REMEDIAL ACTION PLAN UPDATE

for the

MILWAUKEE ESTUARY AREA OF CONCERN

December 2015

Wisconsin Department of Natural Resources
Office of the Great Lakes
2015 Remedial Action Plan Update
for the
Milwaukee Estuary Area of Concern

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Disclaimer: The Great Lakes Water Quality Agreement is a non-regulatory agreement between the U.S. and Canada, and criteria developed under its auspices are non-regulatory in nature. Any actions identified in this document as needed to remove the impaired beneficial uses are not subject to enforcement or regulatory actions.

Cover Photo: Lincoln Park Sediment Remediation, Duane Thomas, EA Engineering
EXECUTIVE SUMMARY

The Milwaukee Estuary Area of Concern (AOC) encompasses portions of three large watersheds and nearshore waters of Lake Michigan. The Wisconsin Department of Natural Resources (WDNR) and partners are working to improve conditions in the Milwaukee Estuary AOC. Changes from the previous Remedial Action Plan (RAP) Update are summarized below to highlight activities that occurred since the 2014 RAP Update.

Summary of Changes for Restrictions on Fish and Wildlife Consumption
- Sampling of waterfowl by WDNR to assess the consumption advisory will continue in 2016. The assessment was funded by a Great Lakes Restoration Initiative (GLRI) grant to WDNR.
- Lincoln Park and Milwaukee River Channels project dredging was completed in 2015.

Summary of Changes for Degradation of Fish and Wildlife Populations
- The fieldwork on the assessment projects continued in 2015. Additional assessment work in the harbor by University of Wisconsin-Milwaukee (UWM) School of Freshwater Science (SFS) was funded at the end of 2015 by the Fund for Lake Michigan.
- The WDNR and Tech Team are continuing the planning process to determine management actions for this impairment.

Summary of Changes for Fish Tumors or Other Deformities
- Results of the fish tumor rate assessment project confirmed that this impairment exists in the AOC. Neoplastic liver tumors were found in 15% of Milwaukee Estuary white suckers. This is greater than the expected background rate. It is also greater than that of the Root River reference site at 8.5%.

Summary of Changes for Bird or Animal Deformities or Reproduction Problems (potentially impaired)
- The U.S. Geological Survey (USGS) continued to collect data on tree swallow hatching effects in the Milwaukee Estuary at five sites and other sites across the Great Lakes. Preliminary results indicate contaminants are present and further assessment may be needed to determine impairment status.

Summary of Changes for Degradation of Benthos
- Results from the USGS benthos assessments in 2012 & 2014 are pending. The data from 2012 is being reassessed using the same statistical analysis as the 2014 data. The final report will include both data sets and final conclusions and is expected in early 2016.

Summary of Changes for Restrictions on Dredging
- The second phase of the Lincoln Park and Milwaukee River Channels dredging is complete and work continues on other cleanups and assessments.
- Sampling for the assessment of sediments in the Menomonee River from the Little Menomonee to the Milwaukee River was completed. Characterization of the sediments in the Turning Basin was completed.

Summary of Changes for Eutrophication or Undesirable Algae
- Results for the Milwaukee Basin Total Maximum Daily Load (TMDL) study for phosphorus have been delayed, and are expected in 2016. TMDL implementation planning will follow.
Summary of Changes for Beach Closings/Recreational Restrictions

- Data collection will continue into 2016 by UWM SFS that will identify and quantify unrecognized sanitary sewage contamination to the AOC.
- Milwaukee County has continued to work on plans to rehabilitate South Shore Beach as part of an overall park planning project.

Summary of Changes for Degraded Aesthetics

- Citizen volunteers carried out aesthetics monitoring at nine sites in 2015. Data analysis is underway.

Summary of Changes for Degraded Phytoplankton and Zooplankton Populations

- Results from the USGS planktonic community assessments in 2012 & 2014 are pending. The data from 2012 is being reassessed using the same statistical analysis as the 2014 data. The final report will include both data sets and final conclusions and is expected in early 2016.

Summary of Changes for Loss of Fish and Wildlife Habitat

- The Tech Team completed project summaries for the list of management actions to address the impairment.
- Progress was made on a number of habitat projects identified as management actions by AOC partners.

Next Steps

For 2016, the Milwaukee AOC Coordinator will be focused on the following:

- Further refining the list of management actions for BUIs;
- Engaging the fish and wildlife technical team to transition to determining management actions for Degradation of Fish and Wildlife Populations BUI and providing input on Loss of Fish and Wildlife Habitat projects being planned and implemented;
- Working with newly revived Community Advisory Committee;
- Developing target refinements and updates as needed;
- Continuing to help partners seek funding for priority habitat projects in the AOC; and,
- Reviewing final assessment data from the numerous completed and on-going assessments and working with partners to develop next actions based on the information.

Sediment cleanups are critically important for removing nearly all impairments. While several sediment cleanups have been completed and others are currently underway, additional assessment and cleanup work is needed. In the next year WDNR sediment staff will continue to work on priority projects in the AOC including non-time critical removal action on the Cedar Creek ponds, and Milwaukee River sediment assessment downstream from the Estabrook Dam to the confluence with the Menomonee River.
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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, 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.

Hotspot
An area where additional characterization is needed to determine if further remedial actions are necessary. Typically, potential hotspots are identified by information related to historic or adjacent land use.

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 were 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

In 2012, the U.S. and Canada signed a renegotiated Great Lakes Water Quality Agreement which removed the “stage” terminology from the AOC Annex, and simply requires Remedial Action Plans to be “developed, periodically updated, and implemented for each AOC.”

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.
**List of Acronyms**

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AOC</td>
<td>Area of Concern</td>
</tr>
<tr>
<td>BCOC</td>
<td>Bioaccumulative chemicals of concern</td>
</tr>
<tr>
<td>BUI</td>
<td>Beneficial Use Impairment</td>
</tr>
<tr>
<td>CAC</td>
<td>Community advisory committee</td>
</tr>
<tr>
<td>CDF</td>
<td>Confined disposal facility</td>
</tr>
<tr>
<td>CSO</td>
<td>Combined sewer overflow</td>
</tr>
<tr>
<td>GLRI</td>
<td>Great Lakes Restoration Initiative</td>
</tr>
<tr>
<td>km</td>
<td>Kilometers</td>
</tr>
<tr>
<td>LOEL</td>
<td>Lowest observable effect level</td>
</tr>
<tr>
<td>mg/L</td>
<td>Milligrams per liter</td>
</tr>
<tr>
<td>MMSD</td>
<td>Milwaukee Metropolitan Sewerage District</td>
</tr>
<tr>
<td>PAH</td>
<td>Polycyclic aromatic hydrocarbon</td>
</tr>
<tr>
<td>PCB</td>
<td>Polychlorinated biphenyl</td>
</tr>
<tr>
<td>RAP</td>
<td>Remedial Action Plan</td>
</tr>
<tr>
<td>SFS</td>
<td>School of Freshwater Sciences</td>
</tr>
<tr>
<td>TMDL</td>
<td>Total Maximum Daily Load</td>
</tr>
<tr>
<td>USEPA</td>
<td>U.S. Environmental Protection Agency</td>
</tr>
<tr>
<td>USFWS</td>
<td>U.S. Fish and Wildlife Service</td>
</tr>
<tr>
<td>USGS</td>
<td>U.S. Geological Survey</td>
</tr>
<tr>
<td>UW-Extension</td>
<td>University of Wisconsin Extension</td>
</tr>
<tr>
<td>UWM</td>
<td>University of Wisconsin-Milwaukee</td>
</tr>
<tr>
<td>WDNR</td>
<td>Wisconsin Department of Natural Resources</td>
</tr>
</tbody>
</table>
PURPOSE STATEMENT

The purpose of this document is to serve as a Remedial Action Plan (RAP) update. Remedial Action Plans are required by Annex 1 of the Great Lakes Water Quality Protocol of 2012 (which replaced the 1987 Protocol amending the Revised Great Lakes Water Quality Agreement of 1978). The 2012 Protocol indicates that Remedial Action Plans must include the following elements:

1. Identification of beneficial use impairments (BUIs) 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 use; and
5. A description of surveillance and monitoring processes to track the effectiveness of remedial measures and confirm restoration of beneficial uses.

This RAP, which updates the 2014 document, 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. It is also a tool for documenting and communicating progress to agency partners and technical stakeholders. Subsequent updates will be completed as needed to incorporate new information that may become available.
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. 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 managed in accordance with the Lakewide Action and Management Plan (LAMP) program, a “whole lake” program that is also set forth in the Agreement. The Agreement is the means for the U.S. and Canada to work together to jointly manage the lakes.

AOC Boundary
The Milwaukee Estuary AOC is one of five Areas of Concern in Wisconsin. The estuary and lower portions of the rivers were designated as an AOC in 1987 and the boundaries were subsequently expanded in 2008 (see Figure 1; note that the documentation associated with the boundary change was attached to the 2011 Milwaukee Estuary RAP Update as Appendix C). The boundaries of the AOC are as follows (with original 1987 boundaries italicized):

- **Milwaukee River**
  - Lower 5 km of the Milwaukee River downstream of (former) North Avenue Dam.
  - Cedar Creek downstream from Bridge Road to confluence with Milwaukee River.
  - Milwaukee River and Lincoln Creek from confluence with Cedar Creek to former North Avenue Dam.

- **Menomonee River**
  - Lower 4.8 km of the Menomonee River downstream of 35th Street.
  - Little Menomonee River from Brown Deer Road to confluence with Menomonee River.
  - Menomonee River downstream from confluence with Little Menomonee River to 35th Street.

- **Kinnickinnic River**
  - Lower 4 km of the Kinnickinnic River downstream of Chase Avenue.

- **Estuary**
  - Inner and outer harbors.
  - Nearshore waters of Lake Michigan, bounded by a line extending north from Sheridan Park to the city of Milwaukee’s Linnwood water intake.

Impairments & Causes
The Milwaukee Estuary was designated an AOC due to the presence of impairments to the beneficial uses of the waters included within its boundaries. Out of a total of fourteen possible beneficial use impairments (BUIs), eleven were designated within the original AOC boundary and four within the expanded boundary. There are several causes of the impairments present, with the most prevalent being legacy contamination. Sediments contaminated with toxic pollutants such as polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and heavy metals contributed to nearly all of the eleven BUIs within the original boundaries of the AOC and all four within the expanded boundary. While loading of toxic substances was one of the primary drivers behind the AOC program, impacts from urbanization and terrestrial and aquatic habitat fragmentation also contribute to the impairments. The waterways within the AOC were also historically modified (straightened and dredged) to accommodate large vessel commercial shipping. Combined sewer overflows from wastewater treatment plants and soil erosion and nutrient enrichment from throughout the estuary’s watershed contributed to degraded water quality.
Figure 1. Map of the Milwaukee Estuary AOC. The original boundaries are shown in red and the expanded boundaries are shown in yellow.
Milwaukee Estuary AOC beneficial use impairments and sources are summarized in Table 1. Note that some impairments must be addressed broadly for the whole AOC, while others must be addressed on a geographic basis (i.e., tributaries are different from each other and are different than the estuary). While significant progress has been made since the first Remedial Action Plan (RAP) document in 1991, no impairments have been removed for this AOC to date. In the expanded AOC boundary, the four BUIs that are most closely tied to sediment contamination are identified as impaired (USEPA, 2009, pp. 1-3). The Lincoln Park/Milwaukee River Channels Legacy Act Sediment project is a prime example of why the AOC boundaries were expanded. That particular site contributed the greatest mass loading of PCBs to the Milwaukee River and Harbor.

Table 1. Causes of Beneficial Use Impairments in the Milwaukee Estuary Area of Concern.

<table>
<thead>
<tr>
<th>Sources of Pollution/Problem</th>
<th>Toxic Substances</th>
<th>Point Source and Runoff Pollution</th>
<th>Physical Habitat Alteration</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impaired Beneficial Use (Original AOC boundaries)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Degradation of fish and wildlife populations</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Loss of fish and wildlife habitat</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Degradation of benthos</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>X</td>
</tr>
<tr>
<td>Restrictions on dredging</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Restrictions on fish and wildlife consumption</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bird/animal deformities or reproduction problems (suspected)</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fish tumors or other deformities</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beach closings/recreational restrictions</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Degraded phytoplankton and zooplankton populations</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Eutrophication or undesirable algae</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Degradation of aesthetics</td>
<td>x</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Impaired Beneficial Use (Expanded AOC boundaries)</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Degradation of fish and wildlife populations</td>
<td>x</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Degradation of benthos</td>
<td>x</td>
<td>x</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Restrictions on dredging</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Restrictions on fish and wildlife consumption</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A lower case x indicates that at the time of the original RAP, these sources were not understood to be part of the source contributing to a particular impaired beneficial use, but are now considered to be a component of the impairment.

Toxic Substances
Loading of toxic substances into AOCs was one of the primary drivers behind the AOC program. Sources of toxic substances include contaminated sediments, spills of such chemicals within the watershed, and atmospheric deposition.
**Point Source and Runoff Pollution**
This category includes loading of sediment, nutrients, and/or bacteria as a result of nonpoint, or diffuse, sources of pollution and includes urban stormwater runoff. Point sources, such as sewer overflows, are also a source of sediment, nutrients, chemicals and bacteria into the AOC and are included in this category. Additionally, noncontact cooling water is a significant source of phosphorus, a nutrient, into the waters of the AOC.

**Physical Habitat Alteration**
Dams, drop structures, concrete-lined channels, and poorly-sized culverts and stream crossings degrade aquatic habitat by impeding the fishes’ ability to get to suitable spawning habitat further upstream. This category also includes shoreline alteration, such as sheet piling, that doesn't provide high-quality habitat the same way that more naturalized, meandering streambanks would. Alterations in riparian habitats ecologically connected to the stream have the ability to impair the life cycles of wildlife, such as the ability of fish to spawn in floodplain wetlands, amphibians and dragonflies to complete the terrestrial part of their life cycle, and ducks to nest in riparian grasslands.

**Other**
In the time since the original RAP documents were written, there has been recognition of the importance of thermal discharges in affecting water quality, specifically dissolved oxygen levels. As water temperature increases, its ability to carry oxygen decreases. Therefore, discharges of water with elevated temperatures can have a significant negative impact on aquatic communities. “Other” for the Degradation of Aesthetics impairment is listed because litter was a primary source of pollution for that impairment.

**Remedial Action Planning & Progress**
The Wisconsin Department of Natural Resources (WDNR) worked with community stakeholders to develop a RAP in 1991, with updates in 1994 and 1999. In 2011, WDNR began working again with stakeholders to identify goals and actions necessary to address the impairments of the AOC. To do this, WDNR develops annual Remedial Action Plan Updates to summarize progress toward improving conditions in the AOC. Annual RAP updates were produced in 2011-2014.

The main priorities for the Milwaukee Estuary AOC include remediation of contaminated sediments, nonpoint source pollution control, improvement of water quality for recreational purposes, enhancement of fish and wildlife populations, and habitat rehabilitation. There has been much progress in the AOC and many projects have occurred that have helped to address the impairments. Citizen engagement has been an integral component of the AOC program since the beginning and continues to be a priority as additional actions are identified and implemented.

This RAP Update concisely lists the current status of each BUI, the next actions needed, and potential issues. This document also captures progress made from the last update completed in 2015 through December 2015. A summary of BUI status is included in Table 2.
Table 2. Milwaukee Estuary Beneficial Use Impairment Status Summary.

<table>
<thead>
<tr>
<th>Beneficial Use Impairment</th>
<th>Beneficial Use Remains Impaired</th>
<th>Summary Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Restrictions on fish and wildlife consumption</td>
<td>Yes</td>
<td>Preliminary results indicate waterfowl consumption advisories will remain in place. Fish consumption advisories also remain in place. Dredging for the Lincoln Park Phase 2 contaminated sediment removal was completed in 2015.</td>
</tr>
<tr>
<td>Degradation of fish and wildlife populations</td>
<td>Yes</td>
<td>Fish and wildlife population assessments developed by the fish and wildlife technical team are underway.</td>
</tr>
<tr>
<td>Fish tumors or other deformities</td>
<td>Yes</td>
<td>Fish tumor study conducted in 2013 determined that an impairment exists with a tumor rate of 15%. This is higher than expected background rates as well as the Root River reference site.</td>
</tr>
<tr>
<td>Bird/animal deformities or reproduction problems</td>
<td>Suspected</td>
<td>USGS tree swallow monitoring continues.</td>
</tr>
<tr>
<td>Degradation of benthos</td>
<td>Yes</td>
<td>Final results from the USGS benthos studies from 2012 and 2014 are pending.</td>
</tr>
<tr>
<td>Restrictions on dredging activities</td>
<td>Yes</td>
<td>Several sediment cleanup projects have been completed; additional sediment assessments and cleanups are needed.</td>
</tr>
<tr>
<td>Eutrophication or undesirable algae</td>
<td>Yes</td>
<td>TMDLs will inform nutrient sources and loading. The TMDLs and TMDL implementation plan have been delayed and are expected to be completed by 2016.</td>
</tr>
<tr>
<td>Beach closings/recreational restrictions</td>
<td>Yes</td>
<td>Bacterial contamination source tracking by UWM, funded through a GLRI grant to WDNR, is underway. Milwaukee County is working on improvements to South Shore Beach.</td>
</tr>
<tr>
<td>Degradation of aesthetics</td>
<td>Yes</td>
<td>On-going citizen-based monitoring will characterize the impairment and may determine what or if anything needs to be addressed.</td>
</tr>
<tr>
<td>Degraded phytoplankton and zooplankton populations</td>
<td>Yes</td>
<td>Final results from the USGS benthos studies from 2012 and 2014 are pending.</td>
</tr>
<tr>
<td>Loss of fish and wildlife habitat</td>
<td>Yes</td>
<td>The fish and wildlife technical team has developed a list of projects to address the BUI. Several of these projects are underway or complete.</td>
</tr>
</tbody>
</table>

Stakeholder Engagement
The original RAP and RAP Update were the result of significant public consultation and involvement and included multiple technical advisory committees and a citizen advisory committee. In 2012 WDNR established a Fish and Wildlife technical team for input on habitat and population related projects and a “Stakeholder Delegation,” a subset of the larger groups of interested stakeholders to advise and support an education, information, and outreach strategy through direct involvement, consultation, and review of outputs.

In fall of 2014, WDNR and UW-Extension began to work with stakeholders on planning for a fully-functioning, official Community Advisory Committee (CAC) for the AOC. UW-Extension identified members from the Stakeholder Delegation and the Fish & Wildlife Technical Team to serve on a CAC Transition Task Force, which was charged with providing recommendations to the agencies, partners and stakeholders on the roles and responsibilities of a Milwaukee CAC and how the CAC would function. UW-Extension led facilitated meetings of the Transition Task Force. In 2015, due to changes in UW-Extension Natural Resources Educator positions, UW-Extension is no longer able to offer education and
outreach support to the AOC program. In preparation for this change in May 2015, the outgoing Natural Resources Educator and AOC Coordinator accelerated the work of the CAC Transition Task Force. The recommendations of the Task Force were presented at a public meeting on May 7 at the Global Water Center. There was interest from stakeholders in continuing the process to form the CAC. In lieu of UW-Extension facilitating the process, CAC support funds were used to provide a short-term facilitator to assist the stakeholders in organizing the group and to Southeast Wisconsin Watersheds Trust to provide support for facilitation and CAC functions. The newly revived Milwaukee Estuary AOC Community Advisory Committee held its first official meeting on August 17, 2015. The group is an association of groups, citizens and stakeholders led by a leadership team of six stakeholders and the AOC Coordinator. The group plans on holding quarterly meetings in 2016. For more information on the CAC please see the organizing documents found in Appendix B.

In addition to the CAC formation activities in 2015, the WDNR continued with existing venues for communicating with the public, including attending events and producing publications. A GovDelivery list was also created for email communication to stakeholders. The first Wisconsin Great Lakes Areas of Concern Restoration Reports were produced in 2013. These illustrate the status of each AOC’s progress towards removing the beneficial use impairments and the next steps for the coming year. The revised Restoration Report was produced in 2015.
**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.

**Target and Status**

<table>
<thead>
<tr>
<th>Updated Targets</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>The updated target based on the 2011 Draft Stage 2 modifications to the 2008 targets for the Milwaukee Estuary AOC are listed here as separate components on each row to clearly show the status of each part of the target.</td>
<td>May be:</td>
</tr>
<tr>
<td></td>
<td>- “Complete”</td>
</tr>
<tr>
<td></td>
<td>- “In progress”</td>
</tr>
<tr>
<td></td>
<td>- “Addressed by current projects”</td>
</tr>
<tr>
<td></td>
<td>- “Action needed”</td>
</tr>
<tr>
<td></td>
<td>- “Unknown”</td>
</tr>
<tr>
<td></td>
<td>- “Assessment in progress” (data collection occurring in years listed in parentheses)</td>
</tr>
</tbody>
</table>

**Target Rationale**
May list one or more of the following:
- Relevant background and explanation related to the target and any applicable modifications.
- If applicable, an explanation of why the updates or clarifications were necessary for the 2008 target updates.

Please note that the information referring to the 2008 delisting targets can be found in the document *Delisting Targets for the Milwaukee Estuary Area of Concern: Final Report*.

**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. Typically, the information from this section is drawn from the existing RAPs for the Milwaukee Estuary that were developed in 1991 and 1994.

**Summary of Key Remedial Actions since the 2014 RAP Update and Current Status**
“Key remedial actions” are those that directly contribute to the current status of the BUI. Note that any items listed here are not an exhaustive list of all the remedial actions completed that may have helped make progress toward removing the BUI. The items listed here are any key actions that were completed since the draft 2013 RAP. The narrative here explains and leads to the “Next action needed.”

**Next actions needed**
This section is a narrative listing of assessments and on-the-ground projects that are clearly delineated and directly address the specific BUI. This is also not an exhaustive list of all actions needed to address the impairment, but rather a list of actions that we know must be implemented to make progress toward removing the impairment. Plans for verifying achievement of delisting targets are listed here, if known. Please also note that because of the urban nature of the AOC, contaminated sediment projects listed in this section are not necessarily the only cleanups that would need to occur before removal of a particular impairment. Rather, the projects listed reflect the current knowledge of what must be addressed so that progress on an impairment can continue.
It is important to keep in mind that the primary goal of the AOC program is to address legacy contamination and issues related to severe water quality degradation. While there are some other important and necessary considerations for making progress toward removing impairments, areas with high concentrations of contaminated sediment that contribute to loading of toxic substances into the AOC may need to be addressed before additional work can occur, especially in the case of any physical habitat improvements. That said, it should be noted that more than contaminated sediment remediation will be required to remove all BUIs.

**Issues (challenges, risks) affecting progress on this BUI**
This section lists project contingency (i.e., one thing has to happen before another can occur), funding obstacles, and any other considerations that could affect the timeline for BUI removal.
RESTRICTIONS ON FISH AND WILDLIFE CONSUMPTION

Target and Status

<table>
<thead>
<tr>
<th>Updated Target (2011)</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fish</strong></td>
<td></td>
</tr>
<tr>
<td>Approach to be used with current level of monitoring for fish consumption advisories within the AOC (every five years):</td>
<td></td>
</tr>
<tr>
<td>• All known man-made sources of BCOCs (including PCBs, mercury, dioxins, and furans) within the AOC and tributary watershed have been controlled or eliminated; and</td>
<td>In progress, and Action needed</td>
</tr>
<tr>
<td>• State fish tissue monitoring confirms that waterbody-specific fish consumption advisories are no longer needed for PCBs for waters in the AOC.</td>
<td>Action needed</td>
</tr>
<tr>
<td>• Waters within the Milwaukee Estuary AOC are not listed as impaired due to fish consumption advisories in the most recent Clean Water Act 303(d) and 305(b) Wisconsin Water Quality Report to Congress (submitted to USEPA every two years).</td>
<td>Assessment in progress (on-going)</td>
</tr>
<tr>
<td>Approach to be used with funding to support additional monitoring:</td>
<td></td>
</tr>
<tr>
<td>• All known man-made sources BCOCs (including PCBs, mercury, dioxins, and furans) within the AOC and tributary watershed have been controlled or eliminated; and</td>
<td></td>
</tr>
<tr>
<td>• A multi-year comparison study of fish tissue contaminant levels demonstrates that there is no statistically significant difference (with a 95% confidence interval) in fish tissue BCOC concentrations in the AOC compared to fish tissue BCOC concentrations in a representative non-impacted control site within the Lake Michigan Basin.</td>
<td></td>
</tr>
<tr>
<td><strong>Wildlife</strong></td>
<td></td>
</tr>
<tr>
<td>There are no waterfowl consumption advisories for resident waterfowl due to contamination originating within the AOC.</td>
<td>Assessment in progress (2013-2016)</td>
</tr>
</tbody>
</table>

Target Rationale

Contaminated sediments are the primary contributor of PCBs to fish and wildlife within the AOC. An effective source control and remediation program is therefore necessary in order to meet delisting goals. Following remedial actions and taking appropriate source control measures, evaluation monitoring must be conducted to determine the state of recovery for this impairment. Please note that for this impairment, PCBs are the contaminant of concern; there are no additional fish consumption advisories pertaining to mercury in the AOC (i.e., beyond the state-wide fish consumption advice that applies for mercury).

Please refer to WDNR’s *Fish Consumption Advice for the Milwaukee Estuary Area of Concern* (WDNR, 2015a) and *Choose wisely: A health guide for eating fish in Wisconsin* (WDNR, 2015b) documents for more information about fish consumption advisories.

It should be noted that unrestricted consumption, as proposed in the 2008 targets, is not a goal that can be supported by the AOC program. For this reason, the target was updated in 2011 to reflect that waters
in the AOC should be no worse than other unimpaired waters of the state. There is, however, statewide
test consumption advice because of other, more widespread sources of contamination.

*Fish*

WDNR monitors fish for contaminant burdens from rivers within the Milwaukee River basin (including the
AOC) on a five-year schedule and from the open waters of Lake Michigan every other year. New data
are reviewed in the context of the existing advisories and previous data. Fish consumption advisories are
updated by the WDNR and Department of Health and Family Services as needed based on WDNR
sampling results. The most current fish consumption advisories for the AOC are available at
http://dnr.wi.gov/topic/fishing/consumption/. Because the state regularly monitors fish tissue
concentrations for the waters of the state, a new monitoring program is not necessary to assess this
impairment. Additionally, the state Impaired Waters List is updated every two years, which means that
the state evaluates new data and analyzes trends over time. If tissue concentrations consistently improve
to the point where fish consumption advisories can be lifted so that there are no waterbody-specific
advisories, then the desired outcome has been met and there is no need to wait to remove the
impairment (if the other parts of the target have been met, i.e., “All known man-made sources of
BCOCs…within the AOC and tributary watershed have been controlled or eliminated”).

Listing guidelines for the state Impaired Waters Program considers a waterbody impaired for fish
consumption if a water body has special PCB-based fish consumption advice of one meal per month or
less frequent for resident fish species (like walleye, carp, smallmouth bass and others) or one meal per
week or less frequent for resident panfish (like yellow perch or bluegill). Special advice for PCBs currently
applies to several of these more resident fish species. There are no special fish consumption advisories
due to mercury for the Milwaukee AOC.

The fish consumption advice that applies to fish from the Milwaukee Estuary AOC depends on the type of
fish. Fish consumption advice is also provided for the Milwaukee River from Estabrook Falls downstream
to the estuary and includes the Menomonee and Kinnickinnic Rivers and Lincoln Creek. This advice is for
species primarily resident within these rivers and the inner harbor. These advisories will be used to
determine when the Restrictions on Fish and Wildlife Consumption BUI in the Milwaukee AOC can be
considered for removal.

Fish species like trout and salmon are migratory and may at times be found or caught in the river.
However, these species spend most of their time in Lake Michigan; therefore, removal of the fish
consumption BUI will not be dependent on these migratory species or on the Lake Michigan fish
consumption advisory.

*Wildlife*

In the 2008 target document, there were no targets proposed for wildlife. Unlike fish consumption
advisories, for which all waters of the state are assessed in Wisconsin, waterfowl advisories are only
assessed in areas with suspected contamination issues. Because of its legacy of contamination, the
Milwaukee Estuary was assessed in the 1980s to determine if a waterfowl consumption advisory should
exist for certain waterbodies or portions of waterbodies. According to the state guidelines for developing
waterfowl consumption advice, portions of the Milwaukee Estuary AOC did exceed state waterfowl
criteria, and thus, the state issued a waterfowl consumption advisory in 1987 for portions of the AOC.
Since the advisory was issued, no additional data had been collected.

In the AOC, the following waterfowl consumption advisories apply (please note that in some cases a
relevant structure or landmark may no longer be present. Assessing the waterfowl consumption advisory
will be necessary to determine the exact locations of any waterfowl consumption advisory, should such advisories still be necessary after reassessment):

- Milwaukee River from Highway 167 (Thiensville) upstream to Lime Kiln Dam at Grafton and Cedar Creek from the Milwaukee River up to Bridge Road in the Village of Cedarburg—do not eat mallard ducks using this water.
- Milwaukee Harbor—do not eat black ducks, mallards, scaup, and ruddy ducks using this water.
- Waters in the City of Cedarburg—do not eat Canada geese using these waters.

Rationale for Listing
Fish samples taken from the Milwaukee River system (which includes the Menomonee and Kinnickinnic Rivers) exceed standards established by the state of Wisconsin for the consumption of sport fish. The state issues consumption advisories for various population groups based on fish species and size classes. Advisories are collectively issued for the presence of mercury and PCBs. The Milwaukee River system has had waterbody-specific fish consumption advisories listed for PCBs for decades. As there is no waterbody-specific advice for mercury for waters of the AOC, waters within the AOC fall under the statewide consumption advisory for mercury.

Summary of Key Remedial Actions since the 2014 RAP Update and Current Status
Because contaminated sediments are the primary contributor of contaminants to fish within the AOC, contaminated sediment cleanups (especially for PCBs) are necessary in making progress toward addressing this impairment. The following dredging related actions were completed in the last year:

- Dredging was completed for Phase 2 of the Lincoln Park/Milwaukee River Channels Great Lakes Legacy Act project in 2015. This was the last in a set of three projects to address PCB laden sediment in the Lincoln Park area of the Milwaukee River.
- Miller Compressing has continued planning for the Burnham Canal Superfund site.
- Mercury Marine has continued planning for the Cedar Creek Superfund Alternative site. This site has PCB-contaminated sediment and needs to be remediated for BUI removal to occur.
- There is interest in pursuing a Legacy Act betterment project in the Milwaukee, Menomonee and Kinnickinnic Rivers and Inner Harbor. Figure 2 shows the status of contaminated sediment projects in the AOC.
- Sediment assessment was completed for the Menomonee River from the Little Menomonee River to the confluence with the Milwaukee River. Characterization of the sediments in the Turning Basin was completed.

WDNR received Great Lakes Restoration Initiative (GLRI) funding to collect data to reassess the status of the waterfowl consumption advisories, determine if any of the existing advisories can be removed or if any additional advisories are warranted. Sample collection will continue in 2016. Preliminary results indicate some type of consumption advisory will remain in place. However, as all data have not been received and analyzed, no change is currently proposed. WDNR Fisheries Management samples waterbodies every 5 years in order to assess consumption advisories. The Milwaukee River and Cedar Creek are due for resampling in 2017 and 2018, respectively.
Figure 2. Sediment progress and sites needing action in the Milwaukee Estuary AOC.
Next action(s) needed
Areas of the AOC contaminated with PCBs or other bioaccumulative chemicals of concern (BCOCs) need assessment and remediation. Consumption advisories for fish and wildlife need to be reassessed until it is determined the delisting targets are met.

Remediation of contaminated sediment is necessary before this BUI can be removed. For contaminated sediment cleanups, when possible upstream sources/sites should be addressed before addressing sites further downstream; however, anytime opportunities present themselves to address contamination, they should be taken, even if a downstream site is cleaned up ahead of a site further upstream. The following actions need to be completed in order to determine contamination related management actions.

- Assess areas on the Milwaukee River from Estabrook Park dam downstream to the estuary.
- Assess the potential impacts to sediments from other manufactured gas plants within the AOC.
- Review and act upon sediment assessment data from other areas of the AOC. This includes, but is not limited to, Kinnickinnic River/Turning Basin, Menomonee River from confluence with Little Menomonee to the harbor and existing Milwaukee River data.

The following management actions are necessary to move towards removing this impairment. This list is not complete (completion depends on the assessment and data review activities listed above). The actions that have been implemented are italicized.

1) Sources of contamination to the benthic community within the AOC need to be remediated.
   - Complete the assessment and cleanup of PCBs at the Cedar Creek Superfund Alternative Site.
   - Complete the management of sediments containing PAHs and metals from the Burnham Canal Superfund Alternative Site.
   - Complete the assessment of contaminated sediment and evaluate and implement clean up related to the Solvay Coke Superfund Alternatives Site.
   - Blatz Pavilion, Lincoln Park Phase 1 and Phase 2 Contaminated Sediment Remediation
   - Kinnickinnic River Legacy Act Cleanup

Issues (challenges, risks) affecting progress on this BUI
The main barrier to progress is ensuring enough funding through programs or responsible parties to complete all the contaminated sediment projects (both assessment and remediation) in a timely manner.
DEGRADATION OF FISH AND WILDLIFE POPULATIONS

Target and Status

<table>
<thead>
<tr>
<th>Updated Target (2011)</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fish</strong></td>
<td></td>
</tr>
<tr>
<td>This BUI will be considered to be eligible for removal when the following have occurred:</td>
<td></td>
</tr>
<tr>
<td>• All contaminated sediment hotspots within the AOC have been identified, and implementation actions to remediate contaminated sites have been completed.</td>
<td>In progress, and Action needed</td>
</tr>
<tr>
<td>• A local fish and wildlife management and rehabilitation plan has been compiled for the estuary that:</td>
<td>In progress</td>
</tr>
<tr>
<td>o Defines the causes of all population impairments within the AOC</td>
<td></td>
</tr>
<tr>
<td>o Establishes site specific local population targets for native indicator fish and wildlife species within the AOC</td>
<td></td>
</tr>
<tr>
<td>o Identifies all fish and wildlife population rehabilitation programs/activities within the AOC and establishes a mechanism to assure coordination among all these programs/activities, including identification of lead and coordinative agencies</td>
<td></td>
</tr>
<tr>
<td>o Establishes a time table, funding mechanism, and lead agency or organization responsibility for all fish and wildlife population activities needed within the AOC.</td>
<td></td>
</tr>
<tr>
<td>o The actions/projects necessary to accomplish the recommendations of the fish and wildlife management and restoration plan are implemented.</td>
<td></td>
</tr>
<tr>
<td>• Populations for native indicator fish species are statistically similar to populations in reference sites with similar habitat but little to no contamination.</td>
<td>Unknown</td>
</tr>
<tr>
<td><strong>Wildlife</strong></td>
<td></td>
</tr>
<tr>
<td>Assess wildlife populations and the possible extent of any impairment within the AOC before setting specific wildlife population targets.</td>
<td>In progress, and Action needed</td>
</tr>
</tbody>
</table>

Target Rationale
While many partners in the AOC have been involved in planning and produced documents that can be a resource for determining management actions for this impairment, a comprehensive plan for habitat restoration in the AOC has not been produced. The target includes provision for just such a plan to assess and organize necessary projects to address the impairment. In 2012, WDNR assembled a team of fish and wildlife experts to provide input on planning for fish and wildlife related impairments needed for this plan. Through a facilitated process the group determined measures of success, developed scopes of work for necessary fish and wildlife assessments, and identified habitat projects that address the loss of fish and wildlife habitat impairment. The work of the fish and wildlife technical team will be assembled into a Habitat Plan for the AOC as called for in the target.
Rationale for Listing
The Stage 1 RAP (WDNR, 1991) and 1994 RAP update (WDNR, 1994) indicated that fish populations in the AOC were severely degraded and that the fish species resident in the AOC were mostly pollution tolerant species due to poor water quality. The lack of natural shoreline and channel features throughout the AOC, urban runoff, point sources, and sediment accumulation were the major factors noted for this impairment (WDNR, 1994, p. 2-17). In terms of the wildlife component of this goal, at the time that the RAP documents were written, there was essentially no data about wildlife populations. In the first RAP document written in 1991, the wildlife component was not considered to be part of the impairment for the Milwaukee Estuary AOC (WDNR, 1991, p. V-3). The RAP revision in 1994 stated that declines in wildlife populations were likely attributable to degraded water quality and loss of habitat, especially the loss of wetlands (WDNR, 1994, p. 2-17). The 1994 RAP also said that contaminants present in the AOC are known to affect wildlife reproduction and growth, and so the use should be considered impaired (WDNR, 1994, p. 2-18).

According to Waller and Rooney (2010), studies published in 2008 assessed ecological change in Milwaukee County and concluded there have been substantial losses of species richness with declines of 20-70% for bird, amphibian, and reptile groups, resulting mainly from habitat loss (2010).

Historically, there is a component of these impairments that has been viewed as being tied to contamination. While it is unclear from the scientific literature the degree to which contamination contributes to the decline of fish and wildlife populations, cleanup of contaminated sites in the AOC remains a key management action for this impairment. The lack of suitable physical habitat in order to support populations of desired fish and wildlife species is also a key feature that will need to be addressed to make progress on this impairment.

Summary of Key Remedial Actions since the 2014 RAP Update and Current Status
Progress continues in assessment work needed to identify the necessary projects to address this impairment. Work on both of the GLRI-funded fish and wildlife population assessments projects continued this year, completing the second year of these three-year projects. The wildlife population assessment is being carried out by Milwaukee County and UW-Milwaukee. The fisheries population assessment is being carried out by the U.S. Geological Survey (USGS) Wisconsin Science Center. In addition, the University of Wisconsin-Milwaukee (UWM) School of Freshwater Science (SFS) sought and received funding this year to provide additional fisheries and aquatic habitat mapping and assessment in the harbor. The data collected from all of the assessments will inform the identification of management actions needed to remove this BUI. WDNR has defined a process and timeline for the completion of the planning and identification of management actions.

Next action(s) needed
The assessment projects will continue into 2017. Management actions will then be identified in consultation with the Fish and Wildlife Technical Team in 2017 and 2018 and a fish and wildlife management and rehabilitation plan will be completed.

The following actions need to be completed in order to determine contamination related management actions.

- Assess areas on the Milwaukee River from Estabrook Park dam downstream to the estuary.
• Assess the potential impacts to sediments from other manufactured gas plants within the AOC.
• Review and act upon sediment assessment data from other areas of the AOC. This includes, but is not limited to, Kinnickinnic River/Turning Basin, Menomonee River from confluence with Little Menomonee to the harbor and existing Milwaukee River data.

The following management actions are necessary to move towards removing this impairment. This list is not complete but is expected to be complete by 2018. The actions that have been implemented are italicized.

1) Sources of contamination within the AOC need to be remediated.
   o Complete the assessment and cleanup of PCBs at the Cedar Creek Superfund Alternative Site.
   o Complete the management of sediments containing PAHs and metals from the Burnham Canal Superfund Alternative Site.
   o Complete the assessment of contaminated sediment and evaluate and implement clean up related to the Solvay Coke Superfund Alternatives Site.
   o *Blatz Pavilion, Lincoln Park Phase 1 and Phase 2 Contaminated Sediment Remediation*
   o *Kinnickinnic River Legacy Act Cleanup*

2) Actions to address physical habitat as identified by the fish and wildlife plan will be determined based upon the data and recommendations of the fish and wildlife population assessments.

**Issues (challenges, risks) affecting progress on this BUI**
We are aware of the difficulties with establishing population-related objectives for this BUI since attracting desired species can be more complicated than just providing them with suitable habitat. Just because habitat is created does not necessarily mean that the desired species can colonize those areas and persist as viable populations. The assessments will determine what species can still be viably sustained within the AOC, given the constraints imposed by the limited amount of habitat extent and diversity that can be restored in an urban environment.
FISH TUMORS OR OTHER DEFORMITIES

Target and Status

<table>
<thead>
<tr>
<th>Updated Target (2011)</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Removal may occur if:</td>
<td>In progress and Action needed</td>
</tr>
<tr>
<td>• All known major sources of PAHs and chlorinated organic compounds within the AOC and tributary watershed have been controlled or eliminated</td>
<td></td>
</tr>
<tr>
<td>• A fish health survey of resident benthic fish species, such as white suckers, finds incidences of tumors or other deformities at a statistically similar incidence rate of minimally impacted reference sites.</td>
<td>Assessment in progress (2012-2015)</td>
</tr>
<tr>
<td>OR, in cases where tumors have been reported:</td>
<td></td>
</tr>
<tr>
<td>• A comparison study of resident benthic fish such as white suckers of comparable age and maturity, or of fish species found with tumors in previous fish health surveys in the AOC, with fish at minimally impacted reference sites indicate that there is no statistically significant difference (with 95% confidence) in the incidence of liver tumors or deformities.</td>
<td>Assessment in progress (2012-2015)</td>
</tr>
</tbody>
</table>

Target Rationale
The 2008 document stated that the first step toward removing this impairment would be to determine if the use was impaired by sampling 50 fish to determine whether the tumor incidence rate was greater than 5%. WDNR’s Office of the Great Lakes has used documented incidence rates and performed rigorous statistical analyses to help guide its approach to assessing the fish tumor impairment. The sampling design suggests a relatively large data collection effort in an attempt to achieve an acceptably high and known degree of confidence in the study results. For more detailed information about WDNR’s sampling strategy for the 2012-2013 evaluation of this BUI, please see Appendix E in the 2012 RAP Update.

The updated target stipulates that the appropriate reference sites would be minimally impacted, as opposed to non-impacted, and that the tumors and deformities need to be contaminant-related since there can be other causes, like pathogens, of tumors and deformities in fish. A zero-percent incidence rate is not achievable, since tumors occur naturally in fish even in the absence of contaminants. The updated target also removed a previous provision stating that resident non-benthic fish should be sampled for this impairment. Given the nature of this particular impairment, and its close connection to contaminated sediments, there was no justifiable basis for this provision.

Rationale for Listing
The 1994 RAP included this BUI as suspected because the concentrations of certain PAHs and metals in AOC sediments were similar to concentrations in areas with verified fish tumors. As of 2008, no fish health surveys had been conducted within the AOC to determine the extent (or existence) of the impairment. This has since changed (see information in next two sections).

Summary of Key Remedial Actions since the 2014 RAP Update and Current Status
Sampling of 200 white suckers was conducted in 2013 in the Milwaukee Estuary to determine if this impairment existed (it was previously listed as suspected). The results of this assessment were received in 2014. Researchers found that 15% of the fish sampled in the Milwaukee Estuary had neoplastic liver tumors. This rate is higher than an expected background rate of fish tumors. This finding confirms that
an impairment exists. Henceforth, the “suspected” reference for this BUI is removed. The change was reflected in the 2014 RAP Update.

In 2014 the Root River (Racine, WI) was sampled to determine the tumor incidence rate at an appropriate minimally impacted reference site. The rate of neoplastic liver tumors in white suckers from this site was 8.5%. Even though this incidence rate is greater than documented background rates, it is still well below that of the Milwaukee Estuary. The reference site confirms that the Milwaukee River is impaired with respect to fish tumors.

Next action(s) needed
Results from the sampling of the Milwaukee Estuary and Root River reference indicate more needs to be done to control or eliminate the sources of contaminants contributing to the fish tumor problem. Sites that contain elevated amounts of PAHs, metals, and other substances that cause fish tumors and deformities must be addressed before removal of this impairment can occur.

The following actions need to be completed in order to determine contamination related management actions.

- Assess areas on the Milwaukee River from Estabrook Park dam downstream to the estuary.
- Assess the potential impacts to sediments from other manufactured gas plants within the AOC.
- Review and act upon sediment assessment data from other areas of the AOC. This includes, but is not limited to, Kinnickinnic River/Turning Basin, Menomonee River from confluence with Little Menomonee to the harbor and existing Milwaukee River data.

The following management actions are necessary to move towards removing this impairment. This list is not complete. The actions that have been implemented are italicized.

1) Sources of contamination within the AOC need to be remediated.
   - Complete the assessment and cleanup of PCBs at the Cedar Creek Superfund Alternative Site.
   - Complete the management of sediments containing PAHs and metals from the Burnham Canal Superfund Alternative Site.
   - Complete the assessment of contaminated sediment and evaluate and implement clean up related to the Solvay Coke Superfund Alternatives Site.
   - Blatz Pavilion, Lincoln Park Phase 1 and Phase 2 Contaminated Sediment Remediation
   - Kinnickinnic River Legacy Act Cleanup

Issues (challenges, risks) affecting progress on this BUI
The main barrier to progress is ensuring enough funding through programs or responsible parties to complete all the contaminated sediment projects (both assessment and remediation) in a timely manner.
## BIRD OR ANIMAL DEFORMITIES OR REPRODUCTION PROBLEMS (POTENTIALLY IMPAIRED)

### Target and Status

<table>
<thead>
<tr>
<th>Updated Target (2011)</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>This BUI can be removed if:</td>
<td>Assessment in progress</td>
</tr>
<tr>
<td>• Studies conducted in the AOC indicate that the beneficial use should not be considered impaired, or</td>
<td>Action needed</td>
</tr>
<tr>
<td>• If studies conducted in the AOC determine that this use is impaired, then two approaches can be considered for delisting:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>o Approach 1 – Observational Data and Direct Measurements of Birds and other Wildlife</td>
</tr>
<tr>
<td></td>
<td>▪ Evaluate observational data of bird or other animal deformities for a minimum of two successive monitoring cycles in indicator species identified in the initial studies as exhibiting deformities or reproductive problems. If deformity or reproductive problem rates are not statistically different than those at minimally impacted reference sites (at a 95% confidence interval), or no reproductive or deformity problems are identified during the two successive monitoring cycles, then the BUI can be removed. If the rates within the AOC are statistically higher than the reference site, it may indicate a source from either within or from outside the AOC. Therefore, if the rates are statistically higher or the data are insufficient for analysis to achieve agreed upon statistical power, then...</td>
</tr>
<tr>
<td></td>
<td>▪ Evaluate tissue contaminant levels in egg, young and/or adult wildlife. If contaminant levels are lower than the Lowest Observable Effect Level (LOEL) for that species for a particular contaminant that are not statistically different than those at minimally impacted reference sites (at a 95% confidence interval), then the BUI can be removed.</td>
</tr>
<tr>
<td></td>
<td>▪ Where direct observation of wildlife and wildlife tissue data are not available, the following approach should be used:</td>
</tr>
</tbody>
</table>
Approach 2 – Fish Tissue Contaminant Levels as an Indicator of Deformities or Reproductive Problems

- If fish tissue concentrations of contaminants known to cause deformities or reproductive suppression identified in the AOC are at or lower than the LOEL known to cause reproductive or developmental problems in fish-eating birds and mammals, the BUI can be delisted, or
- If fish tissue concentrations of contaminants known to cause deformities or reproductive suppression identified in the AOC are not statistically different than Lake Michigan (at 95% confidence interval with sufficient and agreed upon statistical power), then the BUI can be removed. Fish of a size and species considered prey for the wildlife species under consideration must be used for the tissue data.

Target Rationale
Before targets can be developed with confidence for the AOC, sufficient studies must be conducted to determine if this beneficial use is impaired. The targets identified above should be reviewed following completion of the studies and modified in accordance with the findings of those studies.

Rationale for Listing
Insufficient data are available to show if these problems exist with birds or other animals within the AOC. The 1991 RAP considered this use unimpaired because of lack of information. Because contaminants like PCBs and heavy metals that are found in AOC sediments may have the potential to impair reproduction and development in wildlife, this use was considered impaired in the 1994 RAP.

Summary of Key Remedial Actions since the 2014 RAP Update and Current Status
USGS has been using tree swallows as indicators of environmental contamination in areas across the United States, and they previously sampled at least one site in the Milwaukee Estuary. In 2015 five sites were sampled, including: Cedar Creek, Lincoln Park, Three Bridges Park, Lakeshore State Park and Baran Park. This represents one site each on Cedar Creek, Milwaukee River, Menomonee River, Kinnickinnic River and in the Estuary. This sampling will provide data robust enough to determine if this beneficial use is impaired. Preliminary data from USGS for 2015 indicate contaminants are present and further assessment may be needed to determine impairment status.

Next action(s) needed
Continued sampling is needed to gather adequate data to determine whether this is an impaired use in the AOC. Sampling by USGS at the suite of sites in the AOC appears to be the best course of action to assess this impairment.

Issues (challenges, risks) affecting progress on this BUI
Until recently, limited data have been available to aid in the assessment of this impairment.
DEGRADATION OF BENTHOS

Target and Status

<table>
<thead>
<tr>
<th>Updated Target (2011)</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Removal may occur if:</td>
<td></td>
</tr>
<tr>
<td>• Known contaminant sources contributing to sediment contamination and degraded benthos have been identified and control measures implemented; and</td>
<td>In progress</td>
</tr>
<tr>
<td>• All remediation actions for contaminated sediments are completed and monitored according to an approved plan; or</td>
<td>In progress, and</td>
</tr>
<tr>
<td>• The benthic community within the site being evaluated is statistically similar to a reference site with similar habitat and minimal sediment contamination.</td>
<td>Action needed</td>
</tr>
</tbody>
</table>

Target Rationale

There are several considerations for this impairment. First, the harbor portion of the AOC will support different benthic communities than will the tributaries. Benthic communities in the harbor/estuary are subjected to regularly disturbed and altered physical conditions (like dredging and shoreline hardening from the installation of sheet piling). Second, benthic communities, either in the harbor or in the tributaries, are also impacted from pollution. The rationale for this target is to clean up contaminants so that they aren’t substantially impacting benthic communities, and then determine if the degradation of communities in the harbor is likely being caused by the poor physical conditions for which there is little feasible remedy. If there are degraded benthic communities in the tributaries, the main causes could be the presence of contamination or degraded physical habitat (e.g., substrates that don't provide adequate conditions for higher quality benthic communities). For both the harbor and the tributaries, contaminants and pollution must be assessed. Physical habitat should also be assessed to determine whether this could be contributing to the degraded communities, and, where feasible, habitat improvements should be made.

Measures such as sediment quality guidelines, equilibrium partitioning sediment benchmarks, and other sediment guidelines are part of the WDNR review to arrive at an approved remediation plan.

Rationale for Listing

According to earlier RAP documents, this beneficial use is considered impaired because of degraded physical habitat, low dissolved oxygen concentrations, and constituents in sediment toxic to macroinvertebrates, but the extent of the impairment is not well defined. The 1991 and 1994 RAP documents recognize that monitoring is required to better define this impairment. Furthermore, because physical conditions within the AOC are diverse, different final targets may be required for different habitat types within the AOC.

1 The Consensus-Based Sediment Quality Guidelines for Wisconsin (see References) were developed through an assimilation of results from multiple published effects-based toxicity testing to freshwater benthos, so there is a clear and documented connection between contamination and deleterious benthic community impacts.
The RAPs also cite results of several benthic surveys in the AOC that showed benthos were lacking in diversity and were dominated by pollution-tolerant species. It was because of the lack of diversity and the prevalence of pollution-tolerant organisms that this impairment was listed.

**Summary of Key Remedial Actions since the 2014 RAP Update and Current Status**

Results from the benthos assessments in 2012 & 2014 are still pending. The data from 2012 is being reassessed using the same statistical analysis as the 2014 data. The final report will include both data sets and final conclusions and is expected in early 2016.

**Next action(s) needed**

Sources of contamination to the benthic community within the AOC need to be remediated. The following actions need to be completed in order to determine contamination related management actions.

- Assess areas on the Milwaukee River from Estabrook Park dam downstream to the estuary.
- Assess the potential impacts to sediments from other manufactured gas plants within the AOC.
- Review and act upon sediment assessment data from other areas of the AOC. This includes, but is not limited to, Kinnickinnic River/Turning Basin, Menomonee River from confluence with Little Menomonee to the harbor and existing Milwaukee River data.

The status and condition of the benthic community in the AOC needs to be determined. The next step will be to evaluate the findings of the USGS benthos study and then assess the need to supplement the study to adequately characterize the range of benthic conditions in the AOC. A target adjustment may also be needed depending on the results of the study.

The following management actions are necessary to move towards removing this impairment. This list is not complete. The actions that have been implemented are italicized.

1) Sources of contamination to the benthic community within the AOC need to be remediated.
   - Complete the assessment and cleanup of PCBs at the Cedar Creek Superfund Alternative Site.
   - Complete the management of sediments containing PAHs and metals from the Burnham Canal Superfund Alternative Site.
   - Complete the assessment of contaminated sediment and evaluate and implement clean up related to the Solvay Coke Superfund Alternatives Site.
   - *Blatz Pavilion, Lincoln Park Phase 1 and Phase 2 Contaminated Sediment Remediation*
   - *Kinnickinnic River Legacy Act Cleanup*

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

A full assessment of the impairment cannot be made until the final data from 2012 and 2014 are received from USGS. Given the disturbance found in some of the AOC waterways, it is unlikely that high quality benthic communities can be established at all sites. For instance, the inner harbor has high degrees of disturbance, sediment deposition and lack of suitable habitat that tend to be dominated by very tolerant organisms. Changes in the habitat in this area are unlikely. Refinement of the target may be needed, taking into consideration the achievability of targets for BUI removal and the varied benthic conditions throughout the AOC.
RESTRICTIONS ON DREDGING ACTIVITIES

Target and Status

<table>
<thead>
<tr>
<th>Updated Target (2011)</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Removal of this BUI can occur when:</td>
<td></td>
</tr>
<tr>
<td>• Contaminated sediment hotspots within and upstream from the AOC have been identified.</td>
<td>In progress and Action needed</td>
</tr>
<tr>
<td>• Implementation actions to remediate contaminated sites have been completed. As a source control measure and for AOC remediation, known contaminated sites must be addressed before BUI removal is possible.</td>
<td>In progress</td>
</tr>
<tr>
<td>• There are no special handling requirements of material from routine navigational dredging due to contamination originating from controllable sources within the AOC.</td>
<td>In progress</td>
</tr>
</tbody>
</table>

Target Rationale

While many of the AOCs have defined this BUI to only federally maintained navigation channels, the Milwaukee Estuary RAP took a broader view of this issue. The Technical Advisory Committee for the 1994 RAP update recognized that contaminated sediments are linked to most of the BUIs in the AOC. Therefore, addressing contaminated sediments is central to removing this impaired beneficial use.

The intent is to eliminate special handling requirements that go beyond the normal handling requirements for dredged sediments. If sediments that are dredged for navigation, either by the U.S. Army Corps of Engineers or by private companies, contain moderate to high levels of contaminants, then there are additional costs incurred from the proper disposal of such sediments. We seek to eliminate those additional burdens imposed by the presence of contaminants so that parties can dredge and dispose of sediment by simply following required standard testing and disposal as mandated by state law.

Rationale for Listing

Contaminated sediments are recognized as one of the primary sources of pollution in the Milwaukee Estuary AOC. Historically, most of the AOC was modified, dredged, and maintained for large vessel navigation, making the estuary a settling basin for sediments. Over time, sections of the rivers that were previously maintained are no longer needed for deep draft navigation, but the sediments and their associated contaminants remain. This impairment was listed due to the presence of a number of contaminated sediment sites. Contaminants that are issues within the AOC include PAHs, heavy metals, and PCBs.

Summary of Key Remedial Actions since the 2014 RAP Update and Current Status

The following dredging related actions were completed in the last year:

• Dredging was completed for Phase 2 of the Lincoln Park/Milwaukee River Channels Great Lakes Legacy Act project in 2015. This was the last in a set of three projects to address PCB-laden sediment in the Lincoln Park area of the Milwaukee River.

• Miller Compressing has continued planning for the Burnham Canal Superfund site.

• Mercury Marine has continued planning for the Cedar Creek Superfund Alternative site. This site has PCB-contaminated sediment and needs to be remediated for BUI removal to occur.
• There is interest in pursuing a Legacy Act betterment project in the Milwaukee, Menomonee and Kinnickinnic Rivers and Inner Harbor. Figure 2 shows the status of contaminated sediment projects in the AOC.
• Sediment assessment was completed for the Menomonee River from the Little Menomonee River to the confluence with the Milwaukee River. Characterization of the sediments in the Turning Basin was completed.

Next action(s) needed
Remediation of contaminated sediment is necessary before this BUI can be removed. For contaminated sediment cleanups, when possible upstream sources/sites should be addressed before addressing sites further downstream; however, anytime opportunities present themselves to address contamination, they should be taken, even if a downstream site is cleaned up ahead of a site further upstream. The following actions need to be completed in order to determine contamination related management actions.

• Assess areas on the Milwaukee River from Estabrook Park dam downstream to the estuary.
• Assess the potential impacts to sediments from other manufactured gas plants within the AOC.
• Review and act upon sediment assessment data from other areas of the AOC. This includes, but is not limited to, Kinnickinnic River/Turning Basin, Menomonee River from confluence with Little Menomonee to the harbor and existing Milwaukee River data.

The following management actions are necessary to move towards removing this impairment. This list is not complete. The actions that have been implemented are italicized.

1) Sources of contamination to the benthic community within the AOC need to be remediated.
   o Complete the assessment and cleanup of PCBs at the Cedar Creek Superfund Alternative Site.
   o Complete the management of sediments containing PAHs and metals from the Burnham Canal Superfund Alternative Site.
   o Complete the assessment of contaminated sediment and evaluate and implement clean up related to the Solvay Coke Superfund Alternatives Site.
   o Blatz Pavilion, Lincoln Park Phase 1 and Phase 2 Contaminated Sediment Remediation
   o Kinnickinnic River Legacy Act Cleanup

Issues (challenges, risks) affecting progress on this BUI
The main barrier to progress is ensuring enough funding through programs or responsible parties to complete all the contaminated sediment projects (both assessment and remediation) in a timely manner.
EUTROPHICATION OR UNDESIRABLE ALGAE

Target and Status

<table>
<thead>
<tr>
<th>Updated Target (2011)</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Removal of this BUI can occur when:</strong></td>
<td></td>
</tr>
<tr>
<td>• Total phosphorus (TP) concentrations within the AOC rivers, harbors,</td>
<td>In progress and Action needed</td>
</tr>
<tr>
<td>and nearshore waters meet the criteria recommended for the State of Wisconsin,</td>
<td></td>
</tr>
<tr>
<td>as established by WDNR.</td>
<td></td>
</tr>
<tr>
<td>• When the results from the total maximum daily load study for phosphorus,</td>
<td>In progress</td>
</tr>
<tr>
<td>total suspended solids, and bacteria are completed for the Menomonee,</td>
<td></td>
</tr>
<tr>
<td>Kinnickinnic, and Milwaukee Rivers.</td>
<td></td>
</tr>
<tr>
<td>• Measures to meet the Total Maximum Daily Loading Implementation Plan are being</td>
<td>Action needed</td>
</tr>
<tr>
<td>completed.</td>
<td></td>
</tr>
<tr>
<td>• No water bodies within the AOC are included on the list of impaired waters</td>
<td>Action needed</td>
</tr>
<tr>
<td>due to nutrients or excessive algal growths in the most recent WI Impaired Waters</td>
<td></td>
</tr>
<tr>
<td>list.</td>
<td></td>
</tr>
<tr>
<td>• Chlorophyll-α concentrations within the AOC lake and impoundment areas do not</td>
<td>Unknown</td>
</tr>
<tr>
<td>exceed 4.0 µg/L.</td>
<td></td>
</tr>
<tr>
<td>• There are no beach closures in the AOC due to excessive nuisance algae growth.</td>
<td>Unknown</td>
</tr>
</tbody>
</table>

Target Rationale

The target revision was needed because at the time that the proposed targets were being developed in 2008, Wisconsin did not have any criteria for nutrients, but was in the process of developing them. Phosphorus criteria have since been established, and in the AOC, the Menomonee, Milwaukee, and Kinnickinnic Rivers (as well as many of their tributaries) are listed as impaired because of low dissolved oxygen concentrations caused by excessive phosphorus pollution (WDNR, Impaired Waters Program). The Milwaukee Metropolitan Sewerage District (MMSD) has received funding to determine where the sources of contamination are coming from (i.e., a total maximum daily load study, or TMDL), and the results of the study should inform future actions that will be necessary in order to reduce phosphorus pollution to the AOC.

The estuary rivers currently have variance criteria (see NR 104.06 of the Wisconsin Administrative Code) for dissolved oxygen concentrations (2 mg/L), indicating that the estuary is not capable of supporting full fish and aquatic life use designations that would require dissolved oxygen concentrations of at least 5 mg/L. Stakeholders have indicated that they would like waters of the AOC to meet the full fish and aquatic life standard of 5 mg/L, and significant strides have been made in improving water quality. They would like to aim for attaining the full fish and aquatic life standard in cases where there are sometimes lower dissolved oxygen concentrations (e.g., on portions of the Kinnickinnic River).
Rationale for Listing
The 1994 RAP considered this use impaired because phosphorus, nitrogen, and chlorophyll a concentrations within the AOC indicated eutrophic conditions (WDNR, 1994, p. 2-19). Low dissolved oxygen concentrations were also common within the AOC rivers. The estuary acts as a settling basin for suspended materials. The organic portion is broken down through chemical and biological processes that demand oxygen from the water column, leading to lower concentrations. The Milwaukee Estuary, including the lower Menomonee, Milwaukee, and Kinnickinnic Rivers are regularly listed as impaired waters (as part of the state’s Clean Water Act/303(d) program) for excess phosphorus and low dissolved oxygen concentrations. In the 1994 RAP, total phosphorus levels in the AOC exceeded 0.1 mg/L in 40 to 75 percent of the samples taken from the Inner Harbor, and 10 to 25 percent of the time from the Outer Harbor.

Summary of Key Remedial Actions since the 2014 RAP Update and Current Status
MMSD received GLRI funding to complete third-party TMDL analyses on the Kinnickinnic, Menomonee, and Milwaukee Rivers and the Milwaukee Estuary. While the project was scheduled to be completed by the end of 2013, delays have pushed back the completion date to 2016, with implementation to follow.

Next action(s) needed
The results from the TMDL study should be helpful in determining what progress can be made with regard to the issue of phosphorus loading in the estuary, and improving water quality. Once the TMDL has been completed and the implementation plan has been prepared, we will have a better idea if the AOC program will need to do anything further in order to remove this BUI. Support for TMDL implementation will be important, but it is not clear at this time what AOC management actions would be needed.

Nonpoint source pollution is a challenge to making progress on this impairment. Therefore, addressing nonpoint source pollution throughout the watersheds is a priority issue for continuing to make progress in the Estuary. Green infrastructure projects and implementation of other stormwater best management practice projects should be a priority to address this issue.

A complete list of management actions that are necessary to move towards removing this impairment has not been defined. Decisions on management actions can begin when the results of the TMDLs are available.

Issues (challenges, risks) affecting progress on this BUI
The physical conditions within the estuary itself have not changed so despite the substantially decreased contributions of organic material from sewer overflows, meeting the designated fish and aquatic uses may still be difficult. Another challenge for addressing this impairment will be the contribution of orthophosphate to total phosphorus levels in waterbodies in the AOC. Some municipal water supplies in the AOC add orthophosphate as an anticorrosive agent. Under Wisconsin state statute and administrative code (Section 283.35, Wis. Stats. and Section NR 205.08, Wis. Adm. Code), this treated water is used in some non-process waters, (e.g., cooling systems) and directly discharged without having the orthophosphate removed. The orthophosphate increases the total phosphorus concentrations in waterbodies and can contribute to further algal growth.
### BEACH CLOSINGS/RECREATIONAL RESTRICTIONS

#### Target and Status

<table>
<thead>
<tr>
<th>Updated Target (2011 &amp; 2012)</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>This BUI will be considered removed when:</td>
<td></td>
</tr>
<tr>
<td>• All known sources of bacterial contamination to the AOC and tributary watersheds have been identified and, if feasible, have been controlled or treated to reduce possible exposures; and</td>
<td>Assessment in progress, and Action needed</td>
</tr>
<tr>
<td>• No unpermitted overflows (either from sanitary sewers or combined sewers) have occurred within the AOC during the previous five year period.</td>
<td>Unknown</td>
</tr>
<tr>
<td>• All municipalities within the AOC have adopted and are implementing storm water reduction programs including an illicit discharge elimination program; and</td>
<td>Complete</td>
</tr>
<tr>
<td>• No water bodies within the AOC are included on the list of impaired waters due to contamination with pathogens or chemicals having a public health concern (i.e., carcinogenic, mutagenic) in the most recent Wisconsin Impaired Waters list that is submitted to USEPA every two years; and</td>
<td>In progress and Action needed</td>
</tr>
<tr>
<td>• No local or state contact advisories related to the presence of a chemical contaminant have been issued within the AOC during the previous five years.</td>
<td>Unknown</td>
</tr>
<tr>
<td>• No water bodies (including beaches) within the AOC are included on the list of impaired waters for recreational restrictions in the most recent Wisconsin Impaired Waters list.</td>
<td>In progress, and Action needed</td>
</tr>
<tr>
<td>• Implementation of the Milwaukee River Total Maximum Daily Load Study for bacteria is complete.</td>
<td>In progress, and Action needed</td>
</tr>
</tbody>
</table>

#### Target Rationale

At the time that the targets were being proposed, there were several beaches listed for pathogens, and there had been problems with pathogens at beaches. Bradford Beach was closed 28 days in 2006 and South Shore Beach was closed 43 days in 2006. Bradford, McKinley, and South Shore Beaches were listed on the Wisconsin Impaired Waters list because they were not meeting their full recreational uses due to bacterial contamination.

Since that time, conditions at several of the beaches have substantially improved, and for the 2010 impaired waters list, Wisconsin recommended delisting, or removing, Bradford and McKinley beaches from the impaired waters list for pathogens.

In 2012, WDNR modified the targets for this impairment (refer to WDNR, 2012, p. 37-38). The second bullet specifying that there should be no sanitary sewer overflows or unpermitted combined sewer
overflow for a less than 25-year rainfall event was revised, since this language is inconsistent with WDNR’s wastewater permitting language. Additionally, two items of the target relating to no water bodies or beaches in the AOC being listed for recreational restrictions were combined into one target item. Additionally, a target item related to implementation of the TMDL for bacteria was necessary, since implementation of the TMDL should lead to removing the AOC waterbodies from the impaired waters list.

Since the Deep Tunnel system came online in 1994, the frequency of sanitary sewer overflows (SSOs) and combined sewer overflows (CSOs) has decreased dramatically. Complicating matters is that water quality models have shown that 60-75% of the fecal coliform loads cannot be explained by nonpoint source runoff from rooftops, parking lots, streets, and other impervious surfaces (SEWRPC, 2008), especially for the Menomonee and Kinnickinnic Rivers. The Great Lakes Water Institute’s preliminary data demonstrates that exfiltration (leaking) from failing sanitary sewer infrastructure is a major source of fecal indicator bacteria and pathogens in urban stormwater that impacts the AOC. This means that stormwater systems are acting as conduits for conveying sewage from failing infrastructure into surface waters used for drinking water and recreation. This sanitary waste poses a more direct threat to human health, since it is more likely to contain pathogens than urban stormwater runoff. This problem is particularly difficult to address because thousands of localized breaches within the sanitary sewage system are much more difficult to address than combined and sanitary sewage overflows, where sources and system capacities are well understood. Pathogen loading from non-point sources is quite high and must be addressed before state water quality standards for recreation can be met. This is why we are proposing that the TMDL be implemented first before BUI removal occurs. In order to implement the TMDL, there is a need to understand where sewage is getting into the AOC waterways. To this end, a proposal was written to both help with TMDL implementation and BUI removal. This proposal can be found in Appendix G of the 2012 RAP Update.

Although the 2008 targets address some aspects of source control, actions that will address the problems caused by bacteria loading (e.g., excessive beach closures or recommended limits for body contact on AOC rivers attributed to high pathogen levels) need to be considered. This means that additional reductions through the abatement of non-point source loading of bacteria will be necessary in order to remove this impairment.

According to the current methodology in the Wisconsin Consolidated Assessment and Listing Methodology (WisCALM), waters can be listed as impaired for having contaminated sediments that would pose a risk to public welfare and safety (WDNR, 2013b, p. 51). While contaminated sediments are a problem in the AOC, high counts of pathogens are a more widespread recreational hazard and are more directly associated with this impairment.

**Rationale for Listing**

The 1991 RAP indicates that although there are no beaches within the river system, there are several public beaches within the Lake Michigan portion of the AOC that consistently do not meet water quality standards for recreation. Data from the lower river system also exceeds the state recreation standards. The 1994 RAP Update indicates that there were essentially no changes in the status of this BUI between the initial RAP document and the update. Beach closings and recreational restrictions was still considered an impaired beneficial use in the AOC. Potential sources of contamination are indicated as CSO events and both urban and rural storm water. In the early 1990s, South Shore beach along Lake Michigan closed periodically, for 48 to 96 hours, when high bacteria counts occurred after CSO events (WDNR, 1994, p. 2-19). In summary, the waters of the AOC have frequently exceeded state water quality standards for recreation.
Summary of Key Remedial Actions since the 2014 RAP Update and Current Status

Milwaukee County has continued their work on planning improvements to South Shore Park. Designs are currently being prepared for stormwater best management practices and parking lot reconstruction.

Work by Sandra McLellan’s lab at the UWM SFS continued on the “Identification and Quantification of Sanitary Sewage Contamination in the Milwaukee Estuary AOC” or bacterial source tracking project. The project has three objectives, which provide critical information needed to address this impairment. The objectives are:

1) Map and sample stormwater outfalls along the lower Menomonee and Kinnickinnic and perform up the pipe investigations to identify illicit discharges.
2) Quantify amount of sewage contamination loads at three locations in the Menomonee Kinnickinnic, and Milwaukee Rivers and at the estuary.
3) Fill data gaps and interface with TMDL efforts to prioritize implementation strategies.

The project addresses significant impediments to TMDL implementation by identifying infrastructure failures and assisting decision-makers in determining their policy priorities for stormwater management and infrastructure investment. WDNR has extended the agreement with UWM SFS to through 2016.

Next action(s) needed

The following actions need to be completed in order to determine contamination related management actions.

- Reviewing the mapping and reporting from the bacterial source tracking project will help guide efforts to plan actions that will improve water quality in the estuary. Disseminating the results to stakeholders involved in the process will also be important.
- Reviewing the output of the bacterial TMDLs for the AOC will provide important information in decision making for this impairment. The TMDL has been delayed and is expected to be completed in 2016
- Working with Milwaukee County to plan and implement projects to address high bacterial levels at South Shore beach. Improving conditions at the beach will be an important step in addressing this impairment.
- When and where it is feasible, actions should be taken to control sources of bacteria that cause recreational restrictions on AOC waters.

A complete list of management actions that are necessary to move towards removing this impairment has not been defined. Decisions on management actions can begin when the results of the TMDLs and bacteria source tracking are available.

Issues (challenges, risks) affecting progress on this BUI

Bacterial levels will continue to increase as infrastructure ages and lateral sewer lines continue to fail, posing a significant obstacle toward making progress on the recreational restrictions portion of this impairment.
DEGRADATION OF AESTHETICS

Target and Status

<table>
<thead>
<tr>
<th>Target (2008)</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>This delisting target is consistent with Chapter NR 102, Water Quality Standards for Surface Waters. Delisting shall occur when monitoring data within the AOC and/or surveys for any five year period indicates that water bodies in the AOC do not exhibit unacceptable levels of the following properties in quantities which interfere with the Water Quality Standards for Surface Waters:</td>
<td>Assessment in progress</td>
</tr>
<tr>
<td>a) Substances that will cause objectionable deposits on the shore or in the bed of a body of water shall not be present in such amounts as to interfere with public rights in waters of the state.</td>
<td>Assessment in progress</td>
</tr>
<tr>
<td>b) Floating or submerged debris, oil, scum, or other material shall not be present in such amounts as to interfere with public rights in waters of the state.</td>
<td>Assessment in progress</td>
</tr>
<tr>
<td>c) Materials producing color, odor, taste, or unsightliness shall not be present in such amounts as to interfere with public rights in waters of the state.</td>
<td>Assessment in progress</td>
</tr>
<tr>
<td>The following target will also be met to determine when restoration has occurred: Corrective action plans are in-place and being implemented for all known sources of materials contributing to the degradation of aesthetics within the AOC.</td>
<td>Action needed</td>
</tr>
</tbody>
</table>

Target Rationale
The proposed target is consistent with existing state water quality standards, but because of its arbitrariness, we should evaluate whether a five year period is the appropriate amount of time necessary to determine when impairment removal can occur.

Rationale for Listing
This beneficial use is considered impaired because of the poor visual quality of the water resources and adjacent land. The 1994 Milwaukee RAP attributed the likely cause of the impairment to surface water debris, oil and grease, and overdevelopment along the estuary. The likely sources of these causes include point source pollution, nonpoint source pollution, and litter.

After storms, considerable debris can be seen near almost every combined sewer overflow and storm sewer outfall. Floating litter significantly degrades aesthetic value and recreational enjoyment of urban waterways. Floatable trash likely comes from many sources, including illegal dumping of trash into streams; littering into the drainage area of rivers; ill-maintained dumpsters; improper streambank modifications; sanitary sewer overflows and combined sewer overflows; marine sources and recreational users; and, most importantly, from stormwater runoff.

Summary of Key Remedial Actions since the 2014 RAP Update and Current Status
The volunteer aesthetics monitoring program was revived in 2015, with monitoring at nine sites (three beach sites and two on each river). Milwaukee Riverkeeper carried out volunteer management duties and recruited at least 30 volunteers to assess each site. Data analysis is currently underway. Efforts by partners, including river clean up events and operation of the river skimmer, continue within the AOC.
Next action(s) needed
The following actions need to be completed in order to determine contamination related management actions.

- Complete 2015 data analysis.
- Continue aesthetics monitoring in 2016 field season.
- Reassess target to address the need for 5 years of assessment data. Presumably this was included to ensure that a large enough monitoring data set was used to make decisions related to this impairment. However, given the volunteer monitoring approach, a large dataset can be amassed in a shorter time frame.

A complete list of management actions are necessary to move towards removing this impairment has not been defined pending completion of assessment and evaluation of results.

Issues (challenges, risks) affecting progress on this BUI
The impairment was listed primarily for the AOC because of the water’s poor visual appearance and “overdevelopment along the estuary.” At the present time, it is unclear whether some of the potential contributing factors such as overdevelopment that degrades aesthetics may be able to be addressed through the AOC program.
DEGRADED PHYTOPLANKTON AND ZOOPLANKTON POPULATIONS

**Target and Status**

<table>
<thead>
<tr>
<th>Updated Target (2012)</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>A stepped approach is needed for delisting for this impairment:</td>
<td></td>
</tr>
<tr>
<td>1. The first step toward delisting will be to establish a baseline condition for</td>
<td>Assessment in progress (2012-2015)</td>
</tr>
<tr>
<td>the estuary to evaluate the extent of this impairment. Phytoplankton and</td>
<td></td>
</tr>
<tr>
<td>zooplankton community surveys should be conducted and compared to a non-impacted</td>
<td></td>
</tr>
<tr>
<td>or minimally impacted reference site to set the baseline condition. If the community</td>
<td></td>
</tr>
<tr>
<td>structure is statistically different than the reference conditions, this BUI should</td>
<td></td>
</tr>
<tr>
<td>be considered impaired.</td>
<td></td>
</tr>
<tr>
<td>2. Identify the factors leading to this impairment.</td>
<td></td>
</tr>
<tr>
<td>a) Ambient water chemistry sampling should be conducted to determine if nutrient</td>
<td>Action needed</td>
</tr>
<tr>
<td>enrichment is the main contributor. If nutrients are the main contributor, sources</td>
<td></td>
</tr>
<tr>
<td>causing nutrient enrichment to the outer harbor and nearshore waters are identified</td>
<td></td>
</tr>
<tr>
<td>and controlled.</td>
<td></td>
</tr>
<tr>
<td>b) If nutrient enrichment is not considered the cause of the impairment, conduct</td>
<td></td>
</tr>
<tr>
<td>bioassays to determine if ambient water toxicity is causing impairment.</td>
<td></td>
</tr>
</tbody>
</table>

**Target Rationale**

Basic information regarding this impairment is lacking. Assessment is needed to verify the impairment before factors leading to the impairment can be identified. The 1994 RAP indicated that this beneficial use was impaired because of the poor diversity of plankton, attributed to the eutrophic conditions and the increased conductivity in the estuary and Outer Harbor (WDNR, 1994, p. 2-20).

WDNR removed a third item in the targets in 2012 requiring the AOC not to be listed as impaired due to phytoplankton and/or zooplankton toxicity in the most recent Wisconsin Impaired Waters list. It was removed because there are no considerations for listing waterbodies as impaired due to plankton toxicity (WDNR, 2013a). The results of the plankton assessment will be used to try to determine any causes of the impairment. Item two in the targets captures the necessity to look at both water chemistry and possible toxicity effects on plankton communities.

**Rationale for Listing**

This BUI is relevant to the Outer Harbor and nearshore Lake Michigan portions of the Milwaukee Estuary AOC. The 1994 RAP Update indicated that both phytoplankton and zooplankton populations within the Outer Harbor and near shore Lake Michigan are impaired. Like the eutrophication and undesirable algae BUI, these organisms are most affected by nutrient loading and dynamics in the estuary and lake.

According to the 1994 RAP, phytoplankton population data collected by MMSD in the Outer Harbor were representative of nutrient enriched (eutrophic) conditions. Nearshore phytoplankton assemblages had some tolerant organisms, but were more indicative of mesotrophic conditions. The data indicated that the three rivers draining to the Estuary have a significant influence on the phytoplankton community in the Outer Harbor. The nearshore waters in the AOC are also affected by the rivers, but to a lesser extent.
Phytoplankton populations were noted to be affected by high nutrient loads to the rivers and harbor. An increase in species tolerant of eutrophic conditions indicated degraded water quality conditions.

Zooplankton populations were also affected. Studies in the 1980s done by MMSD found declining species richness, and dominance of pollution tolerant species in the outer harbor compared with the community structure of the open lake. Species abundance was greater in the Outer Harbor compared to the lake, which indicates nutrient enrichment (WDNR, 1994).

Summary of Key Remedial Actions since the 2014 RAP Update and Current Status
Results from the plankton assessments in 2012 & 2014 are pending. The data from 2012 is being reassessed using the same statistical analysis as the 2014 data. The final report will include both data sets and final conclusions and is expected in late 2015 or early 2016.

Next action(s) needed
The next step will be to evaluate the findings of the USGS study from 2012 and 2014. If the planktonic community is found to be impaired compared to other Lake Michigan rivers, then investigate if nutrient enrichment and/or toxicity are causes of the plankton impairment. This determination would inform any additional necessary management actions. A target adjustment may also be needed depending on the results of the study.

Sources of contamination to the AOC need to be remediated. The following actions need to be completed in order to determine contamination related management actions.
- Assess areas on the Milwaukee River from Estabrook Park dam downstream to the estuary.
- Assess the potential impacts to sediments from other manufactured gas plants within the AOC.
- Review and act upon sediment assessment data from other areas of the AOC. This includes, but is not limited to, Kinnickinnic River/Turning Basin, Menomonee River from confluence with Little Menomonee to the harbor and existing Milwaukee River data.

The following management actions are necessary to move towards removing this impairment. This list is not complete. The actions that have been implemented are italicized.
1) Sources of contamination to the benthic community within the AOC need to be remediated.
   o Complete the assessment and cleanup of PCBs at the Cedar Creek Superfund Alternative Site.
   o Complete the management of sediments containing PAHs and metals from the Burnham Canal Superfund Alternative Site.
   o Complete the assessment of contaminated sediment and evaluate and implement clean up related to the Solvay Coke Superfund Alternatives Site.
   o Blatz Pavilion, Lincoln Park Phase 1 and Phase 2 Contaminated Sediment Remediation
   o Kinnickinnic River Legacy Act Cleanup

Issues (challenges, risks) affecting progress on this BUI
A full assessment of the impairment cannot be made until the final data from 2012 and 2014 are received from USGS.
**LOSS OF FISH AND WILDLIFE HABITAT**

**Target and Status**

<table>
<thead>
<tr>
<th>Updated Target (2011)</th>
<th>Status</th>
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<tr>
<td>This BUI will be considered to be eligible for removal when the following have occurred:</td>
<td></td>
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<tr>
<td>• All contaminated sediment hotspots within the AOC have been identified, and implementation actions to remediate contaminated sites have been completed.</td>
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<tr>
<td>• A local fish and wildlife management and rehabilitation plan has been compiled for the estuary that:</td>
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<tr>
<td>o Defines the causes of all habitat impairments within the AOC</td>
<td>In progress</td>
</tr>
<tr>
<td>o Establishes site-specific habitat and population targets for native indicator fish and wildlife species within the AOC</td>
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</tr>
<tr>
<td>o Identifies all fish and wildlife habitat rehabilitation programs/activities within the AOC and establishes a mechanism to assure coordination among all these programs/activities, including identification of lead agencies</td>
<td></td>
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<tr>
<td>o Establishes a time table, funding mechanism, and lead agency or organization responsibility for all fish and wildlife habitat rehabilitation activities needed within the AOC.</td>
<td>In progress</td>
</tr>
<tr>
<td>• The programs and actions necessary to accomplish the recommendations of the fish and wildlife habitat plan are implemented, and modified as need to ensure continual improvement.</td>
<td>In progress</td>
</tr>
</tbody>
</table>

**Target Rationale**

Contaminated sediments in the AOC must be addressed in order for this impairment to be removed. A plan also needs to be developed that will list measures of success, focal species, and projects that will help address the physical habitat issues in the AOC.

**Rationale for Listing**

This beneficial use is considered impaired by the 1994 Milwaukee AOC RAP. The 1994 RAP cites urban development in areas adjacent to the estuary as having greatly diminished aquatic and wildlife habitat. Natural stream banks did not, and still do not, exist below the former North Avenue Dam on the Milwaukee River. Almost no natural areas exist on adjacent streambanks in the harbor or along the rivers. The rivers within the estuary have been heavily engineered for shipping and commerce, producing unnatural shorelines and a virtual “ecological desert” for many aquatic and semi-aquatic wildlife species. The habitat in the lower reaches of each of the watersheds draining into the Milwaukee Harbor estuary is typical of that found in a highly urbanized environment, with extensive channelization and placement of sheet piling for bank stabilization. From a water quality perspective, fish and aquatic habitat is impaired by excessive sedimentation (including contaminated sediments) and poor ambient water quality. Nutrient loading and low dissolved oxygen concentrations further degrade habitat available for fish forage and spawning. There is little cover for resident fish species, and few trees, shrubs and other vegetation to provide shade that could temper high water temperatures in summer months. More natural habitat can be generally found in upstream areas of each of the major rivers and their tributaries.
Loss of wildlife habitat was not considered impaired in the 1991 RAP because it was not considered to be caused by contamination, but by lack of physical habitat (WDNR, 1991, p. V-12). The 1994 RAP expanded the scope to include lack of physical habitat as an impairment. There is very little loafing and resting habitat for migratory waterfowl—it is not uncommon to see mallards and other ducks resting on submerged logs, and other floating debris as well as boats due to general lack of natural resting areas in the AOC’s urban waterways (WDNR, 1994, p. 2-21).

The 1994 RAP added that the confined disposal facility (CDF) near Jones Island may be a source of contaminants for waterfowl. The CDF within the outer harbor provides sheltered water habitat and is used for loafing and forage by many migratory and resident duck species and geese. A sentinel duck study was conducted in the summer of 1990 to determine if waterfowl were accumulating contaminants from the Milwaukee CDF. The study concluded that ducks released into the CDF did not accumulate significant concentrations of contaminants compared to field and background levels (WDNR, 1994, p. 2-16). This may be due to the fact that the most contaminated sediments within the CDF were originally deposited in the 1970s and are buried to the extent that they are no longer available to wildlife.

More recent studies documented substantial losses of species richness in Milwaukee County in other wildlife, with declines of 20-70% for bird, amphibian and reptile groups, resulting mainly from habitat loss (Waller and T. Rooney, 2010). Habitat restorations within the AOC will be important for addressing these more regional losses.

**Summary of Key Remedial Actions since the 2014 RAP Update and Current Status**

The Fish and Wildlife Technical Team completed project summaries for all of the projects within the AOC boundaries identified as necessary to address the impairment. The summaries for these 11 projects will be incorporated in to the final fish and wildlife habitat management and rehabilitation plan. Work on habitat projects by partners continued in 2015 including the following:

- Little Menomonee River Parkway Grassland Restoration was completed by Milwaukee County;
- Menomonee River Concrete Removal Phase 1 & 2 implementation by MMSD & U.S. Army Corps of Engineers;
- Burnham Canal Wetland Restoration planning by MMSD;
- Five Low Flow Barriers Removal implementation by MMSD;
- Kinnickinnic River Habitat Rehabilitation feasibility study by MMSD; and,
- Bay View Wetland planning by the City of Milwaukee.

**Next action(s) needed**

Progress on habitat restoration project planning and implementation are the next actions needed for this impairment along with sediment remediation. The following actions need to be completed in order to determine contamination related management actions.

- Assess areas on the Milwaukee River from Estabrook Park dam downstream to the estuary.
- Assess the potential impacts to sediments from other manufactured gas plants within the AOC.
- Review and act upon sediment assessment data from other areas of the AOC. This includes, but is not limited to, Kinnickinnic River/Turning Basin, Menomonee River from confluence with Little Menomonee to the harbor and existing Milwaukee River data.
The following management actions are necessary to move towards removing this impairment. This list is not complete as all sediment projects have not been identified and defined. The actions that have been implemented are italicized.

1) Implement habitat restoration projects defined in the fish and wildlife management and rehabilitation plan (also included in Appendix C).
   a. Little Menomonee Grassland Restoration
   b. Milwaukee River Fish Habitat Enhancement and Expansion
   c. Wheelhouse Gateway Riparian Restoration
   d. Menomonee River Concrete Removal
   e. Five Low Flow Barriers Removal
   f. Kinnickinnic River Habitat Rehabilitation
   g. Burnham Canal Wetland Restoration
   h. Little Menomonee Corridor Restoration
   i. Bay View Wetland Restoration
   j. Estabrook Park Dam Fish Passage
   k. Kletzsch Park Dam Fish Passage

2) Sources of contamination within the AOC need to be remediated.
   o Complete the assessment and cleanup of PCBs at the Cedar Creek Superfund Alternative Site.
   o Complete the management of sediments containing PAHs and metals from the Burnham Canal Superfund Alternative Site.
   o Complete the assessment of contaminated sediment and evaluate and implement clean up related to the Solvay Coke Superfund Alternatives Site.
   o Blatz Pavilion, Lincoln Park Phase 1 and Phase 2 Contaminated Sediment Remediation
   o Kinnickinnic River Legacy Act Cleanup

Issues (challenges, risks) affecting progress on this BUI
Projects in and connected to the AOC can be expensive to complete due to many factors common in implementing projects in urban environments and along historically developed waterways. However, in order for aquatic projects to have an impact in the estuary, they need to be connected to the waterbody.
CONCLUSION

Working with the stakeholders and project partners will be critical to securing support for projects and continuing to make progress in the AOC. Although progress has been made in the AOC, there are still several key actions that need to continue or occur in order to address the impairments. First, the assessment and remediation of contaminated sites is necessary in order to address many of the impairments. Several sites to date have been addressed, but other parts of the AOC need to be characterized and addressed before contamination-related issues in the AOC no longer pose a substantial threat to fish and aquatic life in the AOC.

Work on identifying and implementing other management actions is an important next step in AOC progress. Supporting projects already underway will continue to be a priority in 2016. In some cases additional information is necessary to further refine our actions or in order to assess the status of a BUI. In 2016, continuing bacterial source tracking, fish and wildlife assessments, aesthetics monitoring, assessment of consumption advisories and information from current USGS projects will be crucial to continuing to make headway on addressing impairments. The fish and wildlife technical team will continue to meet and make progress on identifying actions for the fish and wildlife impairments.
REFERENCES


Wisconsin Department of Natural Resources. 2015a. *Fish consumption advice for the Milwaukee Estuary Area of Concern.*

## APPENDICES

<table>
<thead>
<tr>
<th>Appendix A</th>
<th>Milwaukee Estuary AOC Tracking Matrix</th>
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<td>Appendix B</td>
<td>Milwaukee Estuary AOC Community Advisory Committee Documents</td>
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<tr>
<td>Appendix C</td>
<td>Fish and Wildlife Habitat Project Summaries for Fish and Wildlife Management Plan</td>
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Appendix A

Milwaukee Estuary AOC Tracking Matrix

Note that projects listed in the table below 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.
<table>
<thead>
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<th>Project Name</th>
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<th>Action Type</th>
<th>Action Phase</th>
<th>Project Status</th>
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<td>Tainting of Fish and Wildlife Flavor</td>
<td>BUI 9</td>
<td>Restrictions on Drinking Water Consumption or Taste and Odor Problems</td>
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<tr>
<td>BUI 3</td>
<td>Degraded Fish and Wildlife Populations</td>
<td>BUI 10</td>
<td>Beach Closings and Body Contact Restrictions</td>
<td></td>
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<tr>
<td>BUI 4</td>
<td>Fish Tumors and Other Deformities</td>
<td>BUI 11</td>
<td>Degradation of Aesthetics</td>
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<tr>
<td>BUI 5</td>
<td>Bird or Animal Deformities or Reproductive Problems</td>
<td>BUI 12</td>
<td>Added Costs to Agriculture or Industry</td>
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<tr>
<td>BUI 6</td>
<td>Degradation of Benthos</td>
<td>BUI 13</td>
<td>Degradation of Phytoplankton and Zooplankton Populations</td>
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<tr>
<td>BUI 7</td>
<td>Restrictions on Dredging Activities</td>
<td>BUI 14</td>
<td>Loss of Fish and Wildlife Habitat</td>
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</tbody>
</table>
1) **AOC Community Advisory Committee Roles, Responsibilities and Composition:**

Roles, responsibilities and composition of the CAC are defined in the CAC Position Description which was presented and agreed to with revisions at the August 17, 2015 and September 21, 2015 CAC meetings. A copy of the CAC Position Description is included in this document on page 3-4. Membership on the CAC is open to interested persons who subscribe to the CAC purposes and core values/guiding principles and who commit to the following:

   a. Make a 2 year commitment to serve on the Community Advisory Committee. 2 year terms are renewable;
   b. Attend meetings of the CAC which will be held at least on a quarterly basis. (CAC members are required to attend at least two (2) CAC meetings annually); and
   c. Serve as an active, ongoing member of CAC committees and/or workgroups to be established on an as-needed basis.
   d. Prepare in advance for CAC decision-making at CAC meetings; take responsibility for self-education on the major issues before the CAC. Responsibly review and act upon recommendations brought to the CAC for action.

The following people have agreed to serve as members of the CAC at this time:

   - Cheryl Nenn
   - Lilith Fowler
   - Chris Litzau
   - Joan Herriges
   - Elizabeth Hittman
   - Rick Fox
   - Andrew Struck
   - John Hacker
   - Linda Reid
   - Bob Paulson
   - Janee Pedersen

2) **CAC Leadership Team Roles and Responsibilities:** Roles, responsibilities and composition of the CAC Leadership Team are defined in the leadership team Position Description which was presented and agreed to with revisions at the August 17, 2015 CAC meeting. A copy of the CAC Leadership Team Position Description is included in this document on page 5. Membership on the CAC Leadership Team is open to members of the CAC who agree to carry out the responsibilities as defined in the position description.

The following people have agreed to serve as members of the CAC Leadership Team:

   - Cheryl Nenn
   - Lilith Fowler
   - Chris Litzau
   - Andrew Struck
   - John Hacker
   - Linda Reid
3) **Meetings of the CAC:** It is proposed that:
   a. Meetings of the CAC be held at least on a quarterly basis.
   b. The meeting schedule will be set for the next 12 months in the following months: October 2015, January 2016, April 2016, July 2016, and October 2016. Meetings will be held in the afternoon of the second Thursday of the designated months.
   c. Members of the CAC will make every reasonable effort to attend meetings of the CAC in person. In order to facilitate participation provision will be made for attendance via conference call and/or online meeting technology.

4) **Voting by CAC Members:** In order to exercise voting rights, an individual must first decide to join the CAC as a CAC member. As stated in Section 1 above, membership on the CAC is open to interested persons who subscribe to the CAC purposes and core values/guiding principles and who commit to the following:
   a. Make a 2 year commitment to serve on the Community Advisory Committee;
   b. Attend meetings of the CAC that will be held at least on a quarterly basis; and
   c. Serve as an active, ongoing member of CAC committees and/or workgroups to be established on an as-needed basis.

   After joining in this manner, new members of the CAC may exercise voting rights in the second CAC meeting they attend. There is no provision for proxy voting;

5) **CAC Decision-Making:** The CAC will be responsible for making decisions consistent with CAC purposes and responsibilities as defined in the CAC Position Description. It is proposed that:
   a. Examples of decision making areas will include providing feedback during the annual review of the Remedial Action Plan (RAP), removal of BUIs, advising on AOC/RAP priorities, and funding decisions for the purpose of supporting CAC projects and initiatives.
   b. The CAC is committed to achieve consensus on major decisions; if consensus cannot be reached, a 3/5’s majority vote of the CAC will be required in order to take action.

6) **CAC Fiscal Agent:** At the August 17, 2015 meeting of the CAC, Organizational Structure Option #1 was selected in which the CAC will be an unincorporated group operating with a designated fiscal agent. It is proposed that Southeastern Wisconsin Watersheds Trust, Inc. (SWWT) serve as interim fiscal agent until April 2016. The CAC Leadership Team will devise a process for determining the CAC fiscal agent after April 2016. This process may propose that an entity serve as administrative fiscal agent and that another entity serve as fiscal agent for the purpose of pursuing funding opportunities to support activities of the CAC in the future.
The Milwaukee Estuary Area of Concern CAC (CAC) is called to be the long-term voice and leader for cleaning up and delisting the Milwaukee Estuary AOC. To this end the CAC provides a structured way for individual citizens to share their opinions and perspectives on cleanup efforts, and on how policies and programs affect citizens who live and work in the watersheds.

Purpose:
The purpose of the CAC is four-fold:
1. Review and provide comment on the annual Remedial Action Plan (RAP) and participate in the BUI removal process.
2. Devise and assist in implementation of strategies for building public and community support to enact recommendations contained in the Remedial Action Plan for the Milwaukee Estuary Area of Concern;
3. Provide a forum for meaningful and appropriate resident and local stakeholder input into remediation and restoration efforts, and;
4. Advise state and federal agencies on Milwaukee Estuary AOC remediation and restoration.

Core Values/Guiding Principles of the CAC:
- Fostering a sense of public responsibility for restoring and maintaining the ecological integrity of the Milwaukee Estuary;
- Ensuring the expedient development and implementation of a Remedial Action Plan (RAP) for the Milwaukee Estuary Area of Concern (AOC)
- Cultivating a network of diverse audiences and facilitating outreach to increase citizen engagement and public awareness support of Milwaukee Estuary AOC remediation and restoration
- Working together to identify and overcome obstacles to restoring the beneficial uses of the AOC and participate in the BUI removal process.
- Ensuring that planning steps and actions taken to improve the health of the AOC are driven by participatory planning, sound science, and independent evaluation of planned restoration work.

CAC Activities and Responsibilities:
1. Provide two-way communication with the WDNR to share the implications of AOC efforts on community interests.
2. Review and provide comment on the annual Remedial Action Plan (RAP).
3. Participate in the Beneficial Use Impairment (BUI) removal process and weigh in on target changes.
4. Review staff reports and recommendations;
5. Discuss, formulate, and promote well-developed, thoughtful recommendations with a goal of delisting beneficial use impairments (BUIs) in the AOC.
6. Provide letters of support for activities included in the RAP that move the AOC towards delisting.
7. Serve as ambassadors to their communities to foster awareness and understanding of AOC issues.
8. Disseminate information about projects in the AOC through outreach and education activities.
9. Host signature events to raise awareness about their efforts and the broader AOC projects and activities.
10. Increase capacity for CAC efforts by securing grant funds.
11. Other activities consistent with the CAC position description purposes and core values/guiding principles as determined by the CAC in coordination with the Milwaukee Estuary AOC Coordinator.

Members of the CAC agree to the following:
1. Make a 2 year commitment to serve on the Community Advisory Committee.
2. Attend meetings of the CAC that are held at least on a quarterly basis.
3. Serve as an active, ongoing member of CAC committees and/or workgroups to be established on an as-needed basis.
4. Prepare in advance for CAC decision-making at CAC meetings; take responsibility for self-education on the major issues before the CAC. Responsibly review and act upon recommendations brought to the CAC for action.

CAC Committee Composition
The intent is for the CAC to be a broad-based, balanced, and diverse group representing public, private, and nonprofit sectors of the local community, with members from agriculture, construction, business, education, government, industry, environment, law, civic groups, and recreation interests. Membership is voluntary and open to anyone who wishes to participate and make a commitment to carry out responsibilities in the CAC position description. A CAC Leadership Team will be established to organize and guide the efforts of the CAC. (See description below)

The CAC will be representative of broad community interests in the AOC. The CAC will be composed of citizens who are concerned about their environment, especially their water resources, and who are knowledgeable or willing to become so to provide well-informed opinions and perspectives on projects and activities in the AOC. CAC members are aware of their core objectives and roles to improve watershed health. The group will assure that delisting is meaningful and representative of the community at large. The group is committed to a diverse membership, not just “the choir.” A representative cross-section of the community is needed to build community support for AOC projects and activities. Members must be willing and able to put in their time, and the CAC may need their involvement after delisting to achieve additional watershed health goals.

CAC representation will:
- Be diverse racially, economically, and geographically;
- Include participants expected to participate over a long time horizon; some stability in membership is needed;
- Include participants who have support from their organization or affiliation; and
- Be inclusive of environmental interests, faith groups, economic development organizations, business and industry representatives, elected officials, government officials, and other formal and informal community leaders.
CAC Leadership Team

Purpose:
The CAC Leadership Team will be responsible for organizing and guiding the efforts of the CAC consistent with the definition of purposes and responsibilities as defined in the CAC Position Description.

Composition:
The CAC Leadership Team will consist of: CAC Chair who shall be elected by the CAC from among its members, 4-5 CAC members, a representative of the fiscal agent (who may also be a member of the CAC), and the Milwaukee Estuary AOC Coordinator (ex officio). Any one organization is limited to one member on the CAC Leadership Team.

To ensure leadership continuity within the Team, members will serve staggered two year terms. In the first year half of the members will serve one year terms. It will be determined at the next meeting of the Leadership Team who will serve these one year terms.

Responsibilities:

- Regularly communicate with the Milwaukee Estuary AOC Coordinator;
- Organize the work of the CAC consistent with the purposes and core values/guiding principles of the CAC;
- Plan meeting agendas of the CAC to be held at least quarterly; and
- Establish committees, workgroups and other ad hoc structures on an as-needed basis to advance the work of the CAC in a timely and effective manner.
- Prepare in advance for decision-making at Leadership Team meetings; take responsibility for self-education on the major issues before the CAC Leadership Team. Responsibly review and act upon recommendations brought to the CAC Leadership Team for action.
Appendix C

Fish and Wildlife Habitat Project Summaries for Fish and Wildlife Management Plan
**Project Title:** The Little Menomonee Parkway Grassland Restoration Project

**Project Location:** Little Menomonee River Parkway, Milwaukee County, Wisconsin (map attached). The project area is a 32-acre site within the Little Menomonee Parkway, bounded by Appleton Avenue to the South, Little Menomonee River Parkway to the east, 107th Street to the west and Lynx Avenue to the north.

**Project Sponsor:** Milwaukee County Department of Parks, Recreation & Culture

**Project Landowner:** Milwaukee County Department of Parks, Recreation & Culture

**Proposed Work:**
This project enhances/expands the grassland habitat in the AOC, and will improve breeding opportunities for grassland species that are designated as state and/or local species of concern. Currently, there is a lack of upland grassland habitat areas of any significant size elsewhere within the AOC.

The objectives of this project are to:
- Restore native grassland habitat on the site,
- Improve breeding and migratory habitat for bird, invertebrate, and herptile grassland species of local concern,
- Reduce erosion from the site to the Little Menomonee River.

Restoration activities include using a forestry mower and chainsaws to remove the stands of non-native invasive woody species, treating stumps and regenerative growth with herbicide, control of other invasive plants and re-vegetation to native prairie. In total, 22.3 acres of invasive shrubs will be restored to grassland and invasive plant management will occur over several growing seasons on the entire 32.5 acres.

This restoration project is a component of a larger 169-acre Milwaukee County Parks restoration and management (R&M) plan for this section of the Little Menomonee River. The R&M plan is a ten-year project that encompasses all short and long term goals/activities such as invasive species control, wildlife habitat management, hiking trail maintenance, and public use. All R&M plans are developed by DPRC Natural Areas staff, reviewed and approved by the DPRC Chiefs of Operations and Planning.

**Collaboration with Partners**
The project is being implemented by Milwaukee County Department of Parks staff as well as hired contractors. Funding was received through the Wisconsin DNR/Great Lakes Restoration Initiative.

February 2015
Loss of Fish and Wildlife Habitat  
Project Summary

**Timetable and Duration**

<table>
<thead>
<tr>
<th>Woody vegetation removal</th>
<th>March 2013 through May 2014, Spring 2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Invasive species control &amp; native prairie planting</td>
<td>Summer &amp; Fall 2014, Summer &amp; Fall 2015</td>
</tr>
</tbody>
</table>

This project is a component of a larger Restoration and Management Plan along this section of the Little Menomonee River Parkway. As part of that plan, invasive species will be monitored and controlled by Milwaukee County Parks staff to prevent recolonization of the grassland restoration site.

**Project Budget & Funding**

The total estimated cost for project implementation is $37,000 for materials, equipment rental, and labor costs.

<table>
<thead>
<tr>
<th>Quantifables</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grassland Restoration</td>
<td>32.5 Acres</td>
</tr>
<tr>
<td>Forestry Mowing-woody invasives</td>
<td>20 Acres</td>
</tr>
<tr>
<td>1) Equipment rental, labor (DPRC staff or contractor)</td>
<td>$500/acre $10,000.00</td>
</tr>
<tr>
<td>2) Herbicide Treatment (DPRC staff or contractor)</td>
<td>$300/acre $6,000.00</td>
</tr>
<tr>
<td>Prairie Planting Contractor - (Seed, Site Prep, Planting)</td>
<td>20 Acres</td>
</tr>
<tr>
<td>1) Seed</td>
<td>$300/acre $6,000.00</td>
</tr>
<tr>
<td>2) Site prep (options: controlled burn, cut woody veg removal)</td>
<td>$400/acre $8,000.00</td>
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<tr>
<td>3) Planting</td>
<td>$80/acre $1,600.00</td>
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<tr>
<td>Herbaceous Invasives Removal</td>
<td>12.5 Acres</td>
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<tr>
<td>1) DPRC staff time and fringe</td>
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<td>2) Herbicide (materials)</td>
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<tr>
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<td>$37,000.00</td>
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</table>

**Fish and Wildlife Plan Goals Addressed by Project**

4. Improve terrestrial riparian habitat connectivity by expanding riparian buffer habitat quality and continuity.

5. Protecting high-quality areas or environmentally sensitive lands, especially those supporting rare and protected species.

**Project Rationale/Why Critical for BUI Removal**

Large stands of common buckthorn (non-native invasive species) are encroaching on the existing grassland and provide little to no groundcover due to the dense shade they generate. These buckthorn populations are degrading habitat through the reduction of native species.
Loss of Fish and Wildlife Habitat
Project Summary

diversity and the creation of edge habitat which leads to increased predation and parasitism. In addition, the lack of groundcover under the buckthorn makes these areas susceptible to continuous soil erosion during rainfall events. These eroded sediments, along with run off from nearby subdivisions, flow into culverts that drain directly into the Little Menomonee River. By converting the degraded areas (32.5 acres) into grassland through the first phase of this restoration project, erosion issues would be dramatically reduced and absorption of run-off would increase, thereby decreasing the amount of potentially harmful pollutants entering the Little Menomonee River. The removal of the invasive species will also provide critical, improved habitat conditions for breeding and migratory wildlife within a regionally designated environmental corridor (SE WI Regional Planning Commission).

Necessary Project Elements

- Ongoing native plant establishment and invasive plant control will be accomplished by Park Department staff as part of their long-term maintenance for the Little Menomonee River Parkway Natural Areas Plan.
- The project is permanently protected as part of the Milwaukee County Park System.

Criteria for Measuring Project Goals are Met (Qualitative and/or Quantitative)

Goals and Metrics Used

<table>
<thead>
<tr>
<th>Wildlife Habitat Goal</th>
<th>Metric Used to Evaluate Environmental Outcomes</th>
</tr>
</thead>
</table>
| Enhance/improve terrestrial habitat by expanding buffer width to a minimum of 75 feet, or expanding the buffer width to 400’ to 1,000’ to meet core or habitat area needs | • Area of native upland suitable habitat reconstructed  
• Area of native species restored  
• Area of exotic invasive species removed |
| Enhance/improve terrestrial habitat by identifying and enhancing existing potentially restorable habitat areas through fish and wildlife assessments (for portions of the LMR, this process is already underway from a 2011 wildlife assessment) | • Area of native upland suitable habitat reconstructed  
• Number of native species restored  
• Area of exotic invasive species removed  
• Area of native species restored |
Loss of Fish and Wildlife Habitat
Project Summary

February 2015
Loss of Fish and Wildlife Habitat
Project Summary
Loss of Fish and Wildlife Habitat
Project Summary

Project Title: Bay View Wetland/Grand Trunk Wetland Restoration

Project Location: SE Bank of Kinnickinnic River, Adjacent to Estuary

Project Sponsor: City of Milwaukee

Project Landowner: City of Milwaukee Port Authority

Proposed Work
The City has proposed restoring this wetland, which is hydrologically connected to the KK River and Estuary. The wetland site is adjacent to redevelopment property and has a history of filling and other disturbance. Their goal is to restore the wetland to be a benefit for fish and wildlife as well as an amenity for the area.

Collaboration with Partners
The City worked with a stakeholder committee, including WDNR and a few Tech Team members, during the master planning process. The Tech Team and WDNR would like to continue to be involved as Stakeholders in the project going forward.

Timetable and Duration
Master Planning 2013-2014
The timetable and duration of design and implementation phases are unknown and dependent on funding. Design and implementation would be feasible in a two year timeframe.

Project Budget & Funding
Master planning for the site was paid for by a $148,400 grant from Fund for Lake Michigan. Estimates range from $2 Million -$6 Million for total site development, including items beyond wetland restoration.

Fish and Wildlife Plan Goals Addressed by Project
1. Enhance/improve aquatic habitat by...
   A. Identifying and enhancing fish spawning sites from Lake Michigan to the tributaries and headwaters where opportunities exist (e.g., inner and outer harbors, Milwaukee River downstream of the North Ave. Dam pedestrian bridge), and/or
   B. Improving lateral connectivity by connecting aquatic habitat to floodplain wetland with suitable hydroperiod from Lake Michigan to the tributaries and headwaters where opportunities exist.
2. Improve aquatic habitat connectivity by...
   A. Improving linear connectivity by restoring or enhancing fish and aquatic organism passage from Lake Michigan to the tributaries and headwaters, and/or
3. Enhance/improve terrestrial, semi-aquatic, and/or riparian habitat by...
   A. Expanding habitat buffer width to a minimum of 75 feet, and/or
   B. Where possible, expanding shoreline buffers up to 1,000 feet to meet core habitat area needs for semi-aquatic species, and/or
4. Improve terrestrial riparian habitat connectivity by expanding riparian buffer habitat quality and continuity.
Loss of Fish and Wildlife Habitat  
Project Summary

5. Protecting high-quality areas or environmentally sensitive lands, especially those supporting rare and protected species.

Project Rationale/Why Critical for BUI Removal
This site contains one of the only remaining wetlands in the estuary/harbor area, thereby providing an important opportunity for restoration of fish spawning and other wetland and riparian habitat in the estuary. It is the only wetland left in the Kinnickinnic watershed with natural hydrology necessary to restore a functional seiche wetland, which is a critical habitat important for northern pike spawning. The site also contains an isolated population of Butler's Garter snake, a Species of Local Conservation Interest (SLCI) now mostly absent from the estuary and opportunity for restoring populations of several other SLCI which have significantly declined. These include organisms that are dependent upon an ephemeral pond as a critical habitat feature (e.g., primary burrowing crayfish and amphibians) and riparian shoreline habitat (e.g., several breeding and migratory birds and bats). The site could therefore contribute to enhancing habitat and populations of several SLCI.

Necessary Project Elements
- A seiche wetland with a passively controlled hydrologic connection to the river and in turn estuary. The connection should be passable by aquatic organisms, with northern pike the target species to use for design purposes.
- An adequate buffer between aquatic habitats and development (as defined above in goal 3).
- Any passive recreational activities on site should not interfere or be in conflict with the habitat or wildlife value of the site.
- Incorporate ephemeral wetlands on the site that remain fish-free and preserve, enhance and/or creating snake denning sites. These are critical habitats for semi-aquatic SLCI are already present on site.
- Preserve and restore upland habitat on site that support sustainable SLCIs (i.e. first do no harm to existing species inhabiting the site).
- An invasive species and vegetation management plan (aquatic and terrestrial) with provisions made for long-term implementation.
- A stormwater management plan for the entire site is recommended.
- Some type of permanent conservation protection for the site (conservation easement or equivalent).
- Maximize benefits for multiple species (fish, waterfowl, invertebrates, etc.) with a focus on SLCI (see Species Checklists and match SLCI to proposed habitat goals).
- If possible, provide access to the wetland for canoes or kayaks, but limiting access to only non-motorized vessels is recommended.

Criteria for Measuring Project Goals are Met (Qualitative and/or Quantitative)
- Create and protect wetland habitat through the establishment of a functional seiche wetland with suitable Northern Pike spawning habitat on site.
- Spawning of Northern Pike demonstrated.
- Physical establishment of a functional, fish-free, ephemeral wetland habitat on site, occupied by ephemeral wetland dependent SLCI (e.g., amphibians, fairy shrimp).
- A goal of 6.5 acres of wetland and habitat present on site.
- Removing impediments to establish functional aquatic organism passage.
- Removing historic fill.
- Creation or enhancement of upland buffer habitat surrounding wetland habitats.
Loss of Fish and Wildlife Habitat
Project Summary

- An increase in the number of SLCI utilizing the site, as measured by appropriate occupancy documentation.
Loss of Fish and Wildlife Habitat
Project Summary

**Project Title:** Burnham Canal Wetland Restoration Project

**Project Location:** Burnham Canal in the vicinity of S. 11th Street and W. Bruce Street

**Project Sponsors:** Milwaukee Metropolitan Sewerage District (MMSD)

**Project Landowner:** City of Milwaukee, Miller Compressing, and other private owners

**Proposed Work**
MMSD proposes to fill in the Burnham Canal to create wetland habitat, restoring habitat in an area that historically had abundant wetlands but is now nearly entirely devoid. The Burnham Canal is a 3,000 foot long unused shipping canal in the Menomonee River Valley, just south of downtown Milwaukee, Wisconsin. The restoration would create 7.5 acres of wetland habitats along an over half mile corridor in the heart of urban Milwaukee. The project would create an oasis for fish and wildlife of the Menomonee River Valley.

Some work has already been completed that would allow the project to proceed. The Burnham Canal is part of a working industrial harbor and contains contaminated sediments. Both the contamination and navigation issues are being addressed by MMSD. Congress has removed the previous navigable waterway designation as the canal currently serves no use to the local industry. This removes a regulatory barrier for permits to be granted for a fill project. The project area west of the 11th Street Bridge was declared a Superfund Alternative site due to the contamination of metals and polycyclic aromatic hydrocarbons (PAHs) within the sediment. Miller Compressing Company is the cooperating responsible party required to implement the EPA’s Record of Decision (ROD), which includes a 12-inch sand cover over the bed of the canal. MMSD proposed a betterment to the ROD by replacing the 12-inch sand cover with 15-20 feet of granular fill and extending this work west to the Canadian Pacific Railroad (CP RR) Bridge near the mouth of the canal. This alternative cover would allow wetland habitat to be created on top of the cover material.

A combination of shallow marsh and seasonally flooded wetlands would be created within the filled canal. Vegetation and other features would be designed to improve the Canal’s water quality and fish and wildlife habitat. The design will focus on the creation of spawning and nursery habitat for Northern Pike that will be adaptive to climate change and also enhance habitat for other Species of Local Conservation Interest (SLCI). The project will be constructed in two phases divided by the 11th Street Bridge. Phase 1 consists of the area west of the 11th Street Bridge and Phase 2 consists of the area east of the bridge to the CP RR Bridge. When completed, Phase 1 will restore 4.5 acres of wetland and Phase 2 will add an additional 3 acres of wetland habitat.

**Collaboration with Partners**
MMSD has an agreement with Miller Compressing, the responsible party for the Superfund ROD. Under the terms of the agreement, Miller Compressing will pay MMSD $2.2 million to construct the wetland which will satisfy the terms of the ROD. This funding is contingent upon MMSD obtaining additional funding necessary to construct the Phase 1 section by June 30, 2015. If MMSD does not obtain the additional funding then Miller Compressing will not pay MMSD $2.2 million and will construct an

June 2015
aggregate sediment cap. The aggregate cap will meet the requirements of the ROD and allow for the future construction of a wetland, if funding becomes available.

The US Army Corps of Engineers (USACE) is designing the Burnham Canal wetland project under their Remedial Action Plan (RAP) program. MMSD has received grant funding from Fund for Lake Michigan to fund the local share of these design costs. Several members of the Tech Team are working with MMSD and the USACE to provide feedback on the wetland design. This includes the City of Milwaukee, WDNR, and SEWRPC. MMSD will utilize multiple public and private partnerships to perform post construction monitoring and future educational outreach.

**Timetable and Duration**
Design: Ongoing – September, 2015
Permitting and Real Estate: June 2015 – December 2015

Phase 1 Implementation Schedule:
Construction: Spring 2016 – Fall 2019
Post Construction Monitoring: 2020 - 2025

Phase 2 Implementation Schedule: TBD

**Project Budget & Funding**

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Remaining funding needed:

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Miller Compressing will provide $2.2 million towards the Phase 1 work if MMSD obtains the remaining $1.415 million by June 30, 2015. MMSD is seeking grant funding for the $1.4 million through the NOAA Habitat Restoration Grant in 2015. MMSD also has a grant award for $27,500 from the Wisconsin Coastal Management Grant. MMSD will seek additional funds for the Phase 2 work as soon as funding is secured for Phase 1. The design cost for both phases of the project is $300,000. The USACE is funding $195,000 and MMSD received a grant from Fund for Lake Michigan for this remaining $105,000.
Fish and Wildlife Plan Goals Addressed by Project
1. Enhance/improve aquatic habitat by...
   A. Identifying and enhancing fish spawning sites from Lake Michigan to the tributaries and headwaters where opportunities exist (e.g., inner and outer harbors, Milwaukee River downstream of the North Ave. Dam pedestrian bridge), and/or
   B. Improving lateral connectivity by connecting aquatic habitat to floodplain wetland with suitable hydroperiod from Lake Michigan to the tributaries and headwaters where opportunities exist.
2. Improve aquatic habitat connectivity by...
   A. Improving linear connectivity by restoring or enhancing fish and aquatic organism passage from Lake Michigan to the tributaries and headwaters, and/or
3. Enhance/improve terrestrial, semi-aquatic, and/or riparian habitat by...
4. Expanding habitat buffer width to a minimum of 75 feet, and/or Improve terrestrial riparian habitat connectivity by expanding riparian buffer habitat quality and continuity.

Project Rationale/Why Critical for BUI Removal
This project provides one of the only opportunities to restore a seiche wetland to the Menomonee Valley and estuary, where thousands of acres of such wetlands existed prior to 1900. The seiche wetland is a critical habitat important for successful spawning of Northern Pike and other fish species. The project will also provide habitat for numerous bird, mammal, herptile and fish species in an area otherwise lacking appropriate habitat. It will more than double the wetland habitat in this urban area by creating 7.5 acres of shallow marsh and seasonally flooded wetlands.

Necessary Project Elements
- A seiche wetland with a passively controlled hydrologic connection to the estuary. The connection should be passable by aquatic organisms, with northern pike the target species to use for design purposes.
- A design that incorporates a variety of wetland types and includes improvements for other wetland dependent SLCI is recommended (e.g., birds, herptiles) in addition to fish.
- The vegetation plans should be designed to be as resistant to invasive species as possible.
- An invasive species and vegetation management plan (aquatic and terrestrial) that will be implemented in both a short and long term basis.
- Include submergent and emergent vegetation cover types. Shoreline and wetland vegetation should be selected to maximize food resources for breeding and migratory birds.
- Some type of permanent conservation protection for the site (conservation easement, deed restriction or equivalent).

Criteria for Measuring Project Goals are Met (Qualitative and/or Quantitative)
- Establishment of a functional seiche wetland with suitable Northern Pike spawning habitat on site.
- Spawning of Northern Pike demonstrated.
- An increase of acres of wetland and other wildlife habitat present on site.
- An increase in the number of SLCI utilizing the site, as measured by appropriate occupancy documentation.
- Creation of 7.5 acres of wetland habitat.
Loss of Fish and Wildlife Habitat
Project Summary

Burnham Canal Project Site (phases 1 & 2)
Photo of Burnham Canal looking east
Loss of Fish and Wildlife Habitat
Project Summary

Burnham Canal Remediation/Ecosystem Restoration Design
Artistic Rendering

Burnham Canal Artistic Rendering
Loss of Fish and Wildlife Habitat  
Project Summary

Project Title: Milwaukee River Fish Habitat Enhancement and Expansion

Project Location: Milwaukee River, downstream of former North Avenue Dam

Project Sponsor: WDNR

Project Landowner: River Revitalization Foundation/on riverbed

Proposed Work

The Wisconsin Department of Natural Resources (WDNR) constructed Phase 2 of the Milwaukee Estuary Area of Concern (AOC) fish spawning habitat project during October 2014. The project involved the modification and expansion of the existing Phase 1, 0.45-acre rock reef constructed in 2006 (Wawrzyn, 2007). Both phases of the reef project were planned to meet overlapping spawning life-requisites of walleye, lake sturgeon and other game and non-game simple lithophilic spawning fishes. Modifications to the existing reef involved lowering a portion of the existing rock reef to reduce the frequency that areas of the reef are desiccated by long-term (monthly-annual) decreasing Lake Michigan water levels, and more frequent short-term (hourly) fluctuations in water levels caused by lake seiche amplified through the Milwaukee River’s long and confined connecting channel. The existing reef elevations ranged from 576.0-ft to 577.4-ft. Based on Lake Michigan’s 95-year record low elevation of 576.02-ft and seiche of +0.8-ft observed during construction of the Phase 1 reef, the planned maximum elevation for modifying or expanding the reef was proposed to be 575.0-ft. The plan to expand the existing reef by 0.4-acres and 200-linear feet was not feasible. Lake levels increased by 1.7-ft between the planning and construction phase of the project. Higher lake levels required a reduction in the reef length as greater volumes of rock were needed to construct a wider and higher causeway to provide a visible, stable and safe foundation for the contractor equipment and operator.

Collaboration with Partners

Timetable and Duration
Construction completed in October 2014

Project Budget & Funding
$63,331 FFLM &

Fish and Wildlife Plan Goals Addressed by Project

1. Enhance/improve aquatic habitat by...
A. Identifying and enhancing fish spawning sites from Lake Michigan to the tributaries and headwaters where opportunities exist (e.g., inner and outer harbors, Milwaukee River downstream of the North Ave. Dam pedestrian bridge), and/or

May 2015
Loss of Fish and Wildlife Habitat
Project Summary

Project Rationale/Why Critical for BUI Removal
Extensive areas of the Milwaukee River Estuary Inner Harbor and the open water Outer Harbor areas south of the Milwaukee River may not be conducive to rock spawning reef or shoal construction, or use of coarse woody debris and other structures for cover. These features could be subject to burial by sediment transported by the three rivers. Existing sediments are thick and may not bear the weight of rock without specially engineered base caps. Large tracts will continue to be dredged to maintain commercial navigation depths including the Harbor’s Kinnickinnic River channel, the Menomonee River to 25th St., the Milwaukee R. to Buffalo St. extended and Outer Harbor south of its confluence with the Milwaukee R. Placement of physical structures could conflict with navigational uses. Within the Inner Harbor, the Milwaukee R. between the former North Avenue Dam and Humboldt Avenue Bridge and constructed rock spawning reef provide the best opportunities.

Necessary Project Elements

- Enlarged spawning reef located in the area of the former North Avenue Dam. Re-grade the existing reef to the lowest practicable elevation (575.0-ft) without disturbing the original sandy shoal.
- Enhance and expand the existing reef’s function and value for lithophilic spawning fishes.
- Abate the potential impacts caused by low lake levels and seiche oscillations.
- The lateral extent of the reef should be located on riverbed extending from land and river bed titled to the River Revitalization Foundation to the channel centerline.
- Consistent with the spawning life-requisites for walleye and Lake sturgeon (McMahon et al., 1984; Aadland and Kuitunen, 2006).
- Design must be buildable, acceptable to landowners, and permitable by regulatory agencies.

Criteria for Measuring Project Goals are Met (Qualitative and/or Quantitative)

- Completions of spawning reef (size)
- Evidence of native fish spawning.
Bathymetry of Milwaukee River estuary in the vicinity of the former North Avenue Dam and Humboldt Avenue Bridge and constructed Phase 1 reef. Existing reef outline in bold and eight existing reef cross-section lines in magenta. One foot contours. Vertical datum IGLD 1985.
Loss of Fish and Wildlife Habitat  
Project Summary

Project Title: Wheelhouse Gateway Riparian Restoration

Project Location: North Riverboat Road, Milwaukee (west/north bank of the Milwaukee River)

Project Sponsor: River Revitalization Foundation

Project Landowner: River Revitalization Foundation

Proposed Work  
The Wheelhouse site is a 2.8 acre parcel along 650 feet of Milwaukee River shoreline in the AOC, about 1 mile upstream from downtown and Lake Michigan and adjacent to 800 acres of primary environmental corridor contained within Milwaukee, Shorewood, and Glendale. The proposed work addresses shoreline stabilization, erosion control, invasive species removal and the addition and enhancement of native species, canoe launch improvements, rain garden installation, and trail connections. The approach on this project is to use proven bioengineering techniques for bank and slope stabilization and to replace invasive and non-native plants with diverse native vegetation through an all biological engineered solution. This will start at the river bank and continue to the top of the river bluff along most of the site. The project overall will serve as an example of the best combination of fisheries biology, bank stabilization, native vegetation establishment and pollutant reduction in a developed urban area. The proposed construction work will consist of several phases that will take place over three months and be followed by ongoing management, starting with initial site stabilization and sediment control, tree clearing, grading, river bank stabilization, soil placement, compost blanketing, reseeding, slope interrupter placement, biodegradable turf reinforcement mat placement, hydro mulching (2:1 slopes and steeper), and tree and shrub planting. Maintenance and care work will follow immediately and continue for three years (the construction season plus two years). This will include watering, weed control, small erosion repair, and reporting.

Collaboration with Partners  
RRF is a partner in the Southeastern Wisconsin Watersheds Trust (SWWT) funded by the Joyce Foundation, working to improve water quality through a watershed approach. Our role as land trust is to identify, prioritize and implement projects in our Land Protection Plans for the Milwaukee and Menomonee Rivers that are also aligned with the Watershed Restoration Plans for these and the Kinnickinnic River. We are a founding organization of the Milwaukee River Greenway Coalition which is implementing a Greenway Master Plan for the 800 acre river valley protected through City ordinance; this being one of the priority projects within the greenway. Because of our location, we also belong to the Lake Michigan Shorelands Alliance facilitated by Gathering Waters Conservancy working to protect and enhance the lands within the Lake Michigan basin.

Timetable and Duration  
Start Date June 15, 2013 End Date: December 31, 2013 and ongoing maintenance. Maintenance follows in perpetuity.

Project Budget & Funding  
$700,000 – DNR Knowles-Nelson Stewardship Fund – Acquisition 
$40,000 – River Revitalization Foundation (small local funding sources – Building demolition
$248,000 – Fund for Lake Michigan – Shoreline restoration

May 2015
Loss of Fish and Wildlife Habitat
Project Summary

Fish and Wildlife Plan Goals Addressed by Project
3. Enhance/improve terrestrial, semi-aquatic, and/or riparian habitat by...
   A. Expanding habitat buffer width to a minimum of 75 feet, and/or
   B. Where possible, expanding shoreline buffers up to 1,000 feet to meet core habitat area needs for semi-aquatic species
4. Improve terrestrial riparian habitat connectivity by expanding riparian buffer habitat quality and continuity.

Project Rationale/Why Critical for BUI Removal
At the time of acquisition, in 2009, the Wheelhouse site represented one of the only opportunities for habitat restoration within the AOC. The dearth of suitable habitat restoration sites is largely due to the channelized character of most of the rivers within downtown. Habitat restoration efforts would further be challenged by the fragmentation of any terrestrial habitat that was created. The Wheelhouse is located at the southern end of the Milwaukee River Greenway. It is thus connected to over 800 acres of riparian habitat. The site is one of the last parcels on the river that does not have an armored shoreline, making it one of very few candidates for this type of shoreline restoration.

Necessary Project Elements
- **Site Preparation** work will begin with the installation of biodegradable compost filled socks to the site. We will progress through the site from downstream to upstream. This critical first step prevents further sediment laden runoff from entering the river. Filtrexx is preferable to silt fence because there is no trenching necessary for installation. This trenching causes damage to trees and further destabilizes soil.
- **Selective tree and shrub removals** will begin the construction phase. Non-native trees, hazardous trees and invasive trees and shrubs will be cut and treated with herbicide. All woody debris will be chipped and/or used on site for plant protection and habitat. We anticipate removing approximately one third of the current tree cover with future removal taking place over a longer period with native forest dynamics being the goal. Trees that are preserved will be treated with great care during all construction phases.
- **Bank stabilization** will be performed with a system of fabric encapsulated soil lifts that include all biodegradable materials, native plant plugs, native seed, and compost based engineered soils. Areas below the two year flood line are relatively stable and will be undisturbed with the exception of planting an area of emergent aquatic plugs near and below the ordinary high water mark.
- **Fishing access** will be constructed with and wholly integrated into the bank stabilization efforts. They will consist of limestone slabs laid onto the existing FES sections so as to create steps down to the water’s edge, just above the 2 year flood line.
- **Slope stabilization** will take place with a similar pallet of materials as the FES lifts and a common approach; Use all biodegradable materials, low impact construction methods, and the best compost, and aggregate materials available to ensure a weed free, quickly established native plant cover that will offer exceptional resistance to erosion and the best ecosystem support available.
- **Plant species** will be prescribed for each site with consideration given to slope aspect, anticipated weed competition, existing adjacent vegetation, along with consideration of anticipated species dynamics of the site. 4-5 Native emergent aquatic species, 24-30 herbaceous species (grasses,
Loss of Fish and Wildlife Habitat
Project Summary

sedges, and forbs), 8-12 shrub species, and 3-5 tree species will be utilized. All species will be native to Milwaukee County and sourced from the closest genotypic source available. Construction work will take an estimated three months until completion.

- **Ongoing Vegetation management** will take place for 3 years following construction. The main species of concern on this parcel are Crown Vetch, Garlic Mustard, Reed Canary Grass, Thistle, and Burdock. Each species has very different management methodology, all of which will be implemented according to the appropriate ecological timeline (based on weather). The invasive species control will be a continued effort for at least 4 years. During that time, species diversity and invasive eradication will be monitored and management may be adapted to achieve maximum success rates.
- Permanent conservation of the site is ensured by RRF ownership of the property. RRF is committed to continued management.

Criteria for Measuring Project Goals are Met (Qualitative and/or Quantitative)
- Approximately 650 feet of shoreline restored.
- 2.8 acres of restored habitat connected to over 800 acres of Greenway habitat.
- Expand riparian buffer of at least 100 feet between hardscape and river and enhance the quality of the buffer by replacing with native vegetation and habitat features.
- Extend the continuity of natural shoreline by approximately 650 feet, connected to existing natural shoreline.
Loss of Fish and Wildlife Habitat
Project Summary

May 2015
Loss of Fish and Wildlife Habitat
Project Summary

May 2015
Loss of Fish and Wildlife Habitat
Project Summary

**Project Title:** Menomonee River Stream Management (Concrete Removal) Phases 1 & 2

**Project Location:** Menomonee River Soo Line Railroad Bridge to Wisconsin Ave (Phase 1) and Wisconsin Avenue to 500 feet south of Interstate 94 (Phase 2)

**Project Sponsors:** Milwaukee Metropolitan Sewerage District (MMSD) (Phases 1 & 2) and US Army Corps of Engineers (USACE) (Phase 2)

**Project Landowner:** MMSD

**Proposed Work**
MMSD, in partnership with USACE, is completing the removal of 3,700 linear feet of concrete channel lining on the downstream reach of the Menomonee River to remove passage barriers to aquatic organisms and improve habitat conditions within this specific channel reach. This work is being completed in two phases (figure 1). Phase 1 consisted of the 1,100 feet of channel at the upstream portion of this section and was completed by MMSD in 2014. Phase 2 is the downstream 2,600 feet of this section. This phase is currently under construction and is being undertaken by the USACE with MMSD as the local partner. It is scheduled for completion in early 2016.

Concrete channel lining was installed in this section of the Menomonee River in the 1960’s to improve the river’s flood carrying capacity; however, it created a significant barrier to aquatic organisms between Lake Michigan and the upstream Menomonee River watershed. MMSD started the removal of these barriers in 2000 with the removal of 1,100 feet of concrete channel lining and the upstream drop structure. Following the completion of Phases 1 & 2, as well as MMSD’s Low Barrier Removal Project (completion 2015) located upstream of Hart Park, the barriers will be removed opening fish passage from Lake Michigan to the Lepper Dam at Menomonee Falls at Menomonee River mile 17. This will enable fish to access 37 miles of fluvial and 1,000 acres of wetland spawning and nursery habitat and expand recreational fishing opportunities for trout and salmon, and other native game fishes not previously available.

Removal of the concrete invert and replacement with graded stone substrate will also improve conditions by:
- increasing groundwater discharges to the stream
- creating interstitial spaces and flow (hyporheic flow) for macroinvertebrates,
- providing substrate for lithophilic spawning fishes to deposit and protect eggs,
- summer cooling,
- providing cover for juvenile fish, and microbes and biofilms capable of converting inorganic forms of nutrients (e.g., denitrification) thereby improving water quality.

WDNR Fisheries Management has an approved project to evaluate the effectiveness of Phase 1 and 2 projects for enabling fish passage.

**Collaboration with Partners**
MMSD has worked with several members of the Tech Team including the WDNR, SEWRPC, Milwaukee Riverkeeper, and Trout Unlimited on the Menomonee River concrete removal projects. These agencies have provided funding or in-kind contributions for professional services for the project design, pre- and

February 2015
Loss of Fish and Wildlife Habitat
Project Summary

Post-construction monitoring, and education outreach. MMSD also received grant funding from the US Environmental Protection Agency and the National Fish and Wildlife Foundation.

Timetable and Duration
Phase 1
Design: 2010 – 2013
Construction: May 2013 – Dec 2014

Phase 2
Design: 2013 - 2014
Construction: Ongoing – Spring 2016

Post Construction Monitoring (Both Phases): Spring 2016 - 2017

Project Budget & Funding

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*For the Phase 2 project construction costs, the USACE is funding approximately $4 million (65%) and MMSD is funding the remaining $2 million (35%).

Fish and Wildlife Plan Goals Addressed by Project
1. Improve aquatic habitat connectivity by...
   A. Improving linear connectivity by restoring or enhancing fish and aquatic organism passage from Lake Michigan to the tributaries and headwaters, and/or
   B. Improving lateral connectivity by connecting aquatic habitat to floodplain wetland with suitable hydroperiod from Lake Michigan to the tributaries and headwaters where opportunities exist.
2. Improve aquatic habitat connectivity by...
   A. Improving linear connectivity by restoring or enhancing fish and aquatic organism passage from Lake Michigan to the tributaries and headwaters, and/or
   B. Reconnecting high quality habitat downstream of the Bridge Street Dam and Lepper Dam to the main stem rivers of the AOC in cases where that habitat is directly connected to the estuary (i.e., there are no downstream barriers from the proposed project site).

Physical/biological habitat secondary goals:
1. Moderate flow regimes to decrease flashiness.
2. Provide and preserve sufficient baseflow.

Project Rationale/Why Critical for BUI Removal
Prior to European settlement, the Milwaukee Estuary provided extensive fluvial and wetland habitats for a diverse fish assemblage as well as access to hundreds of miles of upstream riverine and floodplain...
Loss of Fish and Wildlife Habitat
Project Summary

habitats for spawning and development. All of the wetlands, conservatively estimated at 6,000 acres, have been filled and all of the estuaries fluvial habitats were dredged and bulkheaded, and access to upstream habitats were obstructed by dams or concrete channel inverts. Existing land and water-based uses in the estuary prevent these historic habitat functions and values from being restored, and as a result, with few exceptions self-sustaining populations of many ecologically and economically important fish stocks are not possible. To mitigate these estuary habitat losses federal, state and local management groups have contributed to the removal of barriers (dams, culverts, concrete inverts) to enable lake and estuary fish to access remaining spawning and nursery habitats upstream of the estuary, and provide a source of return recruitments to the estuary and lake. The removal of this final section of concrete will open up 37 miles of fish passage to historical spawning and rearing habitat including over 1,000 acres of riparian wetlands. It will provide benefits to multiple aquatic and semi-aquatic species including fish and benthos. Game fish species expected to benefit include Lake Sturgeon, Redhorse Sucker species, Walleye, Lake Run Trout, Salmon, Northern Pike and Smallmouth Bass.

Necessary Project Elements
- Replace the concrete channel lining with a stone lined channel throughout the project reach.
- Install pool/ riffle systems that allow native fish (e.g. Northern pike) to pass through the steep section of the river.

Criteria for Measuring Project Goals are Met (Qualitative and/or Quantitative)
- Providing fish passage through this section of the river to allow access to upstream spawning and rearing habitat.
Loss of Fish and Wildlife Habitat
Project Summary

**Project Title:** Kletzsch Park Dam Fish Passage

**Project Location:** Milwaukee River at river mile 10 (10-miles upstream of confluence with Lake Michigan). Between Green Tree Rd. and Bender Rd., City of Glendale, Milwaukee County.

**Project Sponsor:** Milwaukee County

**Project Landowner:** Milwaukee County

**Proposed Work**
The goal of this project is to provide aquatic organism passage at the Kletzsch Park Dam. The dam is a barrier to native fish and other aquatic life passage except during infrequent and extended duration flood events. The structure would be passive by design, require minimal to no operation and maintenance cost, and would permanently allow passage upstream in the Milwaukee River (Aadland, 2010).

**Collaboration with Partners**
The Tech Team and WDNR would like to be involved as Stakeholders in the project.

**Timetable and Duration**
The timetable and duration of design and implementation phases are unknown and dependent on funding. Planning and design through implementation would be feasible in a two year timeframe.

**Project Budget & Funding**
There is currently no funding to plan or construct fish passage at this dam. The County is pursuing funding for that aspect of the project. A rough estimate for planning, design, construction and ancillary tasks is $650,000.

**Fish and Wildlife Plan Goals Addressed by Project**
The proposed project is consistent with the goals set forth in the Milwaukee Estuary AOC Remedial Action Plan 2013 Update, Fish and Wildlife Plan, including;

1. Enhance/improve aquatic habitat by...
   B. Improving lateral connectivity by connecting aquatic habitat to floodplain wetland with suitable hydroporiod from Lake Michigan to the tributaries and headwaters where opportunities exist.

2. Improve aquatic habitat connectivity by...
   A. Improving linear connectivity by restoring or enhancing fish and aquatic organism passage from Lake Michigan to the tributaries and headwaters, and/or
   B. Reconnecting high quality habitat downstream of the Bridge Street Dam and Lepper Dam to the main stem rivers of the AOC in cases where that habitat is directly connected to the estuary (i.e., there are no downstream barriers from the proposed project site).

**Project Rationale/Why Critical for BUI Removal**
This dam, located at river mile 10 and the Estabrook Dam at river mile 7 are the furthest downstream and last remaining fish and aquatic life passage barriers on the Milwaukee River. A similar fish and
aquatic life passage facility is proposed for the Estabrook Dam (see Estabrook Dam Loss of Fish and Wildlife Habitat Project Summary). Since 1997, former dams as barriers to fish and aquatic life passage were removed at river mile 3 (North Avenue Dam at Milwaukee), river mile 30 (Lime Kiln Dam at Grafton), and river mile 31 (Chair Factory Dam at Grafton). A fishway was completed in 2010 at the Mequon-Thiensville Dam. It is a critical component for providing access to reproductive and nursery habitats in the upstream portions of the Milwaukee River.

**Necessary Project Elements**
- The Kletzsch Park Dam is not a complete barrier to aquatic invasive species (AIS). The USFWS and WDNR have determined that the first complete barrier to potential AIS from Lake Michigan is the Village of Grafton Bridge Street Dam at river mile 32. In-water and land-based construction activities will follow WDNR practices and permit requirements for preventing the spread of AIS.
- Milwaukee County owns the Kletzsch Park Dam and either owns or has access easements for lands abutting the dam, and will maintain the fish passage facility.

**Criteria for Measuring Project Goals are Met (Qualitative and/or Quantitative)**
- Enable fish and aquatic life access to an additional 22-mile of barrier free riverine habitat and 2,400-acres of wetland habitat.
- 22 miles of tributary connected to the mainstem of the Milwaukee River, Milwaukee Estuary and Lake Michigan.
- One critical impediment retrofitted for fish and aquatic life passage.
- One riparian area impediment retrofitted to improve continuity of riparian buffers, including improvements to decrease resistance to animal movements.
- Increase in suitable habitat patch size resulting from new connectivity.

**References**

Aadland, Luther, P. 2010. Reconnecting Rivers: Natural Channel Design in Dam Removals and Fish Passage. Minnesota Department of Natural Resources Ecological Resources Division. [http://www.dnr.state.mn.us/eco/streamhab/reconnecting_rivers.html](http://www.dnr.state.mn.us/eco/streamhab/reconnecting_rivers.html)
Loss of Fish and Wildlife Habitat
Project Summary

Milwaukee River Kletzsch Park Dam

Legend
- Rivers and Streams
- Open Water
- 2019 Air Photos (WROC)

Milwaukee R. discharge 3,300 cfs

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June 2015
Project Title: Estabrook Dam Fish Passage

Project Location: Milwaukee River, downstream of Port Washington Road

Project Sponsor: Milwaukee County

Project Landowner: Milwaukee County

Proposed Work
The goal of this project is to provide aquatic organism passage at Estabrook Dam. The passage would be provided by a structure if the dam is to remain in place or by removing the dam entirely. It would be passive in nature and would permanently allow passage upstream in the Milwaukee River. The County must repair or remove the dam, and this work would likely be coordinated with that effort.

Collaboration with Partners
The County has collaborated with the community and stakeholders in preparing an environmental impact statement for this project. The Tech Team and WDNR would like to continue to be involved as Stakeholders in the project going forward.

Timetable and Duration
Environmental Impact Statement 2015
The timetable and duration of design and implementation phases are unknown and dependent on funding. Design and implementation would be feasible in a two year timeframe. The County must repair or remove the dam by December 31, 2016.

Project Budget & Funding
The Milwaukee County 2016 Budget approves borrowing $750,000 to assist with construction of a fish passage at Estabrook Dam. According to the Draft Environmental Impact Statement prepared by AECOM on behalf of Milwaukee County, a rough estimate for dam removal is $2.4 million and a rough estimate for fish passage with dam repair is $3.4 million.

Fish and Wildlife Plan Goals Addressed by Project
1. Enhance/improve aquatic habitat by...
   B. Improving lateral connectivity by connecting aquatic habitat to floodplain wetland with suitable hydroperiod from Lake Michigan to the tributaries and headwaters where opportunities exist.
2. Improve aquatic habitat connectivity by...
   A. Improving linear connectivity by restoring or enhancing fish and aquatic organism passage from Lake Michigan to the tributaries and headwaters, and/or
   B. Reconnecting high quality habitat downstream of the Bridge Street Dam and Lepper Dam to the main stem rivers of the AOC in cases where that habitat is directly connected to the estuary (i.e., there are no downstream barriers from the proposed project site).

Project Rationale/Why Critical for BUI Removal
Loss of Fish and Wildlife Habitat
Project Summary

This dam is the furthest downstream aquatic organism passage barrier on the Milwaukee River. It is a critical link to providing access to habitat in the upstream portions of the Milwaukee River.

Necessary Project Elements
- Aquatic organism passage to upstream of the dam site. The connection should be passive (i.e. not active, such as a fish lift) and passable by aquatic organisms, with northern pike the target species to use for design purposes.
- The passage may be accomplished by dam removal or through a passive fish passage structure.
- Adequate buffer between aquatic habitats and development (as defined above in goal 3).
- An invasive species and vegetation management plan (aquatic and terrestrial) that is implemented at the site.
- Maintenance plan with provisions for implementation for any constructed passageway.
- Some type of permanent conservation protection for any riparian portions of the site (conservation easement or equivalent).
- If the dam remains in place, an operating order must be developed for the dam. The operating order will clarify and establish water levels and specify operational standards for the dam.

Criteria for Measuring Project Goals are Met (Qualitative and/or Quantitative)
- Amount (length) connected as fish and aquatic organism habitat.
- One impediment removed and/or retrofitted.
- Number of tributary miles connected to mainstem.
- One riparian area impediments removed and/or retrofitted to improve continuity of riparian buffers, including improvements to decrease resistance to animal movements.
- Increase in suitable habitat patch size resulting from new connectivity

June 2015
Loss of Fish and Wildlife Habitat
Project Summary

June 2015
Loss of Fish and Wildlife Habitat
Project Summary

Project Title: Five Low Flow Barriers on the Menomonee River

Project Location: Menomonee River between N 90th Street (extd) and N 84th Street (extd)

Project Sponsor: Milwaukee Metropolitan Sewerage District (MMSD)

Project Landowner: Milwaukee County

Proposed Work

MMSD will remove five manmade barriers to fish passage in the Menomonee River channel in order to improve fish passage from the Milwaukee Estuary to the upper reaches of the Menomonee River and its tributaries for over 39 species of fish. Three of the barriers are from a single 24-inch MMSD Metropolitan Intercepting Sewer that crosses the river at three locations. At each of these locations, the sewer creates a 1-1.5 foot drop that impairs fish passage. The fourth location is an old low dam/grade control structure with a 2-3 foot drop constructed in the 1930s. The last barrier is an old concrete road crossing that creates an one foot drop and then a shallow area 10 feet in width behind the drop this is impassable under base flow conditions.

The project consists of abandoning underutilized portions of the MMSD sewer and modifying the remaining active portions in order to allow for the removal of the barriers at the three crossings. The remaining two barriers will also be removed.

Collaboration with Partners

MMSD has worked with several members of the Tech Team including the WDNR, SEWRPC, USGS, Milwaukee Riverkeeper, Trout Unlimited, Friends of Hoyt Park, and Milwaukee County Parks Dept on this project. These agencies have provided funding or in-kind contributions for professional services for the project design, pre- and post-construction monitoring, and education outreach. MMSD also received over $765,000 of grant funding from the Fund for Lake Michigan, National Oceanic and Atmospheric Administration, Sustain Our Great Lakes, and Great Lakes Fisheries Trust.

Timetable and Duration
Design = Ongoing – Summer 2015
Construction = Fall 2015 – Spring 2016

Project Budget & Funding

The total project costs for this project is approximately $2M.
Project grant funding:
  Fund For Lake Michigan - $200,000
  National Oceanographic and Atmospheric Administration - $142,100
  Sustain Our Great Lakes - $400,000
Loss of Fish and Wildlife Habitat
Project Summary

Great Lakes Fisheries Trust - $25,000
MMSD will fund the remaining $1.2 M in project costs.

Fish and Wildlife Plan Goals Addressed by Project
1. Enhance/improve aquatic habitat by...
   B. Improving lateral connectivity by connecting aquatic habitat to floodplain wetland with suitable hydroperiod from Lake Michigan to the tributaries and headwaters where opportunities exist.
2. Improve aquatic habitat connectivity by...
   A. Improving linear connectivity by restoring or enhancing fish and aquatic organism passage from Lake Michigan to the tributaries and headwaters, and/or
   B. Reconnecting high quality habitat downstream of the Bridge Street Dam and Lepper Dam to the main stem rivers of the AOC in cases where that habitat is directly connected to the estuary (i.e., there are no downstream barriers from the proposed project site).

Project Rationale/Why Critical for BUI Removal
The removal of these barriers will improve fish passage from the estuary to 34 miles upstream to historical spawning and rearing habitat including over 1,000 acres of riparian wetlands.

Necessary Project Elements
- Aquatic organism passage to upstream of the dam site by removing five concrete barriers that prevent fish passage during low flow periods.

Criteria for Measuring Project Goals are Met (Qualitative and/or Quantitative)
- Amount (length) connected as fish and aquatic organism habitat.
- Five impediments removed and/or retrofitted.
- Number of tributary miles connected to mainstem.
- Increase in suitable habitat patch size resulting from new connectivity
Map 1: Low Gradient Fish Barriers, Menomonee River, Milwaukee County,
Loss of Fish and Wildlife Habitat
Project Summary

Project Title:  Kinnickinnic (KK) River Habitat Rehabilitation

Project Location:  KK River between I-94 and Becher St.

Project Sponsor:  Milwaukee Metropolitan Sewerage District (MMSD)

Project Landowner:  MMSD, Milwaukee County, City of Milwaukee and other private riparian landowners

Proposed Work
Previous studies have shown this section of the KK River does not sustain a viable aquatic habitat due to low dissolved oxygen levels, lack of flow and limited diversity of channel morphology. In addition, there are contaminated sediments within this stream reach. Improvements to the channel morphology could partially address the habitat issues. The first step in the process is a feasibility study, followed by design and implementation of selected remedy that meets AOC habitat goals. The proposed feasibility study will develop alternatives and select a preferred alternative that meets the following objectives:

- A reduction of the contaminated sediments getting transported to the Milwaukee Estuary through removal or sequestration of contaminated river sediments in the study area.
- Improvement of fish and wildlife habitat through diversifying river channel and stream bank morphology and channel substrate diversity.
- Improve water quality in the study reach of the KK River (dissolved oxygen goal of 5 mg/L).
- No increase in the 1% probability flood elevation.

Collaboration with Partners
MMSD has worked with the WDNR and other members of the Tech Team to secure a NOAA grant in the amount of $200,000 to perform a feasibility study. WDNR and Tech Team would continue to be involved in the feasibility and design of the habitat improvements.

Timetable and Duration
Feasibility Study:  June 2015 – June 2016
Design and Implementation:  contingent on funding

Project Budget & Funding
The total project costs for the feasibility study is approximately $325,000. MMSD has received a NOAA grant in the amount of $200,000. Estimates on design and construction cost will be determined at the end of the feasibility study.

Fish and Wildlife Plan Goals Addressed by Project
Physical/biological habitat primary goals:
1. Enhance/improve aquatic habitat by...
   A. Identifying and enhancing fish spawning sites from Lake Michigan to the tributaries and headwaters where opportunities exist (e.g., inner and outer harbors, Milwaukee River downstream of the North Ave. Dam pedestrian bridge), and/or
   B. Improving lateral connectivity by connecting aquatic habitat to floodplain wetland with suitable hydroperiod from Lake Michigan to the tributaries and headwaters where opportunities exist.
2. Improve aquatic habitat connectivity by...
Loss of Fish and Wildlife Habitat
Project Summary

A. Improving linear connectivity by restoring or enhancing fish and aquatic organism passage from Lake Michigan to the tributaries and headwaters, and/or

**Project Rationale/Why Critical for BUI Removal**
This project will address degraded aquatic habitat conditions in the upper limits of the Milwaukee Estuary AOC on the KK River. This is the one of the only stretches of the KK River that has natural bed and banks remaining.

**Necessary Project Elements**
- Identify feasible alternatives that will meet the project objectives defined above.
- Identify guidelines for an invasive species and vegetation management plan (aquatic and terrestrial) that will be developed in a future design phase.
- Permanent protections will be secured for any areas where habitat improvements are planned.

**Criteria for Measuring Project Goals are Met (Qualitative and/or Quantitative)**
- Improving linear connectivity of the Kinnickinnic River within the AOC and to the estuary.
- Increase in suitable habitat patch size resulting from new connectivity
- Creation or enhancement of upland buffer habitat surrounding along the riparian corridor to improve connectivity.
Loss of Fish and Wildlife Habitat
Project Summary

Figure 1: Project Location

Great Lakes Legacy Act Cleanup (Completed 2009)

Proposed KK River Stream and Habitat Rehabilitation, Milwaukee Estuary AOC

KK River Habitat Restoration (Completed 2012)

W ROSEDALE AVE

E ROSEDALE AVE

S CHASE AVE

S GREELEY ST

S AUSTRIN ST

S SMITH ST

E DEER PL

W HARRISON AVE

W ARTHUR AVE

S 8TH ST

S 9TH ST

S 6TH ST

S 8TH PL

W LINCOLN AVE

W HAYES AVE

W GRANT ST

E BECHER ST

S ROGERS ST

S KINNICKINNOC AVE

E WARD ST

February 2015