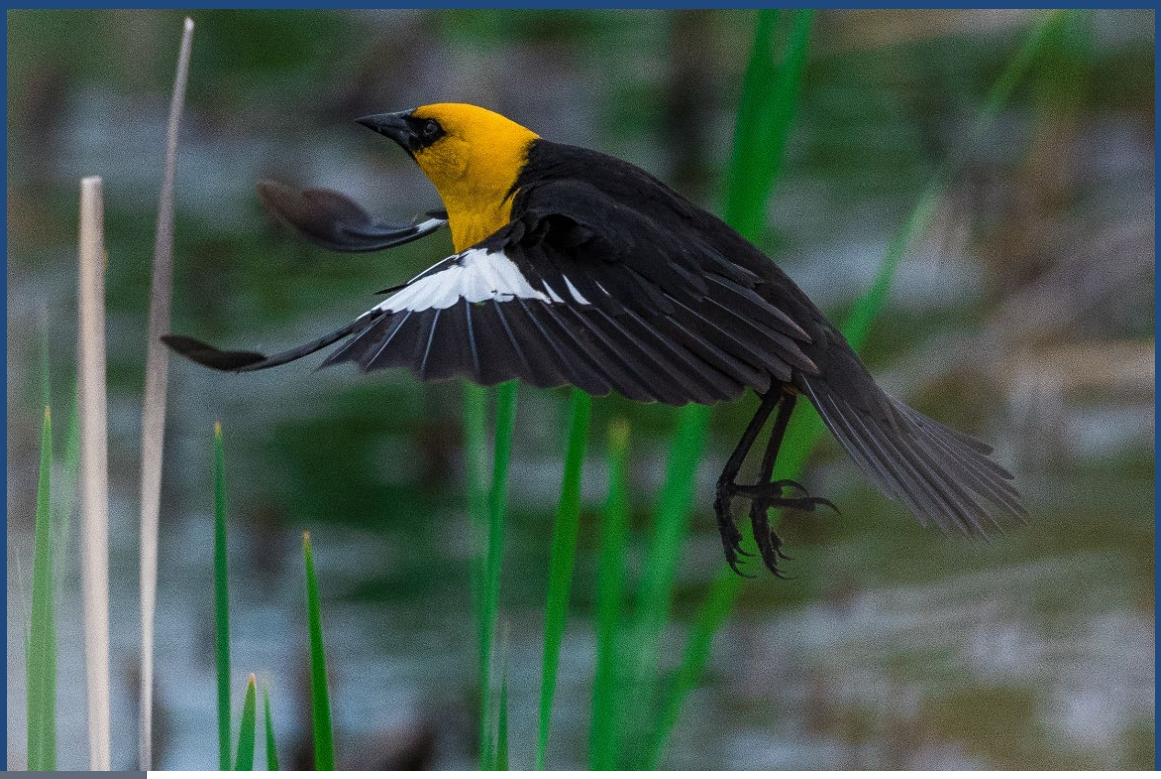
St. Louis River Area of Concern

2023 Remedial Action Plan

Reflects amendments to the 2022 RAP

October 1, 2022 – September 30, 2023



January 2024
EGAD # 3900-2024-01

Cover Photo Credit:
Chuck Sjodin, 2021 SLRA Photo Contest entrant
"Return of the Yellow-headed Blackbird (Mud Lake)"
NOTE: Yellow-headed blackbirds are sensitive to water pollution. Their population has been rebounding over the last few years, which is a testament to improving water quality in the estuary.

Tribal Acknowledgement

We want to acknowledge the Anishinaabe people, as well as the Dakota and other Indigenous peoples who preceded them. SLRAOC work occurs on lands that the Anishinaabe migrated to, looking for *manoomin*, the food that grows on water. Chief *Biauswah* called this place "the center of all good things." The *Gichigami-ziibi* (the Great Lake River) is a revered waterway that has spiritual and personal significance for the ancestral and contemporary Anishinaabe people that have gathered and preserved traditional knowledge for centuries. We honor and respect their past and continuing kinship to this area: its land, water, air and beings. We also affirm their sovereignty and their treaty rights. We hold ourselves accountable to recognize and counter historical and contemporary injustices that continue to impact Anishinaabe people, through mutually beneficial partnerships, policies, and practices that respect Indigeneity. By joining together as partners to heal the injured St. Louis River Area of Concern, we show our commitment to addressing past harms and supporting the traditional lifeways of current and future generations of the Anishinaabe people.

Coordinating Agencies:

NAH-GAH-CHI-WA-NONG
FOND DU LAC
RESERVATION

WISCONSIN DEPT. OF NATURAL RESOURCES

DEPARTMENT OF NATURAL RESOURCES

MINNESOTA POLLUTION CONTROL AGENCY

Major funding sources:

Great Lakes RESTORATION

CLEAN WATER LAND & LEGACY AMENDMENT

About this Document:

The 2013 St. Louis River Area of Concern (SLRAOC) Remedial Action Plan (RAP, hereinafter 2013 RAP Update) forms the basis of this 2023 RAP. The 2013 RAP Update was produced by LimnoTech (MPCA and WDNR, 2013), under contract to the Minnesota Pollution Control Agency and was funded by a United States Environmental Protection Agency (USEPA) Great Lakes Restoration Initiative (GLRI) grant (Federal grant no. GL00E00556) and associated Minnesota and Wisconsin GLRI capacity funding. Many organizations and individuals participated in a variety of ways as collaborators to the 2013 RAP Update, which is updated annually by the SLRAOC Coordinators and leaders. The collaborating agencies include the Minnesota Pollution Control Agency (MPCA), the Minnesota Department of Natural Resources (MNDNR), the Wisconsin Department of Natural Resources (WDNR), and the Fond du Lac Band of Lake Superior Chippewa (FdL), along with the AOC's designated Citizen Action Committee (CAC), the St. Louis River Alliance (SLRA).

The annual update is provided for review and comment to the organizations and individuals participating in the RAP process. A draft redlined version of the RAP, showing changes made for the most recent federal fiscal year (FFY), is open for stakeholder and partner input for a two-week period. AOC Coordinators review and address the stakeholder and partner input before finalizing the RAP update and submitting it to the USEPA – Great Lakes National Program Office (GLNPO). This 2023 RAP is the result of updates to the 2022 RAP and is current as of the federal fiscal year 2023 (October 1, 2022 – September 30, 2023).

Individuals critical to the strategic direction and implementation of the RAP are listed below. Many others, too numerous to list here, have made important contributions to this year's progress by providing technical guidance, administrative support, stakeholder input, and more. A list of current Beneficial Use Impairment (BUI) Technical Team members can be found in Section 5.

St. Louis River AOC Coordinators
Rick Gitar - Fond du Lac
Barb Huberty - MPCA
Melissa Sjolund - MNDNR
Matt Steiger - WDNR

St. Louis River AOC Leaders
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Diane Packett – WDNR
Daryl Peterson – MLT
Jeramy Pinkerton – MNDNR
Steve Schoff – MPCA
Sarah Yost – MPCA

The 2013 RAP Update, its appendices, and the 2023 RAP can be found on the following web sites:

- Minnesota Pollution Control Agency (https://www.pca.state.mn.us/air-water-land-climate/cleaning-up-the-st-louis-river)
- Wisconsin Department of Natural Resources (https://dnr.wisconsin.gov/topic/GreatLakes/StLouis.html)

Disclaimer

The Great Lakes Water Quality Agreement (GLWQA) is a non-regulatory agreement between the United States and Canada and criteria developed under its auspices are non-regulatory. The management actions identified in this document are designed to meet beneficial use impairment (BUI) delisting targets specifically established for the SLRAOC and are not subject to enforcement or regulatory actions.

The management actions identified in RAPs are a prioritized list of management actions that are directly related to BUI removal as outlined in the RAP; however, the list of management actions is adaptive and changes are outlined in the annual RAP updates. For BUI removal purposes, management actions are considered complete when substantial completion of construction is reached. Long-term monitoring, maintenance, and continuing obligations may be needed at some sites, but will not restrict BUI removal.

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List of Appendices

Appendices are from the 2013 RAP Update and are available on the webpages listed on page ii. They are not reproduced in this document.

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List of Acronyms

AIS	Aquatic invasive species
AOC	Area of Concern
BSAF	Biota-Sediment Accumulation Factor
BUI	Beneficial use impairment
CAC	Citizen Action Committee
CPUE	Catch per unit effort
CWA	Clean Water Act
DSPA	Duluth Seaway Port Authority
DUAS	Duluth Urban Area Streams
FCA	Fish consumption advisories
FdL	Fond du Lac Band of Lake Superior Chippewa
FFY	Federal Fiscal Year
FTC	Fish tissue concentrations
GLDIVER	Great Lakes Data Integration Visualization Exploration and Reporting system
GLIFWC	Great Lakes Indian Fish and Wildlife Commission
GLLA	Great Lakes Legacy Act
GLRI	Great Lakes Restoration Initiative
GLWQA	Great Lakes Water Quality Agreement of 1972, amended in 1978, 1987 and 2012
HTAC	Harbor Technical Advisory Committee
HSPF	Hydrological Simulation Program-Fortran
HUC	Hydrologic Unit Code
IJC	International Joint Commission
LAMP	Lakewide Action and Management Plan
LSNERR	Lake Superior National Estuarine Research Reserve
MLT	Minnesota Land Trust
MNDNR	Minnesota Department of Natural Resources
MPCA	Minnesota Pollution Control Agency
MS4	Municipal separate storm sewer system
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
PCBs	Polychlorinated biphenyls
PSD	Proportional stock density
RAP	Remedial Action Plan
R2R	Remediation to restoration
SAA	Sediment Assessment Areas
SAG	Scientific Advisory Group
SIP	Stakeholder Involvement Plan
SLR	St. Louis River
SLRA	St. Louis River Alliance
SLRE	St. Louis River estuary
TMDL	Total Maximum Daily Load
TSS	Total suspended solids
UMD	University of Minnesota
US	United States
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USEPA GLNPO	U.S. Environmental Protection Agency Great Lakes National Program Office
USEPA-GLTED	U.S. Environmental Protection Agency Great Lakes Toxicology and Ecology Division
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USS	U.S. Steel
UWS	University of Wisconsin Superior
WDNR	Wisconsin Department of Natural Resources
WLSSD	Western Lake Superior Sanitary District
WWTP	Wastewater treatment plant

Definitions

Area of Concern (AOC)

Defined by Annex 1 of the US-Canada GLWQA, as amended in 2012:

> Geographic area where significant impairment of beneficial uses has occurred as a result of human activities at the local level.

The goal of the AOC program is to improve these areas so they are no more environmentally degraded than other comparable areas of the Great Lakes. When that improvement has been reached, the AOC can be removed from the list of AOCs, or "delisted."

Beneficial Use Impairment (BUI)

A "beneficial use" is any way that a water body provides benefits for humans, aquatic life, and wildlife (for example, providing fish that are safe to eat.) If the beneficial use is unavailable due to environmental problems (for example, if it is unsafe to eat the fish because of contamination) then that use is impaired. The International Joint Commission (IJC) provided a list of 14 possible beneficial use impairments in the 1987 GLWQA amendment. Nine BUIs apply to the SLRAOC.

Delisting Target

Specific goals and objectives established for BUIs, with measurable indicators to track progress and determine when BUIs can be removed and AOC delisting can occur. Targets are locally derived.

Partners

The agencies, organizations and private entities responsible for funding, implementing, and/or coordinating the SLRAOC program.

Remedial Action Plan (RAP)

According to the US-Canada GLWQA 2012 amendment, a RAP is a document that provides "a systematic and comprehensive ecosystem approach to restoring and protecting beneficial uses in Areas of Concern…" RAPs are required by the GLWQA, which specifies that the Parties shall cooperate with State and Provincial Governments to periodically update and implement them for each AOC. Stages in RAP development (i.e., Stages I, II, and III) have been consolidated into one inclusive RAP process.

An annual RAP update for the SLRAOC will be led by MNDNR, MPCA and WDNR by amending the most recent RAP to incorporate BUI progress and changes that may occur. The RAP will be labeled with the year it has been updated and will be posted online.

Definitions, continued

Remediation

For the SLRAOC, remediation means the actions taken to address beneficial use impairments associated with sediments containing toxic or bio-accumulative contaminants. Remediation includes actions taken to control, minimize, restore or eliminate potential or actual ecological and human health risks from exposure to contaminants. Underwater sediments are the primary driver because beneficial use impairments in the SLRAOC are associated with contaminated sediments. However, other media such as soil, groundwater, and surface water can also be remediated, either directly or indirectly. Examples include, but are not limited to, monitored natural recovery, removal (dredging), capping, in-situ stabilization, treatment, and disposal.

St. Louis River Alliance (SLRA)

The SLR citizen advisory committee was formed in 1989. It was incorporated as the citizen action committee (CAC) and as a 501(c)3 nonprofit organization in 1996 and has been doing business as the St. Louis River Alliance (SLRA) since 2009. The Alliance serves as the citizens' advisory committee for the SLRAOC. The SLRA Vision is: "We envision a clean and healthy St. Louis River with a thriving ecology, economy, and community." The SLRA Mission is: "The St. Louis River Alliance is a membership organization committed to supporting the resiliency of the St. Louis River. As river stewards, we are the voice of the river, working together to protect, restore and enhance the St. Louis River."

Stakeholder

In this document, the term "stakeholder" refers to those who have a vested interest in the SLRAOC; however stakeholders do not have a role in funding, implementing, and/or coordinating the RAP's management actions.

Executive Summary

Background

This St. Louis River Area of Concern (SLRAOC) 2023 Remedial Action Plan (RAP) presents a comprehensive plan outlining management actions necessary for removing each of the remaining beneficial use impairments (BUIs). A goal of delisting the SLRAOC by 2025 was established by the state RAP implementing agencies in 2013. As implementation progress has been made, the complexity of the management actions has become more apparent. The current goal is to complete the construction projects in 2026, with remaining BUI removal and delisting to follow. AOCs do not have a regulatory deadline for delisting.

The SLRAOC made substantial progress toward setting clear delisting goals with the development of the 2013 RAP Update, otherwise known as the Roadmap to Delisting. This 2023 RAP documents the continued progress by describing BUI status and changes to management actions and timelines over the last federal fiscal year (FFY). A draft redlined version of the RAP, showing changes made for the FFY, was open for stakeholder and partner input for a two-week period. AOC staff reviewed and addressed the stakeholder and partner input before finalizing the RAP update and submitting it to the US Environmental Protection Agency Great Lakes National Program Office (USEPA GLNPO).

The purpose of this document is to serve as a RAP update. RAPs are required by Annex 1 of the 2012 Great Lakes Water Quality Agreement (GLWQA). The GLWQA indicates that RAPs must include the following elements:

1. Identification of beneficial use impairments and causes;
2. Criteria for the restoration of beneficial uses that take into account local conditions and established in consultation with the local community;
3. Remedial measures to be taken, including identification of entities responsible for implementing these measures;
4. A summary of the implementation of remedial measures taken and the status of the beneficial uses; and
5. A description of surveillance and monitoring processes to track the effectiveness of remedial measures and confirm restoration of beneficial uses.

The RAP is a bi-state document produced by the AOC Coordinator Team: Fond du Lac Band of Lake Superior Chippewa (FdL), the Minnesota Department of Natural Resources (MNDNR), Minnesota Pollution Control Agency (MPCA), and the Wisconsin Department of Natural Resources (WDNR), with input from AOC partners and stakeholders to document the status and progress of BUI removal through the completion of management actions. These management actions include on-the-ground habitat restoration and remediation projects, monitoring and assessment projects, and stakeholder engagement processes.

The SLRAOC, located on the western arm of Lake Superior and including the twin port cities of Duluth, Minnesota, and Superior, Wisconsin, was listed as one of 43 Great Lakes AOCs in 1987. Historical actions such as unregulated municipal and industrial waste disposal and unchecked land use practices, including dredging and filling of aquatic habitat and damaging logging and manufacturing practices, contributed to the complex set of issues facing the SLRAOC at the time it was listed. The Stage I RAP (MPCA and WDNR, 1992) determined that nine of 14 possible BUIs existed in the SLRAOC including:

BUI 1: Fish Consumption Advisories

BUI 2: Degraded Fish and Wildlife Populations – Removed in 2023

BUI 3: Fish Tumors and Other Deformities – Removed in 2019

BUI 4: Degradation of Benthos

BUI 5: Restrictions on Dredging

BUI 6: Excessive Loading of Sediment and Nutrients –Removed in 2020

BUI 7: Beach Closings and Body Contact Restrictions

BUI 8: Degradation of Aesthetics – Removed in 2014

BUI 9: Loss of Fish and Wildlife Habitat

All the management actions identified in this RAP are underway or complete. As of September 30, 2023, 53 of 80 management actions are either complete or need no further action (66.3%). The remaining management actions that are in progress include: eight remediation projects, eight restoration projects, and eleven “other” projects that encompass studies, plans, data tracking, and data management. The SLRAOC state RAP implementing agencies have a current goal of completing all construction project management actions in 2026, to be followed by completion of the remaining non-construction management actions and delisting. Table ES-1 describes the overall status of each BUI.

Table ES-1. Beneficial Use Impairments Status Summary

Beneficial Use Impairment	Status	Summary of Status and Next Steps
Fish Consumption Advisories (BUI 1)	Impaired	All four management actions are underway. Mercury and PCBs data gap study analysis and interpretation were completed in 2023 with Technical Team review underway. Papers documenting the Hg and PCBs findings are in progress. Development of a multi-year fish tissue concentration study for Management Action 1.03 recovery monitoring of fish consumption advice is underway.
Degraded Fish and Wildlife Populations (BUI 2)	Removed	All six of the management actions are complete. A removal package was finalized and submitted to EPA in late 2022 and the BUI was formally removed in January 2023.
Fish Tumors and Deformities (BUI 3)	Removed	All three management actions are complete. This BUI was formally removed in February 2019.
Degradation of Benthos (BUI 4)	Impaired	Post construction monitoring is the only management action in this BUI and sample collections will typically occur at multiple sites for two field seasons following construction. Data collections focus on benthic macroinvertebrate and vegetative assemblages from both reference sites and within aquatic habitat restoration sites. Post-construction data are compared to previously collected pre-construction biological data and used to assess aquatic community response to habitat restoration improvements. In 2023, 60 stations within Kingsbury Bay and Grassy Point were sampled to complete the final benthic community assessment. Post-construction collections began at 40th Ave West. The USACE delivered four memos assessing pre- and post-construction conditions that will be reviewed by the BUI Technical Team for inclusion in an eventual Degradation of Benthos BUI removal package in 2024. Additional field collections in 2023 included sediment cores extracted to help establish baseline sediment quality conditions in the estuary.
Restrictions on Dredging (BUI 5)	Impaired	Nineteen of 29 management actions are complete. The remaining ten are underway. Site restoration was completed at Ponds behind Erie Pier (5.13) and Scanlon Reservoir (5.20.) The second of two years of dredging at Munger Landing (5.09) was completed. The Thomson Reservoir design is complete. Remedial Options Action Reports were drafted for the Oil Barge Dock Slip (5.21), Tower Avenue Slip (5.22), and General Mills Slip (5.23) and data gap assessments were started. The C Street Slip (5.03) and C. Reiss Coal Slip (5.29) advanced to the design stage. Outstanding and recent datasets continue to be added to GLDIVER. BUI removal is slated for 2027.
Excessive Loading of Nutrients and Sediments (BUI 6)	Removed	All five management actions are complete. The BUI was formally removed in April 2020.
Beach Closings and Body Contact (BUI 7)	Impaired	Two management actions have been completed. The remaining four management actions are underway. A “no swimming” restriction is still present at US Steel/Spirit Lake site and “warning” restrictions are still present at Crawford Creek and Munger Landing. MPCA began developing justification memos to eliminate the body contact restrictions designations for US Steel/Spirit Lake and Munger Landing because the remediation work at those two sites is complete. BUI removal is dependent on body contact restrictions being lifted and is anticipated for 2027, after remediation is completed at Crawford Creek.
Degradation of Aesthetics (BUI 8)	Removed	All five management actions are complete. This BUI was formally removed in August of 2014.
Loss of Fish and Wildlife Habitat (BUI 9)	Impaired	Thirteen management actions are complete. The remaining eight are underway. Progress including design, funding, and contracting continued at many project sites that are underway. Manoomin (wild rice) restoration continued with seeding 12,547 pounds on 51 acres. In-water construction at Pickle Pond was complete in 2023 with restoration and vegetation actions to continue in 2024. BUI removal is slated for 2027.

In addition to its long list of management actions for each of the BUIs, the SLRAOC is spatially large and geographically complex, spanning the Minnesota and Wisconsin state line and including tribal interests. However, most of the management actions included in this RAP focus on: the St. Louis River below Fond du Lac Dam, Crawford Creek, and the Nemadji River watershed, because they represent those portions of the AOC most impacted by historical actions (Figure ES-1 and ES-2). The AOC boundary is described below.

> *The AOC boundary includes the lower 39 miles of the St. Louis River, from upstream of Cloquet, Minnesota to its mouth at the Duluth/Superior Harbor, and that portion of the watershed; the Nemadji River watershed; and the western portion of Lake Superior defined on its eastern edge by a line drawn from the eastern HUC 12 Dutchman Creek watershed boundary in Wisconsin where it intersects the Lake Superior shoreline north to where the eastern HUC 12 Talmadge Creek watershed boundary in Minnesota intersects with the Lake Superior shoreline north to the intersection of the Cloquet River HUC 8.* (MPCA and WDNR, 2014).

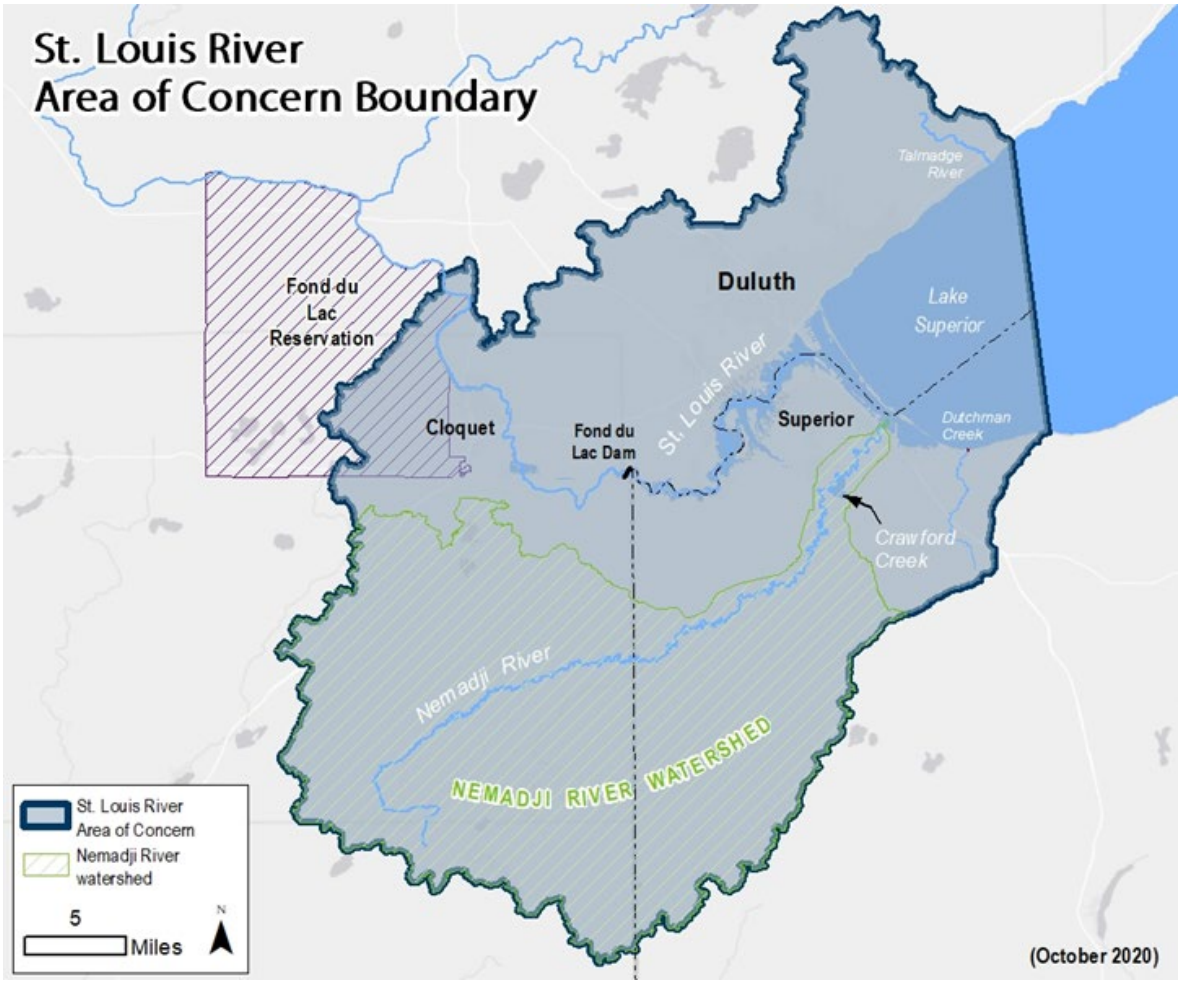


Figure ES-1: St. Louis River AOC Boundary

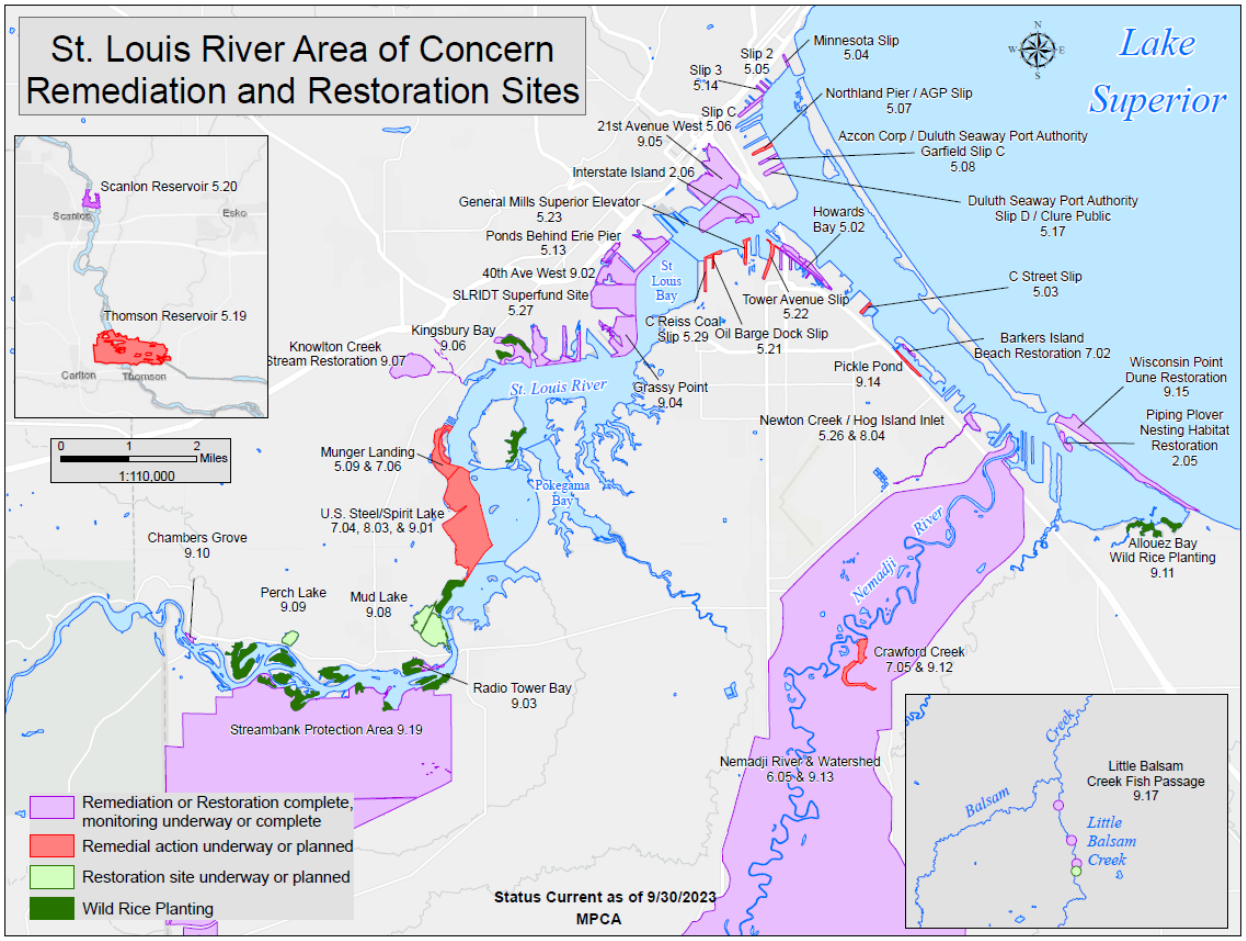


Figure ES-2: Remediation and Restoration Management Action Sites in the St. Louis River AOC (Revised October 2023)

Pre-2013 Actions to Support Delisting

Significant work was done in the SLRAOC between 1978 and publication of the 2013 RAP Update on infrastructure upgrades, habitat restoration projects, and protection efforts. Some examples of significant work include:

- Infrastructure Upgrades:
  - Creation and expansion of the Western Lake Superior Sanitary District (WLSSD)
  - Upgrades to the City of Superior wastewater treatment plant
  - Municipal efforts to control inflow and infiltration to prevent wet weather overflows
- Habitat Restoration and Remediation Projects:
  - Sturgeon stocking and spawning habitat restoration in the St. Louis River, followed by young-of-the year observations
  - Restoration of Tallas Island at the mouth of Knowlton Creek
  - Piping Plover habitat enhancement, maintenance, monitoring and outreach at Wisconsin Point and Schafer Beach

  - Clough Island conifer restoration, invasive species control, and aquatic/terrestrial condition assessment
  - Baseline sampling, surveys, or studies of benthic macroinvertebrates, avian species, aquatic plants, and contaminant extent, magnitude, and bioavailability
- Protection Efforts:
  - Protection of Clough Island
  - Protection of 6,500 acres of geologically sensitive habitat in the St. Louis/Red River Streambank Protection Area
  - Protection of more than 4,500 acres in two Wisconsin State Natural Areas within the Pokegama River watershed

This early work supports BUI removals, but does not fully address legacy sediment contamination and lost habitat, which remain significant stressors to ecosystem health of the St. Louis River estuary (SLRE). These deficiencies are addressed in the 2013 RAP Update and subsequent updates.

BUI Removal and Timelines

Completed and anticipated BUI removal dates are listed in Table ES-2. As can be seen below, BUI 8 was removed in 2014, BUI 3 was removed in 2019, BUI 6 was removed in 2020, and BUI 2 was removed in 2023. BUI's 5, 7, and 9 are slated for removal in 2027 and BUI's 4 and 1 will follow thereafter, along with delisting targeted for 2030.

Table ES-2: Anticipated BUI Removal Timelines

BUI Removal Timeline (in calendar years for completed and planned dates)	2014	2019	2020	2023	2027	2028	2029
Degradation of Aesthetics (BUI 8)	√						
Fish Tumors and Deformities (BUI 3)		√					
Excessive Loading of Sediment & Nutrients (BUI 6)			√				
Degraded Fish and Wildlife Populations (BUI 2)				√			
Beach Closings and Body Contact Restrictions (BUI 7)					●		
Restrictions on Dredging (BUI 5)					●		
Loss of Fish and Wildlife Habitat (BUI 9)					●		
Degradation of Benthos (BUI 4)						●	
Fish Consumption Advisories (BUI 1)							●

Stakeholder Engagement

Stakeholder engagement has been and will continue to be a priority in the SLRAOC. It is not described for each BUI unless

a specific management action or need has been identified. An extensive stakeholder process was undertaken during BUI Blueprint and 2013 RAP Update development. Stakeholder outreach for the rollout of the 2013 RAP Update was coordinated with the assistance of the SLRA. In addition, the 2013 RAP Update was presented to city and county governments in Minnesota and Wisconsin, the Fond du Lac Band of Lake Superior Chippewa (FdL), and the area business community by AOC coordinators and SLRA staff. It is the intention of the SLRAOC staff to continue to reach out to these organizations periodically and when input is needed on significant items. An SLRAOC update is also part of the annual St. Louis River Summit where SLRAOC staff have the opportunity to reach citizens, resource managers, and university and research staff. An annual SLRAOC update is also part of the annual Celebration of Progress event. The SLRAOC-Wide Communication Plan is reviewed each year and updated as needed. SLRAOC information is also made available through GovDelivery notifications from MN and WI agencies and press releases by the state agencies and USEPA. Each agency and SLRA maintain websites with SLRAOC information. Multiple organizations (e.g., the City of Duluth, the SLRA, the Lake Superior National Estuarine Research Reserve, neighborhood groups, etc.) host events related to the St. Louis River at which Coordinators and staff participate to answer questions about the SLRAOC.

A stakeholder input opportunity is a part of the annual RAP update process. The list of stakeholders compiled during development of the 2013 RAP Update is kept up to date by SLRAOC staff as the primary list of partners, agencies, and citizens. Stakeholders are notified of the annual RAP update and given a chance to review and comment on the RAP. Additional public input opportunities also exist at different stages of remediation and restoration projects: feasibility study/preferred alternatives, permitting, environmental review, design, and for BUI removal. For especially complex, multi-year, Great Lakes Legacy Act (GLLA) projects, the USEPA establishes outreach teams to help disseminate project information.

Getting There

Initial cost estimates made during the 2013 RAP Update for implementation of the RAP's management actions were in the range of $300-$400M. In addition to adequate financial support for the management actions, the 2013 RAP Update acknowledged that agency support from USEPA for SLRAOC staff at MPCA, WDNR, MNDNR, and FdL is crucial for successful RAP implementation and management, BUI removal, and ultimate SLRAOC delisting. Completion of the management actions identified in the RAP requires sustained program staff over the long term without interruption. As each construction project is completed, its actual costs are tabulated. These will eventually be tallied to determine a more accurate cost of the SLRAOC Program.

Section 1: AOC Delisting Roadmap

This section presents the St. Louis River Area of Concern (SLRAOC) Delisting Roadmap (Roadmap), which was initially prepared as the 2013 Remedial Action Plan (RAP) Update. For details on the history of actions leading to the development of the 2013 RAP Update and subsequent annual RAPs, see Section 4. Section 1 is organized in the following subsections:

- **Overview of the AOC Roadmap:** provides readers with a concise summary of management actions and timelines and describes the organization, contents, and format of the Roadmap.
- **Roadmap Organization:** explains how the overall SLRAOC and individual BUI Roadmaps are organized.
- **Sediment Characterization:** describes the sediment characterization work completed to support the Beneficial Use Impairment (BUI) removal strategies.
- **Individual BUI Roadmaps:** describe the rational for listing, removal target and strategy, management actions and status, removal timeline, and issues affecting progress for each of the nine BUIs.

Overview of the Roadmap

The BUI information contained in this section was originally developed based on information in the BUI Blueprints developed by the extensive list of stakeholders as described in Section 4. Using the Blueprints as a basis, AOC coordinators and leaders refined the BUI removal target interpretations, articulated BUI removal strategies, and developed the management actions needed to achieve removal of each BUI.

The removal strategies and management actions selected for the 2013 RAP update were intended to represent the remaining work that is necessary to delist the SLRAOC. Significant work contributing to BUI removal was done in the SLRAOC between 1978 and the publication of the 2013 RAP Update on infrastructure upgrades, habitat restoration projects, and protection efforts. Some examples of significant work include:

- Infrastructure Upgrades:
    - Creation and expansion of the Western Lake Superior Sanitary District (WLSSD)
    - Upgrades to the City of Superior wastewater treatment plant
    - Municipal efforts to control inflow and infiltration to prevent wet weather overflows
- Habitat Restoration and Remediation Projects
    - Sturgeon stocking and spawning habitat restoration in the St. Louis River, followed by young-of-the year observations
    - Restoration of Tallas Island at the mouth of Knowlton Creek
    - Piping Plover habitat enhancement, maintenance, monitoring and outreach at Wisconsin Point and Schafer Beach
    - Clough Island conifer restoration, invasive species control, and aquatic/terrestrial condition assessment
    - Baseline sampling, surveys, or studies of benthic macroinvertebrates, avian species, aquatic plants, and contaminant extent, magnitude, and bioavailability

- Protection Efforts:
  - Protection of Clough Island
  - Protection of 6,500 acres of geologically sensitive habitat in the St. Louis/Red River Streambank Protection Area
  - Protection of more than 4,500 acres in two Wisconsin State Natural Areas within the Pokegama River watershed

This early work will support BUI removals. The SLRAOC Coordinators recognize that the RAP is a tool for management and must be adaptive as information becomes available and management actions are completed. Completion status and progress of management actions are updated annually in the RAP.

The primary focus of the remaining "on the ground" management actions is remediation of contaminated sediments and habitat restoration. Toxics contamination in the SLRAOC contributes directly or indirectly to eight of the nine BUIs (BUI 6: Excess Loading of Sediment and Nutrients is the exception). Remediation of contaminated sediments may occur as separate projects or in association with some SLRAOC restoration efforts, depending on the ecological or human health thresholds. Approximately 3,400 acres of aquatic habitat is estimated to have been lost over time in the St. Louis River Estuary (SLRE, Hollenhorst *et al*., 2013). This estimate helped generate the list of restoration projects. Remediation and restoration site locations are shown in Figure ES-2 and Figure 5.

A list of management actions necessary to achieve removal is provided for each BUI. The tables include estimated dates for completion of each identified management action. As of September 30, 2023, 53 of the 80 management actions are either complete or need no further action (66.3%). Based on these lists, anticipated BUI removal timelines are shown in Table 1, with a target delisting year of 2030. Once all the BUIs are removed, the implementing agencies will initiate the delisting process.

Table 1: Anticipated BUI Removal Timelines

BUI Removal Timeline (in calendar years for completed and planned dates)	2014	2019	2020	2023	2027	2028	2029
Degradation of Aesthetics (BUI 8)	√						
Fish Tumors and Deformities (BUI 3)		√					
Excessive Loading of Sediment & Nutrients (BUI 6)			√				
Degraded Fish and Wildlife Populations (BUI 2)				√			
Beach Closings and Body Contact Restrictions (BUI 7)					●		
Restrictions on Dredging (BUI 5)					●		
Loss of Fish and Wildlife Habitat (BUI 9)					●		
Degradation of Benthos (BUI 4)						●	
Fish Consumption Advisories (BUI 1)							●

Extent of the AOC Program

There is an important distinction between the federal AOC program administered by states and other program authorities that local, state, tribal and federal environmental, natural resource, and health agencies may administer. The AOC program addresses "legacy" issues or environmental problems that were known to cause ecosystem impairments at the time of the 1987 AOC designation and that largely occurred before modern environmental regulations were in place. Legacy issues significantly impact geographically-defined sites rather than regional-scale stressors. For the SLRAOC, examples of legacy issues resulted from over 100 years of unregulated disposal of industrial and municipal waste, dredging and filling of the estuary, wood waste deposited in the river and logging of the entire region that exacerbated erosion and sedimentation problems. The Clean Water Act (CWA), passed in 1972, and other environmental regulations have been implemented to protect the environment from these types of large-scale problems. The scope of the AOC program does not include "modern" issues that are now addressed by many existing natural resources program authorities managed by a variety of state and federal agencies. Some examples of modern issues are: contaminants of emerging concern, water-related climate change impacts, non-compliance of point source permits, and impairments identified and regulated under the CWA.

The same environmental and natural resource agencies that implemented the SLRAOC Program will address ongoing issues after the Program has ended, but under different program authorities. This will include long-term monitoring and maintenance of remediation and habitat projects, species management, and regulatory enforcement (Figure 1). Additional description of the SLRAOC background and history can be found in Section 4.

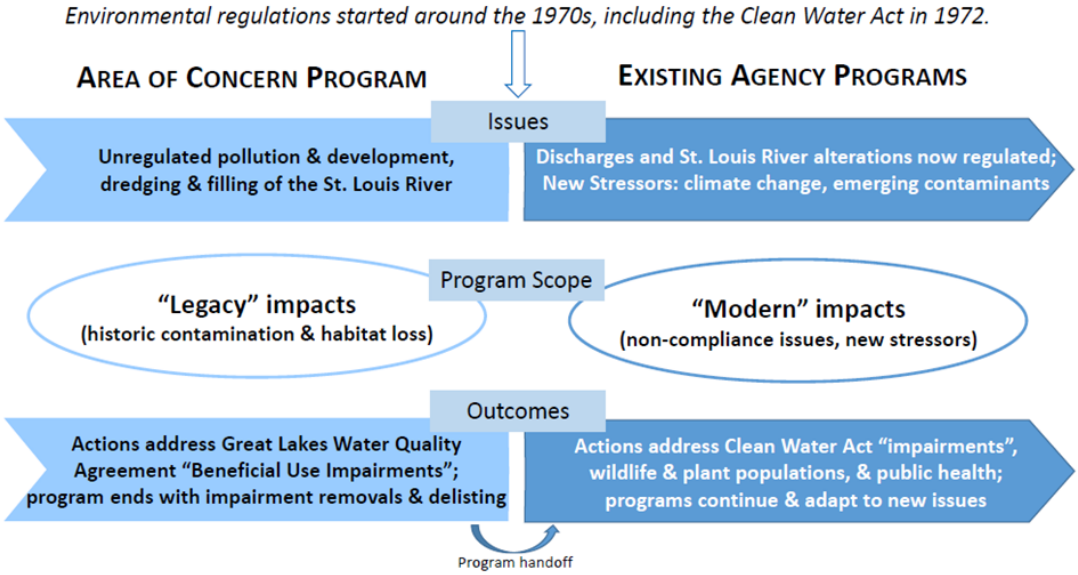


Figure 1: The program scope of the St. Louis River Area of Concern

Several efforts are underway that are not RAP management actions, but that will support BUI removal and eventual delisting, including:

- Updating bathymetry readings at completed SLRAOC project locations
- Obtaining funds from other sources to continue improvements within the boundaries of the SLRAOC. Examples of non-AOC funding sources include:
    - GLRI's Focus Areas 2 (invasive species), 3 (non-point source pollution impacts on nearshore health) & 4 (habitats and species)
    - Minnesota's Clean Water Fund and Outdoor Heritage Fund
    - Minnesota and Wisconsin Coastal Program grants
    - Natural Resources Damages Assessment trusts
    - NOAA's Coastal Habitat Restoration and Resilience grants

  Examples of restoration work already started outside the SLRAOC Program include: hemi-marsh establishment and shoreline softening at Grassy Point, Lower Knowlton Creek fish passage improvements, and hemi-marsh establishment in Allouez Bay. Seeking non-AOC funds will continue after delisting.
- Sharing SLRAOC information with local units of government to help ensure protection of SLRAOC investments.
- Utilizing designated GLRI funding to improve community engagement, environmental justice, and climate resilience.

Additionally, longer-term efforts are underway that will continue after the SLRAOC is delisted. These efforts continue making environmental improvements within the boundaries of the SLRAOC and beyond the scope of the SLRAOC goals. SLRAOC team members have participated in each of these forward-looking efforts to help ensure a smooth transition between the SLRAOC Program and future initiatives. Examples include:

- Data and document system development and utilization so that SLRAOC information continues to be accessible to the public, researchers, and program managers.
- Lake Superior Headwaters Sustainability Partnership development and implementation of the conservation blueprints for the SLR Estuary by the partners that have entered into a memorandum of understanding. Currently, LSHSP Forum members include the City of Duluth, City of Superior, FdL, MNDNR, MPCA, and WDNR.
- Lake Superior Lakewide Action and Management Plan implementation by FdL, MNDNR, MPCA, and WDNR.
- Lake Superior National Estuarine Research Reserve's development of a long-term monitoring strategy for the St. Louis River Estuary.
- Long-Term Monitoring and Maintenance Plan implementation for certain SLRAOC project sites by MNDNR, MPCA, WDNR, and private partners required to do so under the Superfund program.
- Lower St. Louis River Habitat Plan update by the Habitat Work Group.

- Natural Resources Management Program Plan implementation by the City of Duluth.
- Regulated Navigation Area rule development and implementation by the US Coast Guard.
- St. Louis River Estuary National Water Trail Master Plan implementation by SLRA and associated stakeholders.
- St. Louis River Natural Area Management Plan implementation by the City of Duluth.
- St. Louis River Restoration Initiative implementation by the MNDNR.
- Waabizheshikana (Marten Trail) Interpretive Plan implementation by the City of Duluth
- Manoomin Management Plan implementation by the 1854 Treaty Authority, FdL, MNDNR, SLRA, and WDNR.
- A proposal for a manoomin contaminant uptake study and post-doctoral research by LSNERR, 1854 Treaty Authority, FdL, Great Lakes Indian Fish and Wildlife Commission (GLIFWC) and WDNR.
- St. Louis River One Watershed One Plan implementation by Soil and Water Conservation Districts.

Best professional judgment, based on information available in 2013, indicated that contractual costs for implementation of the BUI removal strategies and associated management actions included in the RAP could range from $300-$400M. It is important to note that these were estimated funds needed to implement management actions identified in 2013 and do not include pre-2013 costs already expended on the significant efforts already made towards AOC delisting. As construction projects are completed, actual costs are proving to be significantly higher than the 2013 estimates and will be tracked and summarized in BUI removal and delisting documents.

Roadmap Organization

Section 1 of this Roadmap is organized into ten sub-sections, including an overview subsection that contains information on sediment characterization, followed by nine individual BUI roadmaps.

The sediment characterization section describes the work done by the Minnesota Pollution Control Agency (MPCA) and the Wisconsin Department of Natural Resources (WDNR) to evaluate sediment contaminant levels across the SLRAOC based on data contained in the SLRAOC Data System. This section also describes additional sediment characterization needs identified by MPCA and WDNR that are necessary to support the removal strategies and management actions described in this RAP update.

The individual BUI roadmaps include the following sections:

- **Rationale for Listing** – The rationale for listing, as stated in the Stage I RAP.
- **BUI Removal Target** – The complete BUI removal targets (MPCA and WDNR, 2011). They include definitions of terms, objectives, and interpretations of the BUI. Defining measurable and achievable removal targets for each BUI is emphasized. In addition to the removal target, BUI 2 contains unique removal objectives that are specific to certain fish and wildlife populations. This is due to the complexity of BUI 2, and several removal objectives were defined to assist in assessing the BUI removal target.

- **BUI Removal Strategy** – The strategy developed to meet the BUI removal target is based on the BUI removal objectives and interpretations of the removal target. Major steps necessary to reach the BUI removal target are described.
- **BUI Summary of Key Management Actions, Current Status, and Actions Still Needed** – A current summary of management action status and any BUI decisions, along with a table of management actions still needing completion to achieve BUI removal. Management actions included for each BUI stem from the BUI Blueprints, as refined during RAP updates, and reflect their measurable contribution to BUI removal. Details for each management action include:
  - *Management Action number:* a unique number given to a project
  - *Project name*
  - *Project description:* a brief description of the project intent
  - *In-house/contractual*: indication of who will conduct the work
  - *Date to be completed*
- **Anticipated Timeline to Remove BUI** – This section has been eliminated for removed BUIs. For active BUIs, it includes the year in which the BUI is anticipated to be removed, based on successful completion of the BUI removal strategies and management actions.
- **Issues Affecting Progress** - This section has been eliminated for removed BUIs. For active BUIs, it includes issues that may delay BUI removal (e.g., management actions, targets, funding) and what is being done to address the issue(s).

The date management actions will be completed and the anticipate timeline to remove the BUIs are reviewed and adjusted each year to accommodate changes in project schedules.

Sediment Characterization

Legacy toxics contamination in the SLRAOC contributes directly or indirectly to eight of the nine BUIs. This section describes the sediment characterization work conducted in the SLRAOC to provide information for the development of management actions that support BUI removal strategies and to define where additional sediment contaminant sampling is needed.

To support development of the 2013 RAP Update, MPCA (with GLRI funds) sponsored an AOC-wide sediment characterization project in 2012 to support analysis of the sediment contaminant data contained in the SLRAOC Data System (described in Section 4). The data were analyzed to provide a planning-level view of the status of sediment contamination across the SLRAOC. The Sediment Technical Team (described in Section 4), consisting of staff from MPCA and WDNR, directed the analyses and presentation of the data for their respective states. The SLRAOC-wide characterization work was documented in the *St. Louis River Area of Concern Sediment Characterization: Final Report* (LimnoTech, 2013; Appendix F in the 2013 RAP Update).

To establish a common framework for assessing and displaying sediment contaminant data, the SLRAOC was divided into sediment assessment areas (SAAs). Each SAA was given an individual number and unique name. Maps showing the SAAs within each are provided in Appendix G of the 2013 RAP Update.

The primary goal of the sediment characterization project was to support MPCA and WDNR staff in designating SAAs according to remedial action needs. The SAA remedial needs were categorized as follows:

1. SAAs in need of remediation;
2. SAAs needing further sediment contaminant sampling to determine remedial designation; and
3. SAAs that may need some form of remediation before habitat restoration occurs.

Note: remediation and/or restoration sites can comprise multiple SAAs, each with an SAA-specific remedial designation.

A color scheme was adopted for each SAA to designate what further action was needed, as given in Table 2.

Table 2: Sediment Assessment Area Color Designations

SAA Remedial Designation	Definition
Purple	Remedial action complete, monitoring of effectiveness underway or complete.
Red	Remedial action needed.
Red-gray	Additional characterization and assessment needed to determine if remedial action is necessary.
Yellow	Remediation generally not warranted, but management actions must consider the presence of contaminants, especially bio-accumulative contaminants.
Green	No known contamination. No remedial actions planned.

Where SAAs were in need of further sediment contaminant sampling to confirm their remedial designation (i.e., red-gray sites), additional samples were collected and the data evaluated by the respective states to determine the remedial designation. If a remedial designation of red was confirmed, the sites were added to the list of remediation sites to be addressed in the RAP. It should be noted that further sediment characterization may be needed at remediation or aquatic habitat restoration sites based on site objectives and for feasibility and design purposes. Information on supplemental sediment characterization efforts that have been or may still need to be completed is provided under the roadmap for BUI 5 - Restrictions on Dredging. All information from these studies and reports can be found in the Great Lakes Data Integration Visualization Exploration and Reporting (GLDIVER) data management system.

Sediment sampling for Minnesota's red-gray sites was completed in 2014. Sediment sampling to characterize Wisconsin's red-gray sites was completed in 2020. Remedial decisions at Wisconsin's red-gray sites were made in 2021. There are no more sites identified as red-gray sites.

BUI 1: Fish Consumption Advisories

BUI 1 Rationale for Listing

Historically, some fish samples taken from the St. Louis River and Lake Superior exceeded levels of contaminants established by Minnesota and Wisconsin for the unrestricted consumption of locally-caught fish. Each state has issued their own fish consumption advisories for various population groups based on fish species and size classes. In Wisconsin, those advisories were collectively issued for the presence of mercury and polychlorinated biphenyls (PCBs). In Minnesota, the advisories were either for mercury or mercury plus PCBs. At the time of AOC listing, fish tissue residues of mercury and PCBs exceeded the respective 0.5 mg/kg and 0.1 mg/kg standards established in the 1978 GLWQA for the protection of aquatic life and fish-consuming birds.

BUI 1 Removal Target

The Target for this BUI will be reached when:

> *There are no Area of Concern-specific fish consumption advisories issued for the St. Louis River by the State of Minnesota or the State of Wisconsin. Tissue concentrations of contaminants of concern in representative samples of resident fish are not significantly elevated from regional background samples.* (MPCA and WDNR, 2011)

The two contaminants of concern are mercury and PCBs, as those are the reasons for current consumption advisories in the SLRAOC.

Removal of the Fish Consumption BUI will be justified when:

> There are no fish consumption advisories issued for the SLRAOC by the State of Minnesota or the State of Wisconsin that are more stringent than advice given for other waterbodies in the region; or
>
> Tissue concentrations of contaminants of concern in representative samples of resident fish are not significantly different than reference samples.

The BUI may be removed on either basis, and a different basis may apply for each contaminant of concern. For purposes of this BUI removal target, the definition of "reference site" is as follows:

> Mercury – Waterbody(ies) in northwest Wisconsin and/or northeast Minnesota with conditions (e.g., water chemistry, hydrogeomorphology) similar to that of the St. Louis River estuary
>
> PCBs - St. Louis River upstream of Cloquet and/or Lake Superior

The target established for removal of this BUI is not intended to include consumption advice that may be established for subsistence fishing by tribal members within the St. Louis River.

BUI 1 Removal Strategy

The strategy for BUI removal focuses on fish tissue concentrations (FTCs) of mercury and PCBs. The 2016 revised strategy removed specific actions related to fish consumption advisories (FCAs). The decision is based on the complications with comparing FCAs in different waterbodies and states, and the better likelihood of a meaningful comparison of the SLRAOC and reference site(s) using FTCs. However, if the Minnesota Department of Health and WDNR both revise the FCAs stating the FCAs in the SLRAOC are no more stringent than FCAs at a reference site similar to the SLR, BUI removal is supported.

The strategy for BUI removal includes the management actions listed in Table 3. Two of the management actions are comparisons of FTCs in the SLRAOC to a reference site(s) for PCBs (1.01) and mercury (1.02b). An additional management action for mercury includes studies underway that are assessing the contribution of legacy mercury contamination to present-day methylmercury residues in biota (1.02a). The last action, if needed, is continued monitoring to evaluate recovery of contaminants in fish tissue (1.03). The strategy for removal of this BUI is as follows:

Management Action 1.01 for PCBs

This management action is based on three principles:

1. The reference location is the St. Louis River upstream of Cloquet because this is upstream of known sources of legacy contamination. The fish species collected from each site (to the extent possible) include Walleye, Northern Pike, Yellow Perch, Black Crappie, Smallmouth Bass, and Channel Catfish. A multi-species approach is being used. First, the fish represent multiple diet habits (benthic, pelagic) and trophic levels (prey fish, predators), which is necessary to diagnose changes throughout the food web. Second, the fish have different growth rates and longevity and thus will respond to remediation at different rates (for example, a relatively short-lived species such as Yellow Perch responds faster than Walleye, which lives much longer). Third, these species are common monitoring targets for contaminants and thus comparable data can be found for other waterbodies, which is necessary to develop an appropriate comparison with the reference location.
2. FTC analysis may include PCBs congeners and/or total Aroclors when needed for data comparison and to help identify PCBs sources between a reference location and the AOC and the contribution of legacy PCBs sources to present-day residue in biota.
3. Remediate sites in the SLRAOC associated with PCBs contaminated sediments, if necessary. Then use a BUI decision tree developed by the Technical Team to determine if management action 1.01 is complete.

Management Action 1.02a and 1.02b for Mercury

These management actions are based on three principles:

1. Use existing studies underway to assess if high sediment mercury concentrations are associated with legacy sources and with higher-than-average mercury in biota.
2. Use existing data to evaluate and select a reference location(s) and fish species for comparison of mercury FTCs. The reference locations for mercury should follow the reference site definition

above. A multi-species approach will be followed. The fish species collected from each site (to the extent possible) will include Walleye, Northern Pike, Yellow Perch, Black Crappie, Smallmouth Bass, and Channel Catfish.

3. Remediate sites in the SLRAOC associated with legacy mercury contaminated sediments, if necessary. Then use a decision tree for the mercury management actions to determine when they are complete.

Management Action 1.03 for Recovery Monitoring

This action will be informed by the results of 1.01 and 1.02, if it is determined that additional monitoring of fish tissue is needed outside of the routine consumption advisory monitoring.

If fish tissue concentrations of mercury and PCBs are not in recovery as compared to reference sites, then identify whether non-routine monitoring is needed to inform future consumption advice. Non-routine monitoring may include, but is not limited to, the need to monitor more frequently, sample fish from different habitats, gather an increased sample size, select certain fish species or test for different parameters for BUI removal purposes. If non-routine monitoring is needed, develop a monitoring program appropriate to determine whether existing routine FTCs are in recovery for legacy-related AOC purposes. If FTCs are not recovering as anticipated, continue to monitor and study bioaccumulation in the estuary to better understand factors that are driving mercury and/or PCBs accumulation in the system and to determine if it is AOC-related.

BUI 1 Summary of Key Management Actions, Current Status, and Actions Still Needed

The status of management actions needed to remove this BUI is as follows:

Management Action 1.01 - Study PCBs fish tissue concentrations

The US Environmental Protection Agency Great Lakes Toxicology and Ecology Division's (USEPA-GLTED) biota sediment accumulation factor (BSAF) model evaluated potential bioaccumulation spots for PCBs in the SLRAOC below the Fond du Lac dam. 2021 data were evaluated and showed that many of the suspected bioaccumulation hotspots were not contributing to PCB bioaccumulation. The sampling data did not find any new hotspots. These results were presented to and evaluated by the Technical Team in 2023. The Technical Team applied the 2020 PCBs decision tree and concluded that no further action is needed for PCBs management action 1.01. With the PCBs decision tree now complete, Dr. Hoffman is preparing a report to document the work done for management action 1.01. Completion of this action is anticipated after final Technical Team review of the report.

Management Action 1.02a - Study sources of mercury in fish tissue

The following studies have been conducted to better understand the contribution of legacy mercury contamination to present-day methylmercury residues in biota.

- GLRI funds were used to fingerprint primary sources of mercury (industrial/legacy- sediments, watersheds- runoff, and precipitation- air deposition) through stable isotopic signatures and compare them with fish samples to provide a direct and quantitative measure of the relative source contributions. The initial study, *Examining historical mercury sources in the Saint Louis River estuary: How legacy contamination influences biological mercury levels in Great Lakes coastal regions* was published in 2021 in the journal: Science and the Total Environment. In 2021, USGS continued mercury isotope work to address data gaps identified in the initial study. Laboratory analytical work was completed in 2022 and interpretation of results was completed in 2023. To address the first data gap, the study found that the majority of methylmercury in prey fish (e.g., yellow perch) is not sourced from legacy mercury in Allouez Bay, near Boy Scout Landing and in Spirit Lake. However, in St. Louis Bay and Superior Bay, the majority of methylmercury in fish is from legacy sources (Figure 1b, Janssen 2021). Total mercury in sediment was above decision tree thresholds at four sampling sites, all of which are located within AOC remedial action sites. The Technical Team will evaluate these findings and determine if further ecological or human health risk assessments are needed as part of a multiple lines of evidence review step. To address the second data gap, the study found that isotopic signatures did not require any corrections for methylation and that a consistent offset was observed between total mercury and methylmercury in sediments collected at both remedial areas and background sites. This observation and the careful selection of fish across a gradient of habitats with differing mercury sources allowed for a mass balance approach using total mercury data. All mercury concentration and isotope data from the study has been released under USGS data releases and the final interpretive report is forthcoming (Janssen, et al, 2021 with data release and Janssen, et al, 2023.) Completion of 1.02a and 1.02b actions is anticipated after completion of the multiple lines of evidence evaluation and Technical Team review of the 2021 report.
- WDNR completed a project in the SLRAOC below the Fond du Lac Dam that entailed the development of surface area weighted means for mercury and methylmercury in benthic invertebrates (primary target: Hexagenia spp.; secondary target: isopods). The project sampled invertebrates at 51 randomly distributed sites, as well as 27 known mercury sediment or biota hot spots from previous studies. Isopods were sampled and tested for mercury at some sites where Hexagenia was not present. This information documented the current Hexagenia population in the SLRE and contributed toward an understanding of mercury bioaccumulation in the SLRE food chain. A final report was posted in the WDNR SWIMS database: https://dnr.wi.gov/water/wsSWIMSDocument.ashx?documentSeqNo=256795144
- FdL, MPCA, and Minnesota Power collected water quality data and young-of-year perch mercury concentration data in all the Minnesota Power reservoirs in the main stems of the St. Louis River and Cloquet River, including two reference (non-reservoir) lakes within the watershed (Minnesota Power, 2018). This study provided key information regarding the relative mercury bioaccumulation rate in fish and methylmercury contribution of the managed reservoirs in the watershed.

- Dr. Nathan Johnson, University of Minnesota Duluth (UMD) Civil Engineering Department, received funding from Minnesota Sea Grant to better understand methylmercury production and bioavailability in the SLRE. The researchers collected water, sediment and biota from a variety of locations in the estuary and analyzed them for total mercury and methylmercury. This work provided information to help make decisions concerning beneficial use of dredging materials, habitat restoration and consumption advisories.

Management Action 1.02b –Characterize fish for mercury

The mercury comparison study described in 1.02a investigated water quality, tissue & food web, and sediment components in the following St. Louis River habitats and at the reference site. Data analysis and report writing was completed by USGS in 2021 and findings have been published in the journal: Science and the Total Environment. *Examining historical mercury sources in the Saint Louis River estuary: How legacy contamination influences biological mercury levels in Great Lakes coastal regions*. Data gap analyses were completed as described in 1.02a, above. Dr. Janssen is preparing a report to document the work done for management action 1.02a and 1.02b. Completion of these actions is anticipated after final Technical Team review of the report.

Management Action 1.03–Recovery Monitoring of Consumption Advice

Monitoring FTCs is currently happening through routine state and tribal FCA monitoring about once every five years. However, the Technical Team has determined that the frequency of sampling, sample size, and sample distribution are inadequate to assess recovery trends for the purpose of BUI removal. The Technical Team has been reviewing findings for management actions 1.01, 1.02a and 1.02b throughout 2023 and they began discussions about Management Action 1.03. A subset of the Technical Team, plus fisheries staff and FCA toxicologists from MN and WI are developing a fish tissue concentration study proposal and GLRI funding request to conduct recovery monitoring.

Additional, Related Work

MPCA has initiated work to prepare a Total Maximum Daily Load (TMDL) Report for mercury in the St. Louis River Watershed in Minnesota. Once completed and approved by USEPA, it will identify allocations for both point sources and non-point sources. Thereafter, entities with National Pollutant Discharge Elimination System (NPDES) permits will then be required to meet those allocation limits under the authority of the CWA. This will contribute to further mercury reductions after the SLRAOC is delisted.

Table 3: Management Actions Needed to Achieve Removal of BUI 1

Mgmt Action	Project Name	Project Description	In-house/ Contractual	Date to be Completed
1.01	Study PCBs Fish Tissue concentrations	Compare fish tissue PCBs concentrations for selected fish species at reference locations to fish collected in the AOC.	USEPA-GLTED and MPCA	2023
1.02a	Study sources of mercury in fish tissue	Use studies underway to demonstrate a contribution of legacy mercury to present-day methylmercury residues in biota.	GLRI funded projects (USGS, WDNR, MN/WI Sea Grant, FdL, MPCA, MN Power)	2023
1.02b	Characterize fish for mercury	Compare fish tissue mercury concentrations for selected fish species at a reference location to fish collected in the AOC. Include reservoirs in comparison.	USEPA-GLTED & USGS to perform over multiple years	2023
1.03	Recovery Monitoring of Consumption Advice	If fish tissue concentrations of Hg & PCBs are not in recovery as compared to reference sites, identify whether non-routine monitoring is needed to inform consumption advice.	USEPA-GLTED, USGS, MNDNR, WDNR	2029

This BUI relies on remediation of sites contaminated with mercury and PCBs.

Anticipated Timeline to Remove BUI 1

2022	2023	2024	2025	2026	2027	2028	2029	2030
							●	

BUI 1 Issues Affecting Progress

Management action 1.01 will be complete upon receipt of the PCBs study paper.

Mercury study results show that legacy mercury in portions of the SLRAOC is greater than the reference site as explained in MA 1.02a and 1.02b findings above. The mercury decision tree can be concluded in conjunction with the multiple lines of evidence assessment. These two management actions will be complete upon review of the mercury study paper. Proceeding with recovery monitoring for Management Action 1.03 is pending review and funding of the sampling proposal. If this work is not funded for additional sampling in 2024 it may delay BUI removal.

Stakeholder engagement and education will be critical for removal of this BUI. Clearly explaining how the SLRAOC efforts fit into the development of fish consumption advisories and the scientific basis for BUI removal will be important. Additionally, it will be important to explain that FCAs may remain due to atmospheric and watershed sources managed by other regulatory programs and addressing these modern sources will take actions beyond the AOC program. Coordinating BUI removal with federal, tribal, and state entities is a priority.

BUI 2: Degraded Fish and Wildlife Populations

Although BUI 2 has been removed, the Roadmap content has been retained here for documentation purposes. The removal package can be found on the Impairments tab at https://dnr.wisconsin.gov/topic/GreatLakes/StLouis.html.

BUI 2 Rationale for Listing

During the period of severe organic pollution before 1979, fish populations were degraded and fish kills were common. One reason fish populations recovered since that era is because of improvements in wastewater treatment. Fish populations were also adversely affected by the proliferation of the Ruffe invasive fish species in the early 1990s. At the time of SLRAOC listing, the potential impacts from toxic substances on fish population health were largely unknown. At that time, loss of physical habitat also threatened fish and wildlife populations, including the loss of wetland habitat and the infestation of the invasive plant purple loosestrife. Few population data were available for wildlife, with the exception of colonial nesting birds in the SLRAOC. Populations of the Common Tern and the Piping Plover (threatened and endangered species, respectively) had declined, likely caused by a combination of local and regional factors.

BUI 2 Removal Target

The BUI Removal Target will be reached when:

> *In consultation with their federal, tribal, local, and nonprofit partners, state resource management agencies concur that diverse native fish and wildlife populations are not limited by physical habitat, food sources, water quality, or contaminated sediments.* (MPCA and WDNR, 2011)

Removal of the Degraded Fish and Wildlife Populations BUI will be justified when it is shown that key native species populations of fish (i.e., Walleye, Muskellunge, Sturgeon) and wildlife (i.e., Piping Plover, Common Tern, Great Blue Heron, Bald Eagle, wetland bird species, and semi-aquatic mammals) are present and not limited by physical habitat, food sources, water quality, or contaminated sediments as evidenced by the removal objectives listed below.

BUI 2 Removal Objectives

Due to the complexity of BUI 2 and its removal target, several removal objectives were defined, as outlined below.

Fish

The BUI removal objectives for fish are based on goals established in the MNDNR St. Louis River Estuary Lake Management Plan (MNDNR, 2012), as updated by the BUI Tech team for the 2017 RAP, for three indicator fish species: Walleye, Muskellunge, and Lake Sturgeon. The objectives, which must be demonstrated with fish survey data, are as follows:

- **Walleye**
  Gillnet catch per unit effort (CPUE) is maintained at or above 5.0 per lift with a proportional stock density (PSD) between 30 and 60 in at least 50% of years surveyed since 2000.

- **Muskellunge**
  Trap net CPUE is maintained at or above 1.0 per lift in at least 50% of years surveyed since 1997.
- **Lake Sturgeon**
  Document an increasing trend of 2 to 5-year-old fish captured in summer index nets, with at least 2 index values greater than 2.0 per gillnet lift.

Wildlife

The wildlife species represented in the BUI removal objectives below were selected by AOC resource managers based on their importance for developing consensus among resource managers that wildlife species are no longer limited by physical habitat, food sources, water quality, or contaminated sediments. The removal objectives established for the target wildlife species (i.e., Piping Plover, Common Tern, Great Blue Heron, Bald Eagle, wetland bird species, and semi-aquatic mammals) and invasive species are as follows:

- **Piping Plover**
  Piping Plover populations have been limited by historical habitat losses and may be restricted by factors operating outside of the estuary; however, to support the US Fish and Wildlife Service (USFWS) recovery goal of 150 breeding pairs for the Great Lakes Piping Plover population, efforts are being made to create suitable nesting habitat within the St. Louis River AOC. To remove this BUI, implementation of the Piping Plover habitat project (management action 2.05) in the RAP is necessary.
- **Common Tern**
  Common Tern populations have been limited by historical habitat loss and may be restricted by factors within the estuary such as ice cover, flood events, gull predation and competition for nesting and young rearing habitat, including other regional factors outside of the estuary. Wisconsin's Common Tern Recovery Plan establishes a goal of a 10-year average of 200 nesting pairs with sufficient production of 0.8-1.1 young per breeding pair to maintain population stability in the St. Louis River Estuary (Matteson 1988). To support this goal, efforts are being made to maintain and enhance suitable nesting habitat within the St. Louis River AOC. To remove this BUI, implementation of the Interstate Island restoration project (management action 2.06) in the RAP is necessary. In addition, the state agencies will continue to support habitat management and population monitoring at Interstate Island.
- **Great Blue Heron**
  Removal of this BUI is not dependent on the establishment of a Great Blue Heron rookery, but the recorded presence of the species in the estuary during nesting season since 1997 will provide additional evidence for BUI removal.
- **Bald Eagle**
  Recovery of the Bald Eagle and the recorded presence of the species in the estuary during nesting season since 1997 is an indicator for BUI removal.
- **Wetland Bird Species**
  Removal of this BUI is not dependent on populations of wetland-associated wildlife species. An AOC-wide bird follow-up survey to compare to work done in 1979 is necessary evidence for BUI removal.

- **Invasive Species**
  An analysis of historical data that shows the Ruffe is not inhibiting the native fish population is required to remove this BUI.
- **Semi-Aquatic Mammals**
  Removal of this BUI is not dependent on specific semi-aquatic mammal population numbers. However, to support development of concurrence among state resource management agencies, a semi-aquatic mammal survey will be conducted in the estuary to verify that populations are not limited by physical habitat, food sources, water quality, or contaminated sediments.

BUI 2 Removal Strategy

The strategy for BUI removal included the six management actions listed in Table 4. The management actions for BUI 2 have been completed and a draft removal package for BUI 2 was shared with the Technical Team and the public. The final removal package was submitted in late 2022 for EPA review. The BUI was removed in January 2023 and the final removal package is posted on WDNR's website.

The strategy for removal of the Degraded Fish and Wildlife Populations BUI included:

- Complete a thorough inventory and assessment of populations of the selected target species of birds (as listed above in the removal objectives) across the estuary. Available data on additional bird species from historical and recent monitoring may also be used to assess the overall status of the bird populations (management action 2.01).
- Continue routine MNDNR and WDNR fish population monitoring and reporting to confirm continued health of Walleye and Muskellunge and continued recovery of Lake Sturgeon. Lake Sturgeon populations that meet the objectives above must be documented for two index periods (management action 2.02).
- Complete the analyses of Lake Sturgeon tissues to assess whether legacy contaminants are affecting early life stage and adult fish (management action 2.02).
- Complete an analysis of historical fish population data to confirm that Ruffe are not inhibiting the native fish population (management action 2.03). Note that the prevention and control of other invasive flora and fauna are addressed under the Loss of Fish and Wildlife Habitat BUI.
- Complete an estuary-wide semi-aquatic mammal survey comparing beaver, otter, muskrat and mink to least impaired reference areas (management action 2.04).
- Increase available Piping Plover stopover and nesting habitat within areas identified in Figure 2 (management action 2.05).
- Restore and protect critical nesting habitat for Common Tern and stopover habitat for Piping Plover at Interstate Island (management action 2.06).

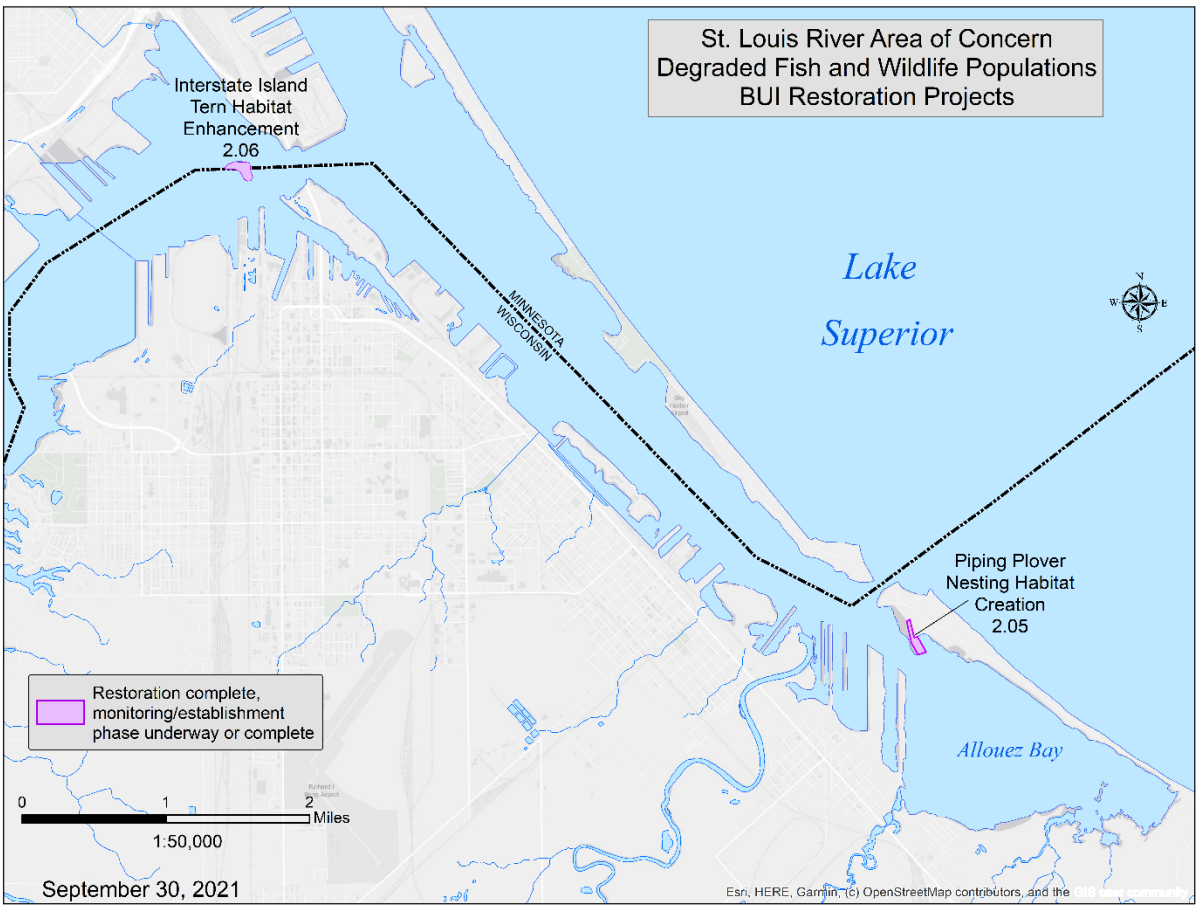


Figure 2: Completed SLRAOC Degraded Fish and Wildlife Populations BUI Restoration Projects

BUI 2 Summary of Key Management Actions, Current Status, and Actions Still Needed

All management actions have been completed and the BUI removal package was submitted to USEPA in late 2022 and it was accepted for removal in January 2023.

Construction was completed on the Interstate Island avian habitat restoration project (management action 2.06) in April 2021. Annual collection of Common Tern nesting information, shorebird use, and management of Interstate Island continues through MNDNR and WDNR wildlife management programs and the University of Minnesota – Duluth's Natural Resources Research Institute. Following construction, MNDNR and WDNR nongame wildlife management programs will jointly implement a long-term maintenance plan and MNDNR anticipates planting dune vegetation on the island in 2022.

WDNR is implementing a monitoring and maintenance plan at the Piping Plover nesting habitat restoration project, including a habitat establishment phase with dune vegetation plantings and continued Piping Plover monitoring during the nesting season.

SLRAOC objectives for management action 2.02 Walleye and Muskellunge have been met and recent data will be included in the removal package. Routine fish population monitoring will continue as part of other MNDNR and WDNR programs.

Enhancement of Lake Sturgeon and Walleye spawning habitat was part of management action 9.10, Chambers Grove Park restoration and earlier habitat work below the Fond du Lac Dam. Despite past efforts to recover SLRAOC Lake Sturgeon populations via fingerling stocking and habitat restoration, Lake Sturgeon objectives were not met. Legacy contaminants in Lake Sturgeon were studied from 2018-2021 and results of these studies showed that there were no indicators of egg mortality or reproductive impairment due to concentrations of the legacy contaminants tested (Doering, 2021). It is believed that slow Lake Sturgeon population recovery is the result of factors outside of the scope of the AOC program and Technical Team members recommended BUI removal. The recovery of Lake Sturgeon in the St. Louis River is a long-term management effort among resource agencies and will continue outside of the AOC program.

Table 4: Management Actions Completed for Removal of BUI 2

Mgmt Action	Project Name	Project Description	In-house/ Contractual	Date to be Completed
2.01	Bird Inventory and Assessment	Conduct an estuary-wide bird inventory for target species to be combined with existing inventory data available. Complete an AOC-wide assessment of bird population status using the combined dataset.	Contractual	2016 completed
2.02	Fish Population Monitoring and Assessment	Continue regular MNDNR and WDNR fish population monitoring and evaluate to track status of target fish species against the BUI removal objectives. Conduct study of Lake Sturgeon tissue to assess adverse effects related to legacy contaminants on early life stage and adult fish.	In-house: Sampling conducted by MNDNR, WDNR, and other partners USEPA-GLTED, MNDNR	Yearly through 2020 completed June 2021 completed
2.03	Ruffe Assessment	Document Ruffe populations in relation to native fish populations within the estuary.	USEPA	2017 completed
2.04	Semi-Aquatic Mammal Survey	Conduct an estuary-wide semi-aquatic mammal survey.	Contractual	2016 completed
2.05	Piping Plover Habitat / Beach Nourishment	Increase available nesting habitat within area designated critical habitat.	WDNR, EPA, USACE, USFWS, SLRA, WI Sea Grant, City of Superior, FdL	2020 Completed
2.06	Interstate Island Avian Habitat Restoration	Restore and protect critical nesting habitat for Common Tern and stopover habitat for Piping Plover.	MNDNR, WDNR, MLT	2021 completed

BUI 3: Fish Tumors and Other Deformities – BUI Removed

Although BUI 3 has been removed, the Roadmap content has been retained here for documentation purposes. The removal package can be found on the Impairments tab at https://dnr.wisconsin.gov/topic/GreatLakes/StLouis.html.

BUI 3 Rationale for Listing

Observations at the time of AOC listing suggested that fish tumors and deformities represented an impaired use in the SLRE. However, no studies documenting the incidence rates of tumors in fish were available at the time.

BUI 3 Removal Target

The BUI Removal Target will be reached when:

> *Incidence rates of contaminant-related internal and external tumors and deformities in resident benthic fish species, including neoplastic or pre-neoplastic liver tumors, do not exceed incidence rates from unimpaired areas elsewhere in the Great Lakes Basin.* (MPCA and WDNR, 2011).

Removal of the Fish Tumors and Other Deformities BUI will be justified when the liver tumor incidence rates in the SLRAOC, as seen in three consecutive samplings of at least 200 white suckers, are statistically similar to, less than, or trending towards the reference site(s) in a six-year period. Comparisons will be made using the variation of tumor incidence rates observed in the reference site(s).

BUI 3 Removal Strategy

The strategy for BUI removal included the three completed management actions listed in Table 5. The strategy for removal of the Fish Tumors and Other Deformities BUI was as follows:

- Determined in 2015 that Mountain Bay was not an applicable reference site for the SLRAOC based on results from the 2013 Canadian AOC sampling (management action 3.02), therefore White Sucker from western Lake Superior will be used as the reference population. This decision was made based on the small sample size, lack of isotope data to show migration information, and no tumors found in White Sucker in Mountain Bay in 2006.
- Determined in 2015 that a stable isotope method (Blazer, et. al, 2014) was more appropriate than fish tagging to determine fish residency (management action 3.03). A logistic regression model factoring habitat usage, sex and age was used to determine the Lake Superior reference population after the final round of data was available in 2016.
- Evaluated SLRAOC White Sucker liver tumor incidence rates (management action 3.01), according to this plan:
  - If SLRAOC tumor incidence rate was within the range of tumor incidence rates of the reference site(s), then samples would be collected two more times within six years, with the intent to remove this BUI if acceptable tumor incidence results continued.

- If SLRAOC tumor incidence rate exceeded the range of tumor incidence rates found at the reference site(s), then another round of representative sampling would be conducted in two years. If two rounds of representative sampling failed to meet the reference range, sampling would be discontinued until at least two remediation projects were completed at sites contaminated with polycyclic aromatic hydrocarbons. Following significant remediation progress, fish sampling would be resumed in two- to three-year intervals. Fish tumor incidence similar to the reference site, as evidenced by data from three sampling rounds, would be assessed for BUI removal.

BUI 3 Summary of Key Management Actions, Current Status, and Actions Still Needed

Management action 3.01 was completed in 2016. Data from 2011, 2013 and 2015 were combined into the final report.

Management action 3.02 was completed in 2014. The method for determining a reference population has been developed by researchers using White Sucker migrating into the estuary from Lake Superior as the reference population. The Lake Superior fish are from a nearby, unimpaired location and are subject to the same regional environmental quality. Lake Superior itself can serve as a reference site because Lake Superior sediments exhibit relatively low levels of contamination (Marvin *et al*. 2004).

Management action 3.03 was completed in 2016. The stable isotope method (Blazer *et al*., 2014) was used to determine the Lake Superior reference population as a medium-term (approximately 2 year), diet-based indicator for movement. The stable isotope analysis provided insight into where fish have spent their recent life history by indicating the percentage of diet from the SLRE and the percentage from Lake Superior. This was necessary because there was no relationship between recent habitat use and where White Sucker were captured during the spawning run (Blazer, *et al*. 2014). A logistic regression model factoring habitat usage, sex and age was used to compare tumor incidence with these factors.

The BUI was formally removed in February 2019.

Table 5: Management Actions Completed for Removal of BUI 3

Mgmt Action	Project Name	Project Description	In-house/ Contractual	Date to be Completed
3.01	Fish Sampling	Conduct representative sampling from the entire AOC.	Contractual	Complete 2016
3.02	Reference Site Determination	Evaluate reference site options. Stable isotope method used for reference site population determination using migratory White Sucker from Lake Superior.	In-house – USEPA-GLTED	Complete 2014
3.03	Residency Determination	Determine appropriate methods for fish residency determination (i.e., fish tagging or stable isotopes).	In-house – USEPA-GLTED	Complete 2016

BUI 4: Degradation of Benthos

BUI 4 Rationale for Listing

At the time of AOC listing, reduced benthic macroinvertebrate density and species richness were reported in areas subjected to habitat alteration or physical disturbance, or being near to known contamination. Benthic communities in disturbed areas were dominated by organic tolerant taxa (e.g., Oligochaeta, Chironomidae; Diptera) and exhibited an overall lack of species diversity.

BUI 4 Removal Target

The BUI removal target will be reached when:

> *The benthic community in historically degraded areas (e.g., chemically, biologically, or physically degraded areas) of the Area of Concern (AOC) does not significantly differ from unimpacted sites of comparable characteristics within the AOC. Benthic communities' characteristics including native species richness, diversity, abundance, and functional groups will be considered when comparing sites.* (MPCA and WDNR, 2011)

Removal of the Degradation of Benthos BUI will be justified when benthic community post-construction sampling results (4.01) are not significantly different from a SLRAOC reference condition. Appropriate reference conditions will be selected using benthic communities collected in comparable habitats to each project site located within distinct geomorphological zones that occur longitudinally along the river course. Geomorphological zones include the upper St Louis River, lower St Louis River, upper St. Louis Bay, St. Louis Bay, and Superior Bay. For contaminated sites undergoing remediation, the benthic community will be considered in recovery once remedial actions are implemented and, where applicable, ecological enhancements meet project specific targets.

BUI 4 Removal Strategy

The strategy for BUI removal included one management action (Table 6). Management action 4.01 began in July 2018 with data collection taking place within the estuary at reference sites and completed restoration sites to provide for post-project comparisons. The strategy for removal of the Degradation of Benthos BUI is as follows:

- Identify appropriate reference conditions and determine useful benthic community diversity metrics to use for comparisons.
- Determine the pre-construction benthic community condition by monitoring aquatic habitat restoration or remediation sites.
- Identify and implement remedial actions as necessary and, if appropriate to the remedial design, incorporate habitat restoration components. The remedial actions at "red" sites identified under BUI 5 are in various stages of implementation. Remedial actions in non-priority benthic habitat locations (e.g., industrial slips) will be considered complete under BUI 4 following implementation of the selected remedies. In general, post-construction benthic macroinvertebrate monitoring at remediation sites will not be necessary for removal of this BUI,

though the need for such monitoring is expected to be determined on a case-by-case bases depending on site specific remedial action objectives.

- Conduct post-construction biological monitoring at prioritized sites and compare to pre-construction biological metrics and metrics from a SLRAOC reference site to evaluate status (management action 4.01).
- If post-construction biological monitoring shows targets are not met or trends are not improving, identify factors that may be contributing and determine appropriate actions.

BUI 4 Summary of Key Management Actions, Current Status, and Actions Still Needed

Researchers in the SLRE have developed an extensive benthic data set with data collected from 1993 to 2015. Researchers at the USEPA-GLTED laboratories have analyzed portions of these data in progress reports to develop metrics for addressing the Degradation of Benthos BUI. The reports include:

- *A Benthos-based Multimetric Index for Use in the St. Louis River Area of Concern*, Draft Progress Report (USEPA, August 2015)
- *Defining Benthos Reference Condition for a Great Lakes Area of Concern* (USEPA, May 2016).
- *A Depth-adjusted Ambient Distribution Approach for Setting Numeric Removal Targets for a Great Lakes Area of Concern Beneficial Use Impairment: Degraded Benthos* (Angradi, *et al*. 2017).

These reports describe data analysis methods for developing biological indicators to assess Minnesota sites. They also present analyses that can be used throughout the estuary to assess benthic community health to inform project design decisions and to support removal of the Degradation of Benthos BUI. No single metric or set of metrics can be expected to apply across the entire estuary and its diverse habitats. Therefore, flexibility will be maintained for the use of site-specific measures of success, where appropriate, on a case-by-case basis.

Progress to date has included:

- Post-construction sample collection and field observations of the benthic community began at reference sites and completed restoration sites during the 2018 field season. By the 2022 field season, assessments to document project performance began concentrating on completed restoration sites. In total, 718 and 1,347 stations have been visited to assess the benthic macroinvertebrate and aquatic macrophyte communities, respectively. As progress is made on remediation and habitat restoration projects, an additional 397 macroinvertebrate and 794 macrophyte stations will be visited to evaluate post-construction performance, likely through 2027.

  Benthos performance reports have been drafted for four of 13 sites. Thus far, performance metrics sampled site-wide suggest about 500 acres of restored habitat is not significantly different than established reference sites.
- To reduce the error introduced by confounding environmental factors occurring longitudinally throughout the estuary, it was decided that restoration success will be based on the site-level

condition compared to least-impaired targets established from reference conditions within the same geomorphic zone (e.g., lower St Louis River, upper St Louis River, upper St. Louis Bay, St Louis Bay, or Superior Bay). Other least-impaired considerations may be needed for project sites in Allouez Bay, Pokegema Bay, and the Upper River since the condition class cutoff has not been fully developed at this time.

Multiple sampling events will be conducted at each of the sampling sites after construction has been completed. However, due to staggered construction progress and only projected construction timelines for future projects, final field collections and observations to assemble the biological data are expected after 2025, with analysis and summaries to follow thereafter. Data will be delivered to the SLRAOC GLDIVER system and each state will be responsible for analyzing this information for their respective sites. Once each state has completed its analysis, the BUI removal package can be prepared.

Table 6: Management Actions Needed to Achieve Removal of BUI 4

Mgmt Action	Project Name	Project Description	In-house/ Contractual	Date to be Completed
4.01	Post-Construction Biological Monitoring	Establish post-construction biological community characteristics evaluation SLR estuary-wide	Contractual	2027

This BUI relies on benthic recovery in aquatic habitat sites listed under BUI 9: Loss of Fish and Wildlife Habitat and the remediation of "red" sites identified in BUI 5: Restrictions on Dredging (Figure 5).

Anticipated Timeline to Remove BUI

2022	2023	2024	2025	2026	2027	2028		2029	2030
						●			

BUI 4 Issue Affecting Progress

Benthic study progress is limited by the pace at which restoration projects are completed. Although sampling is conducted annually, results for specific project sites, or least-impaired reference areas, are only available when an appropriate number of samples per area or project site are reached.

BUI 5: Restrictions on Dredging

BUI 5 Rationale for Listing

At the time of SLRAOC listing, restrictions on dredging was identified as an impaired beneficial use in the SLRAOC. Sediments in many parts of the SLRAOC contained toxic, bio-accumulative contaminants that exceeded guidelines developed by regulatory agencies that could cause adverse effects to aquatic and terrestrial organisms. In addition, economic and social consequences were thought to affect some resource users due to special dredging requirements and obligations for long-term sediment containment.

BUI 5 Removal Target

The BUI removal target will be reached when:

> *All contaminated sediment hotspots within the AOC have been identified and implementation actions to remediate contaminated sites have been completed. There are no special handling requirements of material from routine navigational dredging due to contamination originating from controllable sources within the AOC.* (MPCA and WDNR, 2011).

The following terms were defined for the purposes of interpreting the 2008 target:

> ***Restriction on Dredging*** **-** when additional costs for dredging due to the levels of contaminants in the sediment occur. Contaminant levels could impact the method of dredging (e.g., hydraulic or environmental bucket vs. clam shell), depth of dredging, best management practices, or disposal options (e.g., landfill vs. beneficial reuse). Note: restrictions on in-water placement of dredged material based on contaminant levels should not be considered a restriction under this BUI; only land-based disposal/reuse options may contribute to restrictions.
>
> ***Sediment Assessment Areas (SAAs)*** **-** The SLRAOC was divided into SAAs to establish a common framework for assessing and displaying sediment contaminant data. Each SAA was given an individual number and unique name. SAAs are categorized by color (Table 7). AOC remediation and restoration sites that are depicted on assessment maps are color coded based on the remedial designation of SAAs.

Table 7: Sediment Assessment Area Color Designations

SAA Remedial Designation	Definition
Purple	Remedial action complete, monitoring of effectiveness underway or complete.
Red	Remedial action needed.
Red-gray	Additional characterization and assessment needed to determine if remedial action is necessary.
Yellow	Remediation generally not warranted, but management actions must consider the presence of contaminants, especially bio-accumulative contaminants.
Green	No known contamination. No remedial actions planned.

Hotspots - SAAs where sediment data have shown that contamination poses a human health or ecological risk at a level that requires management action as determined through review by MPCA or WDNR and are designated "red" are considered hotspots.

Navigation - refers to all movements of boats (recreation and commercial) and is not restricted to the federal navigation channel.

Dredging Alternatives Plan for the SLR AOC includes:

- Restrictions that must remain in place to protect human health and the environment
- Restrictions that must remain in place due to Superfund, RCRA or other requirements that are based upon state and federal law
- Priority areas for navigational use
- Priority areas where dredging is needed for other purposes (i.e., utilities)
- Costs associated with removing dredging restrictions in priority areas

Special handling requirements - any requirements that are above and beyond the normal procedures for handling sediments in a working river or harbor where contaminated sediments do not exist. In some cases, agencies may determine it is acceptable to leave contaminants in place if it has been determined that they do not pose a human health or ecological risk, with or without remediation. Such areas would be identified in the dredging alternatives plan.

Removal of the Restrictions on Dredging BUI will be justified when SAAs designated as red are remediated to their respective State's cleanup criteria and the other management actions identified below are completed. Normal navigational dredged material testing, permitting, and certification processes are not considered restrictions. Note: any dredging activity, whether proposed within or outside these routine navigational corridors, requires State regulatory permits as regulated by each state resource agency.

For BUI removal purposes, management actions are considered complete when substantial completion of construction is reached. Long-term monitoring, maintenance, and continuing obligations may be needed at some sites, but will not restrict BUI removal.

BUI 5 Removal Strategy

The strategy for BUI removal includes the management actions shown on Figure 3 and listed in Table 8, as follows:

- Identify long-term housing and maintenance of the St. Louis River Sediment Database and ensure inclusion of current and future partner and US Army Corps of Engineers (USACE) data sets (management action 5.01).
- Remediate contaminated sediments in SAAs that have been designated as red as shown in Figure 3 and listed below in Table 8; develop any necessary dredging alternative plans for the sites (management actions 5.02-5.09 and 5.13-5.29).
- Conduct additional sediment characterization where needed to confirm remedial designations as described in the Sediment Characterization Section. If any of the SAAs located within navigable portions of the St. Louis River AOC are determined to be red, remediate contaminated sediments at these locations, and develop any necessary dredging alternative plans for the site(s) (management actions 5.12).
- Develop a dredging alternatives plan to identify places where dredging restrictions may remain after management actions are implemented and how this relates to beneficial use of dredged material in the AOC. All site-specific dredging alternatives plans and sediment characterization maps will be incorporated in an AOC-wide dredging alternatives plan (management action 5.10).
- Minnesota and Wisconsin will work within their state's agencies, port authorities, and local communities to investigate the need for a bi-state strategic approach to contaminated sediment disposal. In 2019, it was determined that this approach is not feasible, and the AOC approach will not include a bi-state dredged disposal and/or reuse facility for contaminated sediments (management action 5.11). This action is no longer needed.

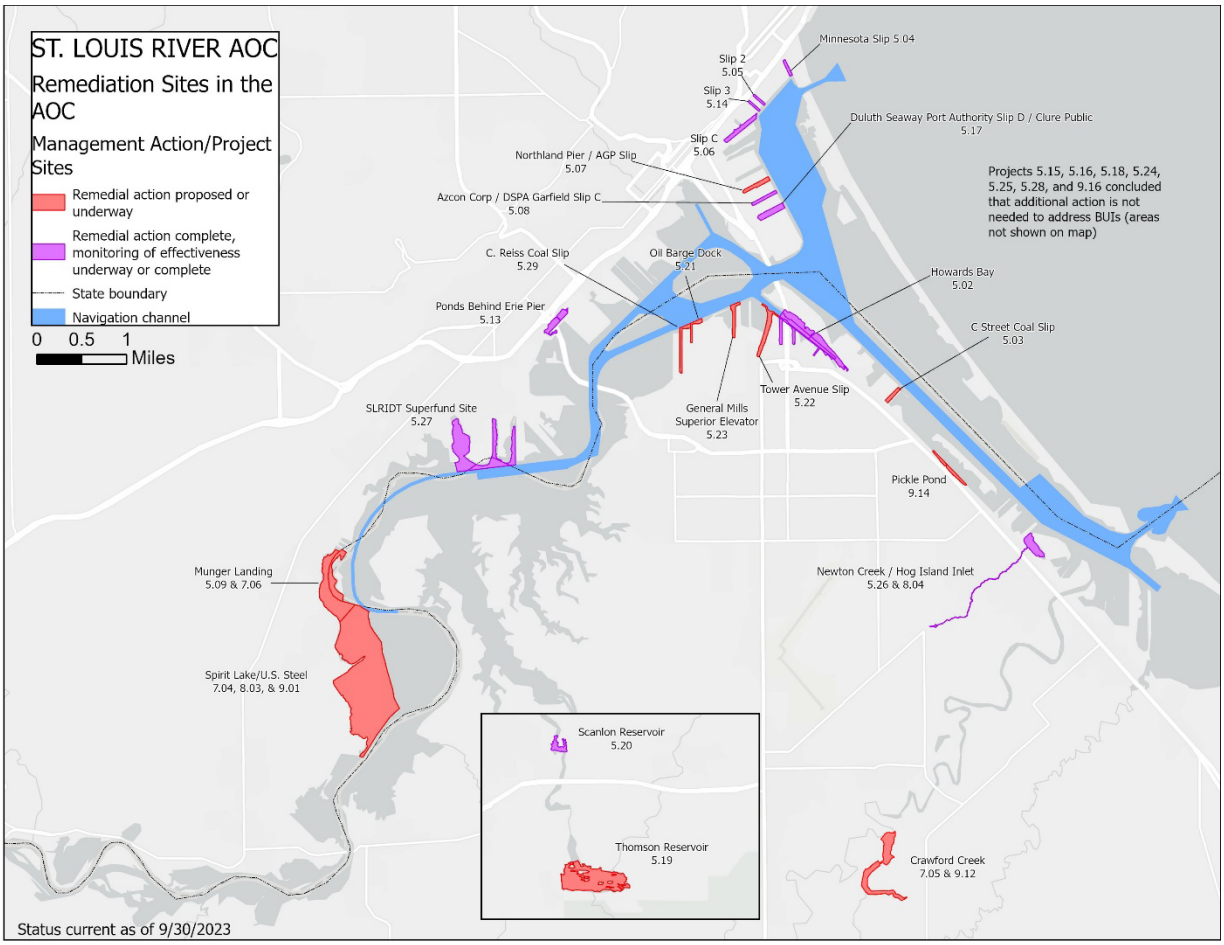


Figure 3: Remediation and Characterization Sites in the St. Louis River AOC (Revised November 2023)

BUI 5 Summary of Key Management Actions, Current Status, and Actions Still Needed

The 2013 RAP Update identified eleven management actions that were needed to address BUI 5 and, as data became available, additional management actions were added in subsequent RAP updates. The 2019 RAP update now lists twenty-nine management actions for BUI 5.

The management actions are identified in Table 8, of which nineteen are complete or require no further AOC action.

Management action 5.01 is Data Systems Operation. MPCA staff process historical and new datasets for Minnesota as an ongoing function. WDNR staff continue to facilitate interactions among the GLDIVER Technical Team and GLDIVER users. Chemical and biological data from the SLRAOC are uploaded to the databases and to GLDIVER, as appropriate. Both states now upload physical, chemical, and biological data to GLDIVER following the existing quality assurance and template processes. The National Oceanic and Atmospheric Administration (NOAA) houses and maintains data in GLDIVER, and coordination between the states and NOAA staff to improve GLDIVER is ongoing. Periodic training workshops to use GLDIVER are provided and the GLDIVER user portal has been upgraded to assist users. The GLDIVER

datasets are being used to develop remediation objectives, remedial designs, and for the development of dredging alternatives plan in support of BUI removal.

Management actions 5.02-5.09 and 5.13-5.29 are contaminated sediment remediation sites ("red" sites) where remedial actions will be needed to address restrictions on dredging activity. All these management actions are underway in different stages of completion: feasibility study, remedial action design and construction and Table 8 includes the current site status. Funding needs are expected to vary based on each site's condition and are influenced in part by the cooperation and participation of any responsible or recruited parties.

Management action 5.10 is developing a "Dredging Alternatives Plan" that will identify places where dredging restrictions may remain after management actions are implemented. A map of locations where engineering controls or restrictions may remain after remediation of all the "red" sites will be a critical component of the dredging alternatives plan. Continued support for adding datasets to GLDIVER under management action 5.01 is also important for completing management action 5.10.

To date, the contaminated sediment disposal approach under management action 5.11 has been applied in Minnesota and Wisconsin on a case-by-case basis for each project using existing state guidance. For example, landfill disposal or on-site consolidation and containment options have been used or are being considered at contaminated sediment sites. This management action was reviewed in 2019 and it was determined that an alternative approach is not needed, so it is considered complete.

Sediment characterization to support SLRAOC remedial site selection has been completed. Additional, site-specific characterization work may be needed to support feasibility, design, and remedial effectiveness efforts at "red" sites or to help identify potential project partners or responsible parties.

The following abbreviations identify the remedial status for each management action that is included in Table 8:

- RI = Remedial Investigation
- FS = Feasibility Study
- RD = Remedial Design
- IU = Implementation Underway
- Complete = Remedial Action Complete
- N/A = remediation does not apply or not necessary

Table 8: Management Actions Needed to Achieve Removal of BUI 5

Mgmt Action	Project Name*	Project Description	In-house/ Contractual	Remedial Status	Date to be Completed
5.01	Data System Operations	Include current and future partner and USACE data sets into the Great Lakes Data Integration Visualization Exploration and Reporting (GLDIVER) tool for SLRAOC; provide web interface to access, query, and download data	Contractual, In-house MPCA & WDNR	N/A	on-going
5.02	Howards Bay, including Hughitt and Cummings Slips (SAAs 49, 49.1, 50, 50.1, 51, 52)	Remediate contaminated sediments	Contractual	Complete	Complete 2022
5.03	C Street Slip (SAA 16)	Remediate contaminated sediments	Contractual	RD	2025
5.04	Minnesota Slip (SAA 20)	Remediate contaminated sediments	Contractual	Complete	Complete 2018
5.05	Slip 2 (SAA 21)	Remediate contaminated sediments	Voluntary Party	Complete	Complete 2016
5.06	Slip C (SAA 23)	Remediate contaminated sediments	Contractual	Complete	Complete 2018
5.07	Northland Pier/ AGP Slip (SAA 27)	Implement institutional controls and monitoring plan	Contractual	RD	2023
5.08	Azcon Corp/ Duluth Seaway Port Authority Garfield Slip C (SAA 28)	Remediate contaminated sediments	Contractual	Complete	Complete 2020
5.09	Munger Landing (SAA 75.2)	Remediate contaminated sediments; restoration	Contractual	IU	2024
5.10	Dredging Alternatives Plan	Develop a Dredging Alternatives Plan to identify and communicate places where restrictions on dredging may remain after remedial actions are completed	In-house MPCA and WDNR	N/A	2026
5.11	Bi-state Contaminated Sediment Disposal Approach	Identify and document a bi-state strategic approach for disposal of contaminated sediment from remediation sites.	In-house MPCA and WDNR	not needed	Complete 2019
5.12	Additional Sediment Characterization	Characterize estuary sediments that have been identified as red-gray or with limited or no data	Contractual, In-house WDNR	Complete	Complete 2021 (for actions 5.21 to 5.23 & 5.28 & 5.29)
5.13	Ponds Behind Erie Pier (SAA 59)	Remediate contaminated sediments	Contractual	Complete	Complete 2023

Mgmt Action	Project Name*	Project Description	In-house/ Contractual	Remedial Status	Date to be Completed
5.14	Slip 3 (SAA 22)	Remediate contaminated sediments	Contractual	Complete	Complete 2018
5.15	Slip near 21st Ave W (SAA 37)	Was characterized as remediation, but after further analysis, no further action is needed	N/A	No action needed	Complete 2015
5.16	End of Rice's Point Off Channel East (SAA 30)	Was characterized as remediation, but after further analysis, no further action is needed	N/A	No action needed	Complete 2015
5.17	DSPA Garfield Slip D (SAA 29)	Remediate contaminated sediments	Contractual	Complete	Complete 2016
5.18	Mud Lake West (SAA 83)	Remediate contaminated sediments	Contractual	No action needed	Complete 2020
5.19	Thomson Reservoir (SAA 99)	Remediate contaminated sediments	Contractual	IU	2025
5.20	Scanlon Reservoir (SAA 102)	Remediate contaminated sediments	Contractual	Complete	Complete 2023
5.21	Oil Barge Dock Slip (SAA 56.1)	Remediate contaminated sediments	Contractual	FS	2026
5.22	Tower Avenue Slip (SAA 53)	Remediate contaminated sediments	Contractual	FS	2026
5.23	General Mills Slip (SAA 55)	Remediate contaminated sediments	Contractual	FS	2026
5.24	Bunge Dock (SAA 7)	Complete assessment on the need for remedial action	N/A	No action needed	Complete 2020
5.25	Superior Ore Docks (SAA 8)	Complete assessment on the need for remedial action	N/A	No Action needed	Complete 2020
5.26	Newton Creek / Hog Island Inlet	Remediate contaminated sediments	N/A	Complete	Complete 2005
5.27	St. Louis River / Interlake / Duluth Tar (SLRIDT)	Remediate contaminated sediments	N/A	Complete	Complete 2010 - MN 2011 – WI
5.28	Clough Island	Complete assessment on the need for remedial action	NA	No Action Needed	Complete 2021
5.29	C. Reiss Coal Slip	Remediate contaminated sediments	Contractual	RD	2024

*SAA refers to sediment assessment areas. See Appendix G of the 2013 RAP Update for SAA location maps.

Web-based story maps for Minnesota's contaminated sediment sites were revamped and are being updated annually. They explain the projects and give visual context to the work. They can be found here: https://storymaps.arcgis.com/collections/636bea98abfb425687bfb78fb34ca9a1.

Anticipated Timeline to Remove BUI 5

2022	2023	2024	2025	2026	2027	2028	2029	2030
					●			

BUI 5 Issues Affecting Progress

The most significant needs in the SLRAOC are securing resources (i.e., staff and funding) to ensure timely progress on the management actions, building partnerships, sequencing projects to facilitate staff capacity, and distributing projects to match contractors' availability to compete for projects without escalating costs.

BUI removal is slated for 2027; however, the complexity of some of these sites, availability of funding, negotiations with responsible parties and voluntary partners, partnership and contractor capacity, and weather may affect the implementation schedule.

BUI 6: Excessive Loading of Sediment and Nutrients

Although BUI 6 has been removed, the Roadmap content has been retained here for documentation purposes. The removal package can be found on the Impairments tab at https://dnr.wisconsin.gov/topic/GreatLakes/StLouis.html.

BUI 6 Rationale for Listing

Prior to the improvements in wastewater treatment in the late 1970s, water quality and biological investigations characterized the SLRE as low in dissolved oxygen and high in total phosphorus and total suspended solids. After the Western Lake Superior Sanitary District (WLSSD) wastewater treatment plant was built and the Superior wastewater treatment plant was upgraded, many indicators of trophic status have shown improvements. For instance, concentrations of total phosphorus have decreased and dissolved nitrogen has shown variable decline in St. Louis Bay. The loading of phosphorus to the estuary from point sources has been reduced substantially. At the time of SLRAOC listing, further work was needed to ascertain the effects of nonpoint source loadings to the system and to Lake Superior. Despite the reductions in point source loadings, phosphorus concentrations in some parts of the estuary remained at levels where eutrophic conditions might be expected. Algal biomass was lower than would be expected, however, given these high phosphorus concentrations. Chlorophyll *a* concentrations measured in the estuary were similar to levels found in mesotrophic or oligotrophic waters. Several investigators proposed that reduced light penetration caused by turbidity and color may be a limiting factor for algal growth in the estuary. Although persistent water quality problems associated with eutrophication were not observed in the estuary, the high levels of nutrients and sediments being delivered to Lake Superior were determined to be an important concern. Therefore, the 1992 Stage I RAP modified the International Joint Commission (IJC) eutrophication BUI criterion to reflect local conditions.

BUI 6 Removal Target

The BUI removal target will be reached when:

> *Nutrient and sediment levels have not been shown to impair water quality and habitat, and do not restrict recreation, including fishing, boating, or body contact in the estuary and within western Lake Superior based on the following criteria:*
>
> 1. *All federal, state, and local point source and nonpoint source discharge permits in the AOC are in compliance with regard to controlling sources of nutrients (particularly nitrogen and phosphorous), organic matter, and sediment; and*
> 2. *Total phosphorus concentrations in the Lake Superior portion of the AOC do not exceed 0.010 mg/l (upper limit of oligotrophic range); and*
> 3. *There are no exceedances of the most protective water quality standard for either state in the western basin of Lake Superior due to excessive inputs of organic matter or algal growth attributed to loadings from wastewater overflows into the St. Louis River; and,*
> 4. *Total phosphorus concentrations within the St. Louis River portion of AOC do not exceed an interim guide of 0.030 mg/l (upper limit of mesotrophic range) or the*

> *most restrictive water quality standards. This ensures that anthropogenic sources and activities in the St. Louis River Area of Concern do not result in excessive productivity and nuisance conditions within the St. Louis River Estuary.* (MPCA and WDNR, 2011).

The 2011 delisting target was based on total phosphorus data in available reports from Minnesota, Wisconsin, and the IJC. At that time, several studies were being conducted by a variety of local agency and university researchers that involved the estuary, the western arm of Lake Superior, and portions of the St. Louis River and Nemadji River watersheds. Consequently, more information was made available to better assess the delisting target and its application to the removal of this BUI.

Removal of the Excessive Loading of Sediment and Nutrients BUI will be justified when:

1. All federal, state, and local point source and nonpoint source discharge permits in the AOC are in compliance with regard to controlling sources of nutrients (particularly nitrogen and phosphorus), organic matter, and sediment.
2. Assessment of current water quality data for the Lake Superior and the SLRE portions of the SLRAOC indicate that water quality meets the water quality goals established by the strategy described below.
3. Watershed management objectives for the Nemadji River watershed that are in the Nemadji Basin Plan (NRCS, 1998) have been adopted and progress towards implementing the objectives is being made.

Total phosphorus data alone will not provide the level of confidence needed to show that nutrient and sediment concentrations do not impair water quality and habitat and do not restrict recreation, including fishing, boating, or body contact in the estuary. Therefore, to protect and restore the condition of the SLRAOC related to the listing of this BUI, a thorough review of historical data and a statistical analysis of the current water quality condition, based on the recommended seven status indicators listed below, are necessary. These analyses will allow the BUI Technical Team to assess the trends and current condition of the SLRE in relation to BUI removal. The seven status indicators include:

- *Chemical* – total phosphorus, un-ionized ammonia, dissolved oxygen
- *Biological* – chlorophyll *a*
- *Physical* – total suspended solids (TSS) and turbidity or other loading metric based on tons of sediment
- *Watershed* – progress toward meeting management objectives to reduce runoff rates and sediment delivery in the Nemadji River watershed

This work is not intended to set or replace State water quality standards, but to develop a BUI removal strategy and water quality goals agreeable to both States and FdL that are consistent with the intent of the BUI removal target. The objectives of the BUI water quality goals are to: protect the riverine and estuarine portions of the AOC from a eutrophic classification, to protect the Lake Superior portion of the AOC from a mesotrophic classification, and to achieve desired levels of sediment and nutrient loading to Lake Superior. SLRAOC managers and the BUI Technical Team decided that additional water quality

goals were not necessary for BUI removal. Sufficient information is available to justify BUI removal using the parameters in the BUI removal target.

BUI 6 Removal Strategy

The strategy for BUI removal included five management actions listed in Table 9. All management actions are complete and the BUI was removed in 2020.

The strategy for removal of the Excessive Loading of Sediment and Nutrients BUI included:

Management action 6.04 is the development of water quality goals appropriate for the reference conditions of biologic, chemical, and physical indicators of water quality. After reviewing results of four water quality assessments performed under AOC management actions, the BUI Technical Team has agreed that the indicators included in the BUI removal target are an appropriate goal to justify BUI removal. The upper limit of mesotrophic range is appropriate for riverine and estuarine portions, while the upper limit of oligotrophic range is appropriate for the Lake Superior portion of the SLRAOC. Results from the four steps described below were used to define current water quality conditions and place them in a broader spatial and historical context.

1. Perform area-wide water quality analyses in the SLRE based on the 2012 monitoring protocols in Bellinger *et al*. (management action 6.01). The objective of this project is to work with SLRAOC program staff and other groups responsible for monitoring and assessing conditions in the SLRE to identify data needs, develop a sampling design to meet those needs, and evaluate the relevancy of the results. Analysis of the water quality indicators will be used to estimate conditions within geographic zones and/or estuary-wide. Results will be used to report whether the SLRE is trending toward or has reached the reference condition or range of conditions considered reasonable for the estuary. Understanding changes in water quality and associated biological conditions that meet BUI removal objectives is the focus of this work and it will include the six chemical water quality status indicators to:
    a. Provide a summary of the six chemical water quality indicators for a period of two to three years and
    b. Assess and verify the relevance of all six status chemical indicators within the SLRE or by geographic zone, if necessary, to determine if the estuary is impaired for these parameters based on agreed-upon reference conditions and accounting for any unique conditions.
2. Perform an expanded historical data set analysis based on methodologies used in Hoffman (2011) to evaluate long-term trends in water quality as it relates to the six chemical status indicators (management action 6.02). Determine the appropriate water quality goals for the reference condition for any or all of the status indicators appropriate for the SLRE and western portion of Lake Superior that will meet approval by Minnesota and Wisconsin as appropriate for the SLRAOC (management action 6.04).
3. Perform a paleolimnological investigation of the SLRE to reconstruct the algal and geochemical history for approximately the last 300 years (management action 6.03). Diatom-based (i.e.,

microfossil algae) models will be applied to identify historical temporal and spatial variations in biological (i.e., chlorophyll, algal load), chemical (i.e., phosphorus, ammonia) and physical (i.e., TSS, turbidity) water quality indicators. Combined with the results of the monitoring data and trend analyses described in 1 and 2 above, the paleolimnological data will provide quantitative and qualitative reconstructions of the important physical, chemical and biological trends that have resulted from natural and anthropogenic drivers.

4. Document progress toward meeting watershed management objectives from the Nemadji Basin Plan (NRCS, 1998) as an indicator of sediment loading to the AOC. The Nemadji plan established watershed objectives to reduce runoff rates and sediment delivery from the Nemadji River watershed into SLRAOC (management action 6.05).

Once the work described above is complete, assess the status of the SLRE in relation to BUI removal:

1. For the water quality indicators:
    a. If the assessments show the current conditions are sustained and the water quality has improved to where it meets the water quality goals, then removal targets are met.
    b. If the assessments show the current conditions are not sustained and water quality is not meeting the water quality goals, then removal targets are not met. Determine possible sources and develop an action plan to address the source(s). Then, re-evaluate annually until it can be shown that water quality meets applicable water quality goals for two consecutive years.
2. For the watershed indicator:
    a. If watershed management objectives for the Nemadji watershed are met or progress over time to meet the objectives can be demonstrated, this information will help support removal of the sediment loading aspect of this BUI.

BUI 6 Summary of Key Management Actions, Current Status and Actions Still Needed

All management actions have been completed and the BUI was removed in 2020.

Studies and findings included in the BUI removal package include:

The paleolimnological study (6.03) identified improvements in water phosphorus concentrations, as inferred from paleo-diatom analyses from mid-channel cores in the SLRAOC over the past 40 years. The study also found increasing phosphorus concentrations exceeding the BUI removal objective in nearshore areas. Some of these nearshore coring locations indicated that phosphorus concentrations were likely above the removal objective prior to European influence. The study stated that increasing nutrients in nearshore areas may be associated with recent development, the continued presence of industrial inputs, climate change, and internal phosphorus loading.

WDNR monitored nearshore areas in Allouez, Pokegema and Kimball's Bays in 2017 and 2018, as part of management action 6.04. The data was used to investigate trends in water quality and the biota of the

nearshore areas. The results of the monitoring were provided in a 2018 report and a summary. Results are documented in a final report that is available in the WIDNR SWIMS database (https://apps.dnr.wi.gov/swims/Documents/DownloadDocument?id=202135163) and in the final removal package (https://dnr.wisconsin.gov/topic/GreatLakes/StLouis.html, on the Impairments tab).

The BUI Technical Team determined that additional water quality goals were not needed and the BUI removal target could be assessed using the thalweg station data sets and the estuary-wide data from management actions 6.01 and 6.02. Dr. Joel Hoffman (USEPA-GLTED) completed this work in consultation with the Technical Team as part of management action 6.04 and results were incorporated into the BUI removal package. Additionally, the Technical Team recommended future work needed to further understand nutrient loading (i.e., phosphorus) in nearshore areas of the St. Louis River and Nemadji River watersheds outside of the AOC program.

Management action 6.05 included a multipronged approach to document progress toward meeting Nemadji River watershed management objectives as follows:

1. Assess the current and historic sediment loading in the Nemadji River watershed. Assess pre-settlement, peak agriculture, and modern sediment loading using an existing Hydrological Simulation Program-Fortran (HSPF) model. Completed in 2016.
2. Assess current sediment loading compared to sediment loads calculated based on 1970's data and reported in the Nemadji Basin Plan (NRCS, 1998). Completed June 2017.
3. Assess the health of natural biological communities in the Nemadji River in Wisconsin through a fish, macroinvertebrate, and water quality sampling effort. This was completed and documented in three final reports that are available in the WIDNR SWIMS database, as follows:
    - Nemadji River Tributaries Water Quality Assessment (Roesler, 2014; https://dnr.wi.gov/water/wsSWIMSDocument.ashx?documentSeqNo=256795253)
    - Lower Nemadji River Water Quality and Macroinvertebrate Community Assessment, 2015 (Roesler, 2015; https://dnr.wi.gov/water/wsSWIMSDocument.ashx?documentSeqNo=256795177)
    - Lower Nemadji River – Douglas County 2015 Fish Community Survey Summary (Nelson, 2015; https://dnr.wi.gov/water/wsSWIMSDocument.ashx?documentSeqNo=133664004)
4. Meet watershed management objectives identified in the Nemadji Basin Plan (NRCS 1998) through an implementation planning effort aimed at educating citizens and local government officials in the Nemadji basin and identifying landowners to implement BMPs on their property. Completed in 2017.

Table 9: Management Actions Completed for Removal of BUI 6

Mgmt Action	Project Name	Project Description	In-house/ Contractual	Date to be Completed
6.01	Perform Area-wide Water Quality Sampling and Analyses	Identify data needs, develop sampling design based on Bellinger *et al*. (2012) and evaluate results.	In-house - USEPA-GLTED	2015 Complete
6.02	Perform Expanded Historical Data Analysis	Conduct a thorough review of current and historical data and a statistical analysis of the six water quality indicators (total phosphorus, un-ionized ammonia, dissolved oxygen, chlorophyll *a*, TSS and turbidity) and evaluate long-term trends in water quality.	In-house - USEPA-GLTED	2015 Complete
6.03	Paleolimnological Investigation	Perform a paleolimnological investigation of the St. Louis River Estuary to reconstruct the algal and geochemical history and develop models to characterize trends in natural and anthropogenic drivers in water quality.	Contractual	2016 Complete
6.04	Develop Water Quality Goals (Compilation of 6.01, 6.02, and 6.03)	Assess results of 6.01, 6.02, and 6.03 and determine appropriate water quality goals for the reference condition of biological, chemical and physical indicators of water quality.	MPCA and WDNR	2018 Complete
6.05	Assessment and Implementation Planning in the Nemadji River Basin	Assess sediment impairments through biological, water quality, and sediment monitoring, and HSPF modelling of historic sediment loads. Support implementation of the Nemadji Basin project recommendations to reduce sedimentation through stakeholder and landowner planning efforts.	In-house WDNR and MPCA Contractual	2018 Complete

BUI 7: Beach Closings and Body Contact Restrictions

BUI 7 Rationale for Listing

Water quality data available at the time of AOC listing indicated that improvements had been made in the St. Louis River and bay since the late 1970s. However, this BUI was listed due to continued sources of microbial contamination , namely sewage bypasses into the AOC in both Minnesota and Wisconsin during storm events. Discharge of inadequately treated wastewater by marine traffic was also a concern. In addition to bacterial contamination, high chemical contaminant levels in the SLRAOC sediments in certain areas were believed to present a health risk for recreational uses, so Body Contact Restrictions was included as a component of this BUI. Sediment remediation at Hog Island Inlet in Wisconsin and Stryker Bay in Minnesota led to the removal of "No Swimming" signs at these locations; however, a "No Swimming" sign remains at the US Steel/Spirit Lake site in Minnesota and "warning" signs are placed at the Munger Landing and Crawford Creek sites in Minnesota and Wisconsin, respectively.

BUI 7 Removal Target

The BUI Removal Target will be reached when:

> *Sources of stormwater and wastewater discharge to the St. Louis River Area of Concern have been identified and measures to reduce the risk of human exposures to disease causing microorganisms have been implemented.*
>
> *There are no body contact advisories due to the presence of harmful chemicals at contaminated sites.*
>
> *No water bodies within the AOC are included on the list of non-attaining waters due to controllable sources of disease-causing microorganisms or chemicals in the most recent State of Wisconsin and State of Minnesota Section 303(d) programs.* (MPCA and WDNR, 2011).

For the purposes of interpreting the 2008 target, "controllable sources" is defined as sources of pathogens of human origin.

Removal of the Beach Closings and Body Contact Restrictions BUI will be justified when the following objectives are met:

Beach Closings

No water bodies within the AOC are included on the list of non-attaining waters due to contamination with pathogens from sewer overflows (defined as sanitary sewer overflows or combined sewer overflows) in either State's most recent Clean Water Act Water Quality and Pollution Control Section 303(d) and 305(b) Integrated Report.

In cases where the water bodies within the AOC are on the list of non-attaining waters due to the presence of sewer overflows originating within the AOC, this beneficial use will be considered restored

when sewer overflows have been eliminated, are being treated, or are otherwise being managed as follows:

a) Municipalities and municipal wastewater treatment plants within the AOC are in compliance with the NPDES wastewater discharge permit conditions or are otherwise entered into an agreement or order addressing sewer overflows, and
b) Municipalities within the AOC are in compliance with their municipal separate storm sewer system (MS4) NPDES permit conditions.

Body Contact Restrictions

No water bodies within the AOC have posted "No Swimming" or "Warning" signs due to chemical contamination that poses a health risk due to body contact, as determined by Public Participation Rules (NR 714.07) in Wisconsin and by Health Departments in Minnesota or Wisconsin.

In cases where the water bodies within the AOC are on the list of non-attaining waters due to the presence of chemical contamination (such as at the US Steel/Spirit Lake or Crawford Creek site), this BUI will be considered restored when significant progress has been made to reduce chemical contamination to allow for the removal of the "No Swimming" or "Warning" signs.

BUI 7 Removal Strategy

The strategy for BUI removal includes six management actions listed in Table 10. The strategy for removal of the Beach Closings and Body Contact Restrictions BUI is as follows:

- Document the compliance status of municipal wastewater treatment and MS4 NPDES permits within the AOC (management action 7.01).
- For the eight impaired AOC beaches (Figure 4) as listed on the 2014 Wisconsin and Minnesota 303(d) lists), conduct microbial source tracking to identify whether pathogens are of human origin. Sand and sediment will be included in addition to water in beach testing, as they can harbor pathogenic populations (data to be used for management actions 7.02 and 7.03).
    - If pathogens are of a human origin, consider if conducting beach restoration will address human sources.
    - If pathogens are not of a human origin, the beach impairment will not be considered an AOC issue.
- Track remediation progress of US Steel/Spirit Lake, Crawford Creek, and Munger Landing sites. When sufficient progress enables removal of the "No Swimming" or "Warning" signs at these sites, coordinate sign removal (management actions 7.04 through 7.06).

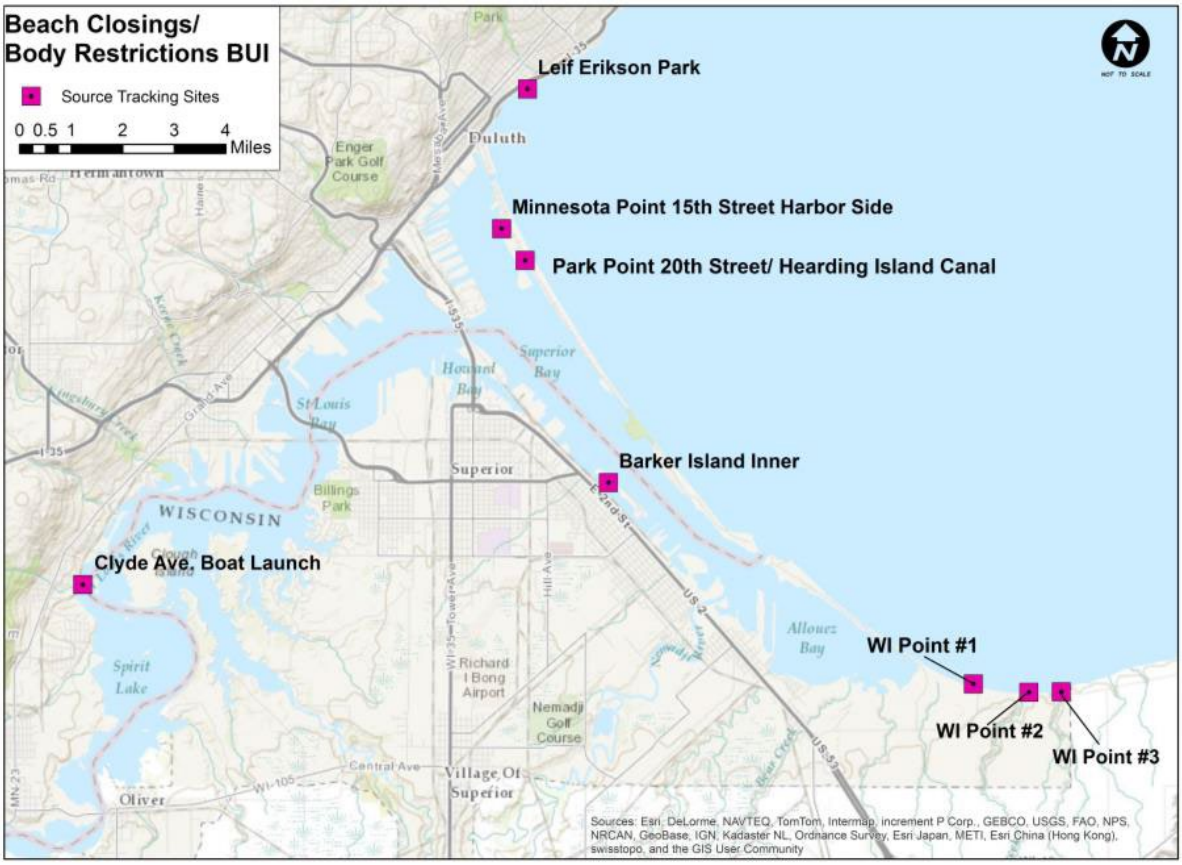


Figure 4: Beaches to be Addressed for BUI 7: Beach Closings and Body Contact Restrictions. (September 2015)

NOTES: Beach names included in the figure above are from 2015, and do not reflect naming changes that occurred to Wisconsin Point after the dune restoration project in 2019. The Clyde Avenue Boat Launch is within the Munger Landing Remediation Site

BUI 7 Summary of Key Management Actions, Current Status, and Actions Still Needed

Staff will compile historic improvements in wastewater and stormwater infrastructure in the AOC. This information, along with permit compliance, will be used to complete management action 7.01. It will be necessary to capture permit compliance until this BUI can be removed (anticipated in 2027).

The Barkers Island beach restoration project (management action 7.02) was completed in 2019. Monitoring and maintenance of the beach continued under GLRI through 2020, with responsibility transferred to the City of Superior and the BEACH Act monitoring program in subsequent years.

The results of management action 7.03, the microbial source tracking at impaired beaches project, concluded that two beaches within the AOC have a significant pathogen contribution from human sources:

- Barkers Island Inner Beach (WI) – Project complete in 2019.

- Leif Erikson Park Beach (MN) –The Duluth Urban Area Streams (DUAS) Watershed Restoration and Protection Strategy (WRAPS) Report was completed and approved on October 13, 2020. The DUAS TMDL Report was completed and approved on November 18, 2020. These reports address *E. coli* impaired beaches and streams within the Duluth Urban Area, including Leif Erikson Park Beach and Chester Creek, which discharges near the Leif Erikson Park Beach.

  The Duluth Area Beaches TMDL Report was approved by EPA on June 29, 2022. This TMDL addresses *E. coli* impaired beaches located within the Minnesota portion of the Duluth-Superior Harbor, St. Louis River Estuary, and Lake Superior. The Duluth Area Beaches TMDL includes 5 impaired beaches within the SLRAOC:
  - Leif Erikson Park
  - MN Point 15th St
  - Park Point 20th St/Hearding Island Canal
  - Park Point Sky Harbor parking lot
  - Boy Scout Landing

  As applicable, *E. coli* impairments at the Leif Erickson Park beach can be addressed by MPCA under their CWA authorities or by local units of government under their public health protection authorities. In accordance with the Duluth Area Beaches TMDL, in their next MS4 permit, the permitted entities within the City of Duluth will need to address excessive bacteria for impaired aquatic recreation uses at their five impaired beaches, including a requirement to inventory bacteria sources and develop a prioritization plan to reduce them. Since 2016, the City has undertaken several measures to reduce *E. coli* and they already have plans in place for additional sanitary sewer and storm sewer improvements and green infrastructure additions.

The City of Duluth completed bacteria studies at Keene & Tischer Creeks, which are within the AOC, and published the Duluth Streams Bacterial Source Identification Study Final Report. It was determined at Keene and Tischer Creeks that *E. coli* was not likely from human sources. However, the percentage of positive results for the human molecular marker at Tischer Creek was higher than would be expected in an urban stream. Because the sample size was small, the City may pursue additional assessment.

The states of MN and WI will prepare documentation justifying the removal of “warning” and “no swimming” signs when remedial actions have been completed and residual contamination levels or exposures are deemed protective of human health by MN or WI regulatory agencies. The public and stakeholders will be notified when the signs are removed, and the beach closing and body contact restrictions are no longer in place.

Completion of management actions 7.04-7.06 are dependent on the status of remediation projects at US Steel/Spirit Lake (9.01), Crawford Creek (9.12), and Munger Landing (5.09). Therefore, the completion dates for 7.04-7.06 are aligned with the remediation schedules. Status of the remediation and restoration sites can be found in Restrictions on Dredging and Loss of Fish and Wildlife BUI sections.

Table 10: Management Actions Needed to Achieve Removal of BUI 7

Mgmt Action	Project Name	Project Description	In-house/ Contractual	Date to be Completed
7.01	Document Permit Compliance Status	Document compliance status of municipal WWTP and MS4 discharge permits in the AOC.	In-house WDNR and MPCA	2027
7.02	Barkers Island Beach Restoration	Design a beach restoration that addresses the stormwater, trash, debris and sources identified in the sanitary survey.	Contractual by City of Superior	Completed 2019
7.03	Conduct Microbial Source Tracking at Impaired Beaches	Conduct microbial source tracking at the four impaired AOC beaches to determine if pathogens are of human origin (i.e., controllable).	Contractual	Completed 2017
7.04	Track US Steel Superfund Remediation Process	Track the remediation process at the US Steel site to determine when the "No Swimming" sign can be removed. Coordinate sign removal.	In-house MPCA	2023
7.05	Track Koppers Inc. RCRA Site Remediation Process	Track remediation of contaminated sediment and floodplain soils in Crawford Creek to determine when the "Warning" signs can be removed. Coordinate sign removal.	RP	2027
7.06	Track Munger Landing Remediation Progress	Track the remediation progress at the Munger Landing site to determine when the swimming advisory sign can be removed. Coordinate sign removal.	In-house MPCA	2023

Anticipated Timeline to Remove BUI 7

2022	2023	2024	2025	2026	2027	2028	2029	2030
					●			

BUI 7 Issues Affecting Progress

BUI target interpretation in the RAP has been focused on human sources and is not intended to address specific 303(d) impairments that have been linked to wildlife sources. Since the BUI removal target is currently linked to the 303 (d) list, one potential issue with this BUI is the addition and removal of beaches within the AOC from emerging 303(d) lists in MN and WI. Therefore, target clarification or change may need to be considered in the future to address whether the BUI removal target should be linked to the more recent 303(d) lists.

Two beaches have been added to Minnesota's 303(d) list since the source tracking study was initiated: the Park Point Sky Harbor Parking Lot Beach (2016) and the Boy Scout Landing Beach (2020). Both of those sites will be addressed in the Duluth Area Beaches TMDL that EPA approved in June 2022. It should be noted that the Clyde Avenue beach was not included in that TMDL since that is a contaminated sediment remediation project that will undergo a full dredged remedy.

Within the SLRAOC, Wisconsin has five beaches that have designations for recreational restrictions - pathogens due to the presence of *E. coli.* Visit the WDNR website for the most recent impaired waters list https://dnr.wisconsin.gov/topic/SurfaceWater/ConditionLists.html. Recent additions to the impaired waters list came after new *E. coli* bacteria criteria were approved by the Wisconsin legislature in 2020. The new criteria allow fewer bacteria spikes over the course of the beach season, which led to additional impairment listings in the 2022 assessment period. Based on the source tracking study, the WI Point Beaches *E. coli* has been linked to bird and wildlife sources and is not addressed under the BUI.

The timeline for body contact actions 7.04-7.06 has been aligned with the scheduled remediation of the US Steel/Spirit Lake, Crawford Creek, and Munger Landing sites. If remedial progress at these sites justifies removal of the “No Swimming” and “Warning” signs, these actions may be completed before the remediation project or associated restoration work is fully completed.

The City of Duluth, City of Superior, and WLSSD will need to be involved with capturing historic improvements to wastewater and stormwater infrastructure and documenting permit compliance in both of these areas. The MPCA, WDNR, and responsible parties will coordinate with the respective site landowners to remove the body contract restriction signage.

BUI 8: Degradation of Aesthetics – BUI Removed

Although BUI 8 has been removed, the Roadmap content has been retained here for documentation purposes. The removal package can be found on the Impairments tab at https://dnr.wisconsin.gov/topic/GreatLakes/StLouis.html.

BUI 8 Rationale for Listing

The rationale for listing the Degradation of Aesthetics BUI included in the Stage I RAP described the aesthetic values of the SLRAOC as impaired at some locations. A systematic collection of qualitative and quantitative data was recommended at that time to determine visual or odiferous locations that were degraded and the sources and types of those degradations (e.g., oil slicks, chemical and tar residues, taconite pellets on shorelines, rotting grain scum on the water surface, etc.). Hog Island Inlet and Stryker Bay were two areas that historically had repeated reports of oil, chemical, and tar residues on the water's surface. Complaints were also registered about smells emanating from the sediments and water of Newton Creek and Hog Island Inlet. Shoreline aesthetics were to be addressed separately through actions taken with riparian interests.

BUI 8 Removal Target

The BUI Removal Target will be reached when:

> *There are no verified persistent occurrences of objectionable properties in the surface waters of St. Louis River Estuary during the previous five-year period. "Persistent occurrences" are defined as objectionable properties that occur more than two times per year and are greater than ten days in duration.* (MPCA and WDNR, 2011)

For the purpose of interpreting the 2011 target, objectionable properties mean a nuisance condition. A nuisance condition is defined as the presence of significant amounts of floating solids, scum, visible oil film, material discoloration, obnoxious odors, deleterious sludge deposits, oil slicks, chemical and tar residues, taconite pellets on shorelines, decomposing grain scum on the water surface, or other offensive or harmful effects.

Removal of the Degradation of Aesthetics BUI was justified when complaint logs and files for the AOC were reviewed and compiled, regulations pertaining to aesthetics were documented, and actions to address the oil sheens at the US Steel site were completed.

BUI 8 Removal Strategy

The strategy for BUI removal included five management actions listed in Table 11. All management actions have been completed, and the BUI was formally removed on August 14, 2014. The public input process included a 15-day comment period, public open house meeting, and press releases from WDNR and MPCA. The final removal package with USEPA approval can be viewed under the impairments tab at https://dnr.wisconsin.gov/topic/GreatLakes/StLouis.html.

The strategy taken to achieve BUI removal included completion of these tasks:

- Reviewed and compiled existing complaint logs and files to assess the existence of persistent occurrences of objectionable properties in the five-year assessment period.
- Demonstrated improvements in federal and state aesthetic regulations through documentation of:
  - Federal vessel discharge regulations and status of upcoming National Pollutant Discharge Elimination System (NPDES) Vessel General Permit,
  - NPDES regulations and discharge permits,
  - Water quality standards related to aesthetics,
  - Air quality regulations related to air particulates,
  - Best management practices (BMPs) to reduce particulates at the ore docks and grain elevators. (Note: a comparison of air quality data was not needed to document improvements in air particulates since SLRAOC listing.).
- Controlled oil sheens at US Steel site.
- Prepared a justification document related to the reported odors at Hog Island/Newton Creek remediation site using existing data and reports to verify this site does not pose a human health or ecological risk.
- Met with the SLRA Board of Directors and any concerned stakeholder groups on the BUI removal strategy (Note: there was not a concern about the strategy that necessitated additional actions.).

BUI 8 Management Actions Implemented to Achieve BUI Removal

All management actions have been completed and the BUI was removed August 14, 2014.

Table 11: Management Actions Completed for Removal of BUI 8

Mgmt Action	Project Name	Project Description	In-house/ Contractual	Date to be Completed
8.01	Complaint File Review and Compilation	Compile and review logs and complaint files within the AOC to provide information suggesting that there have been no nuisance complaints on aesthetics-related issues greater than ten days in duration and occur more than twice a year.	In-house MPCA and WDNR	2014 Completed
8.02	Documentation of Aesthetics-Related Regulations	Demonstrate improvements in federal and state aesthetic regulation through documentation. This effort may include an evaluation of trends in air particulates over time.	In-house MPCA and WDNR	2014 Completed
8.03	US Steel Site Aesthetics Action	Track progress of oil sheen control.	In-house MPCA	2014 Completed
8.04	Hog Island/Newton Creek Documentation	Prepare a justification document related to the reported odors at Hog Island/Newton Creek remediation site using existing data and reports to verify this site does not pose a human health or ecological risk.	In-house WDNR	2014 Completed

Mgmt Action	Project Name	Project Description	In-house/ Contractual	Date to be Completed
8.05	Present BUI Removal Strategy to Stakeholders	Meet with SLRA Board of Directors to present BUI removal strategy	In-house MPCA and WDNR	2014 Completed

BUI 9: Loss of Fish and Wildlife Habitat

BUI 9 Rationale for Listing

At the time of SLRAOC listing, fish and wildlife habitat was threatened by water quality impairment and physical habitat loss. Water quality impairment was due to inadequately treated municipal and industrial wastes, contaminated sediments, and high sedimentation rates resulting in turbidity. Physical habitat impairment included habitat loss through dredging and filling activities and decline in the quality of wetlands from the invasion of non-native vegetation. Reduced water quality and lost habitat led to degraded benthic communities, which are important as the base of the food chain for fish and wildlife.

BUI 9 Removal Target

The BUI removal target will be reached when:

> *State resource management agencies concur, in consultation with their federal, tribal, local, and nonprofit partners, that a reasonable amount, as quantified in the benchmarks, of fish and wildlife habitat, given the presence of industrial development in the estuary, that is currently degraded is enhanced, rehabilitated, and protected against further loss of habitat.* (MPCA and WDNR, 2011)

Removal of the Loss of Fish and Wildlife Habitat BUI will be justified when:

1. Remediation of contaminated sediment at identified sites within the AOC has been completed (see BUI #5 Restrictions on Dredging for the list of sites).
2. Programs are in place to discourage further proliferation and further introduction of non-native invasive species.
3. Approximately 50% of known degraded aquatic habitat acreage (1,700 acres) is rehabilitated through implementation of projects in accordance with a restoration site (Figure 5). Restoration project management actions were selected to fulfil this objective, with restoration work designed and constructed with an overall goal to provide for fish and wildlife habitat for the entire site as a whole. Therefore, project implementation completes this target's numeric goal. For BUI removal purposes, management actions are considered complete when substantial completion of construction is reached. Long-term monitoring, maintenance, and continuing obligations may be needed at some sites, but will not restrict BUI removal.
4. Additional aquatic or hydrologically connected habitat throughout the AOC watersheds has been successfully protected and rehabilitated sufficiently to maintain healthy fish and wildlife populations through implementation of projects at prioritized restoration sites (Figures 4 and 5).

BUI 9 Removal Strategy

The strategy for BUI removal includes the twenty-one management actions listed in Table 12 of which twelve are complete. One management action requires no further action (9.16) and the remainder are in progress. The anticipated BUI removal date is 2025.

The strategy for removal of the Loss of Fish and Wildlife Habitat BUI is as follows:

- Complete remediation of contaminated sediments at "red" sites as listed in BUI 5 and shown on Figures 2 and 4.
- For the US Steel/Spirit Lake site (management action 9.01), that is associated with the adjacent US Steel Superfund site and led by USEPA and US Steel (USS), work cooperatively with them to complete the remedial process.
- Provide information that shows that ongoing actions to control invasive species have been implemented in the AOC under the statutory authority of the States of Wisconsin and Minnesota and are reflective of recommendations in the Lake Superior Lakewide Action and Management Plan's (LAMP) Aquatic Invasive Species Complete Prevention Plan (management action 9.20).
- Complete restoration of habitat at the prioritized Remediation to Restoration (R2R) sites listed in Table 12 (management actions 9.02-9.12, 9.14-9.17 and 9.21) (Figure 5).
- Protect and rehabilitate additional aquatic or hydrologically connected habitat throughout the AOC watersheds to maintain healthy fish and wildlife populations. Completion of the management actions at sites listed in Table 12 and shown on Figure 5 (management actions 9.13, 9.18 and 9.19) will result in achievement of this criterion.

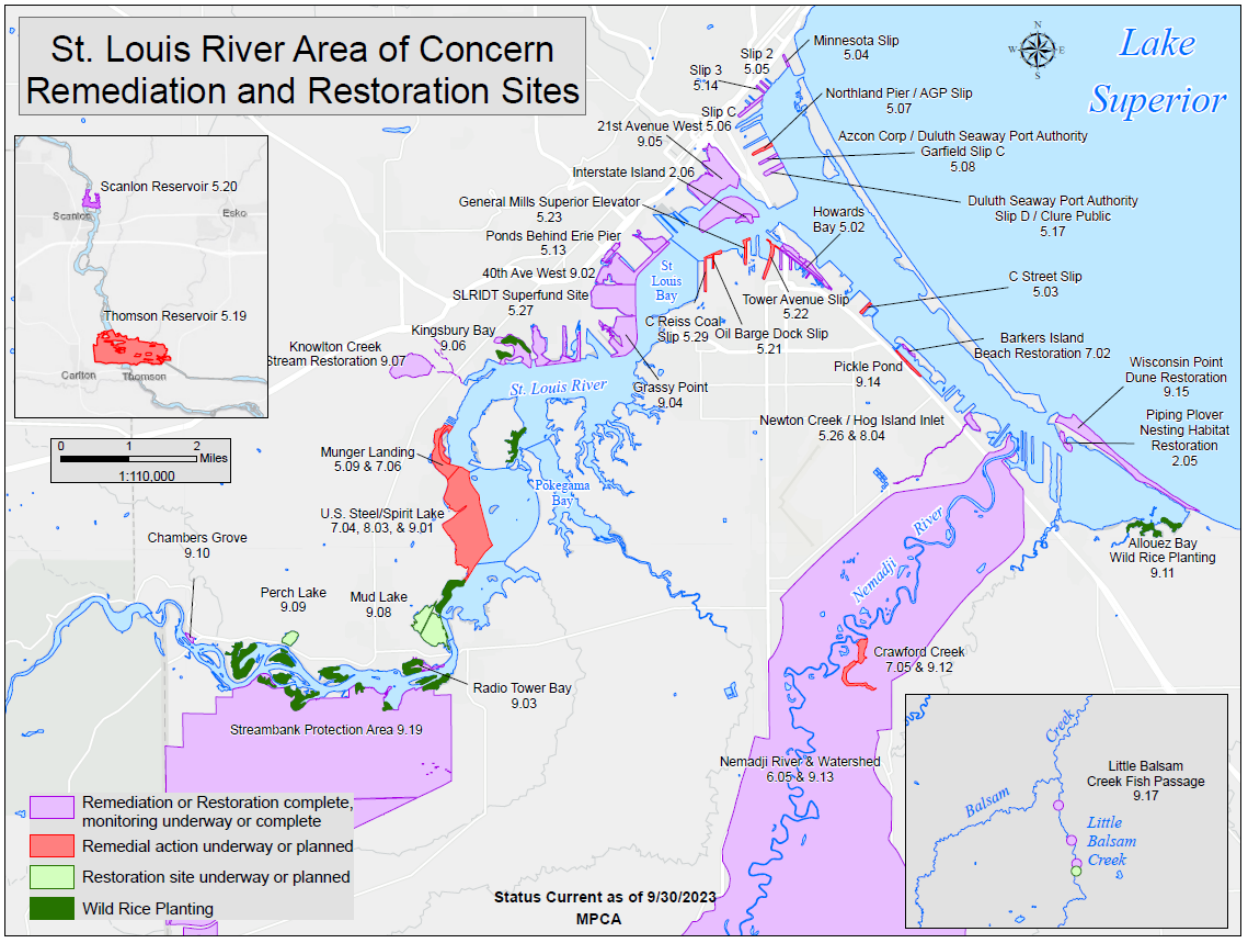


Figure 5: Remediation and Restoration Management Action Sites in the St. Louis River Area of Concern (Revised October 2023)

BUI 9 Summary of Key Management Actions, Current Status, and Actions Still Needed

The management actions needed to complete the BUI removal strategy given above are listed and described in Table 12.

Table 12: Management Actions Needed to Achieve Removal of BUI 9

Mgmt Action	Project Name*	Project Description	In-house/ Contractual	Date to be Completed	Project Status and Notes
9.01	Spirit Lake (Worksheet 2-7; SAAs 76, 77, 78)	Remediate contaminated sediments and restore emergent wetlands	Contractual	2024	Completed remedial tasks, installed recreational features, and began site restoration & vegetative plantings and seeding.

Mgmt Action	Project Name*	Project Description	In-house/ Contractual	Date to be Completed	Project Status and Notes
9.02	40th Avenue West R2R Project (Worksheet 2-9; SAAs 44, 45, 58, 59, 60)	Remediate contaminated sediments and restore habitat	Contractual	Complete 2022	Completed in 2022
9.03	Radio Tower Bay (Worksheet 2-11; SAA 85)	Remove non-native material and restore optimum bathymetry	Contractual	Complete 2015	Completed in 2015
9.04	Grassy Point Restoration (Worksheet 2-27; SAA 63)	Remove non-native material and restore optimum bathymetry	Contractual	Complete 2021	Completed in 2021
9.05	21st Avenue West R2R Project (Worksheet 2-28; 36, 38, 41)	Remediate contaminated sediments and restore habitat	Contractual	Complete 2021	Completed in 2021
9.06	Kingsbury Bay Restoration (Worksheet 2-31; SAA 70, 71.2)	Restore wetland complex at the mouth of Kingsbury Creek to pre-1961 condition	Contractual	Complete 2021	Completed in 2021
9.07	Knowlton Creek Watershed Project (Worksheet 8-1)	Reduce runoff and sediment transport within watershed and restore cold-water stream habitat	Contractual	Complete 2017	Completed in 2017
9.08	Mud Lake (Worksheets 2-8 and 2-26; SAAs 82, 83)	Remediate contaminated sediments, establish more vital hydrologic connection and restore wetland habitat including manoomin; establish deep water	Contractual	2025	Design completed to 30% stage; value engineering study completed and assessed; began environmental review, Section 106, property access, & permit processes.

Mgmt Action	Project Name*	Project Description	In-house/ Contractual	Date to be Completed	Project Status and Notes
9.09	Perch Lake (Worksheet 2-12; SAA 91)	Revitalize biological connection between estuary and Perch Lake and restore optimum bathymetry	Contractual	2024	Construction underway. Phase 1 in-lake dredging completed; seeded disturbed areas, Phase 2 culvert design, permitting, and contracting completed with construction underway. Phase 3 trail crossing design underway
9.10	Chambers Grove Park	Soften and restore shoreline in City of Duluth park	Contractual	Completed 2015	Completed in 2015
9.11	Allouez Bay (Worksheets 1-2, 1-3, 2-24, SAA 6)	Vegetation restoration including removal of AIS and re-establishment of manoomin. Upstream sediment control outreach.	County, City, LSRI, FdL, GLIFWC, St. Croix Tribe, WDNR	2026	Restoration plan update in progress. Seeded 2,000 pounds of manoomin across 10 acres. Herbivory management and annual monitoring conducted by WDNR. SLRAOC agencies will continue planning, seeding & monitoring efforts through 2026 and evaluate density and acreage goal for BUI removal
9.12	Crawford Creek Habitat Restoration (SAA 34)	Remediate contaminated sediments and restore habitat within stream, wetland, and floodplain	Contractual	2026	Focused feasibility study in progress
9.13	Nemadji River Watershed (Worksheets 1-3, 2-24, 9-1)	Conduct habitat assessment and evaluation to determine priority locations for conifer restoration, land protection, and AIS control	County, City, NERR, WWLT, LSRI, WDNR	Complete 2018	Completed in 2018
9.14	Pickle Pond (SAA 14)	Habitat enhancement and sediment remediation	Contractual	2024	In-water construction complete in 2023. Restoration, plantings and seeding underway

Mgmt Action	Project Name*	Project Description	In-house/ Contractual	Date to be Completed	Project Status and Notes
9.15	Wisconsin Point Dune Restoration (Worksheets 2-1, 2-2, 2-3)	Development of appropriate public access infrastructure to protect dunes and conduct dune restoration and invasive species control.	Contractual	Completed 2019	Construction completed in 2019 by the City of Superior, NOAA and Wisconsin Coastal Management.
9.16	Hog Island (Worksheet 2-16)	Nesting area enhancement, habitat restoration	In-house WDNR, County	Action Removed 2018	Action not necessary as other project locations are better suited to provide shorebird habitat.
9.17	Fish Passage Culverts (Worksheet 12-2)	Replace or retrofit a minimum of two perched culverts to allow for fish passage and other aquatic organism passage.	Contractual	2024	Design, environmental review and bidding completed. contracting and construction underway in 2023/2024. Final barrier removal will open 5 miles of Class I trout stream.
9.18	Wisconsin Habitat Protection & Rehabilitation	Document existing WI habitat protection and rehabilitation projects since 1987 AOC designation and prepare a map(s) showing locations of these projects.	In-house WDNR	Initial document completed in 2015. Update at the time of BUI removal	Initial document finished in 2015 with updates, if needed, at the time of BUI removal. Document can be found on WDNR's SWIMS database: https://apps.dnr.wi.gov/swims/Documents/DownloadDocument?id=119518696
9.19	St Louis River Stream Bank Protection Area	Initiate WDNR master planning including natural and undisturbed ecosystem management plan for islands and bays.	In-house WDNR	AOC requirement complete in 2018. On-going with state planning.	AOC action complete. Master planning initiated and WDNR will continue based on statewide priorities. NERR completed regional and property analysis. (See page 94 of the Superior Coastal Plain Regional Master Plan)

Mgmt Action	Project Name*	Project Description	In-house/ Contractual	Date to be Completed	Project Status and Notes
9.20	Document actions taken to control invasive species	Document the appropriate area-specific plans relative to invasive species control in the AOC and incorporate it into an information tool to provide a joint MN/WI view of the ongoing invasive species control efforts. Distribute the information to help provide for efficient and expedited efforts in the AOC	In-house WDNR and MNDNR	Initial document completed in 2015. Update at the time of BUI removal.	AOC action complete. Report is included with project 9.18. Final documentation will be updated at the time of BUI removal. Document can be found on WDNR's SWIMS database: https://apps.dnr.wi.gov/swims/Documents/DownloadDocument?id=119518696
9.21	Manoomin Plan and Associated Restoration Sites	Develop and implement a plan that outlines AOC goals and metrics, restoration tactics and identifies restoration sites.	Contractual	2026	Plan was completed in 2014; an update is in progress and will be final in 2024. Updated plan will establish AOC goals and metrics. In 2023, 10,547 pounds was seeded on 51 acres in MN & WI. Annual monitoring was completed by 1854TA. AOC Agencies will continue planning, seeding and monitoring efforts through 2026 and evaluate density and acreage goal for BUI removal.

*Note: Where given, "worksheet" and number refer to the Lower St. Louis River Habitat Plan Appendix 9 Implementation Strategies Worksheet number (SLRA, 2011); SAA refers to the sediment assessment areas addressed with the listed project (see Appendix G for SAA location maps).

Web-based story maps were created for all the habitat restoration project sites located in Minnesota and Wisconsin. They explain the projects and give visual context to the work. They will be updated annually and can be found here: https://storymaps.arcgis.com/collections/636bea98abfb425687bfb78fb34ca9a1

MNDNR published a report: Habitat Restoration and Protection, St. Louis River Area of Concern, Minnesota (October 2020) that summarizes habitat restoration and protection work that was completed within the AOC between 1987 and September 2020, but was not included as RAP management actions. This report complements WDNR's management action 9.18 and will be used to support BUI 9 removal.

The WDNR document can be found at:
https://widnr.widen.net/content/qno7opxbni/pdf/GW_SLR_HabitatProjects2015.pdf.

Anticipated Timeline to Remove BUI 9

2022	2023	2024	2025	2026	2027	2028	2029	2030
					●			

BUI 9 Issues Affecting Progress

Although all the remaining habitat restoration projects are underway, continued effort is needed to: secure resources (i.e., staff and funding) to ensure timely progress on the restoration projects, maintain partnerships, sequence projects to facilitate staff capacity, and distribute projects to match contractors' availability to compete for projects without escalating costs. The current goal is to complete all the construction work by 2026 and remove the BUI by 2027. However, the complexity of some of these sites, availability of funding, partnership and contractor capacity, and weather may affect the implementation schedule.

Stakeholder engagement is being pursued through each Restoration Site Team. As part of the communication plan developed with the 2013 RAP Update, each restoration site is to assign a Restoration Site Team that includes partners and stakeholders involved in the technical aspects of the project design and implementation process. These teams are led and coordinated by agency staff and other stakeholders are updated and added to the team as needed. Public input opportunities often exist at different stages of remediation and restoration projects: feasibility study/preferred alternatives, permitting, environmental review, design, and for BUI removal.

Section 2: St. Louis River AOC Management and Decision-Making Framework

Management of the SLRAOC is complex not only because of its large size and large number of BUIs, but also because of the numerous partner agencies involved in decision-making, funding, contracting, and project management, as well as the large number of interested stakeholder groups. To implement this RAP update, a coordinated management and decision-making plan that outlines the roles and responsibilities of the partner agencies is needed. This section presents an overview of the management and decision-making framework that applies to the SLRAOC.

Partner Agencies and Organizations

The management and decision-making framework for the SLRAOC will build on the complex agency involvement process that was developed first for the RAP Update process. As the SLRAOC moves into site-specific and AOC-wide on-the-ground projects, a variety of groups and resources will need to be engaged at different stages. The roles and responsibilities of each of the following groups are outlined below.

Interagency Manager's Team – MPCA and WDNR are the state agencies responsible for leading the SLRAOC program in their respective states, including reviewing, approving, and submitting BUI removal and SLRAOC delisting requests, and reporting to U.S. EPA. These two agencies along with MNDNR are also responsible for implementing the AOC program. Managers from these three agencies make up the Interagency Manager's Team and will coordinate within and between states on the SLRAOC outcomes and progress, as needed.

Leadership Team – Lead supervisors from these three agencies and FdL comprise the leadership team. These team members are regularly involved in the monthly Coordinator meetings.

AOC Coordinator Team – The SLRAOC Coordinator Team includes the Coordinator from MPCA, WDNR, MNDNR, and FdL. While FdL does not have regulatory obligations associated with the SLRAOC, they are a key stakeholder and partner providing oversight on the implementation of management actions.

Site Teams – Site teams will be formed, as needed, with the partners having the expertise and skills necessary to manage and implement projects at remediation and/or restoration sites. Site teams may include people from each of the teams/agencies listed here as well as other stakeholder organizations (i.e., property owners, researchers). Different people may be involved in different phases of projects occurring at each site.

St. Louis River Alliance – The SLRA, an independent 501(c)(3) organization, is the designated citizen's advisory committee for the SLRAOC. They are an important partner in outreach, education, and communication efforts with stakeholders that provide support for BUI removal and AOC delisting.

Partner Agencies – The federal agencies of the USACE, USEPA, USFWS, USGS, and NOAA are active partners in the SLRAOC RAP implementation process. These agencies administer GLRI funding for BUI management actions and/or implementation services such as: technical review, engineering design, contract management, and contractor oversight.

Stakeholder Groups – Stakeholders involved in the implementation of the RAP update include the Harbor Technical Advisory Committee, local units of government (e.g., the Cities of Duluth and Superior), nongovernmental organizations (e.g., SLRA and the Minnesota Land Trust [MLT]), and research institutions (e.g., UMD Natural Resources Research Institute [NRRI], USEPA-GLTED, and University of Wisconsin [UWS]). These and other partners provide technical feedback related to data collection and analysis. In addition, they provide important collaboration related to funding, outreach, and project support.

State Agency Coordination and Management

In order to enable FdL, MPCA, MNDNR, and WDNR to effectively carry out the responsibility for implementing the SLRAOC program, SLRAOC coordinators and leaders have agreed that coordinated information gathering and communication is essential. Where complex external partnerships exist, the development of more detailed or project-specific communications plans may be warranted, but they will be developed in coordination with the implementing agencies.

The AOC coordinators meetings are the primary means of communication and this group will continue to meet monthly to:

- Discuss overall AOC-related issues,
- Stay informed of project progress and issues on a site-by-site basis, and
- Direct challenges and concerns to state agency leaders or managers as needed to resolve issues.

Meeting coordination, which includes scheduling, agenda development, and preparation and distribution of meeting minutes, will rotate between the MPCA and WDNR SLRAOC Coordinators.

State agency leaders or managers will meet as needed to complete tasks, such as:

- Reviewing monthly meeting minutes from the SLRAOC coordinators and receiving updates from project managers,
- Addressing and resolving challenges and concerns,
- Evaluating policy implications and identifying strategic opportunities,
- Ensuring the appropriate allocation of financial and human resources, and
- Documenting and distributing meeting decisions to SLRAOC coordinators and others as necessary.

Meeting coordination, which includes scheduling, agenda development, and preparation and distribution of meeting minutes, will alternate among the RAP implementing agencies (MPCA, WDNR).

Community Involvement and Outreach/Education

The SLRA is currently under contract with the MPCA as part of their Management Assistance Award from the USEPA GLNPO to assist with providing outreach, communication, and education opportunities to stakeholders to develop support for BUI removal and AOC delisting. The specific tasks for which they are responsible are outlined in their contract and work plan, which is developed with input from FdL, WDNR and MNDNR. The SLRA also obtains funding from other sources for other projects that support the BUI removal objectives, such as manoomin seeding events and piping plover monitoring and habitat work. As the contract manager, MPCA coordinates directly with SLRA to ensure the dissemination of coordinated, accurate, timely and consistent messaging reflective of the shared RAP vision and of progress toward achieving identified goals.

An annual stakeholder input opportunity will be announced when AOC coordinators and leadership have amended the RAP. A draft version will be available for a two-week public input period before changes are made final.

An SLRAOC-Wide Communication Plan was updated in 2019, consolidating approaches contained in several, separate prior documents. It is reviewed annually and updated as needed. SLRAOC information is available through GovDelivery notifications and press releases from MN and WI agencies.

Additional public input opportunities also often exist at different stages of remediation and restoration projects: feasibility study/preferred alternatives, permitting, environmental review, design, and for BUI removal.

As a result of the 2020 Engagement Survey findings, overview presentations about the SLRAOC were made to 10 groups with about 170 attendees. Quarterly updates of AOC progress are provided to the Advisory Board of the Lake Superior National Estuarine Research Reserve. At their request, regular updates of MN progress are provided to the League of Women Voters Environmental Action Committee.

The SLRA has been designated as the primary entity through which social media posts are made, using Facebook, and Instagram. A social media plan is developed each fall to identify monthly topics that can be highlighted in the upcoming year. Additionally, SLRA now includes the SLRAOC social media content in their monthly “River Voice” e-newsletters and posts them to their SLRAOC website.

Another important communication effort is the need to memorialize the SLRAOC accomplishments, so a public historical record is in place by the time of delisting. In addition to web site content already developed, manoomin signs that utilize an Indigenous context have been installed at several sites. A permanent interpretive sign describing the problems and remedies at the St. Louis River-Interlake-Duluth Tar Site has been installed at the trailhead of the City’s Waabizheshikana (Marten Trail). More opportunities and partnerships for signs, exhibits, and displays will continue to be sought.

Adaptive Management

The BUI removal strategies and management actions still needed to achieve removal are contained in the Roadmap (Section 1) and based on the current body of knowledge for each BUI. A number of ongoing sampling efforts, studies, modeling efforts, and other assessments will continue to provide valuable information for the SLRAOC that may suggest modification of the RAP is warranted. SLRAOC coordinators, leaders, and managers recognize the importance of having a comprehensive RAP while acknowledging the potential for adjustment as new information becomes available.

The Roadmap is based on the principles of adaptive management: it puts forth a solid set of management actions to be implemented over time and will be updated to incorporate new information and lessons learned as the RAP implementation moves forward. At this time, SLRAOC leaders have agreed that SLRAOC coordinators will prepare an updated RAP once per year for the purpose of officially documenting progress and changes to the SLRAOC RAP. The draft annual RAP update will be reviewed and revised as necessary by the state agency leaders and, upon concurrence, will be sent to the USEPA as an official RAP update. The RAP update will be titled with the year it was produced.

Section 3: St. Louis River (Gichigami-ziibi) Cultural Corridor

Gichigami-ziibi (the Great Lake River) provides a major Cultural Corridor known through oral tradition and archaeological evidence of more than 10,000 years of Indigenous history. These resources form an irreplaceable source of knowledge of events, people and lifeways of the region.

Overland trails were once ubiquitous throughout the region, connecting villages, campsites, ceremonial sites, hunting, gathering, and fishing grounds, seasonal locations, trade centers and other important locations throughout the Ceded Territories (Figure 6).

The entrance of the St. Louis River at the western end of Lake Superior provided land and water routes between the Great Lakes and the Mississippi River, and ultimately to Hudson Bay. Canoe passages, portages, and winter trails constituting the route were part of an extensive social and trade network established by Indigenous People long before the first European explorers, fur traders, and missionaries travelled the same routes (Hart 1927). The route connected the villages and later trading establishments of Fond du Lac and Sandy Lake. At Fond du Lac Village, the American Fur Company operated a trading post from 1817-1847. Sandy Lake became an important trading center for both British and American fur traders beginning in 1796 with the establishment of a Northwest Company post on the lake's western shore (Luukkonen 2007).

The Grand Portage of the St. Louis River Trail is one of the most iconic historic travel routes in northern Minnesota, linking major watersheds – St. Louis River/Lake Superior, Mississippi River and Hudson Bay/Rainy River. It provided access to much of what is now the United States and parts of Canada. The Grand Portage was extensively used by Native Americans, and subsequently by the fur traders and explorers, to access the upper lakes. It was long, difficult and treacherous, and during the fur trade era, it was in continual use (Fritzen 1978:4-5). The Grand Portage of the St. Louis River Trail was initially listed on the National Register of Historic Places in 1973.

Water features are sources of potable water and formed essential travel routes, such as The Winter Trail. Streams, lakes, and wetlands are critical habitats for food and other natural resources used by Tribes ancestral to the area. Edges and shores of both existing and remnants of former water features are culturally important topographic locations.

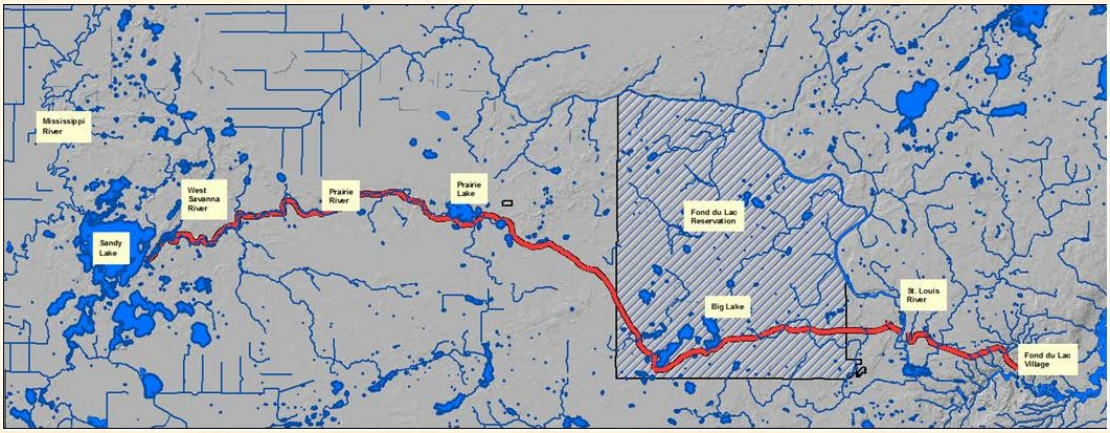
The Winter Trail

The Winter Trail

The Winter Trail (also known as the Northwest Trail) was a land and water route that connected Lake Superior and the Great Lakes with the Mississippi River. Anchoring each end of the route were the villages and later trading establishments of Fond du Lac and Sandy Lake. The canoe portages and winter route that constituted the Winter Trail were established by Indigenous People long before the first European explorers, fur traders, and missionaries followed the same routes in the eighteenth and nineteenth centuries (Luukkonen 2007:50-51).

Some parts of the Winter Trail located on dry land survived to be noted in the Government Land Survey notes in the 1860s and 1870s. Today, two state parks are found at each end of the route—Jay Cooke and Savanna Portage.

The winter trail crossed the Fond du Lac Reservation on its way from Lake Superior to the Mississippi River.



The St. Louis River Watershed drains millions of acres and empties into Lake Superior. The watershed is unique and diverse, with forest, wetland, grassland, and the largest coastal freshwater wetland ecosystem on Lake Superior at the mouth of the St. Louis River. It provides critical habitat for an immense variety of plants, fish, and wildlife.

Manoomin was once abundant in the St. Louis River Estuary, but today only remnant stands exist, mostly where restoration efforts have occurred. The MNDNR, MPCA, WDNR, FdL Band, 1854 Treaty Authority, Great Lakes Indian Fish and Wildlife Commission, and MLT have worked to restore manoomin in the estuary. Gichigami-ziibi remains the primary fishery for the FdL Band.

The Fond du Lac Reservation falls partially within Carlton County and St. Louis County. Within the Reservation there are five primary manoomin-producing waterbodies: Perch Lake, Mud Lake, Rice Portage Lake, Jaskari Lake, and Deadfish Lake. Fond du Lac Band members traditionally and currently harvest manoomin within these waterbodies.

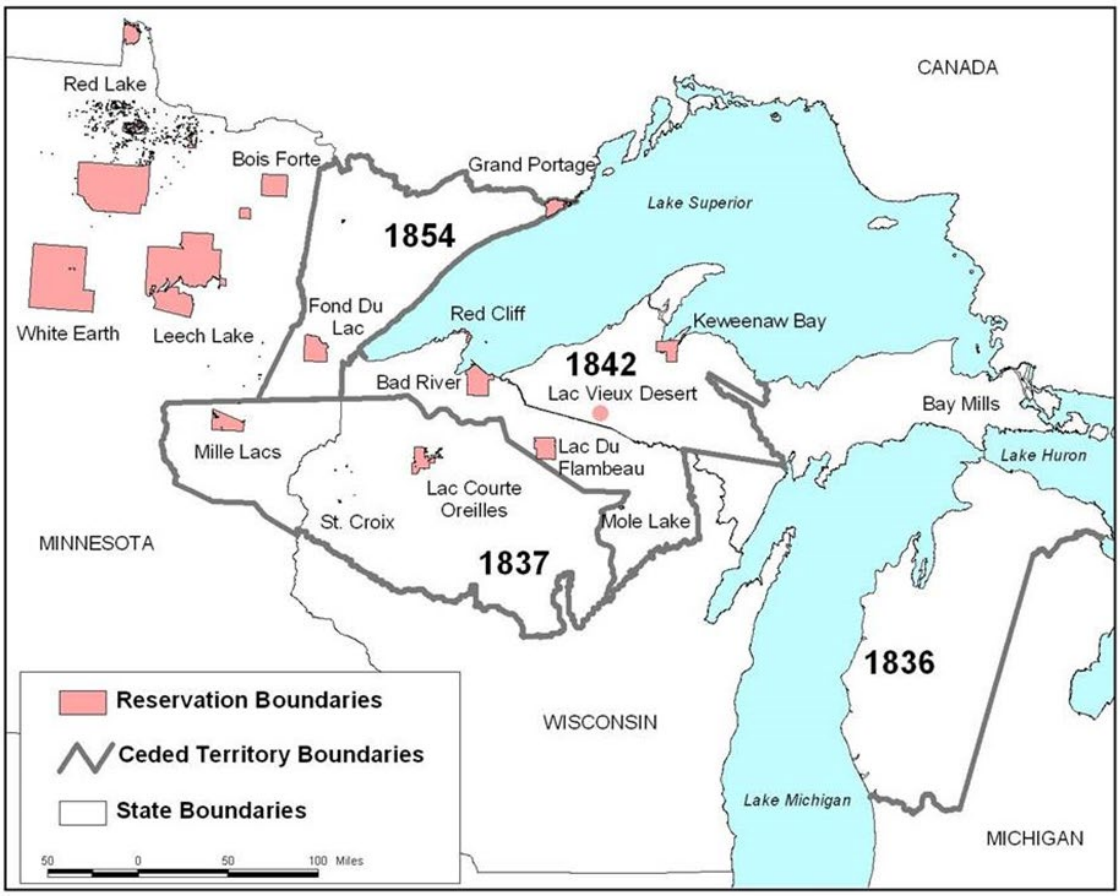


Figure 6: Ojibwa Ceded Territory and Reservation Boundaries

In 2022, the SLRAOC Coordinators team developed a tribal land acknowledgement to recognize the Indigenous peoples that came before, the harm that they endured, and the efforts being taken under the SLRAOC Program to redress it. The tribal land acknowledgement is now read at the beginning of public meetings and included in SLRAOC documents.

Section 4: Remedial Action Plan History

Introduction

A series of RAPs have been developed between 1992 and the present for the SLRAOC. The first comprehensive plan that details the management actions necessary to remove each of the nine BUIs was prepared as the 2013 RAP Update, which was developed through the Implementation Framework Project funded by a USEPA GLRI Grant awarded to the MPCA in 2011. The two-year Implementation Framework Project was led by SLRAOC Coordinators from the MPCA, WDNR, MNDNR, and FdL, and the Executive Director of the SLRA. An extensive stakeholder involvement process was undertaken for the project to develop this important SLRAOC plan. In addition to these organizations, the following partners were involved with its development:

- AMI Consultants
- Audubon Minnesota
- Barr Engineering
- City of Duluth, MN
- City of Superior, WI
- Douglas County, WI
- Douglas County Health Department
- Duluth Seaway Port Authority (DSPA)
- Harbor Technical Advisory Committee (HTAC) of the Duluth-Superior Metropolitan Interstate Council
- Lake Superior National Estuarine Research Reserve (LSNERR)
- LimnoTech
- Marine Tech
- Minnesota Department of Health
- Minnesota Land Trust (MLT)
- National Oceanic and Atmospheric Administration
- Short, Elliot, Hendrickson
- University of Minnesota–Duluth
- University of Wisconsin-Superior
- University of Wisconsin-Superior Extension
- University of Minnesota Natural Resources Research Institute
- US Department of Agriculture (USDA)
- US EPA Mid-Continent Ecology Division (now US EPA-Great Lakes Toxicology and Ecology Division)
- US Fish and Wildlife Service
- US Army Corps of Engineers Detroit District
- Western Lake Superior Sanitary District
- Western Wisconsin Land Trust (now the Wisconsin Landmark Conservancy)
- Wisconsin Sea Grant

The RAP was originally organized in the following major sections:

Section 1: Introduction

Section 2: Background

Section 3: Overview of the Implementation Framework Project

Section 4: AOC Delisting Roadmap

Section 5: St. Louis River AOC Management and Decision-Making Framework

Section 6: BUI Technical Teams

Section 7: References

With the 2018 RAP, the original three sections were combined and moved into what is now Section 4: Remedial Action Plan History. This was done to emphasize the active portion of the RAP at the beginning of the document, resulting in this format:

Section 1: AOC Delisting Roadmap

Section 2: St. Louis River AOC Management and Decision-Making Framework

Section 3: Remedial Action Plan History

Section 4: BUI Technical Teams

Section 5: References

Appendices for the 2013 RAP Update are provided under separate cover in Volume II and will not receive annual updates. Appendices can be accessed online at the websites listed on page ii of this document.

Attributes of the AOC Delisting Roadmap

The Roadmap contained in the 2013 RAP Update was developed through the combined efforts of numerous SLRAOC partners/stakeholders, in addition to the SLRAOC coordinators and leaders who represent the agencies responsible for BUI removal and SLRAOC delisting. The Roadmap was developed to embody four key attributes:

Inclusive – It was developed with an extensive stakeholder involvement process that involved over 70 individuals from approximately 30 partners including: agencies, local units of government, research institutions, nongovernmental organizations, and stakeholder groups. Work completed by BUI teams and other supporting groups formed the basis of the Roadmap.

Comprehensive and Targeted – It addressed all nine BUIs and their interrelationships. For each BUI, targeted removal objectives, strategies, management actions needed to achieve BUI removal, timelines and estimated costs were provided. The plan also included a management and decision-making framework necessary to sustain AOC-wide communication and implement the management actions in the RAP.

Aggressive – The original goal of the Roadmap is delisting of the SLRAOC by 2025. This will require coordination of state agencies and partners in an unprecedented fashion as they work to implement the identified management actions and adapt to BUI removal needs as more information becomes available. As implementation progress has been made, the complexity of the management actions has become more apparent. The current goal is to complete the construction projects by September 30, 2024 (timeline established by GLRI Action Plan III), with remaining BUI removal and delisting to follow.

Timely – It allowed the agencies and SLRAOC partners to maximize and leverage available funding sources that may not exist in the future, including the federal GLRI and Minnesota Clean Water, Land and Legacy funds.

Outcomes

The plan for the implementation of the management actions included in the 2013 RAP included these goals:

- Restoration of more than 1,700 acres of aquatic habitat in the SLRE.
- Remediation of a minimum of 13 contaminated sites, including the U.S. Steel Superfund site and Minnesota Slip in Minnesota and Crawford Creek and Howard's Bay in Wisconsin.
- Restoration of hydrologically connected habitat, including creation of suitable nesting habitat for the endangered Piping Plover.
- Removal of all BUIs and the AOC delisted by 2025.
- Development of partnerships to sustainably manage the SLRE into the future.

Following adaptive management principles, goals are evaluated with each RAP update and modified as needed to implement the RAP and meet the BUI removal targets.

Background

This section provides a brief background on the GLWQA, listing of the SLRAOC, and a timeline of important SLRAOC work products leading up to this 2018 RAP.

Great Lakes Water Quality Agreement

Initially signed in 1972, the GLWQA is a non-regulatory agreement between the US and Canada that requires the governments to take specific steps to reduce discharges of conventional pollutants and signals a commitment to reverse the progressive decline and deterioration of the Great Lakes ecosystem. The GLWQA reflects each country's commitment "to restore and maintain the chemical, physical and biological integrity of the Great Lakes Basin Ecosystem" and includes a number of objectives and guidelines to achieve these goals.

There were noticeable improvements in Great Lakes water quality following the implementation of the GLWQA. An estimated nine billion dollars was spent toward controlling conventional pollutants through upgrades or construction of wastewater treatment plants. In the years following the 1972 GLWQA, continued monitoring and research showed that toxic chemicals in the environment presented a potentially greater threat than conventional pollutants. Consequently, the GLWQA was amended in 1978 to address toxic pollutants. It soon became clear, however, that the GLWQA generally lacked an effective means of implementation.

In 1987, the GLWQA was amended once again to strengthen the programs, practices, and technology described in the 1978 amendment, and to increase accountability for their implementation. As a result, timetables were developed for implementation of specific programs. The 1987 amendment also established the concept of "Areas of Concern" that represented the most severely impacted geographic areas around the Great Lakes Basin and set forth the remedial action plan (RAP) process to address them. The RAP process incorporated a systematic and comprehensive ecosystem approach that also included substantial citizen participation. The 1987 amendment required that RAP documents be submitted at three stages: I. Definition of the problem is complete; II. Remedial and regulatory measures

have been selected; and III. Monitoring indicates that beneficial uses have been restored (and the AOC can be delisted). An amendment to the GLWQA signed in 2012 consolidated the previously described stages of the RAP process (i.e., Stages I, II, and III) into one inclusive RAP process. The St. Louis River AOC was identified as one of 43 AOCs across the Great Lakes. MPCA and WDNR are the regulatory agencies designated by USEPA to address AOCs in their respective states.

Listing of the St. Louis River AOC

The SLRAOC is the single AOC in Minnesota and one of five AOCs in Wisconsin. The geographic, geological, hydrologic, and industrial historical contexts of the SLRAOC are described in detail in the Stage I RAP (MPCA and WDNR, 1992), Stage II RAP (MPCA and WDNR, 1995) and the Lower St. Louis River Habitat Plan (SLRCAC, 2002).

The geographic region outlining the St. Louis River AOC was initially defined as the St. Louis River below Fond du Lac Dam and including St. Louis Bay and Superior Bay. Consideration is to be given to "any factor within the St. Louis River watershed contributing to problems of the water resource" (SLRCAC, 1992). Later, the AOC was expanded to include the St. Louis River from upstream of the City of Cloquet downstream to Lake Superior, and the Nemadji River watershed (Stage II RAP; MPCA and WDNR, 1995). The current AOC boundary is defined as:

> The AOC boundary includes the lower 39 miles of the St. Louis River, from upstream of Cloquet, Minnesota to its mouth at the Duluth/Superior Harbor, and that portion of the watershed; the Nemadji River watershed; and the western portion of Lake Superior defined on its eastern edge by a line drawn from the eastern HUC 12 Dutchman Creek watershed boundary in Wisconsin where it intersects the Lake Superior shoreline north to where the eastern HUC 12 Talmadge Creek watershed boundary in Minnesota intersects with the Lake Superior shoreline north to the intersection of the Cloquet River HUC 8 (Figure 7).

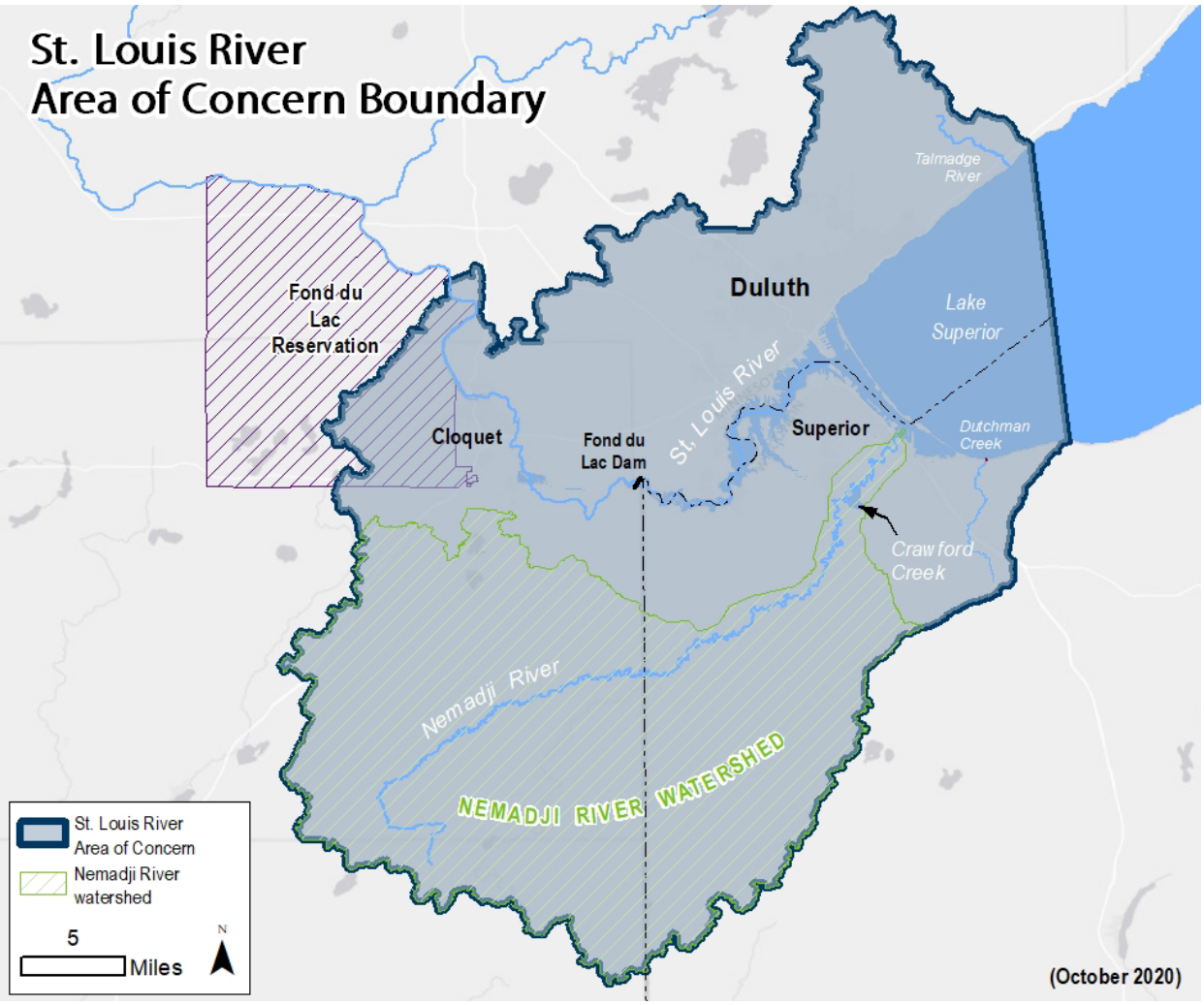


Figure 7: St. Louis River AOC Boundary

Most of the management actions included in this SLRAOC RAP focus on the St. Louis River below the Fond du Lac Dam, Crawford Creek, and the Nemadji River watershed, as they represent those portions of the SLRAOC most impacted by historical actions.

The St. Louis River was originally listed as an AOC in 1987 because of the large amount of suspended solids, nutrients, and biochemical oxygen demand discharged to the river from various industries and communities (MPCA and WDNR, 1992). By the time the Stage I RAP was developed in 1992, many of these discharges were being treated as required by the CWA. The primary concerns for the SLRAOC were legacy contamination and degradation of hydrologically connected and aquatic habitat, as well as excess sediment and nutrient inputs. These sources of impairment led to the designation of nine of the possible 14 BUIs:

BUI 1: Fish Consumption Advisories

BUI 2: Degraded Fish and Wildlife Populations

BUI 3: Fish Tumors and Other Deformities

BUI 4: Degradation of Benthos

BUI 5: Restrictions on Dredging

BUI 6: Excessive Loading of Sediment and Nutrients

BUI 7: Beach Closings and Body Contact Restrictions

BUI 8: Degradation of Aesthetics

BUI 9: Loss of Fish and Wildlife Habitat

The majority of the BUIs for the SLRAOC are related to historical habitat loss from extensive filling of wetlands, dredging of shallow aquatic habitat, and inputs of harmful chemicals that contaminated the sediments and water in the estuary. Since 1861, approximately 3,400 acres of wetlands have been lost in the estuary through a combination of dredging and filling; this includes 1,700 acres of shallow, open-water aquatic habitat in St. Louis Bay and Superior Bay that was converted to deep shipping channels (Hollenhorst *et al*., 2013). There is no clear documentation on how the Duluth-Superior area handled solid and liquid wastes prior to the 1970s, but it is known that a number of industries discharged directly and indirectly into the river or bay. Consequently, a number of sites within the SLRAOC contain legacy pollutants from historical contamination from chemicals or toxic waste products. Several of these contaminated sites have been or are currently being addressed by State or federal regulatory and resource management programs. Priorities to achieve SLRAOC delisting are continued remediation of contaminated sediments and restoration of aquatic or hydrologically connected habitat.

Timeline of AOC Work Products

The SLRAOC Stage I RAP (MPCA and WDNR, 1992) was developed as a collaborative effort between the MPCA and the WDNR. At that time, these agencies supported an extensive public participation process that resulted in the development of the Stage 1 RAP and the Stage 2 RAP Progress Report (MPCA and WDNR, 1995). Many efforts associated with the RAP have taken place since this time. These efforts and associated publications are briefly described chronologically in the following sections.

Stage I RAP (1992)

The St. Louis River System Stage I RAP was published in 1992 (MPCA and WDNR, 1992). A 32-member CAC was formed to oversee development of the document, which was a collaborative effort between MPCA and WDNR. The Stage I RAP described the environmental problems in the St. Louis River AOC and presented 16 overall goals for the RAP process. These goals were intended to provide a framework for the development of recommendations to address BUIs. For each of the nine BUIs, the RAP details the rationale for listing, provides historical perspective, and describes the available data and supporting evidence used as the basis for impairment selection in the SLRAOC.

St. Louis River Remedial Action Plan Progress Report (1995)

A progress report containing recommendations to restore the beneficial uses in the SLRAOC was published in 1995 by MPCA and WDNR (MPCA and WDNR, 1995). The document outlined 43

recommendations, approved by the CAC, to address the environmental problems identified in the Stage I RAP.

Implementation of these recommendations began immediately and continues today. Early recommended actions that were completed include: (1) land acquisition, with 34,000 acres bordering the St. Louis River permanently protected by purchase or donation; (2) connection of the Fond du Lac neighborhood of Duluth, MN, responsible for a high percentage of failing septic systems, to the WLSSD; (3) programs to reduce sewage bypasses by keeping stormwater out of sanitary sewer systems; and (4) completion of a habitat plan for the lower St. Louis River.

Progress Report Update (2001)

The 2001 SLR Remedial Action Plan Assessment (MPCA and WDNR, 2001) outlines the 43 RAP recommendations from the 1995 Progress Report. The assessment details the up-to-date progress made toward implementing each recommendation, including the percent complete for each recommendation and an assigned grade for the level of implementation based on percent completion.

Lower St. Louis River Habitat Plan (2002)

The Lower St. Louis River Habitat Plan (Habitat Plan; SLRCAC, 2002) was published in 2002. The plan was funded by a grant through the USEPA with additional support from the MNDNR Conservation Partners Program, the USFWS, and The Nature Conservancy. The Habitat Plan was developed by the CAC to "to facilitate protection of the ecological diversity of the Lower St. Louis River".

Conservation targets were developed to define the native species, plant communities, aquatic habitats, and ecological systems that are the focus for conservation in the Lower St. Louis River. The Habitat Plan presents 18 strategies to address the most significant identified threats to the conservation targets and to move toward achieving conservation goals.

Hog Island and Newton Creek Ecological Restoration Master Plan (2007)

The Hog Island and Newton Creek Ecological Restoration Master Plan (Biohabitats, 2007) was developed to provide a plan for the restoration of natural communities and ecosystem processes for Newton Creek, the Hog Island Inlet, and Hog Island in Superior, Wisconsin. The plan incorporated specific recommendations of the Lower St. Louis River Habitat Plan and was intended to address a suite of AOC BUIs.

WDNR and USEPA partnered to use Great Lakes Legacy Act (GLLA) funds to implement contaminated sediment remediation of the Newton Creek and Hog Island Inlet system in 2005. This work resulted in the removal of ecological and human health hazards. Following sediment remediation, additional work was completed at the site to provide habitat enhancements.

St. Louis River Area of Concern Complete Delisting Targets (2011)

In 2008, the SLRA facilitated a process to combine delisting targets from Minnesota and Wisconsin. A list of targets describing desired outcomes for each BUI was provided to the USEPA (MPCA and WDNR, 2008). In 2011, The Complete Delisting Targets document (MPCA and WDNR, 2011) was developed to

include the 2008 delisting targets along with IJC guidelines that were established for a particular BUI ("IJC Criteria"), the basis for listing nine of the fourteen possible BUIs in the St. Louis River AOC ("Rationale for Listing"), and the basis for the target chosen for a particular BUI ("Rationale for Removal"). The 2008 delisting targets, as completed in 2011, are referred to as "BUI removal targets" in this RAP.

Lower St. Louis River Habitat Plan Appendix 9 Implementation Planning Worksheets (2011)

Appendix 9 of the Lower St. Louis River Habitat Plan (SLRCAC, 2002) was published in 2011 (SLRCAC, 2011). As described above, the Habitat Plan was prepared to facilitate protection of the ecological diversity in the St. Louis River. Appendix 9 contains a set of project descriptions termed "Strategies Implementation Planning Worksheets" associated with 15 of the 18 strategies included in the Habitat Plan. The projects were identified by SLRAOC stakeholders to mitigate threats to the SLR.

Each project worksheet included background information, goals, a listing of BUIs addressed, project locations, relative project priority, anticipated duration, potential funding mechanisms, partnering organizations, estimated costs, any special considerations surrounding the project, and description of how success of the project will be measured.

Appendix 9 is to be updated and maintained by the Habitat Working Group, an ad hoc group of representatives from agencies and organizations interested in habitat restoration in the SLR estuary. This group has worked to support implementation of the projects listed in the worksheets. Numerous habitat restoration projects listed under BUI 9: Loss of Fish and Wildlife Habitat originated as worksheets.

Stage 2 Remedial Action Plan Update for the St. Louis Area of Concern (2011)

The 2011 Stage 2 RAP Update (WDNR, 2011) served as an update to the 1995 SLRAOC RAP Progress Report. It was produced by the WDNR, with input from SLRAOC partners, to provide short-term direction for overall statewide SLRAOC coordination in Wisconsin. The document was intended to be a concise summary of BUI status and specific actions necessary for reaching the BUI delisting targets. Actions included on-the-ground restoration projects, monitoring and assessment projects, and/or stakeholder engagement processes. The 2011 Progress Update also identified challenges affecting progress on each BUI.

Remedial Action Plan Update for the St. Louis River Area of Concern (2012)

The 2012 RAP Update (WDNR, 2012) was developed by WDNR, with input from SLRAOC partners, as an interim document to assist in providing direction in the short-term for overall statewide SLRAOC coordination in Wisconsin. The 2012 update followed the same format as the 2011 update, presenting the current status of each BUI, next actions identified, and issues affecting BUI progress.

Remedial Action Plan Implementation Framework: Roadmap to Delisting (2013)

A comprehensive plan for delisting the SLRAOC details the management actions necessary to remove BUIs identified for the SLRAOC. The RAP is updated annually by editing the 2013 RAP Update and naming the updated RAP according to the year it was updated (e.g., 201X RAP). Previous versions are archived to track progress.

Remedial Action Plan Update for the St. Louis River Area of Concern (2014)

The 2014 RAP was developed by WDNR and MPCA, with input from SLRAOC partners and stakeholders. The 2014 update followed the same format as the 2012 update, presenting the current status of each BUI, next management actions identified, and issues affecting BUI progress. This format has been combined with the 2013 RAP Update to capture and retain the additional information contained in the framework and the roadmap to delisting. This current format will be used going forward for updates to the RAP.

Remedial Action Plan Update for the St. Louis River Area of Concern (post-2014)

In each year, the RAP update was developed by SLRAOC staff from WDNR, MPCA, MNDNR and FdL. A redlined document was used to show changes when the document was presented for review to SLRAOC partners and stakeholders. All comments receive a response and the final version is made available online and sent to USEPA GLNPO.

Overview of the Implementation Framework Project

This section provides an overview of the 2013 Implementation Framework - Roadmap to Delisting RAP Update, including descriptions of project goals and process, the stakeholder involvement process, BUI Blueprints, and the SLRAOC R2R Template.

Goals and Process

The MPCA was awarded a competitive GLRI grant from USEPA in 2011 for the “Implementation Framework” (Framework) project. The primary goal of the project was to support SLRAOC coordinators for MPCA, MNDNR, WDNR and FdL in developing a plan for delisting the SLRAOC. This goal was achieved through the development of BUI Blueprints, which were subsequently used to design a roadmap to delist the SLRAOC. A secondary goal of the project was to support restoration planning for priority sites through development of R2R concept plans that could be used to seek funding for project implementation. This goal was achieved through development of an R2R Template that established a common understanding of the R2R process, as well as development of six concept plans for high-priority R2R sites.

The Framework project was supported by the MPCA contractor, LimnoTech, as selected by SLRAOC coordinators from MPCA, WDNR, MNDNR, and FdL, and the Executive Director of the SLRA.

Beginning in June 2011, the four SLRAOC coordinators and the SLRA Executive Director began meeting twice monthly for the Framework project with LimnoTech. This group was responsible for developing the coordinated bi-state approach for project completion. Their responsibilities included:

- Defining project deliverables and timelines
- Decision-making on SLRAOC program direction
- Defining the stakeholder process that would be used throughout the project
- Reviewing and approving of all project documents
- Decision-making regarding the necessary and sufficient management actions to address each BUI
- Representing respective agency viewpoints on BUI removal objectives and strategies during development of the SLRAOC Delisting Roadmap

The primary outcome of the Framework is the SLRAOC Delisting Roadmap (also known as the 2013 RAP Update), which defines the measurable targets, removal strategies, and management actions for each of the nine BUIs in the SLRAOC. The Roadmap contains the management actions necessary to address each BUI based on the current body of knowledge for each BUI. It is an adaptive management plan, and therefore will be updated annually by the SLRAOC coordinators to incorporate new information and progress.

The Roadmap is based on the set of BUI Blueprints created by the stakeholder process designed for the Framework project. The stakeholder involvement plan, BUI Blueprints, and the SLRAOC R2R Template are described briefly below and are provided in full in Appendices A, D, and E of the 2013 RAP Update. The SLRAOC Delisting Roadmap is described in Section 1. The management and decision-making framework for implementing the SLRAOC Delisting Roadmap is described in Section 2.

Stakeholder Involvement

A stakeholder involvement plan (SIP) was developed at the start of the Framework project (Appendix A). The primary objective of the stakeholder process was to enable all SLRAOC stakeholders, not only the State regulatory agencies, to take action to improve the SLRAOC in a coordinated, cooperative, and directed manner. Therefore, the SIP resulted in comprehensive contributions to BUI removal objectives and provided a sense of ownership of the SLRAOC Delisting Roadmap.

Because of the complexity of issues addressed in the Framework project, a key element for project success involved educating and informing stakeholders early. Stakeholders were informed of how the project would proceed and the vision for the primary work products. In addition, given the significant knowledge and experience of the stakeholders in the SLRAOC, the SIP was designed to involve stakeholder groups in meaningful ways throughout the project to maximize the value of their contributions.

The SIP identified key existing stakeholder groups (SLRAOC Coordinators, SLRA, and the HTAC) to be involved in the project, and described additional groups that were formed for the project, including the BUI Teams and Scientific Advisory Group (SAG). The organization of the stakeholder groups as it existed

during the preparation of the 2013 RAP Update is presented in Figure 8. Engagement was categorized as follows:

- **Inform** through presentations at regularly scheduled meetings.
- **Solicit comment** on project elements after providing documents for review or presentations at regularly scheduled meetings. Comments were considered for incorporation into final documents.
- **Direct input** was requested to develop project elements at task-specific workshops or meetings.
- **Review and approval** of documents for incorporation into final project deliverables.

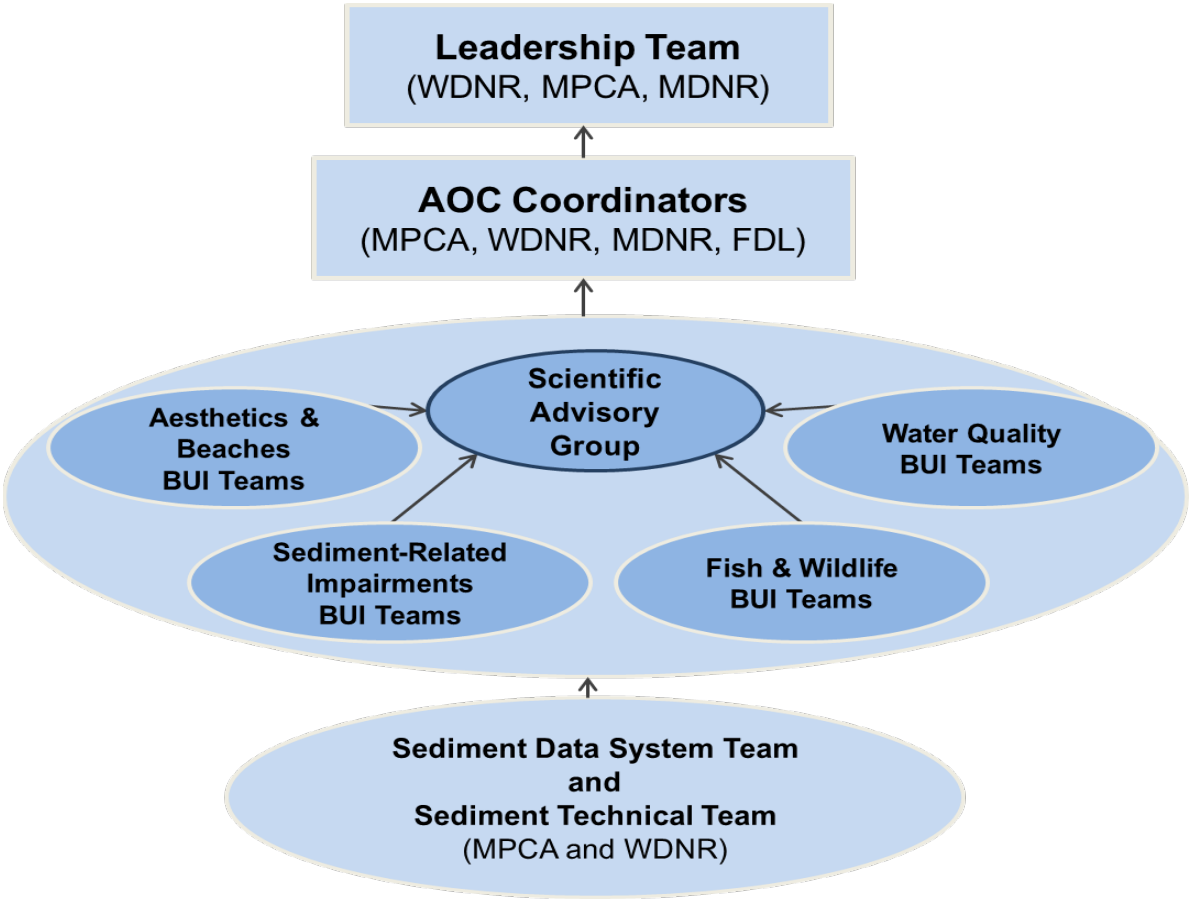


Figure 8: Organizational and Decision-Making Structure of AOC Stakeholders during the preparation of the 2013 RAP

The two primary groups charged with developing the Roadmap were the SRLAOC Coordinators and BUI Teams. The SAG reviewed project elements at key points in the process. Two additional teams, the SLRAOC Data System Team and the Sediment Technical Team, were formed to provide technical support to the Framework project on sediment contaminant issues. Development of the stakeholder teams, including their roles and responsibilities, is described below.

BUI Teams

BUI Teams were formed with the charge of developing BUI Blueprints (described in the following section) for each BUI. The intent of the SLRAOC coordinators in forming and tasking the BUI Teams was twofold: 1) incorporate the wealth and breadth of local stakeholders' knowledge and expertise of SLRAOC issues; and 2) align ongoing research and projects to better serve SLRAOC delisting.

Four BUI Teams were formed to address the nine BUIs as follows:

Aesthetics and Beaches BUIs – Led by SLRA Executive Director

- Degradation of Aesthetics (BUI 8)
- Beach Closings and Body Contact Restrictions (BUI 7)

Sediment-Related BUIs – Led by WDNR SLRAOC Coordinator

- Fish Consumption Advisories (BUI 1)
- Fish Tumors and Deformities (BUI 3)
- Restrictions on Dredging (BUI 5)
- Degradation of Benthos (BUI 4)

Fish and Wildlife BUIs – Led by MNDNR and FdL SLRAOC Coordinators

- Degraded Fish and Wildlife Populations (BUI 2)
- Loss of Fish and Wildlife Habitat (BUI 9)

Water Quality BUI – Led by MPCA SLRAOC Coordinator

- Excessive Loading of Sediment and Nutrients (BUI 6)

The BUI Team leader(s) were tasked with developing initial lists of possible members for their teams with a focus on bi-state and tribal representation. These lists were reviewed and refined by the SLRAOC coordinators. Members of the SLRA Habitat Working Group, HTAC, SLRA, local units of government, federal agencies, non-governmental organizations, private sector firms, and research institutions were invited to join one or more BUI Teams. SLRAOC coordinators sent invitations to potential team members; volunteers were also accepted (no one was excluded from the BUI Teams). The resulting BUI Team participants were provided in Appendix B of the 2013 RAP Update. The nine teams consisted of over 50 individuals representing the breadth of SLRAOC partners and stakeholders. The teams served an important role during the development of the Framework.

The BUI Teams have evolved into BUI Technical teams and the current members are listed in Section 6. Many of these individuals participate in the annual RAP update process.

Scientific Advisory Group

The SAG was formed to provide technical advice and peer review of the BUI Blueprints. The SAG was requested to review the scientific basis of the BUI Blueprints, as well as specific components of the blueprints, such as source/stressor models and cause-effect relationships in the system.

A list of potential members for the SAG was developed by the SLRAOC leadership team from MPCA and WDNR, with a focus on developing a bi-state and a tribal panel of experts that covered the breadth of topics involved with the nine BUIs. The list of nine SAG members is provided in Appendix B of the 2013 RAP Update. The SAG has not been assigned an advisory duty since the BUI Blueprints were finalized.

SLRAOC Data System Team

The SLRAOC Data System Team was formed to oversee expansion and improvement of the AOC sediment contaminant database into a broader SLRAOC Data System. The SLRAOC Data System was transferred to the NOAA GLDIVER system in 2015. The team managing the transition was led by staff from MPCA, WDNR and NOAA.

Sediment Technical Team

The original Sediment Technical Team consisted of staff from MPCA and WDNR and data users. They were responsible for developing protocols for assessing sediment contaminant data across the SLRAOC, determining the need for remedial action at locations across the SLRAOC, and supporting SLRAOC coordinators and the leadership team in decision-making on necessary actions to address sediment contamination.

BUI Blueprints

BUI Teams were tasked with developing BUI Blueprints following the BUI Team Charge (Appendix C, 2013 RAP Update), which served as a work plan for BUI Team tasks. Each team was provided with a preliminary BUI Blueprint prepared by LimnoTech to serve as a starting point. The complete Blueprints developed by the BUI Teams were reviewed by the SAG. The BUI Teams considered SAG comments in finalizing the Blueprints. The work began in November 2011, and the majority of BUI Blueprints were completed by June 2012.

BUI Team leaders developed their own meeting schedules and communication methods. A website was created for the project to facilitate information and document sharing; the website also allowed online document editing. The team leaders convened bimonthly with LimnoTech staff to discuss issues arising from team efforts, processes, formats, and to make project decisions. Assistance was provided by LimnoTech staff at BUI Team meetings and in finalizing team documents, as requested by the team leaders.

Each BUI Blueprint consisted of the following major sections:

- **Summary Statement** - A summary that documented the BUI Team process, including important decisions regarding BUI delisting target interpretation and removal strategies.
- **Source/Stressor Model** - The source/stressor model that was developed based on existing research and monitoring in the AOC. It identified the primary sources of each system stressor and the relationships between the sources and the nine BUIs. The intent of the conceptual model was to assist in identifying applicable BUI indicators, remaining legacy sources, and management actions that affect multiple BUIs.

- **Measurable Indicators Specific to the BUI** –The set of BUI-specific indicators, including status indicators and other measurable indicators that were selected by the BUI Team to measure BUI condition. Indicators were selected to provide measurable objectives for the Final Delisting Targets developed in 2008.
- **Rationale for Listing** – The historical conditions of stressors and sources were described in this section based on information from the Stage I RAP; the rationale focused on the original basis for listing the BUI.
- **Statement of Current Conditions** – The current conditions of stressors and sources and measurable indicators were described based on the most recent available assessments of monitoring and research data, as reviewed and compiled by the BUI Team.
- **Information Gaps** – Information gaps on historical conditions, current conditions, stressors and sources, and measurable indicators were listed. Projects to address identified information gaps were included in the list of management actions.
- **Sequential List of Management Actions to Achieve BUI Removal** – A sequential list of management actions was developed by BUI Teams based on several sources. This included management actions defined to address any identified information gaps, priority R2R projects identified by stakeholder groups, and applicable projects already described in existing AOC plans (e.g., Lower St. Louis River Habitat Plan). Priorities were assigned by each BUI Team.
- **Permitting and Regulatory Process** – A listing of important regulatory process steps and permits potentially required to implement the management actions to achieve BUI removal.
- **Resources Needed** – A list of potential partners, landowners, and funding sources needed to implement identified management actions or R2R projects.
- **Anticipated Timeline for Achieving BUI Removal** – Anticipated timelines developed for removing the BUI, based on the best professional judgment of the BUI Team.
- **Costs** – Order of magnitude cost projections developed for implementing the identified management actions using the best professional judgment and information on-hand.
- **Ongoing Monitoring Needs** – Monitoring needs related to ongoing tracking of measurable indicators were described.
- **Future Issues or Concerns** – A “parking lot” section for upcoming issues identified by the BUI Team that potentially affect the BUI but were not part of the original rationale for listing.

The final BUI Blueprints, as developed and reviewed by stakeholder teams, are provided in Appendix D of the 2013 RAP Update. These blueprints represent the final product of each BUI stakeholder process and are therefore written with different voices and perspectives based on the varied history, knowledge, and makeup of a particular BUI Team. The blueprints served as the basis for the development of the Roadmap (Section 1).

Remediation to Restoration (R2R) Template

The SLRAOC Coordinators adopted a systematic approach for simultaneously addressing contaminated sediments and degraded aquatic and hydrologically connected habitat while incorporating desired environmental and economic outcomes. This approach has been termed the R2R process.

During the Framework project, the need to document the major steps in the R2R process was identified to more effectively communicate the process to AOC stakeholders and partners. As a result, the SLRAOC R2R Template was developed (LimnoTech, 2012; Appendix E). The document describes the major steps in the R2R process, as indicated in Figure 9.

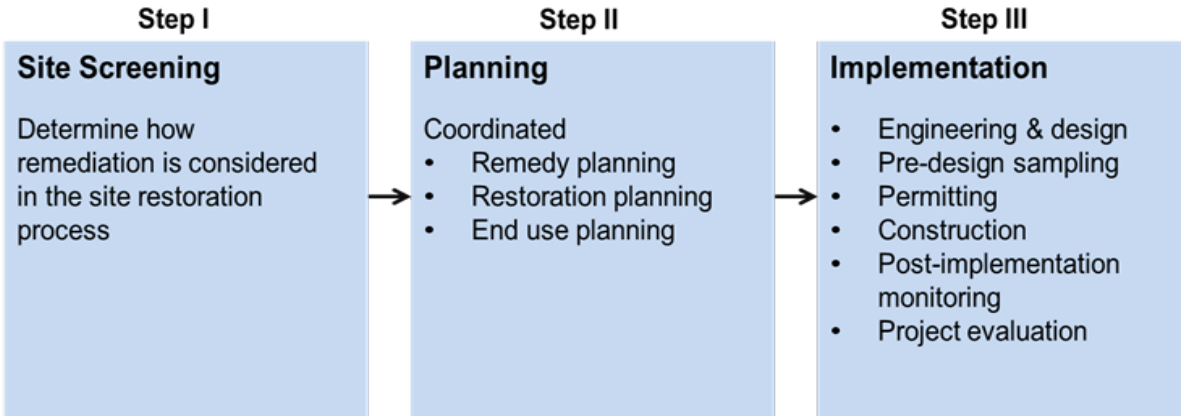


Figure 9: Major Components of the R2R Process

The R2R template is intended to create a common understanding throughout the decision-making and planning process for those elements that should be considered concurrently when undertaking restoration activities. A restoration plan for any R2R site guided by the template ensures that continuity and critical oversight are embedded with remediation recommendations, restoration objectives, and human use needs. The R2R process described in the template ensures compatibility among remediation targets, restoration objectives, and resulting human use services.

A draft of the R2R template was reviewed by a wide group of AOC partners, including MPCA, MNDNR, WDNR, FdL, HTAC, MLT, USFWS, US EPA GLNPO, USEPA-GLTED, USACE Detroit District, and SAG. Comments from reviewers were carefully considered by a subset of SLRAOC coordinators (MPCA and FdL) and the document was revised and finalized to reflect the body of comments received.

St. Louis River AOC Data System and Sediment Characterization

Prior to and during the development of the 2013 RAP Update, the SLRAOC sediment contaminant database (previously called the Phase IV database) underwent improvements to organize past, present and future data to serve the short- and long-term needs of the SLRAOC. This effort included importing the extensive sediment contaminant datasets for the SLRAOC from sampling efforts in 2010 and 2011 by USEPA and USACE. The data system project was initiated when partners and stakeholders asked for a user-friendly and accessible tool that contained the data that had been collected since 1992. This led to the conceptualization of the SLRAOC Data System that would serve as a tool to help assess the various data on a site-by-site basis, inform resource management decisions, and evaluate and track implementation progress to inform BUI removal strategies. Data System improvement efforts were overseen by the Sediment Data System Team (as described above; Figure 8).

The SLRAOC Data System was designed to accept new data, standardize elements within the data for statistical analysis, calculate benthic macroinvertebrate community metrics, calculate sediment contaminant measures for comparison to consensus-based sediment quality guidelines established for the SLRAOC, calculate additional sediment contaminant measures (i.e., sediment quality index or SeQI), assist in identifying data gaps, and act as a central data repository for the SLRAOC. The AOC Data System included sediment data (both physical and chemical), benthic macroinvertebrate and macrophyte data, and sediment toxicity data. It was envisioned that additional data types important to the SLRAOC delisting efforts could be incorporated into the database over time (e.g., bird surveys, water quality, and vegetation).

The sediment contaminant data contained in the SLRAOC Data System was used to conduct an AOC-wide sediment characterization to support development of the 2013 RAP Update. This effort, which is described further in Section 4, was overseen by the Sediment Technical Team (as described above; Figure 8) and is documented in the *St. Louis River Area of Concern Sediment Characterization: Final Report* (LimnoTech, 2013; Appendix F).

St. Louis River AOC Data System Integration with NOAA's GL DIVER

NOAA selected the SLRE as a habitat focus area under NOAA's Habitat Blueprint program. The goal of this program was to increase the effectiveness of NOAA's habitat conservation science and management efforts to meet multiple habitat objectives on a watershed scale. Since the selection, NOAA completed an implementation plan for the St. Louis River estuary to provide a forward-looking framework for NOAA to think and act strategically with partner organizations to address the growing challenge of coastal habitat loss and degradation (NOAA, 2016). NOAA's Office of Response and Restoration was selected to act as the data repository for Great Lakes environmental data. To achieve this, NOAA developed the GLDIVER system, a web-based data management and query application built upon NOAA's Query Manager data standard and query tools.

The SLRAOC was the first AOC to work with NOAA to fully migrate its existing sediment and benthos databases into GLDIVER. Staff from NOAA, MPCA, WDNR, and their respective contractors migrated the existing data from the SLRAOC database into GLDIVER. From January 2015 to January 2018, the three agencies established processes and a communication network for data preparation and data system input to transition the data storage from the SLRAOC Data System to GLDIVER.

The data team continues to meet monthly to address ongoing GLDIVER needs, such as data input and coding issues. Additionally, the data team is responsible for entering other types of data into GLDIVER, such as: histopathology (e.g., tumors, lesions), general population information (e.g., aquatic vegetation, fish, birds, mammals, benthic invertebrate), and bioassay data.

Section 5: BUI Technical Teams

BUI Technical Teams provide expertise and recommendations to SLRAOC staff and leaders on BUI goals, removal strategies, and the scientific interpretation of the BUI status. BUI Technical Teams were originally formed during the RAP 2013 process. Since then, the team memberships have changed depending on technical expertise needed and member availability. The BUI Leaders manage these teams and convene them as needed for their feedback on particular BUI management actions. Core team members for active teams are listed here; however, these teams are not exclusive and other experts may be invited as needed.

As BUIs are removed, the corresponding technical team list will be removed from this section, however past technical team lists may be found in previous versions of the RAP or the BUI removal package.

BUI 1. Fish Consumption Advisories: Barb Huberty (MPCA, Lead), Matt Steiger (WDNR), EPA Technical Review Lead: Brian Lenell, USEPA

Donalea Dinsmore, Wisconsin Department of Natural Resources
Joel Hoffman, US Environmental Protection Agency
Angela Preimesberger, Minnesota Department of Health
Sarah Janssen, US Geological Survey
Nate Johnson, University of Minnesota
Jennifer Brentrup, Minnesota Pollution Control Agency
Sarah Acquah, Minnesota Pollution Control Agency
Nancy Schuldt, Fond du Lac Band
Isaiah Tolo, Minnesota Department of Natural Resources

BUI 4. Degraded Benthos: Dan Breneman (MPCA, lead) & Matt Steiger (WDNR), EPA Technical Review Lead: Matt Pawlowski, USEPA

Joel Hoffman, US Environmental Protection Agency
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BUI 5. Restrictions on Dredging: Matt Steiger (WDNR) & LaRae Lehto (MPCA)
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BUI 7. Beach Closings & Body Contact Restrictions: Matt Steiger (WDNR, lead) & Barb Huberty (MPCA)
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BUI 9. Loss of Fish and Wildlife Habitat: Rick Gitar (FdL), Melissa Sjolund (MNDNR, lead) and Matt Steiger (WDNR)
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Deserae Hendrickson and Melissa Koelsch, Minnesota Department of Natural Resources
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Section 6: References

Angradi Ted R., Will M. Bartsch, Anett S. Trebitz, Valerie J. Brady, and Jonathon J. Launspach. 2017. A depth-adjusted ambient distribution approach for setting numeric removal targets for a Great Lakes Area of Concern beneficial use impairment: degraded benthos. *Journal of Great Lakes Research.* 43:108-120.

Angradi T, Bolgrien D. 2014. A Benthos-based Multimetric Index for Use in the St. Louis River Area of Concern-Draft. U.S. Environmental Protection Agency Mid-Continent Ecology Division, Duluth, MN. August 27, 2014.

Bellinger, *et al*. 2012. A sampling design for monitoring the status of water quality and biological conditions and assessing trends toward AOC delisting targets in the St. Louis River Estuary.

Blazer VS, Hoffman JC, Walsh HL, Braham RP, Hahn C, Collins P, Jorgenson Z, Ledder T. 2014. Health of white sucker within the St Louis River Area of Concern associated with habitat usage as assessed using stable isotopes. Ecotoxicology 23:236-251.

Biohabitats. 2007. Hog Island and Newton Creek Ecological Restoration Master Plan. https://archive.epa.gov/ecopage/web/pdf/hog-island-newton-creek-ecological-restoration-master-plan-200709-136pp.pdf

Doering, Jon A. 2021. Assessing whether maternal transfer of legacy dioxin-like chemicals is limited lake sturgeon natural recruitment in the St. Louis River Area of Concern. Natural Research Council, Duluth, MN.

Fritzen, John. 1978. The History of Fond du Lac and Jay Cooke Park. St. Louis County Historical Society, Stewart-Taylor Co., Duluth.

Hart, Irving H. 1927. The Old Savanna Portage, Minnesota History Magazine, vol. 8, no. 2, 1927, pp. 117-139. Minnesota Historical Society.

Hollenhorst T, Peterson D, Bolgrien D, Angradi T, Pearson M, Starry M. 2013. One-Hundred and Fifty Years of Change Comparing Pre-Development and Post Development Wetland Distribution in the St. Louis River Estuary. Proceedings of the St. Louis River Estuary 2013 Summit. February 26-27, 2013 Yellowjacket Union, University of Wisconsin – Superior.

Janssen, Sarah, et al. Examining historical mercury sources in the Saint Louis River estuary: How legacy contamination influences biological mercury levels in Great Lakes coastal regions. Science of the Total Environment. Volume 779, July 2021, 146284.

Janssen, S.E., Hoffman, J.C., Krabbenhoft, D.P., Walters, D., Eagles-Smith, C.A., and Mills, M.A., 2021, Assessment of Mercury Cycling in the St Louis River, MN using Mercury and Food Web (Carbon and Nitrogen) Stable Isotopes: U.S. Geological Survey data release, https://doi.org/10.5066/P9EOTIR3.

Janssen, S. E., Tate, M. T., Hoffman, J. C., Rumrill, C. T., Eagles-Smith, C. A., Walters, D. M., Kotalik, C. J., Peterson, G., Beaubien, G. B., and Mills, M. A., 2023, Assessment of Mercury and Mercury Stable Isotopes in Sediments and Biota from Reservoirs and Remedial Zones within the Saint Louis River, Minnesota: U.S. Geological Survey data release, https://doi.org/10.5066/P96HIBA4.

LimnoTech. 2012. St. Louis River Area of Concern Remediation to Restoration (R2R) Template. Prepared for Minnesota Pollution Control Agency.

LimnoTech. 2013. St. Louis River Area of Concern Sediment Characterization: Final Report.

Luukkonen, Larry 2007 Between the Waters, Tracing the Northwest Trail from Lake Superior to the Mississippi, Bang Printing, Brainerd.

Marvin, C, Painter S, Williams D, Richardson V, Rossman R, Van Hoof P. 2004. Spatial and temporal trends in surface water and sediment contamination in the Laurentian Great Lakes. Environ Poll 129:131-144.

Matteson, S. W., (1988). Wisconsin Common Tern Recovery Plan. Wisconsin Endangered Resources Report 41. Wisconsin Department of Natural Resources, June 1988.

Minnesota Department of Natural Resources (MNDNR). 2012. Lake Management Plan. St. Louis River Estuary (69-1291-02).

Minnesota Pollution Control Agency and Wisconsin Department of Natural Resources (MPCA and WDNR). 1992. The St. Louis River System Remedial Action Plan Stage One. https://dnr.wi.gov/topic/GreatLakes/documents/SLRRAP1992.pdf

Minnesota Pollution Control Agency and Wisconsin Department of Natural Resources (MPCA and WDNR). 1995. The St. Louis River System Remedial Action Plan Progress Report. https://dnr.wi.gov/topic/GreatLakes/documents/SLRRAPProgressReport.pdf

Minnesota Pollution Control Agency and Wisconsin Department of Natural Resources (MPCA and WDNR). 2001. St. Louis River Remedial Action Plan Assessment.

Minnesota Pollution Control Agency and Wisconsin Department of Natural Resources (MPCA and WDNR). 2008. Final Delisting Targets.
Minnesota Pollution Control Agency and Wisconsin Department of Natural Resources (MPCA and WDNR). 2011. St. Louis River Area of Concern Complete Delisting Targets.

Minnesota Pollution Control Agency and Wisconsin Department of Natural Resources (MPCA and WDNR). 2013. St. Louis River Area of Concern Implementation Framework: Roadmap to Delisting (Remedial Action Plan Update), LimnoTech. St. Paul, Minnesota. July 15, 2013. http://www.pca.state.mn.us/index.php/view-document.html?gid=19677

Minnesota Pollution Control Agency and Wisconsin Department of Natural Resources (MPCA and WDNR). 2014. St. Louis River Area of Concern 2014 Remedial Action Plan.

Minnesota Power, Environmental and Land Management Department. 2018. Water Quality and Fish Tissue Report for the St. Louis River Project System, 2010-2015.

National Oceanic Atmospheric Administration (NOAA). 2016. Implementation Plan for the St. Louis River Estuary Habitat Focus Area. https://www.habitatblueprint.noaa.gov/wp-content/uploads/2016/04/FINAL-Implementation-Plan-for-the-St-Louis-River-Estuary-HFA_ImpPlan.pdf

Natural Resources Conservation Service (NRCS). 1998. Erosion and Sedimentation in the Nemadji River Basin: Nemadji River Basin Project Final Report.

Nelson, A. 2015 Lower Nemadji River – Douglas County 2015 Fish Community Survey Summary. Wisconsin Department of Natural Resources.

Roesler, C. 2014. Nemadji River and Tributaries Water Quality Assessment. Wisconsin Department of Natural Resources.

Roesler, C. 2015. Lower Nemadji River Water Quality and Macroinvertebrate Community Assessment. Wisconsin Department of Natural Resources.

St. Louis River Alliance (SLRA). 2011. Lower St. Louis River Habitat Plan, Appendix 9: Strategies Implementation Planning Worksheets.

St. Louis River Citizens Advisory Committee (SLRCAC). 2002. Lower St. Louis River Habitat Plan. https://dnr.wi.gov/topic/GreatLakes/documents/SLRHabitatPlan.pdf

USEPA. 2015 A Benthos-based Multimetric Index for use in the St. Louis River Area of Concern, Draft Progress Report.

USEPA. 2016. Defining benthos reference conditions for a Great Lakes Area of Concern.

Wisconsin Department of Natural Resources Office of the Great Lakes (WDNR). 2011. Stage 2 Remedial Action Plan Update for the St. Louis River Area of Concern. https://dnr.wi.gov/topic/GreatLakes/documents/Stage2RAPSLR.pdf

Wisconsin Department of Natural Resources Office of the Great Lakes (WDNR). 2012. Remedial Action Plan Update for the St. Louis River Area of Concern.