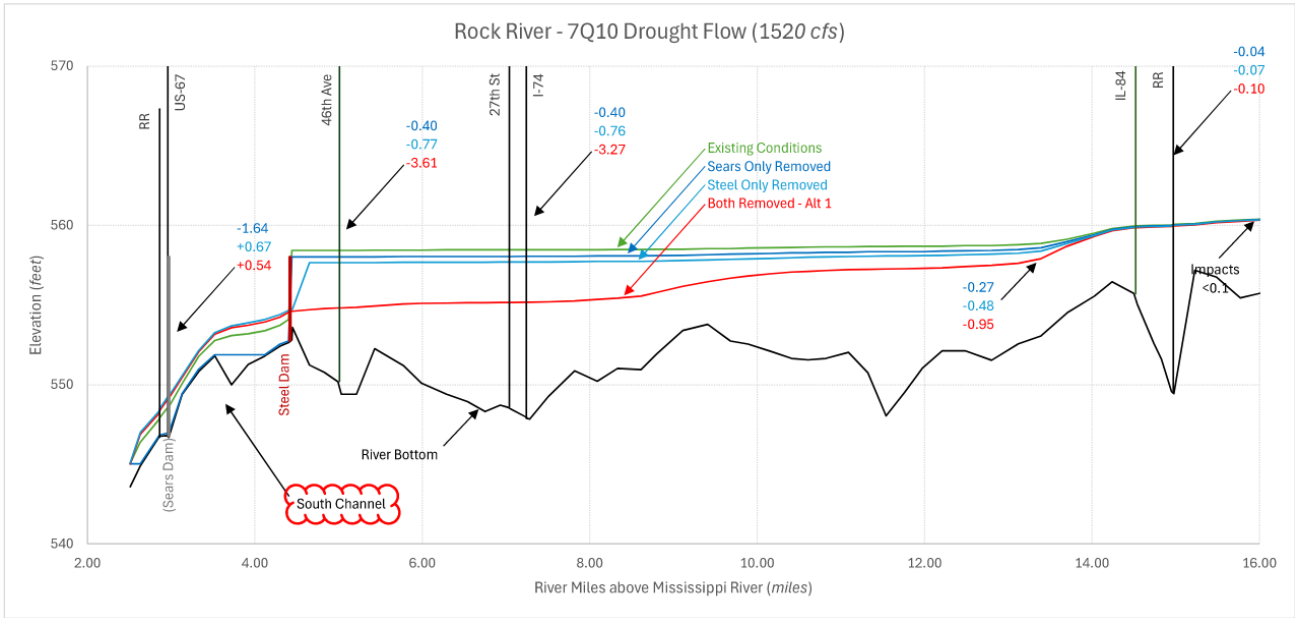


Figure 35 - River Impacts under Varying Dam Removal Conditions (Low Flows, South Channel)

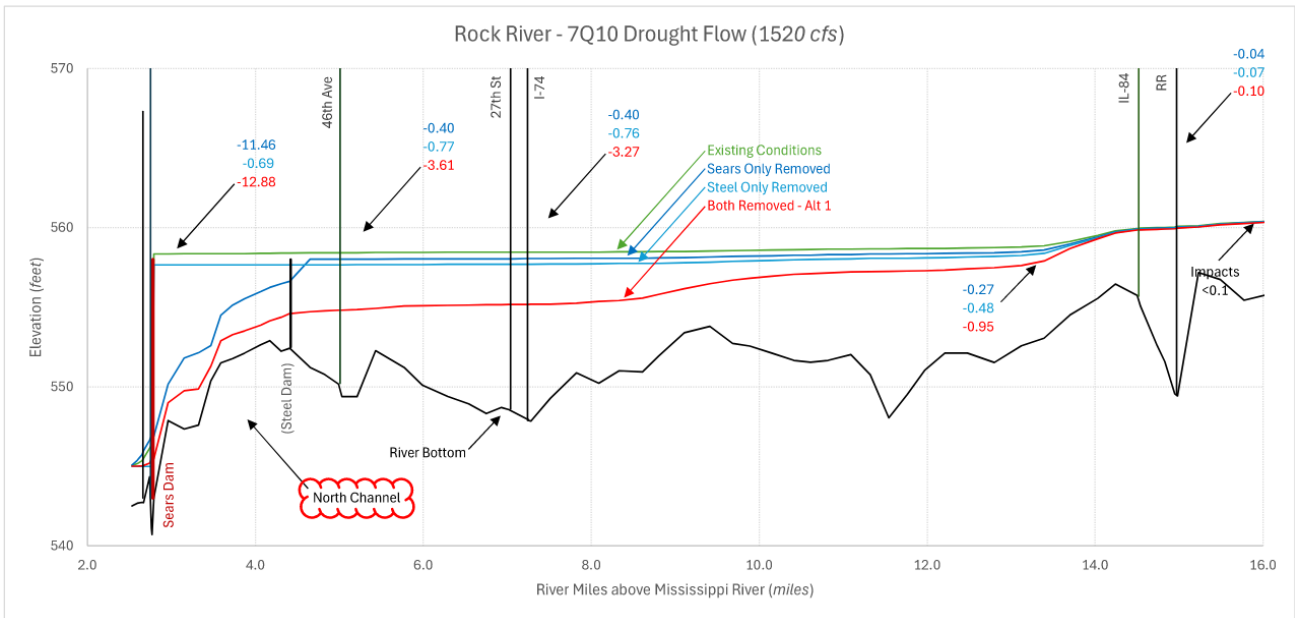


Figure 36 - River Impacts under Varying Dam Removal Conditions (Low Flows, North Channel)

Table 9 provides detailed hydraulic model results for multiple recreational flow simulations, as well as the 1% (100-year) flood condition. The change in flow distribution between North and South Channels can be determined from this table as well as corresponding water surface elevation changes. Key findings from the table show that removal of Steel with Sears remaining in place would result in no flow over the Sears Dam for average and low recreational conditions. Under extreme flood conditions (1%/100-year) there is minimal impact to the river flows and elevation with any dam removal scenario. Additionally, the flow distribution between the North Channel and the South Channel for the 1% (100-year) are nearly the same when both dams are removed compared to existing conditions.

Table 9 - 1D hydraulic model results comparison for Recreation and 1% (100-year) AEP flows

Alternative	Low Recreation								
	Total Flow (cfs)	Sears Flow (cfs)	Sears % of total	Steel Flow (cfs)	Steel % of total	WSEL Upstream of Sears (ft)	WSEL (Upstream of Sears) Reduction Alternative - Existing	WSEL Upstream of Flow Split (ft)	WSEL (Upstream of Flow Split) Reduction Alternative - Existing
Existing	2,700	1,330	49	1,370	51	558.57	0.00	558.7	0.00
Both Removed	2,700	374	14	2,326	86	546.07	-12.50	555.29	-3.41
Sears Removed	2,700	2,700	100	-	0	547.7	-10.87	558.02	-0.68
Steel Removed	2,700	-	0	2,700	100	557.66	-0.91	555.47	-3.23

Alternative	Average Recreation								
	Total Flow (cfs)	Sears Flow (cfs)	Sears % of total	Steel Flow (cfs)	Steel % of total	WSEL Upstream of Sears (ft)	WSEL (Upstream of Sears) Reduction Alternative - Existing	WSEL Upstream of Flow Split (ft)	WSEL (Upstream of Flow Split) Reduction Alternative - Existing
Existing	7,900	2,990	38	4,910	62	559.19	0.00	559.62	0.00
Both Removed	7,900	1,659	21	6,241	79	548.62	-10.57	556.93	-2.69
Sears Removed	7,900	5,277	67	2,623	33	549.3	-9.89	559.08	-0.54
Steel Removed	7,900	-	0	7,900	100	557.66	-1.53	557.45	-2.17

Alternative	High Recreation								
	Total Flow (cfs)	Sears Flow (cfs)	Sears % of total	Steel Flow (cfs)	Steel % of total	WSEL Upstream of Sears (ft)	WSEL (Upstream of Sears) Reduction Alternative - Existing	WSEL Upstream of Flow Split (ft)	WSEL (Upstream of Flow Split) Reduction Alternative - Existing
Existing	11,500	4,051	35	7,449	65	559.52	0.00	560.13	0.00
Both Removed	11,500	2,687	23	8,813	77	550.01	-9.51	557.73	-2.40
Sears Removed	11,500	6,460	56	5,040	44	550.44	-9.08	559.66	-0.47
Steel Removed	11,500	525	5	10,975	95	558.15	-1.37	558.32	-1.81

Alternative	Maximum Recreation								
	Total Flow (cfs)	Sears Flow (cfs)	Sears % of total	Steel Flow (cfs)	Steel % of total	WSEL Upstream of Sears (ft)	WSEL (Upstream of Sears) Reduction Alternative - Existing	WSEL Upstream of Flow Split (ft)	WSEL (Upstream of Flow Split) Reduction Alternative - Existing
Existing	16,000	5,276	33	10,724	67	559.84	0.00	560.69	0.00
Both Removed	16,000	4,088	26	11,912	74	551.48	-8.36	558.57	-2.12
Sears Removed	16,000	7,801	49	8,199	51	551.76	-8.08	560.27	-0.42
Steel Removed	16,000	1,841	12	14,159	88	558.79	-1.05	559.11	-1.58

Alternative	1% (100-year) - Unsteady Flow								
	Total Flow (cfs)	Sears Flow (cfs)	Sears % of total	Steel Flow (cfs)	Steel % of total	WSEL Upstream of Sears (ft)	WSEL (Upstream of Sears) Reduction Alternative - Existing	WSEL Upstream of Flow Split (ft)	WSEL (Upstream of Flow Split) Reduction Alternative - Existing
Existing	51,900	16,058	31	35,842	69	561.93	0.00	564.03	0.00
Both Removed	51,900	16,313	31	35,587	69	559.77	-2.16	563.32	-0.71
Sears Removed	51,900	18,180	35	33,720	65	559.81	-2.12	563.78	-0.25
Steel Removed	51,900	14,301	28	37,599	72	561.67	-0.26	563.57	-0.46

Note: Negative values indicate that water surface elevations are lower than existing conditions for this and all similar tables.

8.3.1 Alt 1 - Remove Both Dams

8.3.1.1 Alternative Description

Alternative 1 includes removal of both Sears and Steel Dam spillways to restore a free-flowing river system. Removal includes spillways and associated structural elements necessary to reestablish a stable channel.

At the Sears Dam, the abandoned powerhouse structure and its associated approach guide walls and all appurtenances are assumed to remain, in conformance with IDNR-OWR direction. The removal effort is therefore focused on eliminating the hydraulic control structure formed by the spillways while

preserving non-hydraulic historic or structural features that are outside the study scope. Riverbanks at former dam abutments will be reconstructed using a combination of riprap armoring and bioengineering methods, including native vegetation establishment to provide long-term stability.

It is anticipated that sediment management under this alternative is to be controlled through passive release, meaning that sediment accumulated behind both dams will be mobilized and transported downstream through natural hydraulic processes during river drawdown and subsequent flow events. This approach minimizes direct sediment removal but requires careful consideration of downstream impacts and short-term water quality effects.

8.3.1.2 Hydraulics

1D Hydraulic Modeling

The removal of both dams results in a significant reduction in upstream water surface elevations, reflecting the elimination of backwater conditions previously maintained by the structures. Modeling results indicate that water surface elevations decrease by approximately 2.12-feet during maximum recreational flows and 3.41-feet during low recreational flow conditions. More substantial localized reductions occur immediately upstream of Sears Dam, where the removal of the spillway eliminates the primary hydraulic control. In these areas, water surface reductions approaching 10.57-feet are observed under average recreational flows, as illustrated in the hydraulic modeling outputs associated with [Figure 34](#). Farther upstream, the magnitude of water surface change gradually diminishes as the influence of the dams decreases. By the upstream boundary of the modeled domain, changes are relatively minor, indicating that the effects of dam removal are most pronounced within the immediate dam reach and below IL-84.

Removal of both dams produces a fundamental shift in hydraulic behavior from a controlled, impounded system to a free-flowing channel. Hydraulic modeling using both 1D and 2D HEC-RAS frameworks indicates a consistent lowering of upstream water surface elevations, increased flow velocities, and redistribution of flow between the North and South Channels around Vandruff Island.

The flow split at Vandruff Island between the North and South Channels is strongly influenced by Steel Dam under existing conditions due to its proximity to North and South Channel flow split and its control of upstream pool elevation. Removal of both dams eliminates this control and allows flow distribution to become a function of channel conveyance capacity. Model results show that at high flow events, including the 10% (10-year) and 1% (100-year) floods, the overall flow split between the North and South Channels remains similar to existing conditions. However, at lower and recreational flows, notable redistribution occurs.

At a maximum recreational flow of approximately 16,000 cfs, the proportion of flow in the North Channel decreases from about 33 percent to 28 percent, with the South Channel conveying a correspondingly greater share. At lower flows, this shift becomes more pronounced, with the South Channel receiving up to 35 percent more discharge relative to existing conditions. This redistribution reflects the removal of the Steel Dam control, which currently elevates water levels upstream and biases flow toward the North Channel.

With removal of both dams, channel velocities increase across much of the study reach due to reduced flow depth and increased hydraulic gradient. The most significant increases occur in areas directly influenced by the former impoundments. 2D hydraulic modeling results, presented in [Figure 37](#) through [Figure 39](#), show localized velocity increases of up to 2-feet per second in the North Channel immediately upstream of the former dam locations. In mid-reach areas, typical increases are on the order of 0.7-ft/s, while upstream boundary conditions show more limited changes, generally around 0.3-ft/s even under larger flow conditions. These velocity increases produce corresponding increases in bed shear stress, enhancing the river's capacity to mobilize and transport sediment (see [Appendix F](#)). As a result, sediment that has accumulated under impounded conditions becomes susceptible to erosion and downstream transport.

Below, [Table 10](#) and [Table 11](#) provide the changes in average channel velocities in the North and South Channel for maximum recreational flows (16,000 cfs) with both dams removed. The North Channel experiences the most significant increase in channel velocity with the largest change at the cross-section directly upstream of the dam, which is to be expected.

Table 10. Removal of Both Dams – North Channel Velocity Change (Max Recreation Flow)

	Feet Above Sears Dam	Average Channel Velocity (ft/s)		Change in Velocity (ft/s)
		Existing	Both Dams Removed	
Flow Split	8606	2.01	2.55	0.54
	8078	1.76	2.22	0.46
	7339	2.23	2.87	0.64
	6758	2.63	3.56	0.93
	5755	1.67	2.56	0.89
	5016	1.39	2.39	1.00
	4277	1.84	3.96	2.12
	3643	1.96	5.78	3.82
	2851	1.91	3.65	1.74
	1954	1.97	3.86	1.89
	950	1.86	8.36	6.50
	53	1.34	1.30	-0.04
	-53	1.45	1.13	-0.32
	-106	1.41	1.11	-0.30
	-211	1.87	1.47	-0.40
DS Confluence	-581	2.37	1.85	-0.52
	-686	2.52	1.96	-0.56
	-1003	2.16	1.68	-0.48
	-1320	1.83	1.41	-0.42

Table 11. Removal of Both Dams – South Channel Velocity Change (Max Recreation Flow)

	Feet Above Sears Dam	Average Channel Velocity (ft/s)		Change in Velocity (ft/s)
		Existing	Both Dams Removed	
Flow Split	8290	2.30	2.72	0.42
	7128	2.22	2.70	0.48
	5333	2.19	2.82	0.63
	4171	2.37	3.00	0.63
	3221	2.23	2.86	0.63
	3010	2.15	2.81	0.66
	2165	2.08	2.78	0.70
	1214	2.08	2.85	0.77
	158	2.35	2.88	0.53
	106	2.14	2.62	0.48
	-106	3.13	3.26	0.13
	-634	3.11	3.24	0.13
	-1584	3.02	3.16	0.14
	-2640	3.09	3.25	0.16
	-3696	3.57	3.77	0.20
DS Confluence	-4752	5.07	5.29	0.22
	-5755	4.28	4.42	0.14
	-6811	3.87	4.02	0.15
	-7656	4.98	5.28	0.30
	-7762	4.54	4.81	0.27
	-8184	4.48	4.80	0.32
	-8290	4.64	5.02	0.38
	-9451	2.71	2.99	0.28
	-10085	2.11	2.34	0.23

Note: Positive feet above Sears Dam means distance upstream of the dam and negative values indicate the distance downstream of the dam.

Under Federal Highway Administration (FHWA) recommendations, the 1% (100-yr) design flood is the standard for bridge scour analysis. In the full dam removal scenario, discharge ratios between the North and South Channels remain relatively unchanged for events exceeding the 10-year flood. Therefore, the downstream structures are not expected to experience significant changes in scour parameters.

Changes in velocity and depth resulting from dam removal are expected to influence scour potential at upstream bridges and other infrastructure. At the Milan Beltway crossing, modeling of 1% (100-yr) flows indicates a reduction in flow depth of approximately 0.60-feet with an increase in velocity of 0.29 ft/s, increasing potential for riverbed and bridge pier scour. Further upstream structures such as Old Highway 150 and I-74 are not expected to experience significant immediate hydraulic impacts.

Nevertheless, long-term degradation of sediment within the impounded reach may remove material that historically supported bridge foundations. Removal of material assumed in place during original design could increase the vulnerability of these structures. As such, coordination with bridge owners and evaluation of existing scour countermeasures are recommended as part of final design.

2D Hydraulic Modeling

A critical component of Alternative 1 (full removal of both dams) is the release of sediment currently stored upstream of the dams. Hydraulic modeling evaluated both an initial minimum condition (no immediate channel adjustment) and a long-term maximum condition in which the channel degrades to the surveyed depth-of-refusal (DOR) elevations. This captures the full range of potential outcomes and defines the maximum impact.

The 2D hydraulic model was used to provide more refined results for changes in bed shear and velocity due to removal of both the Sears and Steel Dams. Two potential proposed scenarios were analyzed to bracket potential future river conditions due to removal of both dams including: (1) no changes to the channel geometry (anticipated short-term condition) and (2) the upstream channel degraded down to the full depth of refusal measured from field surveys. The terrain for scenario 2 was developed by subtracting the depth of refusal survey information from the existing channel geometry. It should be noted that full depth degradation is not expected but illustrates the worst-case scenario.

Three flow conditions were selected for evaluation in the 2D model to capture a range of scenarios: the 1% (100-year) AEP, the 10% (10-year) AEP, and a 15,500-cfs event (termed Calibration). The 15,500-cfs event was used for model calibration as this was the flow rate during field surveys when water elevations were captured. This flow is approximately equivalent to a maximum recreational flow.

Scenario 1 – Short-Term

The flow split fraction between the North and South Channels around Vandruff Island is shown in [Table 12](#). For a flow of 15,500-cfs, the fraction of flow in the North Channel reduces from 33% to 28% from existing to proposed removal. The flow split remains the same between the existing and proposed conditions models for the 10% (10-year) and 1% (100-year) flows. This is in line with results of the 1D hydraulic model which showed more significant changes in the percent of flow to the South Channel for low flows and no change in flow split for the higher flows. This is likely a result of the greater capacity of the South Channel and the proximity of the Steel Dam to the flow split. Under existing conditions, the Steel Dam is directly downstream of the flow split and has a more significant influence on the buildup of the upstream pool that diverts flow through the North Channel. As expected, the influence of the dams diminishes at higher flows.

Table 12 - Results Comparison - Removal of Both Dams with no Changes to the Channel Geometry

Alternative	Calibration Flow								
	Total Flow (cfs)	Sears Flow (cfs)	Sears % of total	Steel Flow (cfs)	Steel % of total	WSEL Upstream of Sears (ft)	WSEL (Upstream of Sears) Reduction Alternative - Existing	WSEL Upstream of Flow Split (ft)	WSEL (Upstream of Flow Split) Reduction Alternative - Existing
Existing	15,500	5,134	33	10,366	67	559.91	0.00	560.64	0.00
Both Removed	15,500	4,263	28	11,237	72	555.43	-4.48	558.60	-2.04

Alternative	10-Year								
	Total Flow (cfs)	Sears Flow (cfs)	Sears % of total	Steel Flow (cfs)	Steel % of total	WSEL Upstream of Sears (ft)	WSEL (Upstream of Sears) Reduction Alternative - Existing	WSEL Upstream of Flow Split (ft)	WSEL (Upstream of Flow Split) Reduction Alternative - Existing
Existing	47,400	15,578	33	31,806	67	562.30	0.00	564.42	0.00
Both Removed	47,400	15,607	33	31,754	67	559.35	-2.95	563.44	-0.98

Alternative	100-Year								
	Total Flow (cfs)	Sears Flow (cfs)	Sears % of total	Steel Flow (cfs)	Steel % of total	WSEL Upstream of Sears (ft)	WSEL (Upstream of Sears) Reduction Alternative - Existing	WSEL Upstream of Flow Split (ft)	WSEL (Upstream of Flow Split) Reduction Alternative - Existing
Existing	51,900	17,326	33	34,567	67	562.65	0.00	564.96	0.00
Both Removed	51,900	17,270	33	34,626	67	559.90	-2.75	564.03	-0.93

Figure 37 provides the change (delta) in velocity from existing to proposed in the 2D model reach for the 15,500-cfs calibration event. Results of the 2D model show increases of up to 2-ft/s for a large area in the North Channel above Sears Dam and a smaller area directly upstream of Steel Dam. Velocity impacts drop to approximately 0.7-ft/s at the upstream limits of the model domain. There is no significant change in velocity downstream of Steel Dam since the flow split is generally well maintained (a change of 5%) between existing conditions and conditions with both dams removed. Similar impacts were identified at higher flows. Velocities in the North and South Channel have significant scour potential, as shown in Figure 38 for the calibration event and Figure 39 for the 1% (100-year) event. The increase in channel velocities with the proposed dam removal results in commensurate increases in bed shear stress which will influence the transport of impounded bed material downstream. Similar maps depicting the increases in bed shear stress for the proposed dam removal were also developed and available in Appendix F.



Figure 37: 15,500-cfs (Calibration/Max Recreation Flow) Change in Velocity-ft/s (Proposed Removal – Existing)

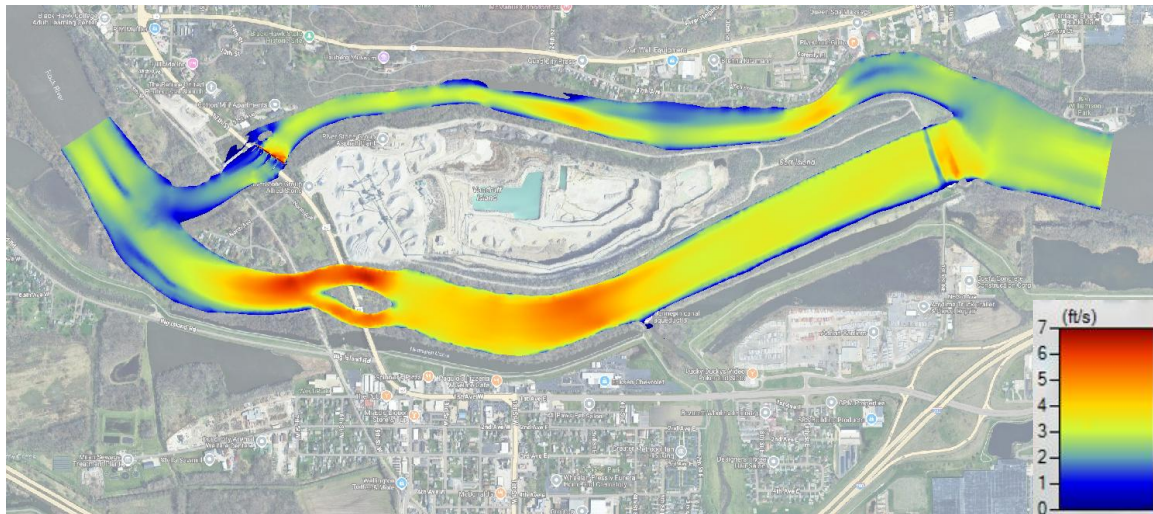


Figure 38: Proposed Conditions - 15,500-cfs (Calibration/Max Recreation Flow) Velocity-ft/s

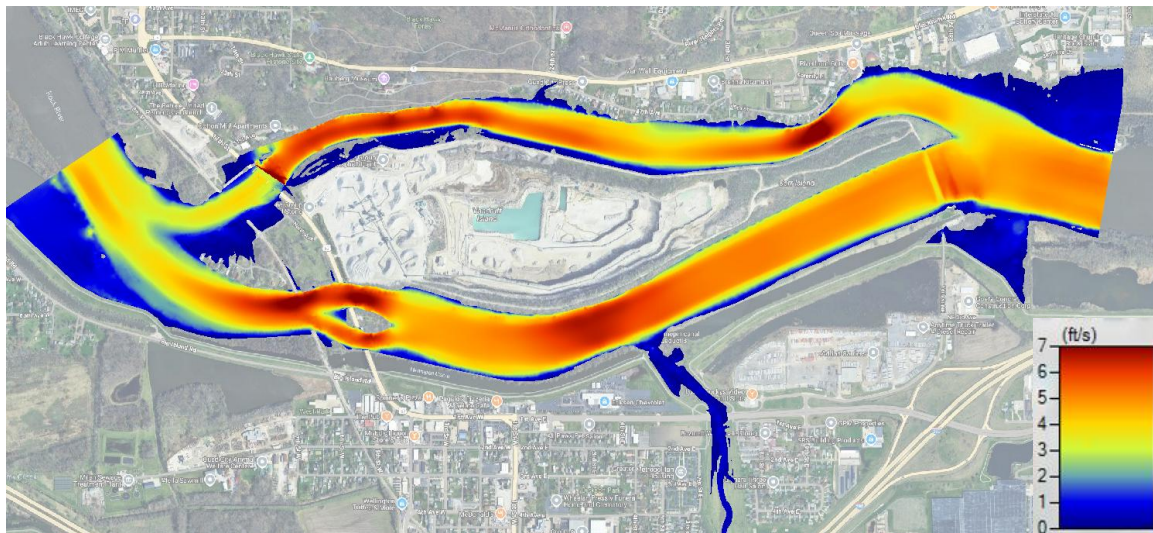


Figure 39: Proposed Conditions - 100-YR Velocity-ft/s

Scenario 2 – Long-Term

Full removal of the dams with the upstream channel degraded was analyzed to identify potential impacts to the upstream pool elevation and changes in the flow distribution around Vandruff Island under the most extreme degradation condition. Table 13 provides a comparison of discharges and water surface elevations between the existing and proposed conditions with the channel degraded. Results of the model show a significant increase in the percentage of flow through the North Channel compared to existing conditions. The fraction of flow in the North Channel increases from 33% to 40% from existing to proposed removal with the channel degraded for the 15,500-cfs, 10-YR, and 100-YR flows. This increase in flow to the North Channel is due to the greater presence of impounded material in the North Channel upstream of the dam which is prone to movement.

Alternative	Calibration Flow								
	Total Flow (cfs)	Sears Flow (cfs)	Sears % of total	Steel Flow (cfs)	Steel % of total	WSEL Upstream of Sears (ft)	WSEL (Upstream of Sears) Reduction Alternative - Existing	WSEL Upstream of Flow Split (ft)	WSEL (Upstream of Flow Split) Reduction Alternative - Existing
Existing	15,500	5,134	33	10,366	67	559.91	0.00	560.64	0.00
Both Removed	15,500	6,275	40	9,228	60	551.44	-8.47	557.87	-2.77

Alternative	10-Year								
	Total Flow (cfs)	Sears Flow (cfs)	Sears % of total	Steel Flow (cfs)	Steel % of total	WSEL Upstream of Sears (ft)	WSEL (Upstream of Sears) Reduction Alternative - Existing	WSEL Upstream of Flow Split (ft)	WSEL (Upstream of Flow Split) Reduction Alternative - Existing
Existing	47,400	15,578	33	31,806	67	562.30	0.00	564.42	0.00
Both Removed	47,400	19,129	40	28,252	60	559.44	-2.86	562.86	-1.56

Alternative	100-Year								
	Total Flow (cfs)	Sears Flow (cfs)	Sears % of total	Steel Flow (cfs)	Steel % of total	WSEL Upstream of Sears (ft)	WSEL (Upstream of Sears) Reduction Alternative - Existing	WSEL Upstream of Flow Split (ft)	WSEL (Upstream of Flow Split) Reduction Alternative - Existing
Existing	51,900	17,326	33	34,567	67	562.65	0.00	564.96	0.00
Both Removed	51,900	20,954	40	30,941	60	559.99	-2.66	563.45	-1.51

Table 13 - Results Comparison - Removal of Both Dams with Upstream Channel Degraded to the Approximate Depth of Refusal

Under the degraded conditions, additional lowering of water surface elevations occurs. For example, modeling indicates an additional reduction of approximately 2.77-feet at representative recreational flows, as shown in in Table 13.

Figure 40 shows the depth of refusal depths which correspond to the amount of material removed from the modeled channel terrain. The removal of sediment alters channel hydraulics by increasing conveyance, particularly within the North Channel where significant deposits are present. This may lead to a redistribution of flow over time, with increased discharge routed through the channel that experiences greater degradation. The system is expected to undergo a period of dynamic geomorphic adjustment following removal, including channel incision, bar formation, and realignment of flow paths before stabilizing into a new equilibrium condition.

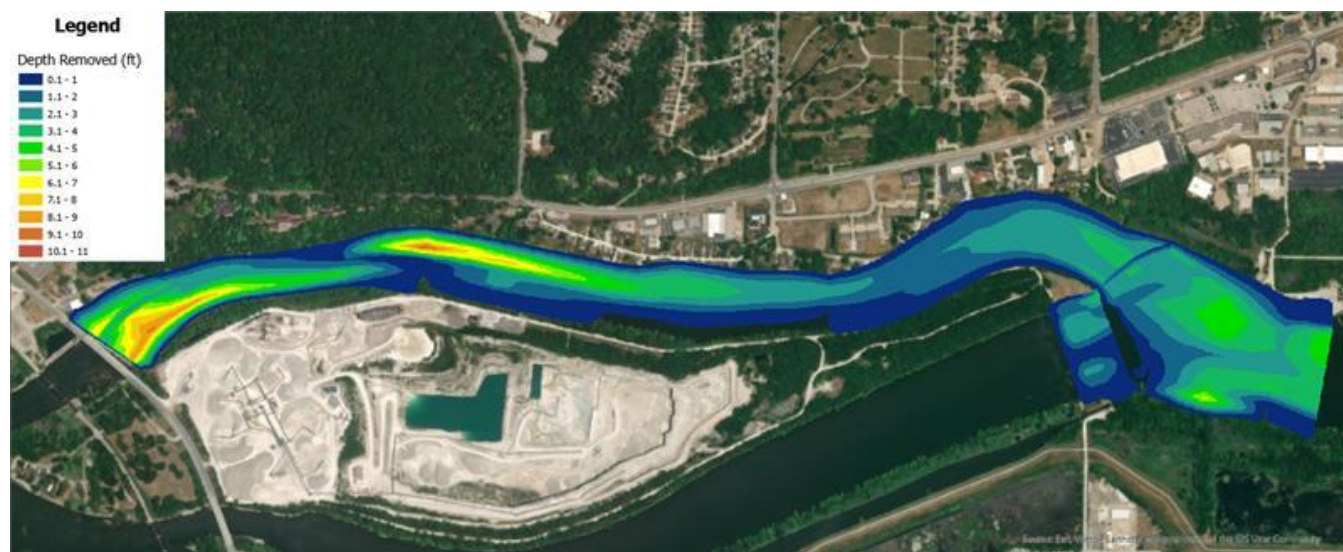


Figure 40: Depth of Material Removed from Channel Terrain

8.3.1.3 Construction Considerations

Construction of Alternative 1 involves large-scale demolition activities conducted under partially wet conditions. Access to the site is expected to be provided from 14th Street NE, utilizing the existing visitor parking area as a staging location. A temporary bridge spanning the historic lock may be required

to connect staging areas with the upstream causeway and dam site. Additional access points may include the left and right abutments of each dam, as well as public right-of-way along US 67 on the south side of the river, where temporary ramps to the channel may be constructed.

Drawdown Strategy

Prior to demolition, the impounded reaches must be dewatered. Two drawdown approaches are considered:

- A **staged drawdown**, which incrementally lowers the water surface and provides greater control over sediment release and bank stability,
- A **rapid drawdown**, which is more efficient but may result in higher turbidity and greater risk of slope instability.

The staged drawdown is recommended for the improved sediment control. Sequencing of drawdown can influence construction efficiency. Lowering the pool at Sears Dam first is expected to improve access to Steel Dam and reduce construction complexity more effectively than reversing the sequence. Concept-level construction drawings are provided in [Appendix A](#) with quantities and costs provided in [Appendix B](#).

Demolition and Material Handling

Removal of the spillway structures will be conducted using excavators equipped with hydraulic breakers. Concrete debris will be removed from the site, with potential reuse as riprap evaluated where feasible. For purposes of this study, it was assumed that all the concrete will be removed from the site. At the north end of the spillway, contractors will be instructed to use special care to leave the powerhouse approach guide wall undamaged. At the south end of the spillway there are upstream retaining walls that extend downstream and connect to the US 67 bridge approach slope wall. The upstream walls and portions of the downstream walls will be removed to the extent necessary to shape the bank grading back to its natural condition.

Water Control and Environmental Measures

Construction will occur under wet conditions potentially requiring localized dewatering and the installation of cofferdams to isolate work areas and prevent backflow from the Mississippi and Rock Rivers. Turbidity increases are expected during both drawdown and demolition. Best management practices, including erosion and sediment control measures and turbidity monitoring, will be implemented to minimize environmental impacts.

Site Restoration and Additional Considerations

Following removal, the river channel will naturally adjust to establish a stable grade over time. Banks will be stabilized using riprap and revegetation to prevent bank sloughing.

A unique feature of the Steel dam is a memorial garden dedicated to drowning victims lost at the dam located adjacent to the south abutment. Removal of the abutment and regrading the area will disturb the memorial. We assume the existing memorial will be moved to an appropriate location or that a new memorial will be designed and constructed nearby in cooperation with the families of the victims.

8.3.1.4 River Impacts

The following section summarizes potential impacts and outcomes of the alternative relative to fish passage, river ecology, sediment evacuation and geomorphology, recreational impacts, bank stabilization requirements, and impoundment restoration. This report does not analyze the safety of recreational activities under any alternative due to the inherent risks associated with any river conditions; and it does not include potential economic impacts to local businesses and shoreline residential properties.

The most notable impact of Alternative 1 is the transition from an impounded river system (lentic) to a free-flowing channel (lotic) with reduced pool area. Approximately 2.5-acres of wetlands within 1,000-feet of the dams will be permanently impacted by full dam removal and an additional 22.5-acres potentially impacted upstream. There will be opportunities for wetland creation in final design as well as mitigation bank options. Restoration of the natural sediment transport processes within the Rock River allows impounded sediments to be passively evacuated, with minimal manual excavation required near the structures for demolition. It is estimated that as much as 4.3-million cubic yards of sediment currently stored behind the dams would potentially become mobilized, in time, following dam removal. This volume represents roughly 5- to 10-years of sediment transport capacity for the Rock River but less than one year for the downstream Mississippi River. Hydraulic modeling indicates that the mobilized sediment would be conveyed through both the North and South Channels and would preferentially deposit in low-velocity environments downstream, including side channels, backwaters, floodplains, existing bars, pools, and within the navigational pool upstream of Lock and Dam 16, located approximately 22-river miles downstream of the Rock River confluence. Overall, the anticipated sediment mobilization is substantial but expected to be gradually redistributed downstream in a manner consistent with natural fluvial processes.

Ecologically, removal of both dams would fully reconnect approximately 70-miles of the Rock River, shifting from lentic to lotic fish communities. While short-term sediment release may temporarily elevate turbidity and stress aquatic species, long-term conditions are expected to improve overall river health. Hydraulic modeling indicates that Alternative 1 generally provides conditions favorable for fish passage, with velocities typically below 4.0-ft/s and adequate flow depths, meeting thresholds based on the swimming abilities of key species such as Northern Pike and Lake Sturgeon. Although some localized higher velocities may occur, the presence of low-velocity refuge zones is expected to allow successful passage for most native fish species. This may also facilitate upstream movement of invasive species from the Mississippi River basin into the Rock River system. Movement of species such as Asian carp is not prevented by the dams, but it could expand under fully connected conditions.

With the passive sediment management approach, large pulses of previously impounded sediment may temporarily move through downstream reaches of the Rock and Mississippi Rivers, depositing in main and side channels where they could smother fish eggs, freshwater mussels, and existing habitat features, and increase overbank deposition. Most sediment would move in suspension and ultimately settle in areas already prone to deposition or in downstream impoundments. Mobile species such as fish are expected to be less affected, as they can relocate to newly available upstream habitats, while sessile organisms like mussels may experience short-term burial and turbidity impacts. However, these effects are expected to be temporary, and long-term conditions would improve, with increased mussel abundance and habitat biodiversity following restoration of natural river processes.

Impacts to federally and state-listed threatened and endangered species are expected to be largely beneficial or minimal. Terrestrial species such as Indiana bat and northern long-eared bat are anticipated to experience no impact if tree clearing is timed appropriately. No effects are expected for the eastern prairie fringed orchid due to lack of suitable habitat, though restored hydrology may create future habitat potential. The rusty patched bumblebee may experience minor, temporary disturbance during construction, but impact can be minimized through timing and may ultimately result in net habitat benefits. These findings are preliminary and subject to refinement through permitting and regulatory coordination, with required measures expected to minimize impacts and support long-term ecological gains.

Recreational conditions will shift from flatwater boating to riverine conditions. This will impact adjacent users such as the Backwater Gamblers water ski group with less predictable water-skiing conditions. The Sunset Marina on the Mississippi River will not be impacted. While this eliminates some existing uses, it also enhances opportunities for kayaking and canoeing through a continuous river system. The former impoundment is expected to function as a low-gradient river with generally mild hydraulics, low velocities, and sufficient depths to continue supporting boating, paddling, and angling, with fishing opportunities likely improving due to enhanced fish passage. Land-based recreation would remain supported at existing access points such as Hennepin Canal Parkway Lock #30, Black Hawk State Historic Site, and Ben Williamson Park, with opportunities for enhanced access, trails, and interpretive features. This analysis does not evaluate recreational safety; as with any river system, users assume inherent risks associated with moving water.

Impoundment restoration following dam removal provides an opportunity to stabilize the channel, revegetate newly exposed floodplain areas, and improve degraded habitat. Based on sediment probing, most deposited material upstream of Vandruff Island is less than 4-feet thick, with deeper accumulations in localized depositional areas. Hydraulic modeling indicates the post-removal channel will narrow by approximately 30- to 40-feet, concentrating revegetation efforts along channel margins. It is expected that vegetation will naturally volunteer in these margins. However, select areas slow to revegetate can be assisted with native seeding, woody plantings, or bioengineering methods such as fabric-based stabilization if needed.

Additional habitat enhancements may include installation of large wood, targeted revegetation, invasive species management, gravel augmentation, and selective bank grading. Future stakeholder coordination will need to refine restoration strategies and identify areas for treatment, if needed. Detailed evaluation is also needed to identify locations prone to excessive bank erosion after dam removal. These areas are expected to include reaches where existing bank vegetation is limited, particularly near residential and commercial properties downstream of 27th Street. Tributaries within the impoundment should also be assessed for potential impacts which are expected to be limited to the confluence area. Under typical conditions, water levels in this area are expected to drop by 2- to 4-feet, with modest increases in velocity of about 1 to 2-ft/s. Bioengineering solutions such as a stone toe combined with vegetation or large wood are likely to be effective at stabilizing these banks. The dam removal/modification project is limited to state-owned property and adjacent land required for temporary access and construction activities. Improvements or restoration outside of the immediate project area will need to be coordinated with local stakeholders. Riverbank adjustments are expected to resolve through natural processes.

8.3.1.5 Alt 1 Costs

Because this alternative removes the primary structures requiring ongoing maintenance, long-term maintenance needs are relatively limited. Activities will consist primarily of monitoring channel conditions, bank stability, and vegetation establishment following construction. Construction activities associated with this alternative are expected to be completed within two to three months for each dam removal and restoration.

The planning-level cost estimate for Alternative 1 reflects demolition, site access, restoration, and contingency allowances appropriate for a conceptual design stage is \$10.9 M. Detailed cost analysis is provided in [Appendix B](#) and a summary of anticipated project costs for all alternatives is included in [Table 17](#).

- Alternate 1: \$10.9M

[Figure 41](#) displays the Alternative 1 project concept. For additional details, including construction staging, refer to the full plan set provided in [Appendix A](#).

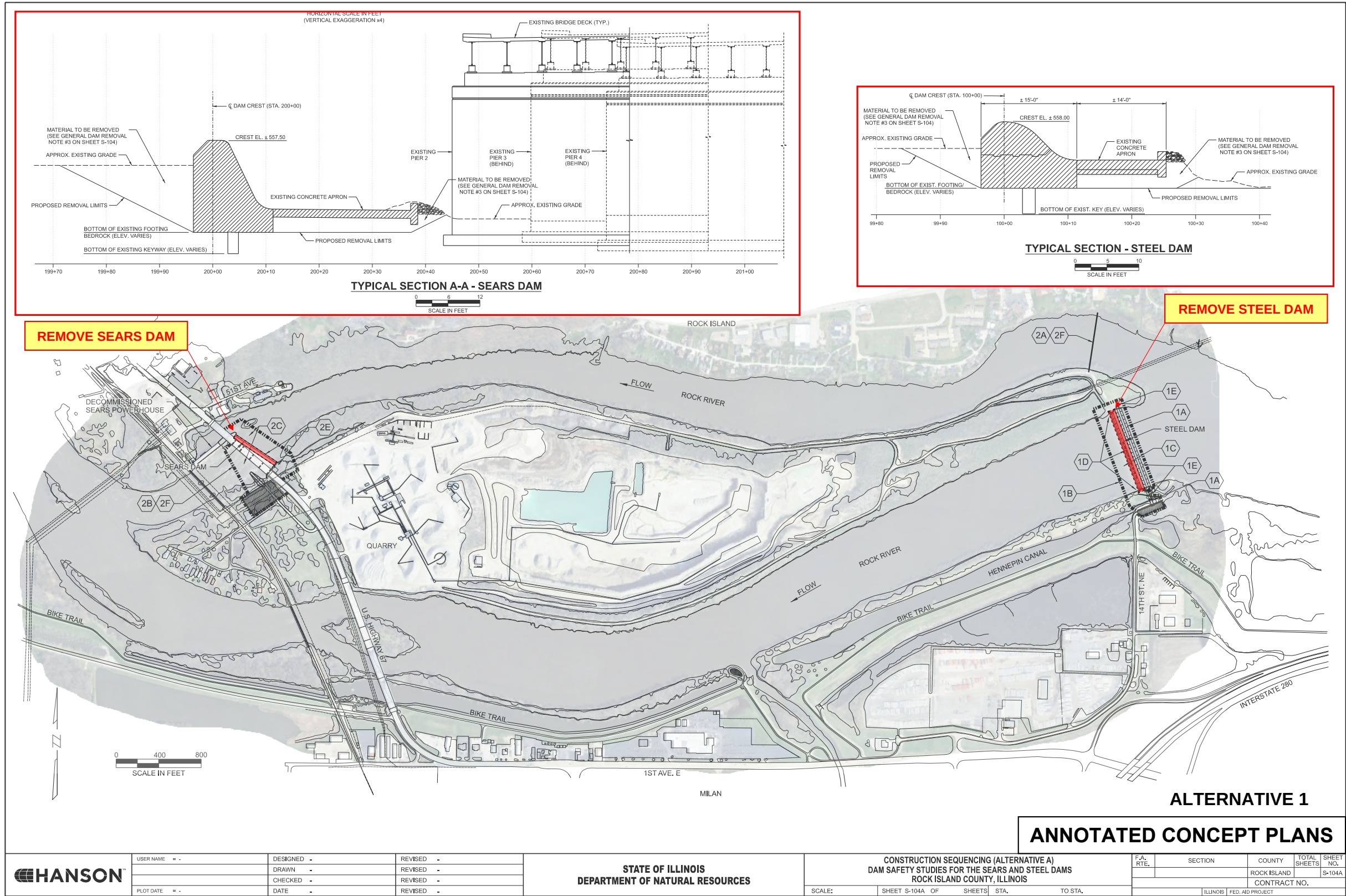


Figure 41. Alternative 1 Concept Plan

8.3.2 Alt 2 - Remove Sears, modify Steel Steps

8.3.2.1 Alternative Description

Alternative 2 includes removal of the Sears Dam spillway and modification of Steel Dam using stepped spillway features. Step modifications have been proven to improve safety for run-of-the-river dams. A physical model study was conducted by the University of Illinois at Urbana-Champaign (UIUC) to assess improving spillway safety at Glen D. Palmer Dam at Yorkville, IL on the Fox River (Freeman, 1996). The results of that work were used to modify Glen D. Palmer Dam which was completed by IDNR-OWR in 2010. The UIUC study recommended a stepped slope of 1 to 5 to dissipate the energy on the spillway and eliminate the hydraulic roller on the existing dam. CFD modeling was also used by UIUC to confirm the stepped spillway ratio. Based on this study, the 1 to 5 stepped ratio was used for Steel Dam. The stepped spillway is constructed along the downstream face of the existing Steel Dam, extending from the crest, across the apron, and into the downstream channel. The design involves drilling and grouting reinforcing steel into the existing spillway and apron, with additional anchoring into the underlying bedrock where the stepped structure extends beyond the original foundation. An existing scour hole downstream of the dam is filled and graded with riprap to create a stable transition between the modified structure and the natural riverbed.

The stepped configuration is intended to disrupt the formation of a recirculating hydraulic roller, which is the primary safety concern associated with low-head dams. By breaking the hydraulic drop into a series of smaller steps, energy is dissipated progressively through the water column instead of being concentrated at the base of the dam.

Removal of Sears Dam and retention of Steel Dam results in a system that partially restores river function while maintaining a significant portion of the upstream impoundment. As such, Alternative 2 represents a hybrid condition, balancing safety improvements, ecological benefits, and preservation of existing recreational resources.

8.3.2.2 Hydraulics

CFD Hydraulic Modeling

Remediation of Steel Dam with a series of reinforced concrete steps was analyzed in a CFD analysis to evaluate and visualize the breakup of the roller and conditions downstream of the dam. As shown [Figure 42](#), the hydraulic roller does not form downstream of the stepped spillway in the CFD model. High velocities are redirected towards the surface of the water column away from the dam and no longer recirculate back towards the dam. High velocities over the crest of the dam are maintained and there is significant flow turbulence as hydrodynamic flow energy is dissipated closer to the surface of the water, resulting in some residual risk to recreationists.

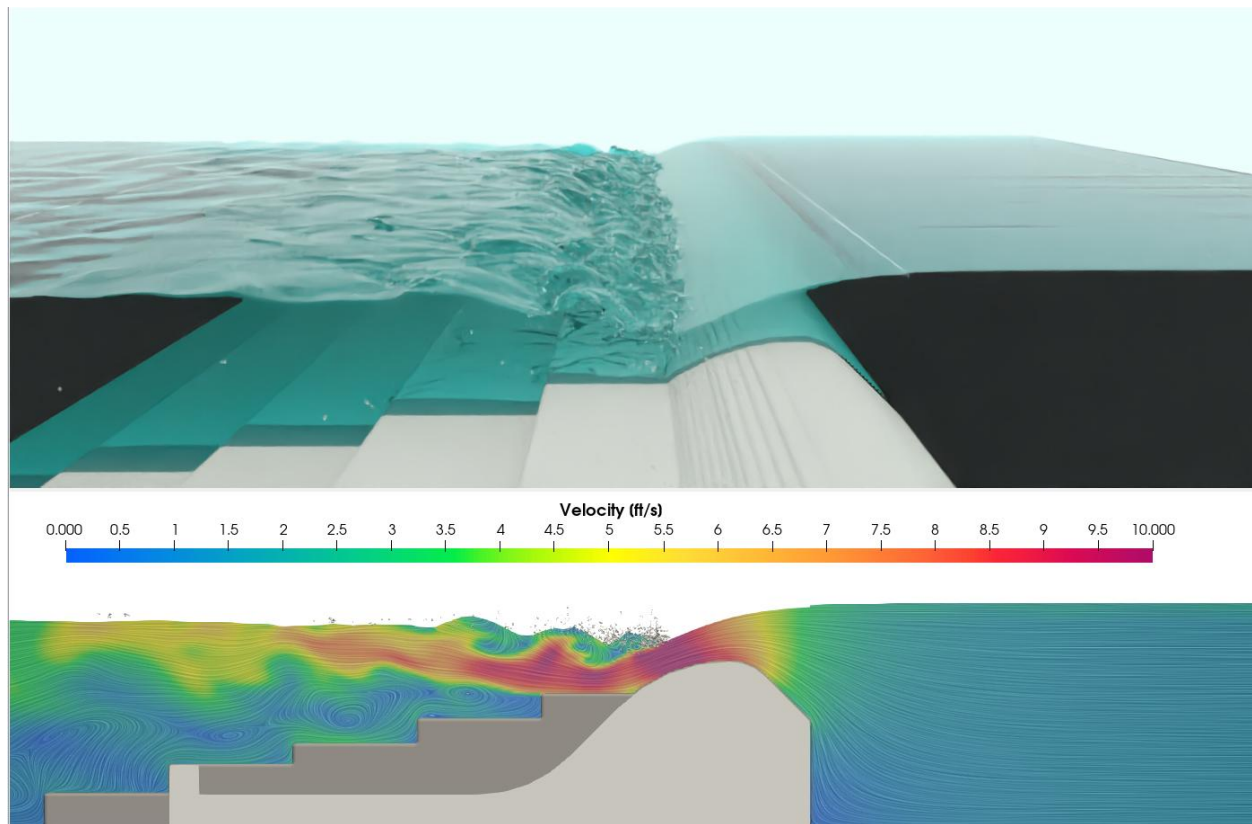


Figure 42: Steel Dam Remediated with Steps at Max Recreation Flows.

The CFD analysis for this feasibility report was cursory and provides a proof-of-concept that adding spillway steps for Steel Dam is an effective safety improvement by reducing or eliminating the dangerous hydraulic roller. For future design considerations, a more refined CFD analysis is required to better capture the following:

1. Confirm elimination of roller activity for the full range of flows across the full width of dam.
2. Extend modeling downstream of the remediation to define scour protection needs.
3. Ensure that dangerous conditions are not generated in the existing scour pool downstream of the dam and that the proposed rehabilitation adequately armors/repairs the scour pool.
4. Refine and calibrate the weir discharge coefficient for use in the 1D and 2D hydraulic models. The refined weir discharge coefficient across the full range of flows will improve estimates of changes to the flow split, upstream pool elevations, and changes in bed velocity and shear.
5. Incorporate air entrainment into the CFD analysis for more accurate determinations of flow density, flow bulking, and energy dissipation for the preferred alternative.
6. Optimizing mesh spacing in the model domain to improve computation accuracy and time.
7. Extend the limits of the CFD domain to capture influence of hydraulic features downstream of the dam.
8. Analyze large woody debris impacts to the proposed structure.

1D and 2D Hydraulic Modeling

1D and 2D modeling were also performed to understand resultant flow distribution changes between the North and South Channels and to help identify other potential river impacts. At high flood flows (above

10% (10-year) AEP) removing Sears Dam with Steel remaining in place demonstrates an increase of only 4% in the North Channel (without Sears Dam) percentage of total flows. The North Channel experiences more significant increases in the percent of flow for recreational events receiving approximately 16% more at maximum recreation flows, 33% for average recreation flows, and 51% more of the total for low recreation flows. This also results in **no flow** over Steel Dam for low recreation flow and drought flow events, effectively eliminating discharge through the South Channel. The reduction in South Channel flow has implications for both sediment transport and ecological connectivity in that reach.

The river's hydraulic response to Alternative 2 is governed primarily by the continued presence of Steel Dam, which remains the dominant control structure for upstream water surface elevations. Removal of Sears Dam reduces headloss through the North Channel, but the Steel Dam maintains much of the upstream pool. Hydraulic modeling indicates that removal of Sears Dam produces a modest reduction in upstream water surface elevation due to the nearly two miles of channel between the dam and the primary pool location. Pool reduction is approximately 0.42-feet under maximum recreational flow conditions, 0.54-feet under average recreational and 0.68-feet under low flow conditions. This modest reduction contrasts sharply with Alternative 1, where pool reductions exceed 2-feet and extend further upstream.

Within the North Channel, localized increases are more substantial due to concentration of flow in a smaller effective cross-sectional area following the redistribution of discharge. These increased velocities contribute to enhanced sediment transport capacity and potential channel adjustment. In contrast, the South Channel experiences reduced velocities as discharge decreases. At low flows, with low tailwater conditions on the Mississippi River, there is potential for the South Channel to become significantly dewatered.

[Table 14](#) and [Table 15](#) provide the changes in average channel velocities in the North and South Channels for maximum recreational flows with only Sears Dam removed. This promotes an increase in discharge in the North Channel along with a reduction in the flow depth upstream of the demolished dam resulting in increased channel velocities. The existing channel upstream of the North and South Channel flow split sees an increase in velocity of only 0.12-ft/s during maximum recreational flows.

Table 14. Removal of Sears Dam – North Channel Velocity Change (Max Recreation Flow)

North Channel - Velocity Change - Removal of Sears Dam			
Feet Above Sears Dam	Average Channel Velocity (ft/s)		Change in Velocity (ft/s)
	Existing	Sears Dam Removed	
Flow Split			
8606	2.01	3.27	1.26
8078	1.76	2.89	1.13
7339	2.23	3.82	1.59
6758	2.63	4.79	2.16
5755	1.67	3.34	1.67
5016	1.39	2.99	1.60
4277	1.84	4.47	2.63
3643	1.96	6.06	4.10
2851	1.91	5.08	3.17
1954	1.97	5.23	3.26
950	1.86	10.08	8.22
53	1.34	2.37	1.03
-53	1.45	2.09	0.64
-106	1.41	2.04	0.63
-211	1.87	2.68	0.81
-581	2.37	3.46	1.09
DS Confluence			
-686	2.52	3.71	1.19
-1003	2.16	3.20	1.04
-1320	1.83	2.71	0.88

Table 15. Removal of Sears Dam – South Channel Velocity Change (Max Recreation Flow)

South Channel - Velocity Change - Removal of Sears Dam			
Feet Above Sears Dam	Average Channel Velocity (ft/s)		Change in Velocity (ft/s)
	Existing	Sears Dam Removed	
Flow Split			
8290	2.30	2.38	0.08
7128	2.22	2.31	0.09
5333	2.19	2.30	0.11
4171	2.37	2.48	0.11
3221	2.23	2.34	0.11
3010	2.15	2.26	0.11
2165	2.08	2.20	0.12
1214	2.08	2.20	0.12
158	2.35	1.92	-0.43
106	2.14	1.74	-0.40
-106	3.13	2.84	-0.29
-634	3.11	2.81	-0.30
-1584	3.02	2.67	-0.35
-2640	3.09	2.73	-0.36
-3696	3.57	3.10	-0.47
-4752	5.07	4.53	-0.54
-5755	4.28	3.93	-0.35
-6811	3.87	3.49	-0.38
-7656	4.98	4.24	-0.74
-7762	4.54	3.86	-0.68
-8184	4.48	3.67	-0.81
-8290	4.64	3.73	-0.91
-9451	2.71	2.10	-0.61
DS Confluence			
-10085	2.11	1.61	-0.50

Note: Positive feet above Sears Dam means distance upstream of the dam and negative values indicate the distance downstream of the dam.

Removal of Sears Dam initiates the mobilization of sediment stored within the North Channel. Increased velocities and a steeper hydraulic gradient promote erosion of this material, potentially resulting in channel degradation down to the underlying depth-of-refusal elevation. Hydraulic modeling was extended in the 1D hydraulics model to evaluate long-term degradation effects, with results summarized in Table 16. Under degraded conditions, the conveyance capacity of the North Channel increases significantly, further reducing the amount of flow passing over Steel Dam. At low flow conditions, the 1D hydraulics model predicts no flow over Steel Dam, while at average recreational flows, discharge across the structure is reduced to approximately 6-percent of total flow, compared to approximately 33-percent under non-degraded conditions. This reduction in discharge lowers the upstream pool further. Relative to existing conditions, total pool reductions increase to approximately 1.21-feet at average recreational flows and 1.06-feet at higher recreational flows when full degradation is considered. The influence of degradation extends significantly upstream, with diminishing water surface changes approximately 12 miles upstream of the dam, indicating that long-term geomorphic adjustment has potentially system-wide effects.

Table 16 - 1D hydraulic model results comparison for Recreation Flows with Sears removed and degradation to DOR

Alternative	Low Recreation								
	Total Flow (cfs)	Sears Flow (cfs)	Sears % of total	Steel Flow (cfs)	Steel % of total	WSEL Upstream of Sears (ft)	WSEL (Upstream of Sears) Reduction Alternative - Existing	WSEL Upstream of Flow Split (ft)	WSEL (Upstream of Flow Split) Reduction Alternative - Existing
Existing	2,700	1,330	49	1,370	51	558.57	0.00	558.70	0.00
Sears Removed	2,700	2,700	100	-	0	547.70	-10.87	558.02	-0.68
Sears Removed (Degraded to DOR)	2,700	2,700	100	-	0	547.70	-10.87	558.02	-0.68

Alternative	Average Recreation								
	Total Flow (cfs)	Sears Flow (cfs)	Sears % of total	Steel Flow (cfs)	Steel % of total	WSEL Upstream of Sears (ft)	WSEL (Upstream of Sears) Reduction Alternative - Existing	WSEL Upstream of Flow Split (ft)	WSEL (Upstream of Flow Split) Reduction Alternative - Existing
Existing	7,900	2,990	38	4,910	62	559.19	0.00	559.62	0.00
Sears Removed	7,900	5,277	67	2,623	33	549.30	-9.89	559.08	-0.54
Sears Removed (Degraded to DOR)	7,900	7,443	94	457	6	549.86	-9.33	558.41	-1.21

Alternative	Higher Recreation								
	Total Flow (cfs)	Sears Flow (cfs)	Sears % of total	Steel Flow (cfs)	Steel % of total	WSEL Upstream of Sears (ft)	WSEL (Upstream of Sears) Reduction Alternative - Existing	WSEL Upstream of Flow Split (ft)	WSEL (Upstream of Flow Split) Reduction Alternative - Existing
Existing	11,500	4,051	35	7,449	65	559.52	0.00	560.13	0.00
Sears Removed	11,500	6,460	56	5,040	44	550.44	-9.08	559.66	-0.47
Sears Removed (Degraded to DOR)	11,500	9,077	79	2,423	21	550.89	-8.63	559.07	-1.06

Alternative	High Recreation								
	Total Flow (cfs)	Sears Flow (cfs)	Sears % of total	Steel Flow (cfs)	Steel % of total	WSEL Upstream of Sears (ft)	WSEL (Upstream of Sears) Reduction Alternative - Existing	WSEL Upstream of Flow Split (ft)	WSEL (Upstream of Flow Split) Reduction Alternative - Existing
Existing	16,000	5,276	33	10,724	67	559.84	0.00	560.69	0.00
Sears Removed	16,000	7,801	49	8,199	51	551.76	-8.08	560.27	-0.42
Sears Removed (Degraded to DOR)	16,000	10,827	68	5,173	32	552.13	-7.71	559.72	-0.97

In addition to these immediate hydraulic changes, long-term degradation may remove sediment that currently contributes to foundation stability. Bridge structures located within the former impounded reach, including crossings at 11th Street, Milan Beltway, 27th Street, Highway 6, and Illinois Route 84, should be evaluated to confirm that existing scour protection measures are adequate under future conditions.

8.3.2.3 Construction Considerations

Construction of Alternative 2 involves two primary phases: removal of Sears Dam and modification of Steel Dam. Removal of Sears Dam is generally consistent with the approach described for Alternative 1, including drawdown, demolition using hydraulic equipment, and channel restoration. Modification of Steel Dam requires construction of the stepped spillway, including installation of reinforced concrete elements anchored into the existing structure and bedrock. A causeway is assumed to be constructed upstream of the spillway to facilitate access, with indications that remnants of a previous causeway from dam spillway rehabilitation in the 1980s may be present and can be modified to meet project needs.

Construction is expected to occur largely under wet conditions, though localized dewatering and cofferdams may be required to isolate work areas and ensure quality installation. Sequencing considerations are particularly important, as the Steel Dam continues to control upstream water levels throughout construction.

8.3.2.4 River Impacts

Alternative 2 significantly improves river safety by eliminating the hazardous conditions at Sears Dam and significantly reducing the hydraulic hazard at Steel Dam. The potential elimination of the recirculating roller addresses the primary safety concern; however, the structure continues to present residual risks associated with turbulence and high velocities.

With Steel Dam remaining and Sears Dam removed, most flow would shift to the North Channel—reversing current conditions where the South Channel carries the majority of river flows. This shift is

most pronounced at low flows and decreases as flows increase. The South Channel would receive no flow below ~5,500-cfs and exceed 1-foot depth only above ~8,000-cfs. Under median spring flow, the North Channel would have velocities of 3–7 ft/s with depths of 4–6 ft. In contrast, the South Channel would have reduced depths of 1–2 ft, lower velocities (<1 to 2.5 ft/s), and more variable conditions. Compared to Alternative 1, upstream changes would be smaller: water surface elevations would be 0–1.5-ft lower, with velocities of 1.8–3 ft/s, about 0–0.5 ft/s higher than existing.

Ecologically, removal of Sears Dam improves connectivity within the North Channel and enhances fish passage. However, the continued presence of Steel Dam limits full restoration of longitudinal connectivity, particularly in the South Channel, where reduced flows may impede movement under certain conditions. Changes in flow distribution would further limit passage. In the North Channel, typical velocities of 4–7 ft/s exceed the swimming capacity of Northern Pike and Lake Sturgeon, though channel margins may offer limited resting or passage areas.

Following removal of one dam, long-term gains for native freshwater mussels are expected to be limited. While restoring and reconnecting habitat may increase abundance and diversity, the remaining impoundment upstream of Steel Dam will likely continue to provide poor habitat. Because mussels are largely immobile, most individuals are unlikely to colonize newly restored areas. In the short term, they may be affected by burial in depositional zones and increased turbidity from sediment transport. More mobile aquatic macroinvertebrates can already pass low-head dams and likely occur on both sides, so removal may not significantly change community composition, though it could increase habitat diversity.

Sediment transport and impoundment evacuation would generally mirror the volumes, rates, and outcomes within the North Channel as described for Alternative 1. Increased flow energy in the North Channel would also enhance sediment transport within impounded areas along the north side of the river. However, sediments immediately upstream of Steel Dam may persist after modifications, and this reach would likely remain depositional over time. The total volume of sediment transport would be reduced.

Removing Sears Dam would improve connectivity and benefit state-endangered fish by eliminating a passage barrier. For terrestrial species, no effects are expected for Indiana bat, northern long-eared bat (with no tree clearing), or eastern prairie fringed orchid due to lack of suitable habitat. Retaining Steel Dam may limit restoration of natural water fluctuations needed for orchid habitat. The rusty patched bumblebee may experience temporary, localized impacts from bank disturbance, with limited overlap with nesting areas. With construction timing and pollinator-friendly restoration (e.g., native seed mixes, extended bloom, invasive control), impacts are expected to be minor and likely net positive, though smaller in extent than under Alternative 1.

Recreationally, the alternative preserves the majority of the upstream pool, maintaining flatwater boating conditions while allowing improved passage for paddlers through the North Channel. The South Channel would only support use during higher flows with sufficient depth. Increased flow and velocities in the North Channel would favor a shift from flatwater to swift-water activities. Upstream of Vandruff Island, angling opportunities would likely improve due to better fish passage.

Alternative 2 would result in minimal changes to the limits of the upstream impoundment and river hydraulics. In the North Channel, banks susceptible to erosion would need to be stabilized to protect against the increased hydraulic forces and increased water levels that channel would experience relative to the full dam removal option. Because the impoundment upstream of Vandruff Island will experience only minor changes to river widths, opportunities for revegetation or habitat restoration are minimal.

8.3.2.5 Alt 2 Costs

By preserving Steel Dam in Alternative 2, residual annual maintenance costs remain, but at a lower level than existing conditions with two dams. Dam maintenance requires engineering inspections, safety reviews, concrete repairs, removal of woody debris and trash, mowing and controlling trees and invasive species. These residual costs typically range from \$10,000 to \$100,000 per year depending on conditions. For the purposes of this study, an average annual maintenance cost of \$50,000 was applied.

Converting the \$50,000 average annual costs to present worth value with a 4% average interest rate and 50-year project life correlates to \$1,074,000. The construction cost for Sears Dam removal (\$5.6M) and Steel Dam rehabilitation with steps (\$10.3M) is \$15.9M. Adding the maintenance costs for Steel Dam produces a total cost of:

- Alternate 2: \$17.0M

Figure 43 displays the Alternative 2 project concept.

8.3.2.6 Alt 2A

It should be noted that the (Alt 2A) concept of adding steps at Sears Dam to eliminate the roller was also explored but excluded due to high costs. The location of the US-67 bridge immediately adjacent to the dam raises hydraulic and structural concerns with this concept. Extending the spillway via steps would block a significant portion of the bridge opening and could adversely impact the flood conveyance capacity at critical flood events. Extending steps through the bridge also conflicts with the existing piers and structural support of the bridge. Structural remediation would be required for the bridge, or alternatively, the bridge would need to be relocated away from the dam conflict. The minimum added costs for bridge modification are estimated at \$1.2 million and full relocation would be at least \$14.4 million. These costs are in addition to the dam modification (stepped spillway) costs at Sears of \$14.1 million. As such, this concept was deemed cost prohibitive and not explored further. Total Sears Dam costs range from \$15,350,000 to \$28,550,000, plus \$10,280,000 for the stepped spillway at Steel, creates a total alternative project cost of \$25.6 to \$38.8 million.

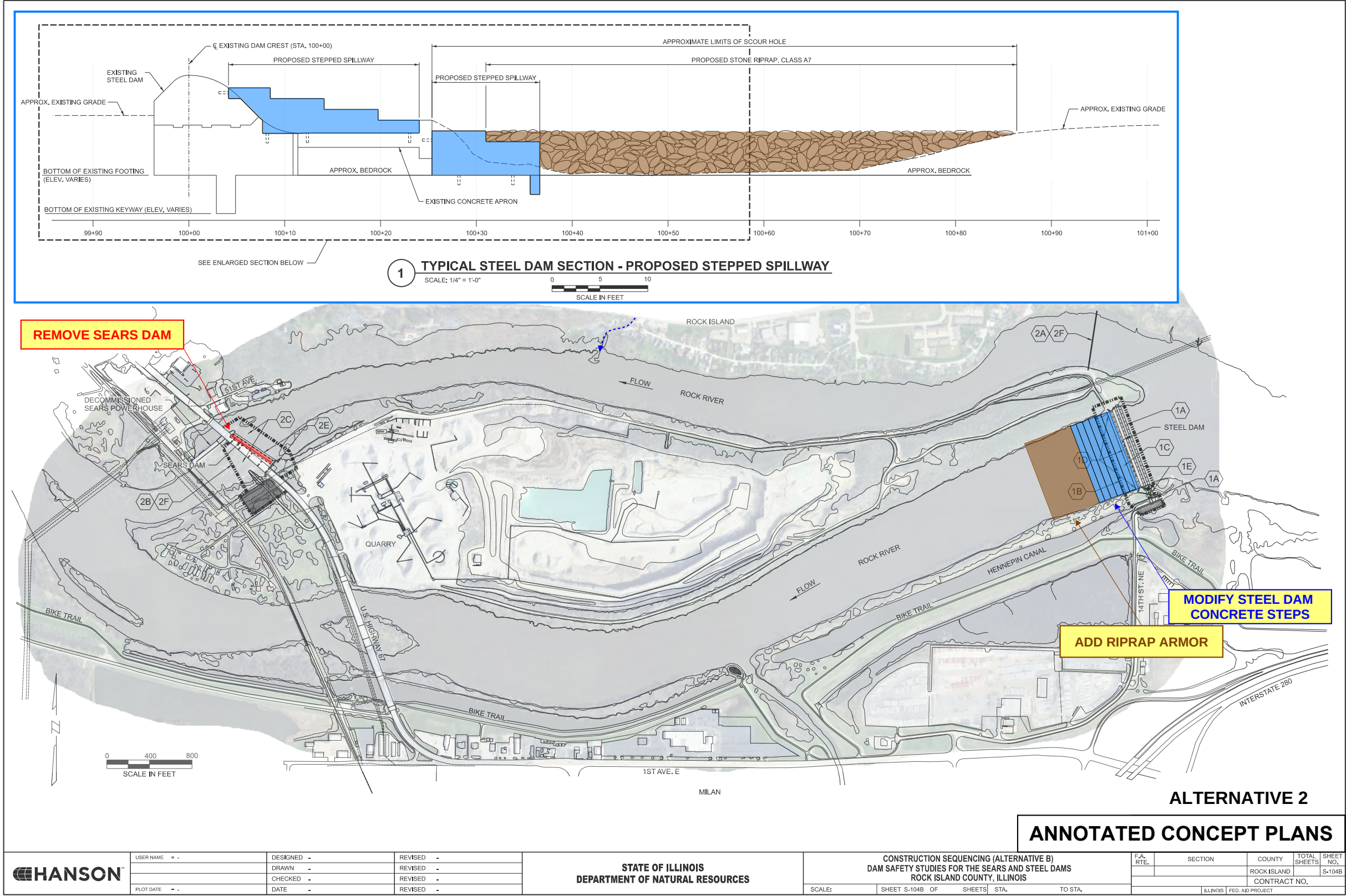


Figure 43. Alternative 2 Concept Plan

8.3.3 Alt 3 - Remove Sears, modify Steel Rock Ramp

8.3.3.1 Alternative Description

Alternative 3 consists of the complete removal of Sears Dam coupled with modification of the Steel Dam through construction of a rock ramp spillway extending along the downstream face of the existing structure. The objective of this alternative is to achieve the same fundamental safety improvement as Alternative 2—elimination of the hydraulic roller—while utilizing a more naturalized, geomorphic-based design approach.

The proposed rock ramp is constructed by placing a layer of grouted riprap directly on the existing spillway and apron, anchored to the structure to resist hydraulic forces. Downstream of this grouted section, the ramp transitions into ungrouted riprap placed to fill the existing scour hole and extend into the downstream channel at an approximate slope of 4 percent (1 vertical to 25 horizontal). This creates a continuous transition from the dam crest to the natural riverbed and distributes energy dissipation over a longer distance.

8.3.3.2 Hydraulics

Although Alternatives 2 and 3 achieve the primary objective of eliminating the hydraulic roller, they do so through different mechanisms. The stepped spillway dissipates energy through a series of discrete drops, whereas the rock ramp relies on continuous roughness and slope. These differences do not significantly influence upstream water surface elevations or flow distribution.

The hydraulics essentially mirror those for Alternative 2, see 8.3.2.2 for more information.

8.3.3.3 Construction Considerations

Construction of Alternative 3 includes removal of Sears Dam, followed by installation of the rock ramp at Steel Dam. Removal operations are similar to those described for Alternatives 1 and 2, including drawdown, demolition, and channel restoration. Installation of the rock ramp requires placement of large riprap material over a relatively extensive footprint downstream of the dam. The grouted section near the crest must be carefully constructed to ensure proper anchoring and bonding to the existing structure. Downstream portions involve bulk placement and grading of rock to achieve the specified slope and profile.

Because the ramp extends downstream beyond the existing apron, construction requires additional material quantities and a larger working footprint compared to the stepped spillway option. Access may be provided via temporary causeways, staging areas, or barge operations, depending on site constraints. Construction is expected to occur under partially wet conditions, with localized dewatering or cofferdams used as necessary to facilitate installation of the grouted section.

8.3.3.4 River Impacts

The river impacts associated with Alternative 3 are largely consistent with those of Alternative 2. Removal of Sears Dam improves connectivity within the North Channel and initiates sediment transport processes that move the system toward a more natural state. The rock ramp reduces the immediate hazard associated with the hydraulic roller; however, the presence of a constructed structure and

potential long-term degradation introduces residual safety concerns. The river remains partially controlled, and hydraulic conditions may vary over time depending on the condition of the ramp.

From an ecological perspective, the rock ramp may provide slightly improved habitat complexity relative to a concrete structure due to its rough, irregular surface. However, this benefit is dependent on design and maintenance, and the overall ecological outcome remains constrained by the presence of the Steel Dam.

The long-term performance of the rock ramp is the defining differentiator for Alternative 3 when compared to Alternative 2. Although initial hydraulic performance is comparable, the durability of the rock ramp introduces additional uncertainties. The grouted rock layer near the crest is subjected to continuous high-velocity flow and impact forces from transported debris. Over time, these forces can degrade the grout matrix, loosen rock, and create localized areas of instability. Once degradation begins, the affected areas may experience increased turbulence, which accelerates further erosion and structural breakdown. Debris accumulation presents an additional concern. Large woody debris or manmade materials can become lodged within the rock matrix, creating obstructions that alter local flow patterns and increase turbulence. These localized effects may result in concentrated forces that promote additional degradation.

If the rock ramp deteriorates to the point that underlying portions of the Steel Dam spillway become exposed, the hydraulic behavior of the structure may revert toward a more classical low-head dam profile. In such a scenario, the potential for formation of hazardous recirculating flow would increase, undermining the primary safety objective of the modification. For these reasons, Alternative 3 requires a comprehensive and ongoing maintenance program.

8.3.3.5 Alt 3 Costs

Similar to Alternative 2, residual annual maintenance costs remain, but at a higher level than Alternative 2. As such, the estimated annual maintenance cost is \$75,000 in anticipation of more frequent inspections and repairs. Inspections are recommended on at least an annual basis and following significant flow events to assess the condition of the ramp, identify areas of displacement or erosion, and address debris accumulation. Additional maintenance actions may include replacement of rock, re-grouting, and stabilization of affected areas.

Converting the \$75,000 average annual costs to a present worth value with a 4% average interest rate and 50-year project life correlates to \$1,611,000. The construction cost for Sears Dam removal (\$5.6M) and Steel Dam rehabilitation with rock ramp (\$5.6M) is \$11.2M. Adding the maintenance costs for Steel Dam produces a total cost of:

- Alternate 3: \$12.9M

Figure 44 displays the Alternative 3 project concept.

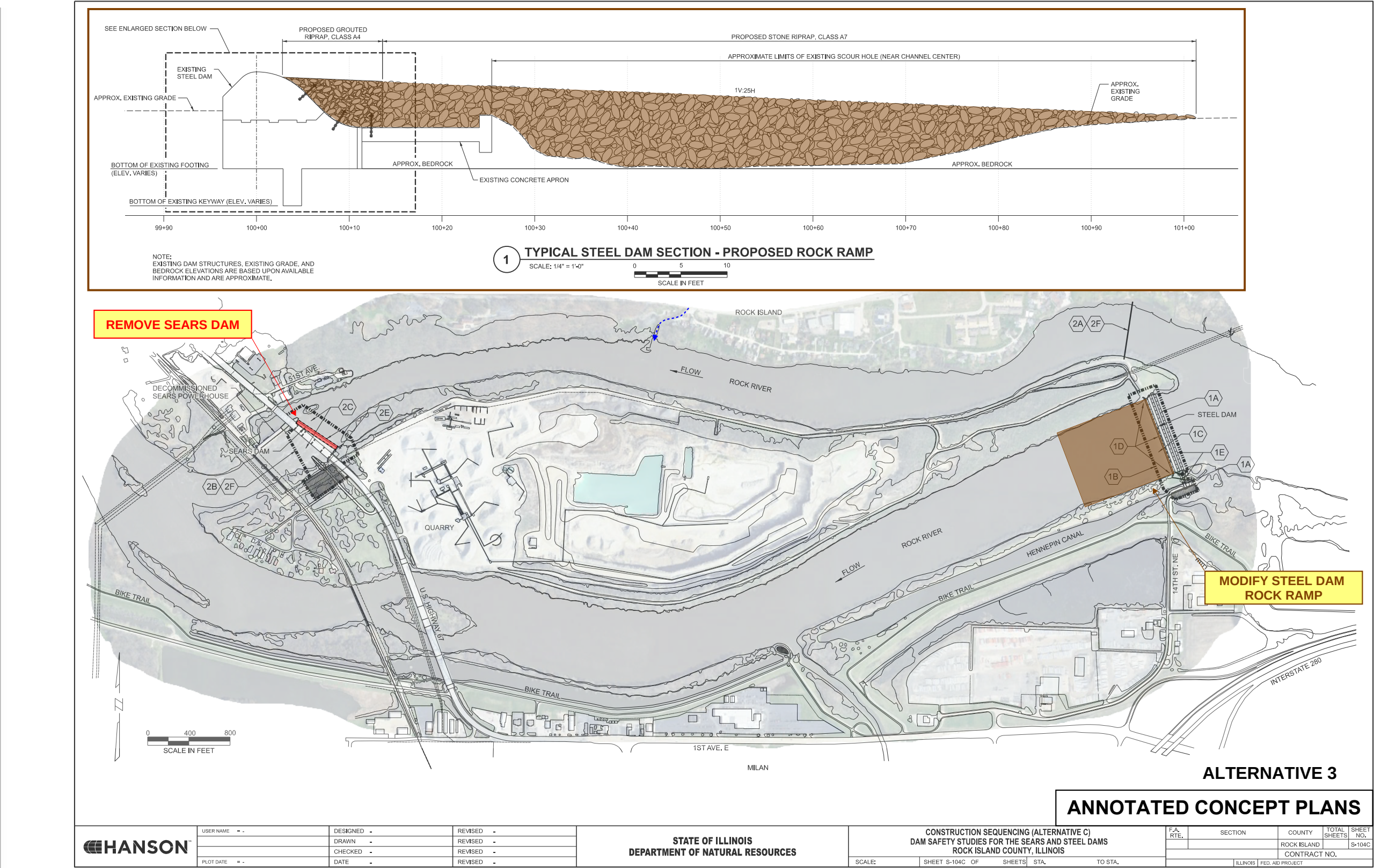


Figure 44. Alternative 3 Concept Plan

8.3.4 Alt 4 - Remove Sears, modify Steel Steps, add Riffles

8.3.4.1 Alternative Description

Alternative 4 builds directly on the framework developed for Alternative 2 by combining removal of Sears Dam with modification of Steel Dam using a stepped spillway and further augmenting the system through the addition of a series of rock riffles within the North Channel. The defining objective of this alternative is to preserve the upstream recreational pool while simultaneously addressing public safety concerns and improving ecological function within the river system.

Under this configuration, the Steel Dam remains the primary structural control; however, the introduction of the riffle system fundamentally redistributes hydraulic control within the reach. Instead of relying solely on the downstream structure to maintain pool elevation, Alternative 4 introduces distributed grade control elements in the North Channel that collectively elevate upstream water surface conditions and limit channel incision following removal of Sears Dam.

The riffles are conceptualized as broad, low-gradient structures constructed using large rock material, extending across portions of the North Channel. As reflected in the conceptual design ([Figure 46](#)), four riffles are located at approximate HEC-RAS cross sections 4.07, 3.72, 3.35, and 2.99, positioned to maximize backwater influence while also stabilizing sediment and moderating velocities. Each riffle is designed with heights generally between 3 and 4 feet, with lengths ranging from 300 to 500 feet, and slopes on the order of 2 percent, with the exception of the upstream-most riffle, which is approximately 4.3-foot high and functions as the primary control on upstream pool elevation. Riffle locations and configurations can be refined during design if this alternative is selected.

8.3.4.2 Hydraulics

The hydraulic behavior of Alternative 4 differs from the preceding alternatives in that water surface control is distributed spatially rather than concentrated at a single structure. While the Steel Dam continues to influence overall system hydraulics, the riffles establish intermediate control points that collectively define the channel profile and energy gradient. A key insight from the hydraulic analysis is that the upstream riffle can replicate the effect of the removed Sears Dam because it is located at a higher channel bed elevation. There is approximately 10-feet of longitudinal elevation difference between the original Sears Dam location and the upstream riffle site. This allows a relatively modest vertical structure (on the order of 4 feet) to produce a backwater condition comparable to that previously sustained by the dam. If this alternative is selected, the riffle slope should be optimized for fish passage during final design.

Hydraulic modeling indicates that the riffle system is capable of preserving upstream pool elevations under recreational flow conditions. As shown in [Figure 45](#), the water surface profile under the riffle-based alternative closely tracks the existing impounded condition upstream of the riffle system. Without riffles (as in Alternative 2), removal of Sears Dam produces a pool reduction of less than one foot. Under Alternative 4, this loss is effectively offset by the backwater created by the riffles, particularly the upstream structure. As a result, little to no noticeable change in water surface elevation is anticipated upstream of the riffle system during typical recreational flows.

Downstream of the riffles, water surface elevations reflect the stepped condition established by the riffles themselves, resulting in a transition from impounded to more riverine conditions within a controlled reach.

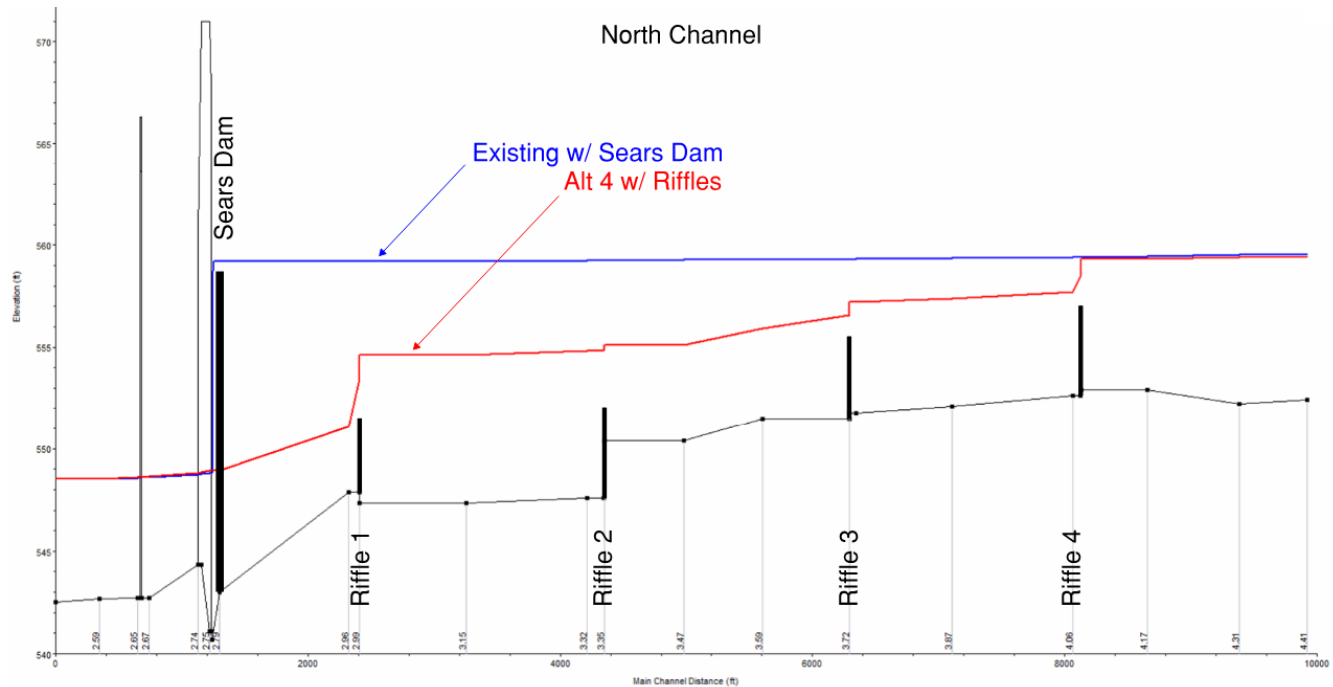


Figure 45 - Average Recreation Flows – Pool preservation through rock riffles w/ existing (blue) vs proposed riffles (red)

The introduction of riffles significantly alters velocity patterns in the North Channel. Under Alternatives 2 and 3, increased discharge through the North Channel results in elevated velocities throughout the reach. In Alternative 4, these velocity increases are moderated by the presence of riffles, which increase flow depth locally and create backwater zones upstream of each structure. While localized increases in turbulence and shear occur at riffle crests and downstream transitions, the overall reduction in channel slope and velocity reduces the potential for large-scale scour and bed degradation. Each riffle must be designed with adequate toe protection and embedded depth to resist localized scour and prevent undermining. The distributed nature of the structures reduces the likelihood of catastrophic failure at a single location but introduces multiple points requiring design considerations and future monitoring and maintenance.

Hydraulic modeling indicates that velocities upstream of the riffles are reduced to levels that are less erosive and more favorable for fish passage compared to the higher velocities predicted under Alternatives 2 and 3. Between riffles, localized acceleration occurs, but the spacing and geometry of the structures distribute energy dissipation throughout the reach rather than concentrating it at a single location. This configuration results in a step-pool hydraulic regime, where alternating zones of reduced and increased velocity provide a more heterogeneous flow environment compared to the relatively uniform conditions associated with dam-controlled or fully free-flowing systems.

A key function of the riffle system is sediment stabilization within the North Channel following the removal of Sears Dam. Under Alternatives 2 and 3, increased velocities and channel slope promote

erosion of impounded sediment and long-term degradation toward depth-of-refusal conditions. The riffles act as grade control structures, effectively segmenting the channel profile into shorter reaches with reduced slope. This significantly reduces the erosive capacity of the flow and limits large-scale channel incision. Sediment transport is therefore moderated, with deposition occurring upstream of each riffle where velocities are reduced. The cumulative effect is a more stable channel profile, reducing the extent of downstream sediment transport and associated turbidity impacts. The stabilization also mitigates the long-term lowering of the upstream pool that would otherwise occur as sediment is removed from the system.

By maintaining higher upstream water surface elevations, the riffles influence the overall hydraulic gradient at Vandruff Island. Because pool elevation is preserved and channel stability is improved, the magnitude of flow redistribution will be less sensitive to long-term degradation effects. Also, maintaining upstream pool elevation helps sustain flow over the Steel Dam for a broader range of conditions than in Alternatives 2 and 3, where channel degradation may significantly reduce or eliminate flow across the structure at lower discharges.

8.3.4.3 Construction Considerations

Construction of Alternative 4 is more complex than the previous alternatives due to the addition of multiple in-channel structures. In addition to all construction considerations noted in Alternative 2, this alternative adds construction of four riffle structures within the North Channel. Each riffle requires placement of large rock material across substantial channel widths and lengths. Construction access will likely involve a combination of temporary access roads, staging areas along the riverbanks, and potentially barge-based operations depending on site constraints. Because the riffles extend over hundreds of feet and involve significant material volumes, construction effort and duration will be greater than for Alternatives 1, 2 and 3. Sequencing is particularly important to ensure that pool control is maintained during removal of Sears Dam. In practice, construction of the upstream riffle may need to precede or be coordinated with dam removal to prevent uncontrolled drawdown.

Riffle construction must occur before removal of Sears Dam to prevent significant sediment evacuation within the impoundment. Riffle construction is anticipated to occur within the dry. This requires large cofferdams and dewatering to construct segments of each riffle or the entire reach. Given impounded water conditions, this effort adds significant cost. Impounded sediments within each cofferdam would need to be excavated and potentially disposed of offsite. This has potential to add additional costs to this alternative.

Access to riffle locations would likely require access from existing roads owned by the quarry on Vandruff Island. Impounded sediments located between riffles would quickly mobilize and transport downstream. The quantity of material that would evacuate following construction represents a minor volume compared to the overall volume of impounded sediment at the site. Maintaining the existing impoundment, therefore would not result in substantial evacuation of impounded areas upstream of Vandruff Island.

8.3.4.4 River Impacts

Alternative 4 produces a distinct combination of impacts compared to the other alternatives by simultaneously addressing safety, preserving existing recreation, and improving ecological objectives.

From a public safety perspective, the removal of Sears Dam eliminates the primary dam hazard, and the stepped spillway modification at Steel Dam mitigates the hydraulic roller. Residual risks associated with turbulence remain but are reduced relative to existing conditions. Alternative 4 represents a partially controlled system rather than full river restoration. Sediment transport is moderated rather than fully restored, and the channel remains stabilized through engineered features.

Recreationally, Alternative 4 uniquely preserves the upstream pool to a degree comparable to existing conditions. This allows continued flatwater boating upstream while introducing localized riffle features that may also enhance paddling experiences in certain reaches. Potentially incorporating river access from Black Hawk State Historic Site could provide significant recreational enhancements. Some boaters or paddlers would be able to navigate the series of constructed riffles at certain flow conditions. Angling opportunities within the impoundment would increase given improved fish passage conditions. Recreational activities in the water within the project area will still retain river safety risks as is the case with any river recreation. Adding features that may draw more users could lower the public safety enhancement provided by dam removal. Recreational users must be aware that they are responsible for their own safety and should understand the risks of recreating on or near a moving water system.

Ecologically, the riffle system introduces habitat diversity by creating a sequence of pools and riffles that support varied hydraulic conditions. These features improve fish passage relative to high-velocity conditions in Alternative 2 and provide more naturalized channel characteristics than the constructed solutions alone.

During final design, Alternative 4 would be designed to support native fish passage requirements. Conceptual hydraulic modeling confirmed pool preservation by adding vertical riffle elements to the existing bed. Final design will require additional analysis to ensure passage criteria are met. Riffles are assumed to have a maximum slope of 2%, considered passable for most native species, with intervening resting areas providing low-velocity refuges. Designs would mimic natural riffles using varied rock and boulder roughness to create complex flow patterns. Effectiveness will depend on crest elevation, stone size, flow range, and available low-velocity pathways.

Restoring passage in the North Channel would benefit most species—especially migratory and weak swimmers like Northern Pike and Lake Sturgeon—by improving upstream access. However, upstream passage would still be less effective than under full dam removal. Alternative 4 provides the lowest ecological benefit given that it maintains impounded water conditions. Fish that pass above the dams via the North Channel would experience degraded conditions within the impoundment and would need to swim upstream of the impoundment to find higher-quality spawning and nursery habitat. Bed impacts in the North Channel are greater than the other alternatives and may impact benthic organisms in some areas. Mussels would not benefit from any added habitat area. Threatened and Endangered species outcome characteristics would be similar to those of Alternative 2 and 3.

8.3.4.5 Alt 4 Costs

The distributed nature of the riffle system introduces a broader maintenance footprint compared to other alternatives. While rock riffles are generally durable, they are subject to displacement, settlement, and local erosion over time, particularly during high flow events. Maintenance requirements include periodic inspection of each riffle, replacement of displaced material, and monitoring of channel

conditions between structures. Compared to Alternative 2, where maintenance is concentrated at a single structure, Alternative 4 adds maintenance responsibilities across multiple locations. It is estimated that maintenance costs will average \$25,000 for each riffle per year. The total maintenance cost including rock riffles and maintenance of Steel dam is estimated to be \$150,000 per year.

Converting the \$150,000 average annual costs to a present worth value with a 4% average interest rate and 50-year project life correlates to \$3,222,300. The estimated construction cost for Alternative 4 is \$24.1 million, reflecting the significant increase in material quantities, construction effort, and complexity associated with installing multiple large-scale in-channel structures. Adding the maintenance costs for the riffle structures and for Steel Dam produces a total cost of:

- Alternate 4: \$27.4M

Figure 46 displays the Alternative 4 project concept.

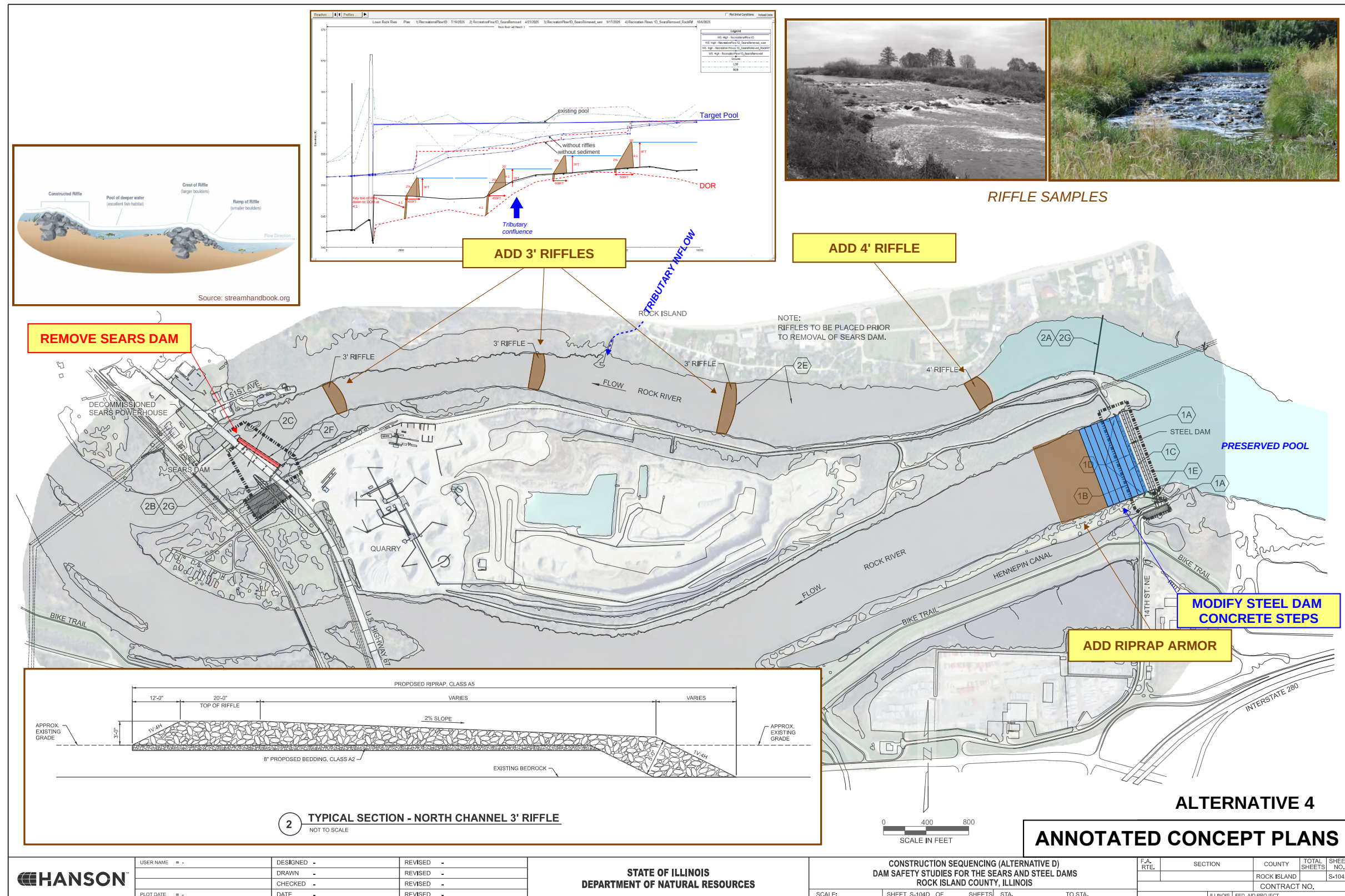


Figure 46. Alternative 4 Concept Plan

8.3.5 Alt 5 - Remove Sears, modify Steel Steps with Bypass

8.3.5.1 Alternative Description

Alternative 5 consists of the removal of Sears Dam combined with a multifaceted modification of Steel Dam that integrates three coordinated design elements: a stepped spillway configuration, a notched crest, and a nature-like fish bypass channel (see [Figure 47](#)). This alternative is intended to address the key deficiencies identified in Alternatives 2 and 3—specifically the loss of flow in the South Channel and limited fish passage—while maintaining a portion of the upstream recreational pool.

The Steel Dam is partially modified to include a 100-foot-wide and approximately 3-foot-deep notch in the spillway crest. This notch allows controlled discharge through the dam at lower flows while preserving upstream water surface elevation to a degree. The remainder of the spillway is reconstructed with concrete steps, similar to Alternative 2, to dissipate energy and eliminate the recirculating hydraulic roller. In addition to these modifications, a separate fish bypass channel is constructed along the southern side of the spillway. This bypass extends approximately 750-feet downstream at a longitudinal slope of about 1 percent, providing a continuous, low-gradient flow path independent of the main spillway. A separation wall isolates the bypass flow from the stepped spillway to maintain consistent hydraulic conditions suitable for fish passage.

Collectively, these components enable Alternative 5 to function as a hybrid system that improves safety, restores limited hydraulic connectivity, and enhances ecological performance while retaining partial impoundment.

8.3.5.2 Hydraulics

The addition of the notch introduces a controlled reduction in the crest elevation of Steel Dam, allowing a portion of flow to pass through the structure under conditions where Alternatives 2 and 3 would have little to no overtopping flow. As a result, upstream water surface elevations are reduced relative to existing conditions, but not to the extent observed under full dam removal. Hydraulic modeling indicates that under average recreational flows, the upstream water surface elevation is approximately 558.69 feet, representing a reduction of 0.93-feet relative to the existing pool elevation of 559.62 feet.

Despite this reduction, the pool remains substantially elevated compared to Alternative 1 conditions. Under full removal (Alternative 1), the same flow produces an elevation of approximately 556.93 feet, meaning Alternative 5 preserves approximately 1.76-feet of additional pool elevation. This intermediate pool condition reflects the role of the notch as a controlled outlet rather than complete removal of hydraulic control.

One of the most significant hydraulic improvements associated with Alternative 5 is the restoration of flow through the South Channel. Under Alternatives 2 and 3, removal of Sears Dam results in the North Channel capturing the majority of flow at lower discharges, leaving the South Channel effectively dry. The notch in Steel Dam modifies this behavior by providing a lower elevation flow path, allowing water to pass into the South Channel even under low flow conditions. Modeling results indicate that under low recreational flows, discharge through the South Channel increases from 0-cfs under Alternatives 2 and 3 to approximately 869-cfs with the notch in place. This restoration of flow improves hydraulic connectivity across both channels and maintains a more balanced distribution of discharge throughout

the system. It also supports ecological processes that depend on flow in both channels and enhances recreational continuity.

As with Alternatives 2 and 3, long-term geomorphic adjustment in the North Channel plays a significant role in system performance. Modeling was performed to evaluate conditions in which the North Channel degrades to the depth-of-refusal elevation following removal of Sears Dam. Under this scenario, the upstream pool is further reduced to approximately 557.92 feet, representing a total reduction of approximately 1.70-feet from existing conditions. The redistribution of flow under degraded conditions also affects the effectiveness of the notch. With increased conveyance in the North Channel, a greater proportion of flow is diverted away from Steel Dam. As a result, discharge through the notch decreases significantly. Under low flow conditions, South Channel discharge is reduced from 869-cfs to approximately 211.5-cfs. This indicates that while the notch improves hydraulic connectivity initially, its long-term effectiveness is dependent on channel stability upstream and may diminish over time if degradation in the North Channel is not managed.

The fish bypass channel represents a significant advancement in ecological function compared to other alternatives. Unlike the main spillway, which operates under varying flow conditions, the bypass is designed to provide a consistent hydraulic environment suitable for fish passage across a wide range of discharges. The channel's 1 percent slope over 750-feet creates a gradual elevation transition, minimizing velocities and providing sufficient depth for aquatic organisms. Because the bypass is hydraulically separated from the stepped spillway, it avoids the turbulence and flow variability associated with the main structure. The effectiveness of the bypass depends on careful design of entrance and exit conditions, as well as confirmation that velocities and depths fall within acceptable ranges for target species. Further refinement using computational fluid dynamics (CFD) is recommended to accurately model headloss, optimize flow distribution, and ensure functionality under both low and high flow conditions.

Sediment transport dynamics are similar to those observed in Alternatives 2 and 3. Removal of Sears Dam initiates mobilization of sediment within the North Channel, driven by increased velocities and steeper hydraulic gradients. The addition of the notch introduces some redistribution of sediment transport by restoring flow to the South Channel. This allows sediment loads to be shared between both channels rather than being concentrated entirely in the North Channel. However, this redistribution is limited by the amount of flow conveyed through the notch, which decreases under degraded conditions. The fish bypass channel is expected to function independently of sediment transport processes in the main channel and should be designed to avoid excessive sediment deposition that could impair functionality.

The redistribution of flow resulting from the notch has implications for scour potential throughout the system. Increased discharge in the South Channel relative to Alternatives 2 and 3 may result in localized increases in velocity and associated scour potential at structures within that reach. In the North Channel, increased conveyance resulting from Sears removal continues to elevate velocities and requires evaluation of existing bridges and infrastructure, as noted in Alternatives 2 and 3. At Steel Dam, the combination of stepped spillway, notch, and bypass channel introduces complex flow interactions that must be addressed in design. Scour protection is required at the base of the spillway and within the transition zones associated with the notch and bypass channel.

8.3.5.3 Construction Considerations

Alternative 5 presents one of the most complex construction scenarios among the evaluated alternatives due to the integration of multiple structural components. Construction includes removal of Sears Dam, modification of Steel Dam to incorporate both a stepped spillway and a notched crest, and construction of a new bypass channel. The bypass channel requires excavation, grading, and installation of a separation wall to isolate flows from the main spillway.

Sequencing is critical to maintain control of flow during construction. Temporary cofferdams or diversion structures may be required to isolate work areas and ensure safe and effective installation. Construction may occur under partially wet conditions, with localized dewatering as needed. The complexity of the design translates to increased construction duration and coordination requirements compared to other alternatives.

8.3.5.4 River Impacts

Alternative 5 provides a comprehensive set of improvements to river function. Public safety is enhanced through elimination of the hydraulic roller at Steel Dam and removal of Sears Dam. While turbulence remains, the most hazardous recirculating conditions are eliminated.

Ecologically, Alternative 5 offers the most significant improvement short of full dam removal. The combination of restored flow in the South Channel and the addition of a dedicated fish bypass channel significantly enhances connectivity for aquatic species. This represents a substantial improvement over Alternatives 2 and 3, where low flows may isolate portions of the river.

Recreationally, the alternative maintains a portion of the upstream pool while improving navigability and connectivity across both channels. This provides a balance between preservation of existing uses and restoration of riverine conditions. However, as with other partial-removal alternatives, the system remains influenced by structural controls, and long-term channel adjustment processes continue to affect hydraulic performance.

8.3.5.5 Alt 5 Costs

Alternative 5 introduces multiple structural elements that require ongoing maintenance, including the stepped spillway, notch, and fish bypass channel. Regular inspection is required to ensure structural integrity, maintain flow distribution, and prevent obstruction of the bypass channel. As such, the estimated annual maintenance cost is increased from Alternative 2 to \$75,000 in anticipation of more frequent inspections and repairs. Inspections are recommended on at least an annual basis and following significant flow events to assess the condition of the ramp, identify areas of displacement or erosion, and address debris accumulation. Additional maintenance actions may include replacement of rock and stabilization of affected areas.

Converting the \$75,000 average annual costs to a present worth value with a 4% average interest rate and 50-year project life correlates to \$1,611,000. The construction cost for Sears Dam removal (\$5.6M) and Steel Dam rehabilitation with steps and fish ramp (\$14.1M) is \$19.8M. Adding the maintenance costs for Steel Dam produces a total cost of:

- Alternate 5: \$21.4M

Figure 47 displays the Alternative 5 project concept.

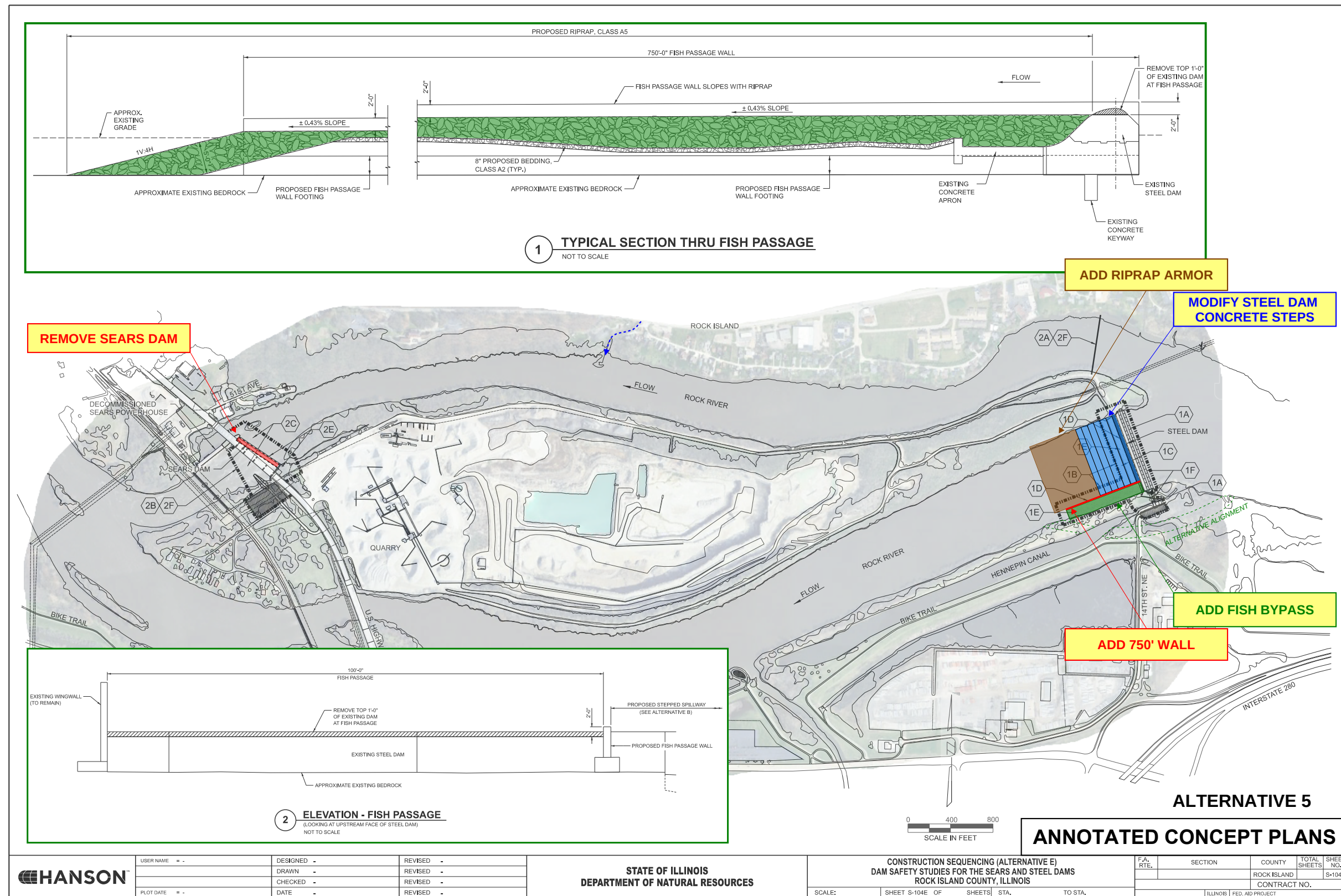


Figure 47. Alternative 5 Concept Plan

8.3.6 Alt 6 – No Change to Sears, modify Steel Steps

8.3.6.1 Alternative Description

Following the March 16, 2026, Public Outreach meeting, several comments were received requesting an alternative that does not fully remove Sears Dam. Specifically, stakeholders expressed interest in preserving the existing river pool while improving safety conditions at Steel Dam, which has experienced significantly more safety incidents.

In response, Alternative 6 has been added to emphasize safety enhancements at Steel Dam—where higher hazard events have occurred—by proposing the addition of concrete steps along the spillway. For Sears Dam, where fewer hazard incidents have been documented, safety improvements could include additional signage and/or installation of safety cables or buoys.

This alternative has been incorporated into the report to address public feedback and to allow for future evaluation. The costs associated with Alt 6 were taken from the Steel Dam portion of Alt 2.

8.3.6.2 Hydraulics

This alternative produces no changes to hydraulics from existing conditions.

8.3.6.3 Construction Considerations

Construction includes the same elements for modification of Steel Dam as described in Alt 2.

8.3.6.4 River Impacts

No river impacts are associated with this alternative as it preserves existing river conditions.

8.3.6.5 Alt 6 Costs

Alternative 6 maintains the two dams with structural elements that require ongoing maintenance. Regular inspection is required to ensure structural integrity, maintain flow distribution, and prevent obstructions. The estimated annual maintenance cost is increased to \$100,000 to account for two dams. Inspections are recommended on at least an annual basis and following significant flow events to assess the condition of the dams, identify areas of displacement or erosion, and address debris accumulation. Additional maintenance actions may include concrete repair and stabilization of affected areas.

The construction cost for Steel Dam rehabilitation with steps is \$10.3M. Adding the maintenance costs for Sears Dam and Steel Dam produces a total cost of:

- Alternate 6: \$12.4M

8.4 Cost Comparison

Table 17 provides a planning-level cost comparison for the six studied alternatives, including estimated construction costs and the present-worth value of assumed long-term maintenance obligations where structures remain. These estimates are intended for feasibility-level comparison and should be refined during design as construction sequencing, access requirements, water control, disposal needs, and permitting conditions are better defined.

Table 17 - Summary of Costs for the Alternatives

Alternative	Sears	Steel	Maintenance	Total	Description
1	\$5,647,010	\$5,318,880	\$0	\$10,965,890	Remove Both Dams
2	\$5,647,010	\$10,282,067	\$1,074,109	\$17,003,186	Remove Sears, modify Steel Steps
3	\$5,647,010	\$5,589,214	\$1,611,164	\$12,847,388	Remove Sears, modify Steel Rock Ramp
4	\$13,857,431	\$10,282,067	\$3,222,328	\$27,361,826	Remove Sears, modify Steel Steps, add Riffles
5	\$5,647,010	\$14,163,280	\$1,611,164	\$21,421,454	Remove Sears, modify Steel Steps with Bypass
6	\$0	\$10,282,067	\$2,148,218	\$12,430,286	No Change to Sears, modify Steel Steps

Based on the current estimates, Alternative 1 has the lowest construction cost among the alternatives as it removes both structures and avoids long-term structural maintenance. Alternative 4 has the highest construction cost due to the combined cost of Sears Dam removal, Steel Dam stepped modification, and construction of multiple large rock riffles in the North Channel to preserve the upstream pool.

Alternatives 2, 3, and 5 have intermediate construction costs because they remove Sears Dam but retain and modify Steel Dam. Alternative 6 has a lower construction cost than several modification alternatives because it modifies only Steel Dam; however, it does not remove the hazard at Sears Dam and retains maintenance responsibility for both structures.

Long-term maintenance costs are lowest for Alternative 1 because both dam spillways are removed and no modified dam structures remain to inspect, repair, or clear of debris. Alternative 6 has the highest retained dam-maintenance burden because both dams remain in place, with Steel Dam modified and Sears Dam preserved. Alternative 4 also has relatively high maintenance costs because it includes Steel Dam maintenance plus periodic inspection and repair of multiple riffle structures. Alternative 3 has higher maintenance than Alternative 2 because a rock ramp is more susceptible to displacement, grout deterioration, debris accumulation, and post-flood repair needs than a concrete stepped spillway.

Potential cost savings should be reviewed during final design and permitting. Items identified during project coordination include limiting dam removal to the extent necessary for hydraulic hazard elimination rather than removing all concrete to bedrock; avoiding full excavation or filling of downstream scour holes where hydraulic and stability analyses demonstrate that natural adjustment or targeted armoring is acceptable; minimizing or eliminating cofferdams where work can safely be performed under controlled wet conditions; and sequencing drawdown and demolition to reduce temporary access, dewatering, and water-control requirements.

9. Environmental Impacts & Permitting Review

This section outlines the anticipated environmental impacts and regulatory considerations associated with the proposed modifications or removal of the Sears and Steel Dams. It provides a comprehensive review of applicable federal and state permitting requirements, including those under the Clean Water Act, Endangered Species Act, and National Pollutant Discharge Elimination System (NPDES), among

others. The section also evaluates potential effects on wetlands, streams, threatened and endangered species, cultural resources, and environmental justice communities. Mitigation strategies and coordination with regulatory agencies such as the U.S. Army Corps of Engineers, Illinois Environmental Protection Agency, and Illinois State Historic Preservation Office are discussed to ensure compliance and minimize adverse impacts. This section serves as a critical foundation for understanding the permitting pathway and environmental responsibilities tied to project implementation.

9.1 Regulatory Requirements

The following permit and compliance requirements will be required for construction of the Project. The Sponsor will need to apply for and secure applicable permits prior to moving forward with the Project.

9.1.1. Clean Water Act (CWA) Sections 404 and 401

Dam removal activities involving placement or discharge of dredged or fill material into waters of the U.S. (e.g., sediment management, bank stabilization, temporary access fills) require authorization from USACE under Section 404 of the CWA. Any activity requiring a federal Section 404 permit must also receive Section 401 Water Quality Certification (WQC) from the state, issued by the Illinois EPA (IEPA).

9.1.2. Migratory Bird Treaty Act, Endangered Species Act Section 7 and State Sensitive Species

The Project area is within the range of two federally endangered bat species (Indiana bat, *Myotis sodalis* and northern long-eared bat, *Myotis septentrionalis*), one federally endangered insect (rusty patched bumble bee, *Bombus affinis*) and one federally threatened plant (eastern prairie fringed orchid, *Platanthera leucophaea*). Two state listed mussel species (*Ebonyshell*, *Reginiaia ebenus* and *elephantear*, *Elliptio crassedens*) and three state endangered fish (western sand darter, *Ammocrypta clara*, pallid shiner, *Hybopsis amnis*, and weed shiner *Notropis texanus*) also occur within the Project Area. See the following Mitigation section (Section 9.2) for consultation guidance with the U.S. Fish and Wildlife Service (USFWS) and Illinois Department of Natural Resources (IDNR) regarding sensitive species. If Bald Eagle (*Haliaeetus leucocephalus*) nests are located in the area, a Bald Eagle Nest Removal Permit may be required from the USFWS.

9.1.3. National Pollution Discharge Elimination System

The National Pollution Discharge Elimination System (NPDES) regulates the discharge of any pollutant from a point source into a water of the United States. The renovation of a dam will discharge sediment and other materials into streams. During the design phase, the sponsor will need to obtain an NPDES Construction General Permit. This permit will outline limits on what pollutants can be discharged, reporting requirements, and other provisions to ensure that the discharge does not adversely affect water quality. This permit may be obtained through the Illinois Environmental Protection Agency (IEPA).

9.1.4. Floodplain Management

Any development within a regulatory floodplain will require a General Permit from IDNR-OWR Division of Water Resource Management (DWRM). All work must be in accordance with the requirements of Illinois Administrative Code 17 § 1(h), Part 3700 Construction in Floodways of Rivers, Lakes, and Streams as well as all other applicable county/city ordinances, federal programs, and the laws and regulations of the State of Illinois. Additionally, the impacts to the FEMA regulatory flood elevations are not anticipated to require remapping but may be considered in the future.

9.1.5. Dam Considerations

Previously, the dams were regulated by the Federal Energy Regulatory Commission (FERC) as the dams were used for hydropower. With the decommissioning of hydropower, this regulation is no longer active. Steel Dam is a High Hazard Potential Dam (HHPD) and any modification to the dam requires coordination with the Federal Emergency Management Agency (FEMA). Grants to conduct such work on HHPD may be available through FEMA. Concurrently, modifications to the dams will also require a Construction and Maintenance of Dams Permit from the IDNR-OWR DWRM.

9.1.6. General Project Implementation

Prior to project construction, Contractor Registration will be required through both the City of Rock Island and Rock Island County.

9.2 Mitigation

The proposed action may impact wetlands and streams. Any permanent impact on waters of the United States (WOTUS) may require mitigation in the form of restoration (re-establishment or rehabilitation), enhancement, or establishment of aquatic resources. The need for compensatory mitigation would be addressed during the CWA Section 404 permitting process. The Sponsor will request an Approved Jurisdictional Determination (AJD) from the USACE – Rock Island Regulatory District to determine whether the wetlands and streams are subject to jurisdiction under Section 404 of the CWA.

The proposed action may also impact sensitive species and cultural resources. Coordination may also be required with the USFWS, IDNR and the Illinois State Historic Preservation Office (ISHPO) to protect or mitigate impacts to these resources.

9.2.1. Wetland Mitigation

Wetland impacts vary by alternative and may require mitigation as defined during the permitting process. For this study an estimate of potential wetland impacts has been defined. Alternative 1 includes removal of both dams and provides the highest wetland impact potential. Up to 25.0 acres may be impacted consisting of bottomland forest (3.5ac), deepwater lake (21.1ac) and perennial deepwater river (0.4ac). The other alternatives produce lesser impacts up to 10.5 acres consisting of bottomland forest (1.6ac), deepwater lake (1.9ac), perennial deepwater river (6.3ac), shallow marsh (0.6ac) and shrub-scrub (0.2ac). There are also 706 acres of wetlands downstream of the dams to the confluence with Mississippi River and within 1,000-feet of the centerline of the Rock River that could be impacted by construction activities. The AJD will determine if the wetlands are jurisdictional. It would then be necessary to determine the impact and assess whether compensatory mitigation would be required; this would likely include agency coordination to help inform this decision. If needed, the Wetland Monitoring and Assessment Program for the State of Illinois (IEPA 2007), or other assessment methodology would generally be applied to determine appropriate mitigation. There are numerous mitigation banks with a service area that includes the Project Area. If mitigation is necessary, it would also be necessary to address the preference hierarchy and other requirements established in the CWA 2008 Mitigation Rule. Historically, the net positive benefits from dam removal projects negate the need for mitigation. However, dam modifications have less overall benefits so might require mitigation efforts.

9.2.2. *Stream Mitigation*

Approximately 13,200 linear feet of streams, the Rock River from the dams to the confluence with the Mississippi River, have potential to be impacted by implementation of the preferred alternative. The AJD will determine if the streams are jurisdictional. It would then be necessary to determine the impact and assess whether compensatory mitigation would be required; this would likely include agency coordination to help inform this decision. If needed, the Illinois Stream Mitigation Guidance (USACE 2010), or other assessment methodology would generally be applied to determine appropriate mitigation. There are numerous mitigation banks with a service area that includes the Project Area. If mitigation is necessary, it would also be necessary to address the preference hierarchy and other requirements established in the CWA 2008 Mitigation Rule. Experience with prior dam removal projects in the state indicate that mitigation is likely not required.

9.2.3. *Migratory Bird Treaty Act and Endangered Species Act Section 7 and State Sensitive Species.*

As the potential for occurrence of both federal and state sensitive species has been identified in the area, an Endangered Species Act (ESA) Section 7 consultation may be required with USFWS, and additional consultation may be necessary with the IDNR. Mitigation measures may include felling potential bat roost trees as needed only during the inactive period of November 16 – March 31 (USFWS 2024) and increasing nectar plants within breeding and migratory areas for insects (USFWS 2021).

9.2.4. *Cultural Resources.*

Potential impacts to adjacent cultural resources must be assessed and mitigated in cooperation with Illinois State Historic Preservation Office (ISHPO). Several archaeological and historic resources have been identified near the dams, including the Saukenauk Village and Sauk Cemetery. While dam removal may not directly affect these areas, appropriate coordination with the ISHPO and adherence to regulatory requirements will ensure that cultural resources are protected.

9.3 *Environmental Justice*

The Illinois EPA is committed to protecting the environment and the health of the residents of Illinois, and to promoting environmental equity in the administration of its programs through its Environmental Justice Policy. The demographic and socioeconomic information summarized in this section is provided to support environmental justice review, public involvement planning, and future funding eligibility evaluations. Census-based indicators such as poverty, income, unemployment, minority population, and educational attainment help identify whether the project area includes populations that may warrant additional outreach or consideration during project development and permitting. These data may also be useful when evaluating eligibility for federal or state funding, grants, or loans that consider disadvantaged, underserved, or economically distressed communities. For Illinois funding programs, the data should be compared, where applicable, with 17 Ill. Adm. Code 3025.36, Distressed Communities Definition and Criteria, which identifies economically distressed communities. The information in this report addresses review of low-income and minority populations based on census data and site visit observations.

9.3.1 *Census Data*

Table 18 through Table 23 summarize the region's population, civilian labor force, unemployment, median household income, educational attainment, diversity, and poverty. Population data can be used to assess socioeconomic characteristics. The civilian labor force is the sum of the currently employed

and unemployed and percent unemployed is a comparison of the unemployed people to the total civilian labor force. Median household income is the income level earned by a given household where half of the homes in a demographic area earn more and half earn less. Educational attainment refers to the highest level of education that an individual has completed. Minorities information reveals diversity in an area. People below the poverty threshold indicates the percentage of individuals in poverty status. Monetary income thresholds are used to determine poverty levels. Data is provided by the United States Census Bureau (USCB) American Community Survey (ACS) estimates for years 2000 through 2023.

Based on the USCB data, the Project Area is in a county with average population for the state. County unemployment is similar to the state, while the median household income is lower. The population and civilian labor force in Rock Island Township and Milan Village has decreased somewhat as compared to the county and state, while the change in percent unemployed has decreased markedly as compared to the county and state. The median household income is much lower in Rock Island Township and somewhat lower in Milan village as compared to the county and state. Educational attainment is higher in the county than the state for High School Diplomas but lower for Bachelor's Degrees. Additionally, the county and Milan Village have a much lower minority population than the state while Rock Island Township's minority population is somewhat higher than the state. The county and Milan Village have a similar poverty percentage while Rock Island Township is much higher (USCB 2023a-e).

Table 18. Population Growth 2000-2023

Population Growth 2000-2023				
Location	2000	2010	2023	Average Annual Change (%) (2000-2023)
State of Illinois	12,419,293	12,830,632	12,549,689	0.0
Rock Island County	149,374	147,546	142,995	-0.2
Rock Island Township	17,995	17,776	15,897	-0.5
Milan Village	5,313	5,099	5,037	-0.2

Source: U.S. Census Bureau, 2000 Decennial Census, and 2010 and 2023 American Community Survey 5-Year Estimates.

Table 19. Civilian Labor Force 2000-2023

Civilian Labor Force 2000-2023				
Location	2000	2010	2023	Average Annual Change (%) (2000-2023)
State of Illinois	6,208,597	6,632,592	6,638,033	0.3
Rock Island County	76,234	75,249	70,242	-0.4
Rock Island Township	8,783	8,222	7,513	-0.7
Milan Village	2,697	2,367	2,622	-0.1

Source: U.S. Census Bureau, 2000 Decennial Census, and 2010 and 2023 American Community Survey 5-Year Estimates.

Table 20. Percent Unemployed 2000-2023

Percent Unemployed 2000-2023				
Location	2000	2010	2023	Average Annual Change (%) (2000-2023)
State of Illinois	3.9	8.6	5.8	1.7

Rock Island County	4.1	7.8	5.7	1.4
Rock Island Township	7.3	10.6	7.1	-0.1
Milan Village	3.8	15	1.2	-4.9

Source: U.S. Census Bureau, 2000 Decennial Census, and 2010 and 2023 American Community Survey 5-Year Estimates.

Table 21. Median Household Income 2000-2023

Median Household Income 2000-2023				
Location	2000	2010	2023	Average Annual Change (%) (2000-2023)
State of Illinois	\$46,590	\$55,735	\$81,702	2.5
Rock Island County	\$38,608	\$46,226	\$66,768	2.4
Rock Island Township	\$27,115	\$30,200	\$40,783	1.8
Milan Village	\$34,556	\$38,674	\$61,188	2.5

Source: U.S. Census Bureau, 2000 Decennial Census, and 2010 and 2023 American Community Survey 5-Year Estimates.

Table 22. Educational Attainment 2023

Educational Attainment 2023		
Location	High School Diploma or Higher (%)	Bachelor's Degree or Higher (%)
State of Illinois	26	35
Rock Island County	32	23
Rock Island Township	38	12
Milan Village	32	22

Source: U.S. Census Bureau, 2000 Decennial Census, and 2010 and 2023 American Community Survey 5-Year Estimates.

Table 23. Summary of Minorities and Poverty 2023

Summary of Minorities and Poverty 2023								
Location	American Indian and Alaska Native (%)	Asian (%)	Black or African American (%)	Hispanic or Latino (%)	Native Hawaiian or Other Pacific Islander (%)	Some Other Race (%)	White (%)	People Below Poverty Threshold (%)
State of Illinois	0.5	5.8	13.8	18.5	0.0	7.3	58.7	11.7
Rock Island County	0.0	3.0	10.4	14.4	0.0	4.4	67.0	15.4
Rock Island Township	0.5	3.4	24.1	19.1	1.0	6.4	50.4	30.3
Milan Village	0.6	0.9	2.0	9.4	0.0	2.2	84.0	15.1

Source: U.S. Census Bureau, 2000 Decennial Census, and 2010 and 2023 American Community Survey 5-Year Estimates

9.4 Permitting Coordination

This section provides a summary of compliance with various regulatory agencies including IDNR-OWR Part 3700, 3702, and 3704 criteria. Potential permitting concerns for the proposed alternative are being identified through coordination with IDNR-OWR regulatory staff. No permit submittals or applications

are included within this study. Additional permitting requirements for dam removals or modifications are anticipated primarily through the IEPA. The permit submittal process will likely be required via a joint permit with IEPA and USACE for CWA 404/401 permits.

9.4.1. IDNR-OWR Coordination

IDNR-OWR is responsible for issuing permits for construction, modification, and removal of dams, work in public waters (rivers, lakes, streams), and construction in regulated floodways. Formal dam removal permits will be required along with floodway construction permits. Under Part 3702 OWR will provide regulatory review of the drawdown/dewatering plan, breach design (size, sequencing, stability), hydraulic analysis (100-year flood conveyance, backwater conditions), sediment management plan, erosion and channel stabilization measures, and channel restoration plans.

9.4.2. IDOT Coordination

Coordination with the Illinois Department of Transportation (IDOT) will be required due to potential adjacent highway bridge impacts, right-of-way, access roads and haul routes. Review of county parcel mapping indicates that part of Sears Dam is located within US-67 right-of-way. Construction activities at Sears Dam will require right-of-way access. IDOT will have project-related interests regarding traffic control measures, bonding, and restoration commitments. IDOT will also review the project for potential impacts to bridge hydraulics, scour, and structural integrity, given the immediate proximity of Sears Dam.

IDOT also provides procedural and contractual guidance for disposal of materials including dredging, regulated substances and contaminated soils.

9.4.3. IEPA Coordination

Permit authority for CWA 401 waters.

- 06-17-2025 Call – The project team discussed whether the sediment and supernatant sampling completed to date would be sufficient to support future IEPA permitting review. IEPA indicated that the data collected generally addresses the parameters included in the *Appendix A* IEPA Compliance Summary Table. IEPA also noted that if elevated supernatant concentrations are identified, additional supernatant testing should be paired with corresponding particle size analysis to help evaluate the relationship between fine sediment and potential water quality concerns. The current TACO-based sediment evaluation, which included 22 of the 126 chemicals listed in TACO Table A, was considered a useful initial screening tool; however, IEPA clarified that TACO criteria are not the most appropriate basis for evaluating potential aquatic impacts. IEPA also described its typical sediment sampling approach for dam removal projects, which considers both sediment stored behind dams and sediment downstream of the structures, while recognizing project-specific resource constraints. The key takeaway from the call was that the existing dataset provides a reasonable starting point, but additional coordination with IEPA is needed to confirm whether the sampling scope fully satisfies future permitting requirements. Follow-up items included providing IEPA with *Appendix A* for clarification, chemical analysis results, sediment sampling location maps, particle size distribution results, and a Teams meeting invitation for a subsequent coordination meeting.

- 08-19-2025 Call – The project team discussed IEPA Bureau of Land (BL) requirements for sediment sampling and how the existing data may support future permitting needs for dam removal. The key clarification from IEPA was that the project would not be permitted through the Bureau of Land; rather, permitting would proceed through IDNR, with sediment disposal requirements governed by the receiving disposal facility. IEPA indicated that if sediment is removed from the site during construction, it would need to meet the acceptance requirements of the selected disposal facility, which would likely be a Clean Construction and Demolition Debris (CCDD) facility or an Uncontaminated Soil Fill Operation (USFO). These facilities typically rely on Maximum Allowable Concentration criteria derived from TACO standards to determine whether material is acceptable as clean soil or fill. IEPA further clarified that each sediment load transported for disposal would need to be accompanied by an IEPA LPC-663 form, certified by the engineer, documenting that the material is clean. IEPA Bureau of Water (BW) requirements may also apply, including preparation of a stormwater pollution prevention plan and a Section 401 Water Quality Certification permit. The team also learned that any proposal to manage or place material on site, along the banks, or within the river would likely require review by USACE.
- 08-26-2025 Call – The project team discussed IEPA Bureau of Water permitting requirements, IEPA’s preliminary review of the sampling results provided in June, and whether the sediment and supernatant data collected to date are sufficient to support future permitting. A key administrative takeaway was that voicemail messages from Hanson had not been reaching IEPA staff, so future coordination should be initiated through formal pre-file meeting requests. IEPA indicated that a follow-up meeting should occur in approximately three to four weeks, during which IEPA would review the information already provided and identify any remaining data gaps. IEPA also indicated that passive sediment release is the preferred sediment management approach, subject to further review of existing data, supernatant testing locations and results, particle size information, and the EnviroScience comparison materials. IEPA noted that additional considerations for permitting will include aquatic resources and threatened and endangered species. The team also confirmed that a joint Clean Water Act Section 404/401 permit application will need to be submitted to the Rock Island District USACE and IEPA as part of the review process. IEPA is expected to provide additional direction in a future meeting regarding construction sequencing and the sediment management approach.

9.4.4. USACE Coordination

The U.S. Army Corps of Engineers (USACE) serves as the primary federal regulatory authority under Section 404 of the Clean Water Act and, where applicable, Section 10 of the Rivers and Harbors Act. Although dam removal is considered a restoration activity, it involves in-water work which requires authorization. USACE recently issued updated Nationwide Permits for Illinois, effective March 15, 2026, under Section 404 and administered by the Rock Island District. Nationwide Permit (NWP) 53—Removal of Low-Head Dams—would be the appropriate authorization for this project. USACE generally considers low-head dam removal to provide ecological benefits. It is recommended to schedule a pre-application meeting early in the design phase.

9.4.5. Local Coordination

The dams are owned and operated by the State of Illinois. The primary permitting authorities are at the state and federal levels as noted above. Coordination with local authorities is recommended as any

construction activities will have direct local impacts. The City of Rock Island bounds Sears Dam to the north and the Village of Milan bounds both dams to the south, including Vandruff Island. The dams are also located within Rock Island County with additional regional interests.

10. Stakeholder Analysis

Public outreach was carried out at the completion of the draft feasibility study to ensure sufficient material was available for discussion and comment. . State Senator Halpin’s (36th District) office hosted and facilitated the event. The public outreach meeting was held on March 16, 2026, at the International Brotherhood of Electrical Workers (IBEW) Hall in Milan, Illinois. IDNR-OWR presented information from the report, and attendees were invited to provide input during the meeting. Written comments were accepted by IDNR-OWR through March 31, 2026. Feedback from local stakeholders is documented in [Appendix H](#).

Public concern noted the lack of alternatives with both dams remaining in place. To address this, text was added to the report to describe one sub-alternative (See Section 8.3.2.6 Alt 2A) that was removed from the report due to excessive costs – spillway modification with concrete steps at both Steel and Sears Dams. A new alternative was also added to the report, Alternative 6, which leaves Sears Dam in place as-is and modifies Steel Dam with concrete steps. These additions are intended to address public concern and convey the full range of potential options.

Additionally, public comments noted that the process seems rushed with inadequate time for local input. This report does not define the “selected” plan. It summarizes possible options, lists pros and cons and offers a recommendation based on the project objectives. Coordination between state and local authorities will be conducted to determine the selected plan. This report serves to provide critical information for the decision-making process.

Several comments were also provided about the potential economic impacts related to river alterations. Pool reduction and lower water elevations may impact local businesses and residential properties. The potential economic impacts of the various alternatives were not addressed in detail in this report and may warrant further consideration during the decision-making process.

11. Alternative Evaluation

This section presents a comparative evaluation of the six structural alternatives developed for the Sears and Steel Dams. Each alternative was assessed against a set of project-specific goals established by the project team through coordination with IDNR–OWR, including public safety, cost efficiency, maintenance requirements, ecological benefits, constructability, recreational impacts with pool preservation, and recreational impacts without pool. The evaluation incorporates both qualitative and quantitative criteria, supported by hydraulic modeling, sediment analysis, ecological assessments, and stakeholder considerations. A scoring matrix ([Table 24](#)) was developed to rank alternatives based on comparative priorities, providing a transparent framework for identifying the most effective and feasible solution. This section culminates in a recommended alternative that best aligns with IDNR–OWR’s objectives for safety, cost consideration, environmental restoration, and long-term sustainability.

11.1 Alternative Evaluation Matrix

The Concept Plans include six proposed structural alternatives for removal or modification to the Sears and Steel Dams on the Rock River in addition to the Do Nothing alternative. Five of the six structural alternatives include full removal of the Sears Dam spillway with the decommissioned powerhouse and approach guide walls to remain intact.

Each project goal was evaluated with a score of 1 to 5, with 5 being the most favorable score ([Table 24](#)). The individual alternatives were scored and evaluated against each other alternative and the “do nothing” option to determine feasibility and identify the most favorable alternative.

Alternative 0 – Do nothing

Alternative 1 – Full removal of Sears Dam
Full removal of Steel Dam

Alternative 2 – Full removal of the Sears Dam
Modification of the Steel Dam to include a stepped concrete downstream geometry

Alternative 3 – Full removal of the Sears Dam
Modification of the Steel Dam to include a sloped rock ramp downstream geometry

Alternative 4 – Full removal of the Sears Dam; Addition of Riffles to North Channel to preserve the Recreational Pool
Modification of the Steel Dam to include a stepped concrete downstream geometry

Alternative 5 – Full removal of the Sears Dam
Modification of the Steel Dam to include a stepped concrete downstream geometry with the addition of a nature-like Fish Passage

Alternative 6 – Sears Dam preservation
Steel Dam modification to include a stepped spillway

Table 24. Alternative Evaluation Matrix

	Do Nothing	Sears and Steel - Full Removal of Both Spillways	Sears - Full Removal of Spillway Steel - Modification of Spillway (Stepped Concrete Spillway)	Sears - Full Removal of Spillway Steel - Modification of Spillway (Rock Ramp Spillway)	Sears - Full Removal of Spillway Steel - Modification of Spillway (Stepped Concrete Spillway) North Channel Riffles	Sears - Full Removal of Spillway Steel - Modification of Spillway (Stepped Concrete Spillway) South Channel Fish Passage	Sears - No Change Steel - Modification of Spillway (Stepped Concrete Spillway)
Evaluation Criteria	Alternative 0	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
Cost (OPCC)	\$0	\$10.97 M	\$17.00 M	\$12.85 M	\$27.36 M	\$21.42 M	\$12.43 M
Evaluation Criteria: 1 (low/negative) to 5 (high/positive) *							
Dam Safety	1	5	3	3	2	3	2
Maintenance and Longterm Costs	2	5	4	3	1	3	2
Recreation with Pool Preservation	5	1	3	3	4	2	5
Recreation with Connected River	1	5	3	3	2	4	1
Environmental Considerations	1	4	3	3	3	4	1
Permitting Considerations	4	3	2	2	2	3	3
Initial Construction Cost	5	4	2	3	1	1	3
Rating Total	19	27	20	20	15	20	17
*NOTE: Evaluation Criteria is relative							

¹ Rating = scale of 0 to 5 with 5 being the best

11.2 DISCUSSION AND RECOMMENDATION

Based on the evaluations discussed in preceding sections, the recommended alternative is Alternative 1, full removal of both dams with passive sediment management. This alternative has the highest weighted score and meets the project goals relative to removing safety hazards from the river, reducing ongoing maintenance obligations, improving river health and re-establishing fish passage in the Rock River at the lowest overall implementation cost relative to other alternatives evaluated. Passive sediment management is a cost-effective means of sediment management that aligns with OWR's preferences and appears to be an appropriate strategy for this location.

Alternative 1 ranks highest in public safety, highest in long-term cost reduction, highest in connected river recreation, highest in ecological enhancement, and highest in reduced construction cost. This alternative is weakest in pool preservation and associated recreational activities. Alternative 6 ranks highest in recreation with pool preservation.

It is recommended that the following be considered in dam removal design:

- Detailed engineering design development, including dam demolition, staging, sequencing, water control, site and impoundment restoration, and material management plans.
- Evaluation of powerhouse structure that is currently impounding water at Sears Dam and consideration for future stability, use, and management.
- 2D hydraulic modeling of the full impoundment and downstream reaches to evaluate potential depositional areas at various river flows.
- Detailed evaluation of banks and adjacent infrastructure within the impoundment.
- Mussel and substrate surveys of downstream reaches of Rock River and Mississippi River, and if necessary, mussel relocation prior to construction.
- Additional sediment sampling to verify disposal requirements, water quality and permitting.

For non-removal designs, it is recommended that additional CFD and/or physical modeling be conducted to verify safety improvements and to inform future designs. Also, maintenance plans will be needed to address any non-removal consideration.

12. Conclusion

The Sears and Steel Dams Feasibility Study, commissioned by the IDNR–OWR, provides an evaluation of the existing conditions, risks, and opportunities associated with the two low-head dams located on the Rock River near Milan, Illinois. The study was initiated in response to the decommissioning of the Sears Powerhouse and the growing public safety concerns, ecological impacts, and sediment management challenges posed by the aging dam infrastructure.

This feasibility study evaluated a range of structural alternatives for addressing public safety hazards associated with the Sears and Steel Dams while also considering ecological restoration, cost, constructability, stakeholder input, and long-term sustainability. Based on comprehensive hydraulic modeling, sediment analysis, environmental review, and alternatives evaluation, Alternative 1 – Full

Removal of Sears and Steel Dams with passive sediment management is recommended as the preferred solution.

12.1 Public Safety and Hazard Reduction

Public safety is the primary driver of this study. Both dams currently generate powerful hydraulic rollers that pose well-documented and persistent drowning hazards across the full range of recreational flows. Historical incidents - including multiple fatalities and near-misses - demonstrate that these hazards cannot be reliably mitigated through signage or partial structural modifications alone.

Alternative 1 provides the only solution that fully eliminates the dam-related hydraulic hazard, thereby achieving the most complete and permanent reduction in public safety risk.

12.2 Ecological and Fish Passage Benefits

The dams currently act as barriers to aquatic organism passage, preventing connectivity between the Mississippi River and upstream reaches of the Rock River. This fragmentation negatively impacts fish migration, mussel populations, and overall riverine ecosystem function. By restoring longitudinal connectivity, Alternative 1 provides the greatest ecological benefit, enabling approximately 70 miles of river to function as a continuous system and supporting recovery of native species and habitat diversity. These benefits are well-supported by regional studies demonstrating improved biological conditions following dam removal.

12.3 Sediment Management

Approximately 4.3 million cubic yards of sediment have accumulated upstream of the dams. Sediment testing indicates generally low contamination levels, supporting the feasibility of passive sediment management. Under Alternative 1, the river is allowed to naturally mobilize and redistribute sediment over time. While short-term turbidity and localized deposition are anticipated, analyses indicate that these impacts are manageable and diminish as the system reaches equilibrium. This approach restores natural sediment transport processes, which are essential to long-term channel stability, habitat formation, and downstream system health. While passive management is expected to be the final approach, additional sediment and background samples and further review may determine otherwise. Requiring active sediment management would be a significant cost burden to the project as discussed in 6.2.3 of this report.

12.4 Recreational Impacts

Recreational opportunities are improved or diminished depending on perspective. While there are those who prefer the opportunities provided by the existing impoundment, there are those who would prefer the opportunities from a natural, connected river. The upstream pool created by the two dams currently offers a large area of calm water, popular for boating and water skiing. Dam removal would lower the pool depth, limiting these activities; however, it would benefit fish habitat, enhance angling opportunities, and open the river to paddlers, creating a continuous boating connection to the Mississippi River.

Implementation of Alternative 1 will transition the river from a pooled, flatwater system to a more natural, free-flowing condition. While this represents a change in use for some stakeholders, it:

- Eliminates dangerous boating hazards at the dams

- Restores continuous navigation along the river corridor
- Enhances opportunities for paddling, fishing, and river-based recreation

12.5 Regulatory Considerations

All potential alternatives require compliance with Clean Water Act Sections 404 and 401, the Endangered Species Act, and floodplain management regulations. IEPA is the primary regulatory agency for dam removal permitting. IDNR-OWR is primary regulatory agency for dam modifications. The USACE regulates waters of the US and will also have regulatory review of proposed river and bank modifications outside of the immediate dam sites.

12.6 Cost, Maintenance, and Long-Term Sustainability

Alternative 1 represents one of the most cost-effective options when both initial construction and long-term considerations are evaluated. While removal requires a significant upfront investment, it:

- Eliminates ongoing maintenance associated with dam structures (e.g., inspections, debris removal, structural repairs, erosion and scour repairs)
- Avoids future rehabilitation costs
- Reduces long-term liability associated with public safety hazards

In contrast, modification alternatives require continued inspection, maintenance, and risk management. Alternative 1 provides the lowest lifecycle cost and the most sustainable long-term solution.

12.7 Alternatives Evaluation and Recommendation

All alternatives were evaluated against project goals including safety, cost, maintenance, ecological benefit, constructability and recreation. While partial-removal and modification alternatives provide incremental improvements, they:

- Retain some level of hydraulic hazard
- Provide reduced ecological benefits
- Require ongoing maintenance and higher long-term costs

Alternative 1 consistently ranked highest across key evaluation criteria, offering the best balance of effectiveness, feasibility, and long-term value. Based on the findings of this study, Alternative 1 – Full Removal of Sears and Steel Dams with passive sediment management is recommended for implementation. This alternative:

- Maximizes public safety by eliminating dam hazards
- Restores ecological connectivity and river function
- Provides a cost-effective and sustainable long-term solution
- Aligns with IDNR-OWR constructability goals and regulatory objectives

While implementation will require careful planning, particularly with respect to sediment release, bank stabilization, and stakeholder coordination, Alternative 1 represents the most effective and defensible path forward for improving safety and restoring the Rock River system.

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