

# **STAGE 2 REMEDIAL ACTION PLAN UPDATE**

**for the**

## **ST. LOUIS RIVER AREA OF CONCERN**

**December 2011**



**Wisconsin Department of Natural Resources  
Office of the Great Lakes**

**Stage 2 Remedial Action Plan Update  
for the  
St. Louis River Area of Concern**

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Disclaimer

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

The actions identified in this Stage 2 RAP Update do not constitute a list of preapproved projects, nor are they a list of projects simply related to BUIs or generally to improve the environment. Actions identified in this document are directly related to removing a BUI and are needed to delist the AOC.

## **EXECUTIVE SUMMARY**

The St. Louis River Area of Concern (AOC) is a bi-state AOC shared by Minnesota and Wisconsin. Staff from each state's natural resource agencies (WDNR, MPCA, and MDNR), along with representatives of the Fond du Lac Tribe and other partners, are working together to identify the actions needed to address the beneficial use impairments.

Minnesota obtained FY11 Great Lakes Restoration Initiative funding to support the development of an "Implementation Framework for Delisting the St. Louis River Area of Concern." The deliverable for the Implementation Framework project is a complete Stage 2 Remedial Action Plan (RAP) that is supported by stakeholders. The Implementation Framework project is underway and involves the formation of a set of workgroups that are tasked with exploring measurable endpoints and actions for the beneficial use impairments. The Implementation Framework project has provided a helpful means of coordinating the efforts of AOC partners.

This Stage 2 RAP Update is an interim document that has been produced by Wisconsin DNR, with input from AOC partners, to assist in providing direction in the short-term for overall statewide AOC coordination in Wisconsin. The final Stage 2 RAP that results from the Implementation Framework project is expected to be completed in 2013.

Even though a final bi-state Stage 2 RAP is not yet available, AOC partners agree that remediation of contaminated sediments continues to be a high priority for delisting the AOC. Updating and maintaining the existing sediment database will be necessary to prioritize and design projects. Wisconsin and Minnesota are working jointly on the database issue. While a number of projects within contaminated slips may require remediation, other sites may require habitat restoration (aquatic habitat shoreline and bathymetry, marine debris removal), and other sites will be chosen for remediation to restoration.

The focus areas for Wisconsin's St. Louis River AOC Coordinator in 2012 are expected to be as follows:

- Participating in appropriate Implementation Framework workgroups;
- Participating in the sediment database workgroup to produce a coordinated bi-state ability within the AOC to analyze and interpret data;
- Reviewing new information and assessing the implications of recent data for the AOC; and,
- Participating in site-specific project planning within the AOC.

Stakeholder engagement has been and will continue to be a priority for the AOC. The St. Louis River Alliance is an important partner for engaging the community in learning about and advocating for improvements to the river.

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**List of Acronyms**

AOC	Area of Concern
BUI	Beneficial use impairment
GLRI	Great Lakes Restoration Initiative
MDNR	Minnesota Department of Natural Resources
MPCA	Minnesota Pollution Control Agency
PAH	Polycyclic aromatic hydrocarbon
PCB	Polychlorinated biphenyl
RAP	Remedial Action Plan
SLRA	St. Louis River Alliance
SLRIDT	St. Louis River Interlake Duluth Tar (Superfund Site)
TMDL	Total Maximum Daily Load
USGS	United States Geological Survey
WDNR	Wisconsin Department of Natural Resources
WLSSD	Western Lake Superior Sanitary District

## **DEFINITIONS**

### **Area of Concern (AOC)**

Defined by Annex 2 of the 1987 Protocol to the U.S.-Canada Great Lakes Water Quality Agreement as “geographic areas that fail to meet the general or specific objectives of the Agreement where such failure has caused or is likely to cause impairment of beneficial use of the area’s ability to support aquatic life.” These areas are the “most contaminated” areas of the Great Lakes, and the goal of the AOC program is to bring these areas to a point at which they are not environmentally degraded more than other comparable areas of the Great Lakes. When that point has been reached, the AOC can be removed from the list of AOCs in the Annex, or “delisted.”

### **Beneficial Use Impairment (BUI)**

A "beneficial use" is any way that a water body can improve the quality of life for humans or for fish 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 provided a list of 14 possible beneficial use impairments in the 1987 Great Lakes Water Quality Agreement amendment.

### **Delisting Target**

Specific goals and objectives established for beneficial use impairments, with measurable indicators to track progress and determine when delisting can occur. Targets should be locally derived.

### ***Escherichia coli (E. coli)***

A bacterium commonly found in natural bodies of water that serves as an indicator of the possible presence of other health risks in the water, such as bacteria, viruses, and other organisms.

### **Goal**

Goals are broad ideas that may take a long time to achieve. They usually don’t change significantly over the life of a project. An example goal statement is, “*Nesting populations of a diverse array of wetland-dependent and riparian-associated birds are consistently present within the AOC.*” The delisting targets for the impairments may also be considered the goal statements (in some cases they may be objectives).

### **Objective**

Objectives are the detailed activities that are needed in order to meet goals. Objectives are normally accomplished in less time than goals. They are important because they provide a means of measuring progress toward plan implementation. Objectives should be SMART: Specific, Measurable, Achievable, Realistic, Time-Constrained.

### **Project**

As defined for this document, a project is a specific activity that has been defined with enough detail to understand who will do the work, how it will be done, and where it will be done. The end result of the activity should be visible and concrete. One or more projects may be defined to meet the goals and objectives for the impairments, if the AOC is not yet eligible for delisting. With this definition, “Coordinating with partners to make sure data is consistently collected and used” would not be a project. However, “XY Agency will Host a data ‘slam’ and write a set of standards for data collection and analysis for the Example AOC” would be a project.

**Remedial Action Plan (RAP)**

According to the 1987 Protocol to the U.S.-Canada Great Lakes Water Quality Agreement, 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 to be submitted to the International Joint Commission at three stages:

- Stage 1: Problem definition
- Stage 2: When remedial and regulatory measures are selected
- Stage 3: When monitoring indicates that identified beneficial uses have been restored

**Remedial Action Plan (RAP) Update**

A RAP Update fulfills the requirement for biennial progress reporting described in Annex 2 of the 1987 Protocol to the U.S.-Canada Great Lakes Water Quality Agreement. Some RAP updates are more comprehensive than others, and contain some of the elements of an AOC delisting strategy (e.g., remedial measures). Most RAP Updates for Wisconsin's AOCs have not included project-specific information regarding who will do each project and how much each will cost.

**St. Louis River Alliance (SLRA)**

St. Louis River Alliance, originating as the St. Louis River Citizen Advisory Committee, incorporating as a 5013c in 1996, and finally becoming the Alliance in 2009.

**Total Maximum Daily Load (TMDL)**

A TMDL is the amount of a pollutant a waterbody can receive and still meet water quality standards. It can be thought of as a pollution "budget" for a water body or watershed that establishes the pollutant reduction needed from each pollutant source to meet water quality goals.

**PURPOSE STATEMENT**

The purpose of this document is to serve as an update to the 1995 St. Louis River Area of Concern (AOC) Remedial Action Plan Progress Report. A final Stage 2 Remedial Action Plan is being developed by AOC partners through an Implementation Framework project that will be completed in 2013. The Implementation Framework project is supported by Great Lakes Restoration Initiative (GLRI) funding.

This Stage 2 Remedial Action Plan Update is an interim document that has been produced by the Wisconsin Department of Natural Resources, with input from AOC partners, to assist in providing direction in the short-term for overall statewide AOC coordination in Wisconsin. It is intended to be a concise summary of beneficial use impairment status and specific actions that will be important for reaching the delisting targets. "Actions" may include on-the-ground restoration projects, monitoring and assessment projects, and stakeholder engagement processes.



## **INTRODUCTION**

Areas of Concern (AOCs) are severely degraded geographic areas within the Great Lakes. The areas – 43 within the Great Lakes region – were designated as AOCs primarily due to contamination of river and harbor sediments by toxic pollutants (sometimes referred to as “legacy” pollutants due to the historical industrial development that often was the source of the pollution). Cleaning up these severely degraded areas is a first step toward restoring the chemical, physical, and biological integrity of the lakes as required by the Great Lakes Water Quality Agreement. When the areas have been cleaned up to the point where they are not more degraded than other, comparable non-AOC areas, they are “delisted” as AOCs; they are then considered to be part of the Lakewide Management Plan (LaMP) program, a “whole lake” program that is also set forth in the Agreement. The Agreement provides the framework for the U.S. and Canada to work together to restore the chemical, physical, and biological integrity of the lakes.

The St. Louis River AOC is one of five Areas of Concern in Wisconsin (Figure 1). It includes the lower St. Louis River, the Nemadji River watershed and a portion of the southwest tip of Lake Superior. The St. Louis River begins at its headwaters in northeastern Minnesota, near Seven Bear Lake. The river flows south and east, and winds through clays and glacial deposits for nearly 100 miles, also running along the northern boundary of the Fond du Lac Reservation. Near the City of Thomson the channel narrows, and the river flows through a rocky rapid-filled gorge before curving to the northeast and widening into an estuary. The river channel in this area marks the Minnesota/Wisconsin state border and separates the cities of Duluth, Minnesota, and Superior, Wisconsin. From below the south western area of Duluth to its outlet at Lake Superior, the Lower St. Louis River is a 12,000-acre freshwater estuary. The lower estuary, protected from the waves of Lake Superior by a baymouth sand bar, was dredged to create the largest industrial port on the Great Lakes. The Nemadji River begins in Pine County, Minnesota, and runs 65 miles to its mouth at the St. Louis River in Superior Bay.

The St. Louis River is the second largest tributary to Lake Superior. The watershed consists of 3,634 square miles in northeastern Minnesota and 263 square miles in northwestern Wisconsin. The morphology of the St. Louis River drainage basin could be characterized as diverse. From its source at Seven Beaver Lake, the river flows in a southwesterly direction 179 miles to the estuary near Lake Superior. As the river approaches Duluth and Superior, it takes on the characteristics of a freshwater estuary. This approximately 12,000-acre estuary is characterized by numerous backwater areas and bays, as well as islands. Parts of the upper estuary are almost wilderness-like. The lower estuary is flanked by a number of industrial users interspersed with vacant or undeveloped tracts (RAP, 1992).

The history of the development of the Duluth-Superior area is well documented in the early Remedial Action Plan (RAP) documents. The shallow, natural harbor was dredged to accommodate shipping, the Duluth entrance was constructed in 1871 to provide an alternative entrance to the original Superior entrance. Logging changed the area as well, it is estimated that there were between 50 and 100 dams along the St. Louis River during the 1800s to serve the logging industry. Iron, ship building, and the grain trade were major industries in the 1880s. Other industries included brewing, railway cars, gas light fueled by acetylene, ice boxes and refrigerators, flax, shoes, cigars and cigarettes, and coke from Lake Erie coal. Superior became a major petroleum refining site. Duluth-Superior is now a regional hub for a variety of transportation modes; highway, rail, pipeline, air and waterborne shipping.

The AOC was listed due to beneficial use impairments (BUIs) related to historic habitat degradation and sediment contamination as well as water quality issues related to excess sediment and nutrient inputs. These sources of impairment led to designation of nine (of the possible fourteen) BUIs. St. Louis River AOC impairments and sources are summarized in Table 1. Impairment status is summarized in Table 2.

The majority of the BUIs for the St. Louis River AOC are tied to historic habitat loss from the extensive filling of wetlands and dredging of shallow aquatic habitat, and to releases of harmful chemicals that contaminated the sediments and water in the estuary. Since 1861, nearly 3,000 acres of wetlands have been filled, and 4,000 acres have been dredged or deepened for navigation (Lower St. Louis River Habitat Plan, p. 15). There is no clear documentation on how the various constituent units of the Duluth-Superior area handled their solid and liquid wastes prior to the 1970s. Evidently, from analyses of river and harbor sediments, water samples, and soils, waste management was not a major concern. It has been established that a number of firms discharged directly and indirectly into the river or bay. The AOC also contains several sites that have been known historically to contain hazardous wastes and chemical contaminants.

Several of these contaminated sites are being addressed by regulatory and resource management programs for the states of Wisconsin and Minnesota, or federal programs. Three contaminated sites in the AOC have been or are being addressed by these programs, including the former site of Koppers Company Superior Plant and Hog Island Inlet/Newton Creek on the Wisconsin side, and the Superfund site of St. Louis River Interlake Duluth Tar (SLRIDT) and U.S. Steel Duluth Works on the Minnesota side.

Major improvements in water quality in the St. Louis River occurred in the early 1980s after improvements in wastewater treatment. More recent projects add to that improvement. The Cities of Superior and Duluth have done substantial work on stormwater overflow control. Sediment quality assessments are being carried out by both Wisconsin and Minnesota, with joint efforts at data management and database maintenance. Wisconsin has begun a ballast water program and several counties have aquatic invasive species coordinators to work on public education for prevention of the spread of aquatic invasive species. Both States manage beach monitoring programs. The Wisconsin Department of Natural Resources (WDNR), Minnesota Department of Natural Resources (MDNR), and the Fond du Lac Tribal Water Resources program recently cooperated under a U.S. Fish and Wildlife Service and U.S. Geological Survey (USGS) project to collect 200 white suckers for analysis for neoplasms. The St. Louis River Alliance (SLRA) has begun gathering current observational information from River users for the Aesthetics BUI. Habitat protection measures taken include the State of Wisconsin's creation of the St. Louis River Streambank Protection Area in 1995; the purchase of Clough Island in 2010 as a State Conservation Area; and Douglas County's restoration of Hog Island project. MDNR and the Minnesota Pollution Control Agency (MPCA) are working on two remediation to restoration (R2R) projects with input from the WDNR.

Today, priorities for delisting the AOC include continued remediation of contaminated sediments. Update and maintenance of the existing sediment database will be necessary to prioritize and design projects. Wisconsin and Minnesota are working jointly on the database issue. While a number of projects within contaminated slips may require remediation, other sites may require habitat restoration (aquatic habitat shoreline and bathymetry, marine debris removal), and other sites will be chosen for remediation to restoration.

### **Stakeholder Engagement**

The two States, Wisconsin and Minnesota, which share this AOC have a long history of working together and with other stakeholders in the creation of the RAP documents and the 2008 Targets. In 2011 and 2012, WDNR, MDNR, MPCA and Fond du Lac Water Resources staff are cooperating within the Minnesota Implementation Framework grant project to gather technical expertise and public participation for the creation of BUI Blueprints. These blueprints will create measureable indicators and recommend actions and milestones leading to the removal of each BUI. These efforts are facilitated by the SLRA, which has a mission to work with others to protect, restore and enhance the St. Louis River. The

environmental firm LimnoTech has been contracted through the MPCA grant to assist in this effort. The Table of Contents for the Stage 2 RAP that will result from the Implementation Framework project is attached as Appendix A.

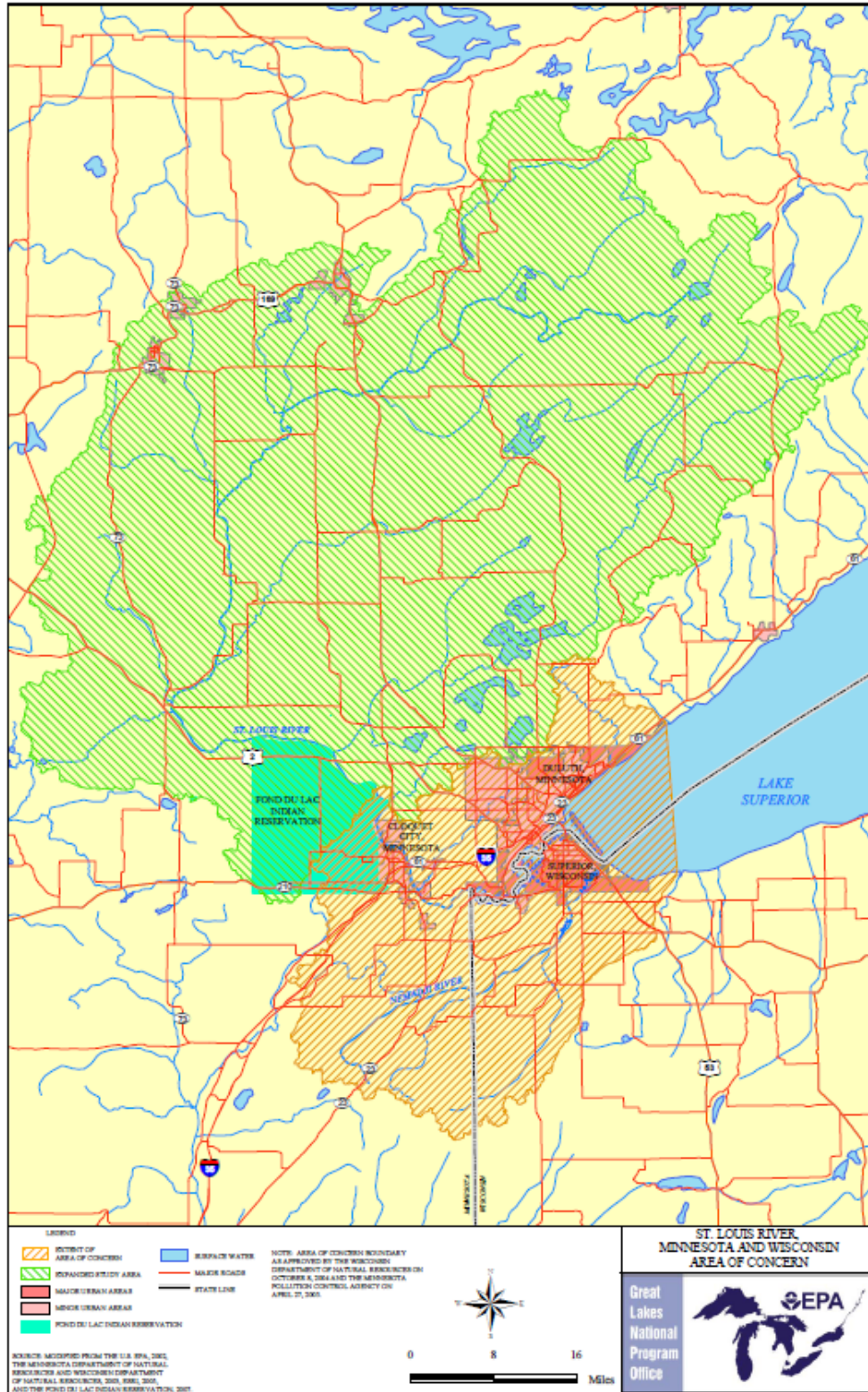


Figure 1. The boundaries of the St. Louis River Area of Concern

**Table 1.** St. Louis River Area of Concern Beneficial Use Impairments Summary

Impaired Beneficial Use	Physical Habitat alteration	Legacy Sediment Contamination	Nonpoint Source Pollution	Point Source Pollution	
Fish Consumption Advisories		X	X	X	
Degraded Fish and Wildlife Populations	X	X			
Fish Tumors and Other Deformities		X		X	
Degradation of Benthos	X	X	X	X	
Restrictions on Dredging		X			
Excessive Loading of Nutrients and Sediments			X	X	
Beach closings/recreational restrictions		X	X	X	
Degradation of aesthetics		X	X	X	
Loss of Fish and Wildlife Habitat	X	X			

**Table 2.** St. Louis River Area of Concern Beneficial Use Impairment Status Summary (refer to Appendix B for more detail)

<b>Beneficial Use Impairment</b>	<b>Beneficial Use Remains Impaired</b>	<b>Summary of Status and Next Steps</b>
Fish Consumption Advisories	Yes	WI and MN regularly sample fish tissue and issue advisories; Compile current and historic fish tissue data and compare to surrounding areas.
Degraded Fish and Wildlife Populations	Yes	Fish populations have seen improvements including the sturgeon. There is no consolidated data on wildlife populations, therefore a next step is to compile and review current status data.
Fish Tumors and Deformities	Yes	200 white suckers sampled in Spring 2011, awaiting data (expected to be available winter 2011); analyze and interpret data.
Degradation of Benthos	Yes	Several contaminated sites have been remediated, habitat restoration on-going. Large scale sediment assessments have been completed on the WI and MN sides of the River. Remaining contaminated sediments must be addressed prior to removing this BUI. The next step is to define reference conditions for aquatic habitats in the St. Louis River.
Restrictions on Dredging	Yes	Several contaminated sites have been remediated; a major portion of the estuary has been sampled for contaminants. In 2007, Erie Pier was converted to a reuse and recycling dredged materials facility. The next steps are to update the sediment database with recent sediment quality assessments; review data; and, collect existing information from sediment samplings during dredging operations and materials management.
Excessive Loading of Nutrients and Sediments	Yes	Major wastewater and stormwater improvements by the Western Lake Superior Sanitary District and the Cities of Superior and Duluth; higher nutrients and excess erosion remain a problem. The next action needed is to compile existing water quality data and compare it to surrounding non-AOCs.
Beach Closings and Body Contact	Yes	Several contaminated sites have been remediated and now allow recreation; <i>E.coli</i> causing beach closings, NRRI initial DNA fingerprinting study indicates major source is waterfowl. The next action needed is to compile current status data for <i>E.coli</i> and for contaminated sediment sites in relation to recreational areas.
Degradation of Aesthetics	Yes	Data on current status is needed. In 2011, the SLRA began distributing surveys to recreational river users for their observations. This preliminary information will be used within the Implementation Framework process to develop a systematic approach to collecting data for assessing BUI status.
Loss of Fish and Wildlife Habitat	Yes	253 acres habitat restored in last several years (Hog Island, Tallas Island), several on-going projects are in progress (Grassy Point, Radio Tower Bay, Knowlton Creek) The next actions needed are to complete data validation and analyses and update the sediment database. The use of the updated sediment database will allow resource managers to determine which sites are in need of remediation alone, which sites are ready for restoration and which sites are candidates for remediation to restoration.

**BENEFICIAL USE IMPAIRMENT UPDATES**

The following pages summarize the current status of each Beneficial Use Impairment using the format below. An explanation of each section is provided after the heading.

**2008 Target and Status**

<b>Beneficial Use Impairment Name</b>	<b>Status</b>
The 2008 St. Louis River AOC delisting targets (WDNR, 2008) are listed here as separate target components on each row to clearly show status of each part of the target.	May be: - "Complete" - "Partly Complete" - "Partly Implemented" - "Not Complete" - "Unknown"

**Note:** may list one or more of the following:

- potential concerns about the target, particularly if the target is not specific enough to define a measurable endpoint for the BUI
- if revisions are anticipated and how such changes might be approached including responsible party and timeline
- if the 2008 target was modified and details of any changes

**Rationale for Listing**

The section briefly summarizes the reason the BUI was known or suspected at the time of listing. If sources contributing to the impairment have been identified since listing, those are included in this section as well.

**Summary of key remedial actions since the last RAP and current status**

"Key remedial actions" are those that directly contributed to the current status of the BUI. A table may be included as an appendix to capture a detailed list of past projects. The narrative here explains and leads to the "Next action needed."

**Next action(s) needed**

This section is a narrative listing of assessments, on-the-ground projects, and stakeholder engagement processes that are clearly delineated and directly address the specific BUI. Plans for verifying achievement of delisting targets are listed here if known.

**Issues (challenges, risks) affecting progress on this BUI**

This section lists project contingencies (i.e., one thing has to happen before another can occur), funding obstacles and any other considerations that could affect the timeline for delisting.

FISH CONSUMPTION ADVISORIES**2008 Target and Status**

Fish Consumption Advisories	Status
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.	Not Complete

**Rationale for Listing**

Fish samples taken from the St. Louis River and Lake Superior exceed standards established by Minnesota and Wisconsin for the unrestricted consumption of sport fish. Each of the two states issues consumption advisories for various population groups, based on fish species and size classes. Advisories are collectively issued for the presence of mercury and polychlorinated biphenyls (PCBs). Fish tissue residues of mercury and PCBs also exceed the 0.5 mg/kg and 0.1 mg/kg standards established in the 1978 Great Lakes Water Quality Agreement for the protection of aquatic life and fish consuming birds.

**Summary of key remedial actions since the last RAP and current status**

Wisconsin and Minnesota periodically collect fish tissue samples for use in updated fish consumption advisories. The data is shared but each state's Department of Health publishes the actual advisory. Both states published updated advisories in 2011.

According to data available from Minnesota's statewide Total Maximum Daily Load (TMDL; approved by the U.S. Environmental Protection Agency in 2007), the sources of mercury are primarily atmospheric.

**Next action(s) needed**

The actions that are needed include the following:

- Compilation of current and historic fish tissue data, and comparison to surrounding areas;
- Determination of the extent of atmospheric deposition as a contributor;
- Analysis of fish tissue data for mercury and PCBs based on the methods recommended by the Implementation Team; and,
- Remediation of remaining contaminated sediments.

**Issues (challenges, risks) affecting progress on this BUI**

Contaminated sediments, air deposition and wastewater discharges all potentially add to mercury and PCB concentrations in fish tissue. There are projects underway by WDNR and MPCA to broadly assess contaminants in sediment in the AOC. Updating and managing the sediment database for remediation needs and prioritization of site work is critical for developing effective BUI removal strategies.



**DEGRADED FISH AND WILDLIFE POPULATIONS**

**2008 Target and Status**

<b>Degraded Fish and Wildlife Populations</b>	<b>Status</b>
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.	Not complete

**Rationale for Listing**

1. Fish Populations – Since 1979, fish populations have been recovering because of improved water quality that resulted from more complete wastewater treatment after formation of the Western Lake Superior Sanitary District (WLSSD), construction of the WLSSD wastewater treatment plant, and improvement of City of Superior wastewater treatment. However, fish populations are still adversely affected by alterations and loss of habitat, proliferation of exotic species, and possibly by exposure to toxic substances (for further detail, refer to Stage I Report, pp. IV-18-26).
2. Wildlife Populations – Little population data is available for wildlife with the exception of colonial nesting birds, herons, and gulls. Populations of the common tern and the piping plover (threatened and endangered species) have declined, the heron population has been declining, and gulls and mallards have experienced die-offs in the recent past. These problems are due to alterations or loss of habitat and possibly toxic contamination (for further detail, refer to Stage I Report, pp. IV-23-28).

**Summary of key remedial actions since the last RAP and current status**

Considerable improvement in fish populations has occurred since the 1980s. In 2011, sturgeon young-of-year were again documented in the St. Louis River after decades of stocking sturgeon. Habitat projects to encourage piping plover are on-going.

**Next action(s) needed**

The actions that are needed include compiling and reviewing current status data. This will lead to the identification of data gaps as part of the Implementation Framework project.

**Issues (challenges, risks) affecting progress on this BUI**

Little is known about wildlife populations, aside from fish and birds, specific to the AOC, historically and currently. Habitat restoration target takes into account the working harbor in recognition that all habitat can not be restored to pre-European status.

**FISH TUMORS AND DEFORMITIES**

**2008 Target and Status**

<b>Fish Tumors and Deformities</b>	<b>Status</b>
Incidence rates of contaminant-related internal and external tumors and deformities in resident benthic fish species, including neoplastic or preneoplastic liver tumors, do not exceed incidence rates from unimpaired areas elsewhere in the Great Lakes basin.	Not complete – data gathered Spring 2011

**Rationale for Listing**

Observations suggested that fish tumors and deformities represented an impaired use in the St. Louis River estuary. However, at listing, there were no studies that documented the incidence rates of tumors in fish. Additional work has been needed to fully determine the incidence of fish tumors and deformities in the AOC.

**Summary of key remedial actions since the last RAP and current status**

In spring of 2011, staff from WDNR, MDNR, and the Fond du Lac Tribal Water Resources Program collected 200 white suckers in conjunction with the US Fish and Wildlife Service. The white suckers are being analyzed by fish tumor experts at the USGS for skin and liver histopathology. St. Louis River tumor incidence rates will be compared to incidence rates for white suckers found in Lake Superior reference sites. The work plan for this project is attached as Appendix C.

**Next action(s) needed**

The next actions that are needed are data analyses and interpretation (winter 2011). Decisions on any further next steps will be made once these actions have been completed.

**Issues (challenges, risks) affecting progress on this BUI**

Staff capacity is needed to develop a bi-state process for managing and interpreting data. A large quantity of data is available and data interpretation will take some time. The most recent data sets are not finalized and are not yet available. Remediation of contaminated sediment sites, especially polycyclic aromatic hydrocarbon (PAH) contaminated sites, as research has made a link between skin and liver neoplasms and PAHs.

**DEGRADATION OF BENTHOS**

**2008 Target and Status**

<b>Degradation of Benthos</b>	<b>Status</b>
The benthic community in historically degraded areas (e.g., chemically, biologically, or physically degraded areas) of the 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.	Not complete

**Rationale for Listing**

Reduced benthic invertebrate density, diversity, and species richness have been reported in areas of the estuary that are subject to physical disturbance or in close proximity to known contaminated sites. In some studied areas, the benthic community is dominated by oligochaetes and chironomids, which are relatively tolerant of organic pollution (Stage I Report, pp. IV-29 to IV-35). In evaluating sediment quality throughout the AOC, WDNR and MPCA have used the triad approach that combines the sediment chemistry, toxicity tests and *in situ* benthic diversity to give a composite picture of the overall sediment "health". The triad approach has demonstrated that the benthic community has been degraded, as evidenced by the lack of species diversity and preponderance of pollutant-tolerant species.

**Summary of remedial actions since the last RAP and current status**

This BUI is dependent upon both the remediation of contaminated sediment sites and habitat restoration. Two major site remediations have been completed: Hog Island Inlet/Newton Creek in Wisconsin and SLIDRT Superfund site in Minnesota. Douglas County continues to work on the habitat restoration project at Hog Island. Several habitat restoration projects are on-going in Minnesota (Radio Tower Bay, Tallas Island/Knowlton Creek, design for 21<sup>st</sup> Ave W and 40<sup>th</sup> Ave W). St. Louis River sediment characterizations are underway by both Minnesota and Wisconsin, which will lead to more remediation and restoration projects. For Wisconsin projects, field work has been completed and the data is being validated and assessed (note that not all data is in the database at the time of writing).

**Next action(s) needed**

The next action needed is to define reference conditions for aquatic habitats in the St. Louis River, which would involve acquiring data on benthic communities at reference sites.

**Issues (challenges, risks) affecting progress on this BUI**

Remediation of contaminated sediments is a priority. This BUI cannot be removed until contaminated sediment cleanups are completed.

RESTRICTIONS ON DREDGING

**2008 Target and Status**

Restrictions on Dredging	Status
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.	Not Complete

**Rationale for Listing**

Restrictions on dredging is a use that can be clearly identified as impaired in the St. Louis River AOC. Sediments in many parts of the AOC exceed guidelines developed by regulatory agencies to characterize in-place sediments and contain a variety of toxic, bio-accumulative contaminants that have been shown to cause adverse effects to aquatic and terrestrial organisms. Serious economic and social consequences are also imposed upon some resource users through special dredging requirements and obligations for long-term sediment containment.

**Summary of remedial actions since the last RAP and current status**

Sediment characterization and site prioritization projects are underway in both Minnesota and Wisconsin. The States are working together via a Sediment Database Team to update the St. Louis River Phase IV Sediment Database that will allow future maintenance of this database and sharing between states and local and federal partners. The charge to the Sediment Database Team is attached as Appendix D. The maintenance and analyses of AOC-wide data is important to determining site remediation priorities and BUI status.

Erie Pier, the primary facility for handling sediments, was converted from a confined disposal facility (CDF) to a reuse and recycling facility in 2007. This transition was made to enhance Erie Pier’s long-term capacity for handling dredged material. Excessively contaminated sediments cannot be accepted at Erie Pier, therefore handling restrictions and economic consequences exist for dredging projects in the contaminated areas.

**Next action(s) needed**

The next actions needed are as follows:

- Update the sediment database with recent sediment quality assessments;
- Review data; and,
- Collect existing information from sediment samplings during dredging operations and materials management.

**Issues (challenges, risks) affecting progress on this BUI**

Not all sediment assessment data has been analyzed or updated to the sediment database. Once that is done, contaminated sites can be compared to operating slips and marinas to prioritize remediation. Need to reach agreement between states on how to define “routine navigational dredging.” It will be important to sustain sediment management options for future dredging projects. Material handled at Erie Pier should be beneficially reused to the extent possible, to create capacity for additional sediments. Also, it is important to maintain each state’s capacity for overseeing contaminated sediment remediation projects.

EXCESSIVE LOADING OF NUTRIENTS AND SEDIMENTS**2008 Target and Status**

<b>Excessive Loading of Nutrients and Sediments</b>	<b>Status</b>
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:	Not Complete
1. All federal, state, and local point sources and nonpoint source discharge permits in the Area of Concern are in compliance with regard to controlling sources of nutrients (particularly nitrogen and phosphorus), organic matter, and sediment, and	Unknown
2. Total phosphorus concentrations in the Lake Superior portion of the AOC do not exceed 0.010 mg/L (upper limit of the oligotrophic range); and	Unknown
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 loading from wastewater overflows into the St. Louis River; and	Partly complete
4. Total phosphorus concentrations within the St. Louis River portion of the AOC do not exceed an interim guide of 0.030 mg/L (upper limit of the 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.	Unknown

**Rationale for Listing**

Prior to improvements in wastewater treatment in the late 1970s in this area, water quality and biological investigations characterized the St. Louis estuary as eutrophic. At this time the WLSSD treatment plant was built and the Superior wastewater treatment plant was upgraded. Since that time, many indicators of trophic status have shown improvements. For instance, concentrations of total phosphorus, ammonia, and organic nitrogen have decreased in the St. Louis Bay. The loading of phosphorus to the estuary from point sources has been reduced substantially. Further work is 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 the estuary remain at levels where eutrophic conditions might be expected. However, algal biomass has been lower than would be expected given these high phosphorus concentration. Chlorophyll-a concentrations measured in the estuary have been similar to levels found in mesotrophic or oligotrophic waters. Several investigators have proposed that reduced light penetration due to turbidity and color may be a limiting factor for algal growth in the estuary. Although persistent water quality problems associated with eutrophication are not observed currently in the estuary, the high levels of nutrients and sediments being delivered to Lake Superior is an important concern. Therefore, the RAP will use a modification of the International Joint Commission's eutrophication criterion to reflect local conditions.

**Summary of remedial actions since the last RAP and current status**

Millions of dollars have been spent on improvements to stormwater control, landowner workshops, wetlands protection and land conservation by the State of Wisconsin, City of Superior, Douglas County and West Wisconsin Land Trust. Projects focus on "slow the flow" to reduce erosion and sedimentation.

A TMDL for turbidity has been completed for the Nemadji River in Minnesota. TMDL implementation has begun and will be important for controlling erosion in the Nemadji River.

**Next action(s) needed**

The next action needed is to compile existing water quality data and compare it to surrounding non-AOCs. Recommendations for data analysis will emerge from the Implementation Framework.

The Implementation Framework will also provide recommendations for specific projects to meet BUI goals. It is anticipated that Douglas County's "slow the flow" projects will be identified by the Implementation Framework as critically important for addressing this BUI and they are recommended for funding.

**Issues (challenges, risks) affecting progress on this BUI**

The AOC is partly in the Lake Superior Red Clay Plain. Due to geological history, the soils in this area are more susceptible to erosion in different regions. The history of logging across the region has significantly altered the historic hydrology and erosion/sedimentation patterns.

BEACH CLOSINGS AND BODY CONTACT**2008 Target and Status**

<b>Beach Closings and Body Contact</b>	<b>Status</b>
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.	Partly Complete
There are no body contact advisories due to the presence of harmful chemicals at contaminated site.	Unknown
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.	Not Complete

**Rationale for Listing**

Water quality data indicate that improvements have been made in the St. Louis River and bay since the late 1970s. However, there are still sources of potential microbial contamination. Sewage bypasses have occurred into the AOC in both Minnesota and Wisconsin during storm events. In addition, localized problems with microbial contamination could occur due to discharge of inadequately treated wastewater by marine traffic. Because of the sewage bypasses in both Minnesota and Wisconsin, body contact recreation is an impaired use.

**Summary of remedial actions since the last RAP and current status**

Millions of dollars have been put toward improvements in storm water control by the City of Superior. Two contaminated sites have been remediated, for example the “No Swimming” sign has been removed from Hog Island Inlet since remediation. Beach closings due to *E. coli* continue to occur. Both Wisconsin and Minnesota have *E. coli* monitoring programs for beach health advisories. More work is needed on defining the source of *E. coli* (human waste water, water fowl and wildlife), and remediation of contaminated sediments.

**Next action(s) needed**

The next action needed is to compile current status data for *E. coli* sources and for contaminated sediment sites in relation to recreational areas.

**Issues (challenges, risks) affecting progress on this BUI**

The Sediment database must be updated in order to assess sediment quality in and adjacent to recreational sites.

DEGRADATION OF AESTHETICS**2008 Target and Status**

<b>Degradation of Aesthetics</b>	<b>Status</b>
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.	Unknown

**Rationale for Listing**

The aesthetic values of the St. Louis River AOC are impaired in some locations. A systematic collection of evidence and data is recommended to determine the specific locations of degraded areas and the sources and types of degrading materials (i.e., oil slicks, chemical and tar residues, taconite pellets on shorelines, rotting grain scum on water surface, etc.) Hog Island Inlet and Stryker Bay are two areas that have repeated reports of oil, chemical, and tar residues on the water's surface. Complaints have also been registered about smells emanating from the sediments and water of Newton Creek and Hog Island Inlet (MPCA, WDNR Complaint Logs 1980-1990). Shoreline aesthetics will be addressed separately and will be remediated through actions taken with riparian interests.

**Summary of remedial actions since the last RAP and current status**

Both Hog Island/Newton Creek and the Stryker Bay site have been remediated. Data is needed on the other occurrences in the estuary and river that may be due to controllable sources. In 2011, the SLRA began distributing surveys to recreational river users to record their observations.

**Next action(s) needed**

The next action needed is to collect current status data. The Implementation Team will use the 2011 SLRA survey information to develop recommendations for further refining the approach to assessing the status of this BUI.

**Issues (challenges, risks) affecting progress on this BUI**

The AOC is quite large (over 12,000 acres). Also, many observational sites are only accessible by boat.



**LOSS OF FISH AND WILDLIFE HABITAT**

**2008 Target and Status**

<b>Loss of Fish and Wildlife Habitat</b>	<b>Status</b>
State resource management agencies concur, in consultation with their federal, tribal, local, and nonprofit partners, that a reasonable amount 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. The following benchmarks could be used as an interim guide.	Not Complete
1. All contaminated sediment hotspots within the AOC have been identified, implementation actions to remediate contaminated sites have been completed; and	Not Complete
2. Programs are in place to discourage further proliferation and to prevent further introduction of non-native invasive species; and	Partly Implemented
3. At least 50% of known degraded aquatic habitat acreage (approx. 1700 acres) is rehabilitated through implementation of projects, such as those outlined in the <u>Lower St. Louis River Habitat Plan</u> (SLRCAC, 2002), Appendix 9 – <u>Habitat Plan Implementation Strategy Worksheets</u> (SLRCAC, 2009); and	Not Complete
4. Additional aquatic or hydrologically connected habitat throughout the AOC watershed has been successfully protected and rehabilitated sufficiently to maintain healthy fish and wildlife populations through implementation of projects, such as those outlined in the <u>Lower St. Louis River Habitat Plan</u> (SLRCAC, 2002), Appendix 9 – <u>Habitat Plan Implementation Strategy Worksheets</u> (SLRCAC, 2009).	Not Complete

**Rationale for Listing**

Fish and wildlife habitat in the AOC is threatened by development and by exotic vegetation. In addition, the contaminated sediments in the river and estuary and the high sedimentation rates in the AOC may contribute to the loss of habitat (for further detail, refer to the Stage I Report, pp. IV-66 to IV-72).

**Summary of remedial actions since the last RAP and current status**

Between Tallas Island, Stryker Bay, and Hog Island Inlet 15% of the 1700-acres have been remediated and/or restored. Douglas County and the WDNR continue to work on programs to prevent the spread of aquatic invasive species. Clough Island and the Red River Breaks areas are under conservation by the State of Wisconsin. The State of Minnesota is working with federal funding to remove marine debris at Radio Tower Bay, and to design habitat restorations at two sites in Minnesota.

**Next action(s) needed**

The next actions needed include completing data validation and analyses and updating the sediment database. The use of the updated sediment database will allow resource managers to determine which sites are in need of remediation alone, which sites are ready for restoration and which sites are candidates for remediation to restoration.

Additionally, Wisconsin partners should identify the key habitat and watershed “slow the flow” projects and AOC partners should determine how habitat protection projects will count toward meeting habitat restoration goals.

Funding is needed for projects to develop site management plans for properties purchased for habitat protection in the AOC, for example St. Louis River Streambank Protection Area and Clough Island which together total approximately 6,000 acres. There may also be potential for habitat restoration projects within these public lands.

**Issues (challenges, risks) affecting progress on this BUI**

Recognition that the AOC is the largest working harbor within the Great Lakes, and that not all potential habitat will be restored.

## **CONCLUSION**

Many of the BUIs in the St. Louis River AOC are related to contaminated sediment from historic discharges or alteration of the estuary ecosystem by filling, damming and dredging. Water quality and fish populations have greatly improved since the late 1970s when waste water treatment facilities were brought on-line or upgraded. Several known contaminated sediment sites within the AOC and watershed have been remediated.

Targets for BUI removal were created by the two states and their many partners in 2008. Currently, the states and partners are working together on the GLRI-funded Implementation Framework to create blueprints for actions and measureable indicators in order to achieve the delisting targets. The product will be a complete Stage 2 RAP (see Appendix A for outline) for use in moving forward on removal of BUIs.

Several of the BUIs will require compilation and interpretation of existing data. Others will require data collection. It is the priority of the WDNR to update the existing sediment database and create a long-term maintenance and management plan for sediment data within the AOC. Data from past and current sediment assessments is critical to moving forward with contaminated sediment site remediation prioritization and planning. Remediation of contaminated sediments is critical for removal for a majority of the BUIs.

## **REFERENCES**

Minnesota Pollution Control Agency and Wisconsin Department of Natural Resources. 1992. The St. Louis River System Remedial Action Plan: Stage One.

Minnesota Pollution Control Agency and Wisconsin Department of Natural Resources. 1995. The St. Louis River System Remedial Action Plan Progress Report.

St. Louis River Citizens Action Committee. 1992. The Lower St. Louis River Habitat Plan.

Wisconsin Department of Natural Resources. 2008. St. Louis River Area of Concern Delisting Targets.

## **APPENDICES**

Appendix A - Stage II RAP outline (Implementation Framework project)

Appendix B - Detailed beneficial use impairment status summary

Note that projects listed in the table are the next clearly delineated action steps that have been identified by WDNR in collaboration with AOC partners and stakeholders to make progress toward delisting the AOC. This list does not necessarily reflect all actions that will ultimately be needed to remove impairments, and will be updated as more information is collected and as actions are completed.

Appendix C - St. Louis River Area of Concern Fish Tumors BUI Assessment Statement of Work

Appendix D - SLRAOC Sediment Database Team Charge, Draft December 8, 2011

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## **Appendix A**

### **Stage II RAP Outline (Implementation Framework project)**

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Comparison of Causes Identified in Stage I RAP to Actions in the AOC Delisting Roadmap and BUI Blueprints (as appropriate)

## **Appendix B**

### **Detailed Beneficial Use Impairment Status Summary**

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# St. Louis River AOC BUI Status Summary

December 2011

Beneficial Use Impairment Name	Status assessment needed? If yes, is it scheduled? (If yes, provide dates)	Actions/Tasks Needed	Funding Source; estimated cost if known	Action status: In progress, Completed, Not started	Project type*	Project Lead	Timeframe for Project Completion	Comments
BUI 1: Fish Consumption Advisories	Yes 2011-2012	1) Compilation of existing data and 2) comparison to other sites	1)Current project 2) unknown	1) In Progress 2) Not Started	2	WDNR, MDNR, state Depts of Health	2013	Implementation Framework project  Decisions are needed on how to pick out "AOC Specific" Advisories from the existing data
BUI 2: Degraded Fish and Wildlife Populations	Yes 2011-2012	1) Current status interpretation 2) Data gaps work	1) Current project 2) unknown	1) In Progress 2) Not Started	2	WDNR, MDNR	2013	Implementation Framework project
BUI 3: Fish Tumors and Deformities	Yes 200 fish collected Spring 2011	1) completion of analysis of fish 2) analyses and interpretation of data	1) USFWS and USGS project	In progress	1 Fish collected	WDNR, MDNR, Fond du Lac Water Program	2012	This data collection effort will result in current status definition; decisions on next step will be made when data is returned and analyzed.
BUI 4: Degradation of Benthos	Yes 2011	1) get data on benthic communities at reference sites 2) utilize info in assessment and restoration	Potential to leverage MPCA and WDNR funds	In planning stage	1	WDNR and MPCA	2012	Benthic community data in reference sites would be collected in 2012.  BUI cannot be removed until contaminated sediment remediations are completed.
BUI 5: Restrictions on Dredging	Yes 2011 to 2012	1) Data being returned for MPCA and WDNR sediment assessments 2) Jointly updating St. Louis River Sediment database (long-term plan)	1) current project 2) on-going	In progress	2	WDNR and MPCA	2013	Implementation Framework project  AOC Sediment Database Management planning will include WDNR, MPCA, NOAA, and USACE  AOC sediments technical team will develop maps showing areas needing feasibility studies or remediation in 2013.
BUI 6: Excessive Loading of Nutrients and Sediments	Yes 2011-2012	1) Compilation of existing data and 2) comparison to other sites 3) Implement watershed projects to	1)Current project 2) unknown 3) unknown	1) In Progress 2) Not Started 3) In progress	2	WDNR, MPCA, Carlton Co (MN), St. Louis Co (MN),	2013	Implementation Framework project  Funding is needed to implement watershed projects (e.g., Nemadji TMDL and "slow the flow" projects)

		prevent erosion				Douglas Co (WI)		
BUI 7: Beach Closings and Body Contact	No WI and MN currently have Beach monitoring programs	1) Compilation of existing data 2) Work on source determination may be necessary	1) Current project 2) unknown	1) In Progress 2) Started not complete	2	WI and MN	2013	Implementation Framework project  Other work by local universities has been done in the past on source assessment – needs completion and planning according to results
BUI 8: Degradation of Aesthetics	Yes Observational surveys begun 2011	1) Compilation of current status data begun by SLRA; 2) Development of a systematic approach for collecting data	1) Grant through WDNR 2) Current project	In progress	1, 2	WDNR, MPCA, SLRA	2013	Implementation Framework project  Implementation Framework project
BUI 9: Loss of Fish and Wildlife Habitat	NO	Continue assessment, remediation and restoration projects by both WI and MN	Various	On-going	2, 3, 4, 5	WDNR, MPCA, MDNR and others	unknown	Implementation Framework project will identify relevant indicators and restoration projects.  Determine how habitat protection projects will count toward meeting habitat restoration goals

\*Project types:

- 1 Baseline assessment through data gathering
- 2 Compile & analyze existing data
- 3 On-the-ground remediation or restoration project
- 4 Stakeholder engagement and/or community education & outreach
- 5 Verification of target achievement through monitoring or other documentation

Implementation Framework = in this table refers to a grant through the MPCA in which the state's and their partners are creating milestones and measureable indicators to reach removal for each BUI. The WDNR AOC Coordinator is working directly with this project as well as others cooperative projects in the AOC.

## **Appendix C**

### **St. Louis River Area of Concern Fish Tumors BUI Assessment Statement of Work**

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## **St. Louis River Area of Concern**

### Incidence Rates of Fish Tumors and Deformities in the St. Louis River Area of Concern: A Preliminary Assessment

Statement of Work

March 1, 2011

Project: This project, developed by consensus among the four St. Louis River AOC Coordinators, is an effort to gather data necessary to remove the “Fish Tumors and Deformities” Beneficial Use Impairment (BUI) in the St. Louis River AOC. Conditions in the AOC have improved in many respects since listing. It is important to establish the current rate of “Fish Tumors and Deformities” in order to move forward in removing this BUI.

#### Background

Under the Great Lakes Water Quality Agreement, 43 sites around the Great Lakes were listed as Areas of Concern (AOCs) because they experienced negative changes in biological, chemical and physical integrity. A list of fourteen potential Beneficial Use Impairments (BUIs) was created to evaluate anthropogenic degradation at each AOC. When the Stage 1 Remedial Action Plan (RAP) for the St. Louis River AOC (Minnesota Pollution Control Agency and Wisconsin Department of Natural Resources, 1992) was completed, one of the BUIs listed was “Fish Tumors and Deformities”. At that time, observational data and known sediment contamination and water quality issues led to the potential for a fish tumor elevated incidence rate. The goal is to restore the beneficial uses, and therefore protect the biological, chemical and physical integrity of the Great Lakes, by removing the impairments.

The target for “Fish Tumors and Deformities” in the St. Louis River is that:

“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.”

The International Joint Commission definition of the Fish Tumors and Deformities BUI defines bullheads and suckers as suitable benthic species for evaluating this BUI. These delisting guidelines imply several key elements for fish tumor monitoring, including;

1. Using bullhead or suckers as an indicator species
2. Comparing tumor or other deformity rates in fish from AOCs to appropriate reference sites.
3. Using liver neoplasms or pre-neoplasm rates, as verified by histopathological analysis, as biomarkers of environmental exposure.

In the 1960's and 1970's, water quality in the St. Louis River was extremely poor due to inadequate wastewater treatment and unregulated industrial use. Fish tumors have been shown to be related to contaminants (Baumann, et al, 1996), especially poly-aromatic hydrocarbons (PAHs) associated with petroleum products and coal tar as is found in the St. Louis River. The Fish Tumors and Deformities BUI was included in this AOC due to observations of external tumors and lesions, and the presence of contaminated sediments. During the development of the Stage 1 RAP, no data were available to establish tumor and deformity incidence rates. Since that time wastewater treatment has been improved dramatically. Two major contaminated sediment areas, known to have elevated levels of PAHs, have been remediated. There continues to be no information available on the incidence rates of tumors in benthic fish in the St. Louis River. To move toward de-listing the St. Louis River as an AOC by removing this BUI, we need to develop this information by gathering data on fish tumors and deformities. Without this information we will be unable to remove the BUI and delisting the AOC will not occur. The Fish Tumors and Deformities BUI is inextricably tied to contaminated sediments, therefore, we would expect to see (and other AOCs, Presque Isle and Jackfish Bay, have seen) a lowering in rates of tumor and deformity incidences as AOC contamination is remediated. Therefore, we expect this proposed project to be the first, on which we base subsequent samplings for fish tumors and deformities.

Objective: Determine the current incidence rate of fish tumors and deformities in the St. Louis River and compare that to the rate in a relatively unimpaired waterbody on Lake Superior. Histopathological

methods will be utilized to distinguish tumors that may be contaminant related from viral or parasitical related deformities.

Methods: In the early 2000s there was a series of conferences on Fish Tumors and Deformities held in Erie, Pennsylvania focusing fish tumor studies on bullheads to assist the Presque Isle AOC. That series of conferences better defined the use of neoplasms as an indicator and refined methodologies for studies of fish tumors. It was also agreed that information on reference sites was required, though “unimpaired” was probably not possible and “least impaired” sites should be researched. Baumann, et. al., 1996 stated that bullhead were used for this type of study more frequently in the lower Great Lakes, while white suckers were used in the upper lakes. The Presque Isle AOC on Lake Erie has utilized brown bullhead, while the Jackfish Bay AOC on Lake Superior has utilized white suckers to evaluate tumor and deformity rates.

Fish biologists working in the St. Louis River agree that there is a higher probability of getting sufficient numbers of white suckers than bullhead to determine incidence rates of fish tumors and deformities in this ecosystem. We, therefore, propose to collect and analyze 50 white suckers in each of four evaluation areas in the St. Louis River AOC. Tumor incidence rates in the AOC will be compared to incidence rates of reference sites established for other AOCs within Lake Superior (Jackfish Bay and others as appropriate).

White suckers will be collected while they are congregating prior to spawning from the following areas;

- 1) Superior Bay -- from Lake Superior to Rice's Point bridge
- 2) St. Louis Bay -- Rice Point bridge to Grassy Point bridge (includes 21<sup>st</sup> Ave and 40<sup>th</sup> Ave sites)
- 3) Middle Estuary -- Grassy Point Bridge to Fond du Lac Dam
- 4) Upper Estuary -- Fond du Lac Dam to upstream reach of the AOC

Fish will be taken from several sites within these areas in order to sample the AOC as a whole, while retaining information on industrial lower estuary areas to compare to results from upper areas.

Fish tissue plugs for 13C analysis will be taken and analyzed to assist in data interpretation. The 13C values would provide information on whether these fish are largely Lake Superior fish (diet derived from Lake Superior) or more broadly have mixed use of the riverine/lake habitats. White suckers actual annual movements within the AOC are unknown at this time.

Fish collection crews will consist of staff from Minnesota DNR, Wisconsin DNR, Fond du Lac Tribe, USEPA-MED, and USFWS. White suckers will be sampled early to mid-May while the USFWS staff are in the St. Louis River near 21<sup>st</sup> and 40<sup>th</sup> Ave sites for a Contaminants of Emerging Concern study. The white suckers collected by cooperators will be added to those collected by the USFWS CEC study for histopathology. Cooperators will work with the USFWS to ensure standardized sample handling.

Analysis parameters will consist of: liver histopathology, external lesion examination with histopathology follow-up for observed lesions and deformities (Blazer, et al, 2006). Additional data on fish age/size, gender, sample location and 13C will be tracked for each fish.

Histology:

The pieces of liver, kidney, spleen, gill, gonad and any lesions collected in the field and preserved will be used for histopathology which provides a cellular-level evaluation of fish health. These methods can be diagnostic. For instance, histopathology is necessary to determine if observed raised lesions are tumors versus proliferative inflammatory responses.

Liver and Skin Tumors

Due to the observations of liver and skin tumors in brown bullhead and other species in many areas around Lake Erie (Baumann 1992; Rafferty et al., 2009), tumors have been evaluated at many sites over the years and there are extensive historical observations to which this study can be compared.

Sections will be cut from 3 to 5 liver pieces, depending on the size of the liver, fixed in the field. Multiple pieces (number dependent on size of the lesion) of all raised skin lesions, melanistic spots and other areas of discoloration will be sampled. Tissue slides and blocks from all tissues examined will be archived at the Leetown Science Center, USGS. Due to the recognized importance of liver pathology, including neoplasia in evaluating contaminant effects on fish, a set of criteria for liver lesions has been established for small laboratory fish species such as fathead minnows (Boorman et al. 1997), as well as brown bullhead (Blazer et al. 2006) and will be followed in this study. Histopathological diagnosis will include altered foci, bile duct proliferation, neoplasms, macrophage aggregates, parasites and other observed abnormalities. A description of these criteria, as well as the skin lesion criteria are presented in the Manual for the Microscopic Diagnosis of Proliferative Liver and Skin Lesions in the Brown Bullhead (*Ameiurus nebulosus*).

Budget: \$76,600  
External lesion and liver histopathology analyses, 200 white suckers - \$50,000.  
    In conjunction with Contaminants of Emerging Concern study  
Data management, interpretation and reporting - \$25,000  
    Contractual  
13C analysis - \$8/fish, 200 fish - \$1,600  
    Analysis by MED Lab  
  
Sample collection – in-kind \$4,500  
    MDNR, middle estuary area, 3 days, 2 people plus equipment use - \$1,500  
    Fond du Lac Tribe, upper estuary – \$1,500  
    WDNR, Superior Bay - \$1,500

Outcome: The first comprehensive documentation of fish tumor incidence rates in the St. Louis River Estuary, on which to base future actions related to the removal of this BUI.

#### Literature Cited

Baumann, P. C. I. R. Smith, and C. D. Metcalfe. 1996. Linkages Between Chemical Contaminants and Tumors in Benthic Great Lakes Fish. *J. Great Lakes Res.* 22(2):131-152.

Minnesota Pollution Control Agency and Wisconsin Department of Natural Resources. 1992. The St. Louis River System Remedial Action Plan: Stage One. Minnesota Pollution Control Agency, St. Paul, MN, and Wisconsin Department of Natural Resources, Madison, WI.

Blazer, VS, Fournie, JW, Wolf, JC, Wolfe, MJ, Manual for the Microscopic Diagnosis of Proliferative Liver and Skin Lesions in the Brown Bullhead (*Ameiurus nebulosus*), February, 2007.

**Appendix D**

**SLRAOC Sediment Database Team Charge, Draft, December 8, 2011**

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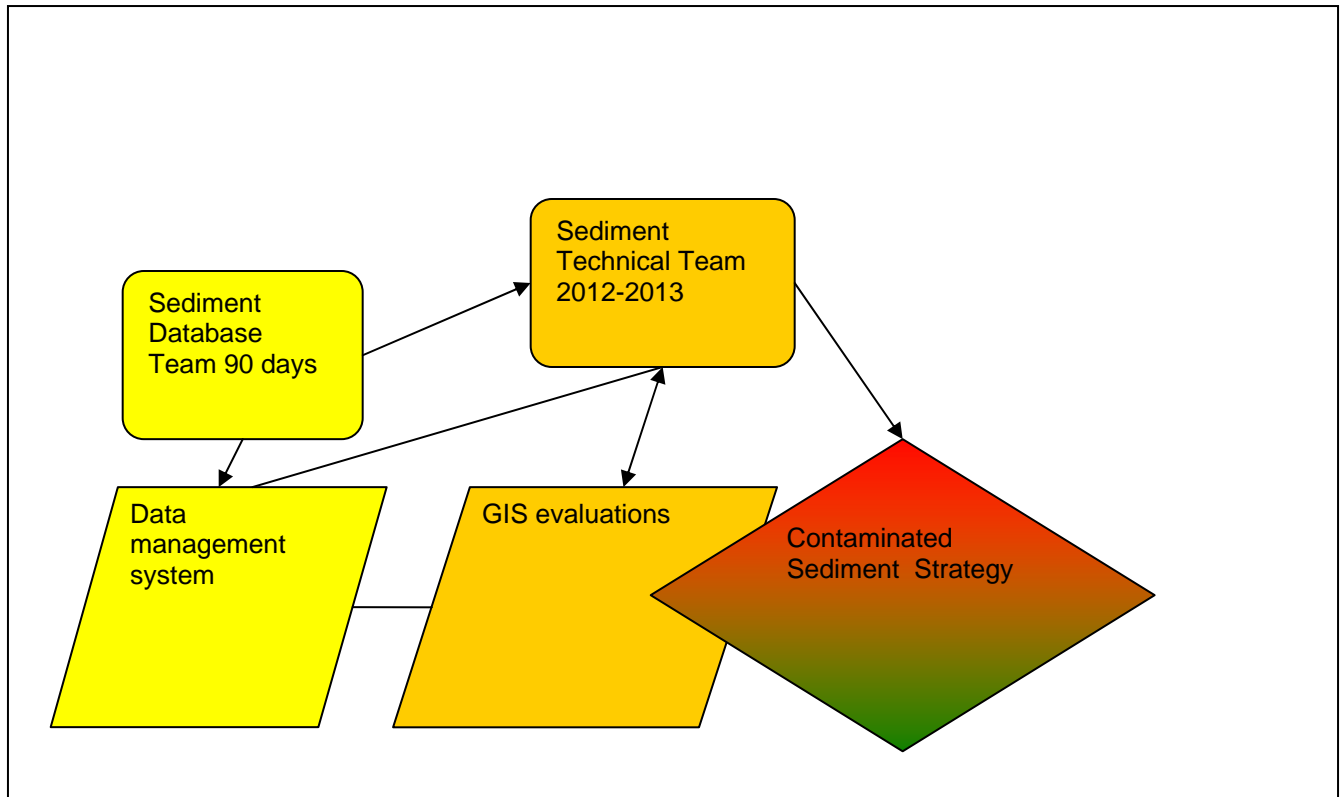
**ST. LOUIS RIVER ESTUARY**  
*Area of Concern to Area of Recovery*  
A Framework for Delisting  
**SLRAOC Database Session**  
November 9-10, 2011

**SLRAOC Sediment Database Team Charge**  
**Draft December 8, 2011**

Recommend system design for data management in the SLRAOC to allow geospatial evaluation that supports development of a contaminated sediment strategy. Develop a pilot system that can be used in other AOCs to evaluate contaminated sediment data in ways that lead to delisting.

1. Work with NOAA to get WI and MN data entered into NOAA Query Manager (QM) database. Identify road blocks to input existing data into QM, and make recommendations for sustainable systems of data entry into the system.
2. Evaluate how to use QM to achieve our objectives and research other systems, tools, and protocols to help meet the AOC needs. Develop a consistent process / system (bridge) to extract data from QM and analyze it to answer the questions needed for the AOC. Assess how the data management system meets the needs of the agencies working on AOC delisting.
3. Identify and agree on nomenclature, schema, and structure.
4. Identify Quality Management issues to ensure usability of out-puts.
5. Identify options to house and maintain data types (such as benthic macroinvertebrate data) that are not included in the QM structure, but may be important to a sediment triad or weight of evidence approach for the AOC. These data may be needed to track progress for BUI delisting as well.
6. Work within a 90 day time frame and report progress in 30, 60, and 90 days. Identify additional resources needed. Report to AOC coordinators and agency managers.
7. Identify critical data management tasks that will need to continue past the 90 day time frame of this team.
8. The work of this team will feed into the sediment technical team, which will develop the contaminated sediment strategy categorizing geographical areas

in the AOC based on the need for remediation. This work will feed into the Delisting Framework project.



**Figure 1. St. Louis River Sediment Database and Contaminated Sediment Technical Teams and Outputs**

Following is a summary of the team charge discussion from the Nov 9-10 2011 St. Louis River database meeting.

**SLRAOC Sediment Database Development  
Team Charge Notes from the Nov 9-10 meeting**

- Develop a set of tools that uses sediment data to be used for BUI removal and delisting
- Agree on Framework (database design) and get data in
- Assess what we have and what we need – gap analysis
- Evaluating Query Manager & Phase IV (or is it now Phase V) database
- What are the data elements we need and the set of nomenclature
- ID the desires for assessment
- Interact with Sediment Technical Team (not yet formed) to give them what they need
- Serve SLRAOC Implementation Team (AOC Coordinators)
- ID short term needs (90 days)
  - **Get sediment data into a system we can all use to prioritize.**

- Should there be a formal memorandum of understanding between organizations?
- Develop a Team Charge and appoint team members by December 1, 2011
- Set course for 30-60-90 day rapid development effort

#### **Skill Sets Desired for SLRAOC Database Team**

- Keep the overarching picture of agency restrictions in mind
- Understands the possibilities – data in and data out
- Understand the universe of tools – database and assessment
- Team charge and objectives
- Understands decision-making based on tools
- Quality assurance
- Knowledge of Phase IV and Query Manager
- Understand how to build relational databases
- Have invested need for product
- BUI delisting – what are we after?
- Technical sediment knowledge
- How to develop database tools
- Spatial and GIS tool knowledge
- Seek outside professional help – consultant with special applied knowledge