DELISTING TARGETS FOR THE SHEBOYGAN RIVER AREA OF CONCERN: FINAL REPORT

Submitted to:

Wisconsin Department of Natural Resources

December 2008

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This publication was funded by Wisconsin Department of Natural Resources through a grant from the U.S. Environmental Protection Agency's Great Lakes National Program Office.

ACKNOWLEDGMENTS

We thank the U.S. Environmental Protection Agency-Great Lakes National Program Office for funding this important initiative, and the Wisconsin Department of Natural Resources for guiding its successful implementation.

Many experts contributed their time, efforts, and talent toward the preparation of this report. We thank the following members of the Remedial Action Plan Steering Committee for their time and input in preparing this report:

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LIST OF ABBREVIATIONS

AOC	area of concern
BCOC	bioaccumulative chemicals of concern
B-IBI	benthic index of biotic integrity
BMP	best management practices
BU	beneficial uses
BUI	beneficial use impairments
CBSQGs	consensus based sediment quality guidelines
CTF	confined treatment facility
DDT	dichloro-diphenyl-trichloroethane
DELT	deformities, eroded fins, lesions and tumors
DLTs	deformities, lesions, and tumors
ESBs	equilibrium partitioning sediment benchmarks
GLNPO	Great Lakes National Program Office
GLWQA	Great Lakes Water Quality Agreement
IJC	International Joint Commission
LaMP	Lakewide Management Plan
LOEL	lowest observable effect level
MDCH	Michigan Department of Community Health
MDEQ	Michigan Department of Environmental Quality
MDNR	Michigan Department of Natural Resources
mIBI	macroinvertebrate index of biotic integrity
NPL	National Priorities List
NEMW	Northeast-Midwest Institute
PAH	polynuclear aromatic hydrocarbons (also polyaromatic hydrocarbons or polycyclic aromatic hydrocarbons)
PCB	polychlorinated biphenyls
PEC	probable effects concentration
PEC-Q	probable effects concentration quotient
PRP	potentially responsible party
PRS	Pollution Risk Services

LIST OF ABBREVIATIONS (continued)

RAP	Remedial Action Plan
ROD	record of decision
SMF	sediment management facility
SRBP	Sheboygan River Basin Partnership
TMDL	total maximum daily load
U.S. EPA	U.S. Environmental Protection Agency
WQS	water quality standard
WDNR	Wisconsin Department of Natural Resources
WWTP	wastewater treatment plant

EXECUTIVE SUMMARY

The Sheboygan River Area of Concern (AOC) was designated as one of 43 Great Lakes "Areas of Concern" by the International Joint Commission (IJC), based on observed impairments to beneficial uses of the river. The Remedial Action Plan (RAP) for the Sheboygan River AOC lists the following nine Beneficial Use Impairments (BUIs):

- Restrictions on fish and wildlife consumption
- Degraded fish and wildlife populations
- Fish tumors and deformities
- Bird or animal deformities or reproduction problems
- Degradation of benthos
- Restrictions on dredging activities
- Eutrophication or undesirable algae
- Degradation of phytoplankton and zooplankton populations
- Loss of fish and wildlife habitat

The process of delisting AOCs is defined by policies and guidance established by the IJC, U.S. EPA, and Environment Canada. The Great Lakes Regional Collaboration strategy includes a milestone that delisting targets for each US AOC should be developed by the end of 2008. The development of delisting targets is meant to be a collaborative process among federal, state, and local partners.

The Sheboygan area, the State of Wisconsin, and the Great Lakes Region will realize significant benefits by restoring the beneficial uses that have been impaired within the AOC. The benefits can be classified under the categories of environmental, social/recreational, health, and economic. There is considerable overlap and strong interrelationship among these categories, as improvements under one category may trigger a cascade of improvements in others. For example, cleaning up contaminated sediments improves the environment through increased ecosystem diversity, which, in turn, improves fisheries and reduces health risks from eating fish, which in turn, benefits the sport fishing industry, tourism and the local economy. The goal of developing delisting targets is to provide an endpoint definition of "how clean is clean" that will support and sustain restoration efforts for the AOC.

This project to develop delisting targets included a review of the region's historical background, land use transformations, ecological conditions, and previous progress toward restoration. The project team reviewed and considered previous studies of the river that related to the BUIs, including documents concerning contaminated sediments and their effect on fish, wildlife and benthic organisms. The project team also reviewed delisting targets previously prepared for other Great Lakes AOCs for their relevance and applicability to the Sheboygan River. The process of developing targets was highly collaborative, and included significant input from technical experts, local stakeholders and the public.

The development of the delisting targets presented in this report marks a significant milestone in efforts to restore the Sheboygan River AOC. The ultimate pathway to restoration, however, is defined by the development of a strategy for restoring the AOC and the effective implementation of actions to assess, remediate, and monitor impairments, as well as to educate, inform and engage the community in realizing the value of a restored watershed. The strategy to restore the AOC should utilize the delisting targets in its overall goals and action plans.

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1.0 INTRODUCTION AND BACKGROUND

According to the Great Lakes Water Quality Agreement (GLWQA) and the Great Lakes Critical Program Act, Remedial Action Plans (RAPs) are required for every Area of Concern (AOC) within the Great Lakes. In 1978, the GLWQA was adopted to address water quality concerns relating to the chemical, physical, and biological integrity of Great Lakes waters. Within the GLWQA there was a provision for the protection of full and unimpaired uses of the Great Lakes. Use impairments were thus impacts on any of the fourteen beneficial uses (BUs). The original listing of Areas of Concern (AOCs) within the Great Lakes was based on the presence of beneficial use impairments (BUIs). BUIs were defined by the International Joint Commission (IJC) along with generalized criteria for determining when a BU was impaired.

The first set of guidance for delisting targets was put forth in 1991 by the International Joint Commission (IJC). These criteria were fairly general, and led to a more specific set of guidance published by the U.S. Environmental Protection Agency (U.S. EPA) in 2001. In addition to the generalized guidance published by U.S. EPA, the states of Michigan (April 2006) and Ohio (2005) have developed generic statewide criteria that can be applied to AOCs within these jurisdictions. These and other AOC-specific criteria were considered in the development of delisting targets for the Sheboygan River AOC.

The process of delisting AOCs is defined by policies and guidance established by the IJC, U.S. EPA, and Environment Canada. These policies are, in turn, carried out by the states and provinces wherein the AOCs reside. The original listing of Great Lakes AOCs was based on the presence of BUIs within each candidate area. The IJC lists fourteen BUIs that may apply to Great Lakes AOCs, nine of which were identified as impaired in the Sheboygan River AOC Remedial Action Plan.

The nine Beneficial Use Impairments for the Sheboygan River AOC are as follows:

- Restrictions on fish and wildlife consumption
- Degraded fish and wildlife populations
- Fish tumors and deformities
- Bird or animal deformities or reproduction problems
- Degradation of benthos
- Restrictions on dredging activities
- Eutrophication or undesirable algae
- Degradation of phytoplankton and zooplankton populations
- Loss of fish and wildlife habitat

Restoration of the AOC will provide numerous ancillary benefits including the following:

- A potential increase in property values within the AOC following restoration;
- Increased desirability of the AOC for investment and development following elimination of the AOC designation;
- Increased public use and enjoyment of the Sheboygan River AOC associated with increased active recreational uses such as fishing and swimming; and
- Increased public use and enjoyment of the Sheboygan River AOC associated with increased non-active recreational uses such as wildlife viewing and the general ability to “connect with nature” as aesthetics improve in the AOC

Lastly, the development of delisting targets for the BUIs within the AOC is essential to the development of an overall strategy for restoring the AOC. These targets will be utilized to specify measurable endpoints that will enable the WDNR and associated stakeholders to know when the remediation in the AOC has accomplished the specified restoration goals. The development of delisting targets allows each AOC section to be evaluated for its applicability to specific BUIs. This information will be utilized in the overall restoration strategy to determine which targets should be applied to which sections of the AOC.

2.0 PROJECT RATIONALE

The goal of this current project is to develop delisting targets, or restoration endpoints, that will define when the impairments that led to the original listing of portions of the Sheboygan River as an Area of Concern (AOC) no longer apply. To appreciate the reasons for developing these targets, we need to better understand the overall benefits of restoring the AOC, the challenges faced in sustaining restoration efforts over time, and the authority and process for delisting an AOC.

2.1 Benefits of Restoring the AOC

The Sheboygan area, the State of Wisconsin, and the Great Lakes Region will realize significant benefits by restoring the beneficial uses that have been impaired within the AOC. The benefits can be classified under the categories of environmental, social/recreational, health, and economic. There is considerable overlap and strong interrelationships among these categories, as improvements under one category may trigger a cascade of improvements in others. For example, cleaning up contaminated sediments improves the environment through increased ecosystem diversity, which, in turn, improves fisheries and reduces health risks from eating fish, which in turn, benefits the sport fishing industry, tourism and the local economy.

Environmental Benefits

For the Sheboygan River AOC, as for many of the Great Lakes AOCs, removing chemical contamination and reducing or eliminating chemical discharges into the waterway is critical to restoring the health of the ecosystem within the Sheboygan River AOC. Chemicals released to the environment cycle between air, soil, water, sediments, and biota. Various studies of the Sheboygan River area have documented the adverse effects of PCBs and other contaminants on aquatic and terrestrial species. Fortunately, significant progress has been made in addressing contaminated sediments in the Sheboygan River. Contaminated sediment cleanup projects include completion of Phases 1 and 2 of the Sheboygan River Superfund Site and substantial progress toward investigation of the Camp Marina Manufactured Gas Plant Site. Additionally, since 1996, groundwater contamination from the Kohler Company Landfill Superfund site is being intercepted and prevented from migrating to the Sheboygan River.

The restoration of the Sheboygan River AOC is not only reliant upon removing industrial chemical contamination. Improvements to agricultural and urban land use practices are also key to restoring the watershed. A high biological loading associated with nutrients from fertilizers, storm water runoff, and erosion can lead to undesirable algal blooms which can affect water quality. Algal blooms can be a threat to human health and can also contribute to a decline in the aesthetics of the watershed leading to a marked decrease in boating and the ability to enjoy the river.

Social/Recreational Benefits

Restoration of the Sheboygan River AOC will provide social benefits to the Sheboygan area by enhancing recreational opportunities such as boating, fishing for recreational catch and consumption, and wildlife viewing. For example, removal of restrictions on dredging will directly impact uses of waterways within the AOC, allowing enhanced recreational, as well as commercial navigation. In addition, restoring the AOC improves the overall quality of life in the area through the enhancement of the natural beauty of the watershed. Many people experience the environment in positive ways, such as a relief from the stresses

and pressures of urban life or through a spiritual connection to the natural world. In general, we can attribute many social and psychological benefits to preserving and sustaining the natural beauty of our environment.

Health Benefits

There are measurable and immeasurable benefits to restoring the AOC in terms of human health effects. Restrictions on fish consumption lead to losses in market revenues from fisheries associated activities and consumption of contaminated fish can cause health effects. Restoration should lead to improvements in human health that cannot easily be quantified due to a lack of our understanding or ability to establish cause-and-effect from exposure to biological and chemical agents from contaminated sites. For example, gastroenteritis can result from swallowing contaminated water while swimming, or from eating contaminated food; the cause for any given incident is likely to be ambiguous. Similarly, the relative contribution of cumulative exposures to chemicals in the environment to major disease processes is very difficult to assess. PCBs, one of the major contaminants in sediments and fish tissues in the Sheboygan River AOC, contribute to several health effects including thyroid problems, reproductive and immune system impairments, decreased IQ in children of mothers with PCBs stored in their bodies, diabetes, and cancer.

Economic Benefits

The positive effects of environmental restoration on economic benefits are often not easily quantified, yet studies that have attempted to do so have shown that restoring the environment provides economic value to the community. For example, a 2006 study by the Northeast-Midwest Institute estimated that remediation of contaminated sediment in Sheboygan River could increase individual property values by a range of $21,000 to $53,000 (Braden, et al, 2006). In Thunder Bay, Sustainable Futures et al. (1996) estimated that $50 million in investments in economic development would ensue from cleanup of contaminated sediments in this AOC.

2.2 Focusing and Sustaining Restoration Efforts

Delisting targets are helpful to focus and sustain restoration efforts over an extended time period. Restoring a degraded ecosystem such as the Sheboygan River AOC is inherently a long-term process, measured in decades, and requiring focus and persistence from citizens, governments and other stakeholders. In this regard, the Sheboygan River AOC is not unlike numerous other restoration efforts across the Great Lakes, where public interest, political will and government funding must be sustained for a generation or more. Yet our political culture is defined by election cycles measured in years and our popular culture is characterized by ever shorter attention spans. Adding to the difficulty of incompatible time horizons, those directly involved in restoration efforts face internal challenges to focus and sustain momentum despite generational turnover, ongoing changes to the landscape and updated scientific understanding.

In the face of such challenges to sustain restoration efforts, it is critical to establish unambiguous endpoints. Delisting targets serve this role and also assist to communicate a clear vision for the restoration process. Delisting targets serve as touchstones to sustain restoration efforts across generational and political time horizons. It is for these reasons that local stakeholders, the Wisconsin Department of Natural Resources, and the U.S. Environmental Protection Agency are engaged in this current effort to define delisting targets for the Sheboygan River Area of Concern (AOC). The goal of developing delisting targets is to provide an

endpoint definition of "how clean is clean" that will support and sustain the creation of a vision for the restoration of the AOC.

2.3 The Delisting Process for the Sheboygan River AOC

The process for delisting an AOC is largely defined by the International Joint Commission (IJC), the U.S. Environmental Protection Agency (U.S. EPA), and Environment Canada in various policies and guidance. The process is not a regulatory requirement unless adopted by rule or similar institutional arrangement at the state, provincial or federal level. More commonly, the steps toward delisting are carried out by the states and provinces through existing programs and through collaboration with local initiatives.

The Great Lakes Regional Collaboration recommended that all the AOCs have delisting targets defined by December 31, 2008 to determine at what point impaired beneficial uses can be considered restored. This recommendation has resulted in a renewed interest in determining goals and targets for "delisting" AOCs. This renewed interest in delisting is especially relevant for the Sheboygan River AOC, where active involvement by the Wisconsin Department of Natural Resources (WDNR), Sheboygan River Basin Partnership (SRBP), various local and regional governments, universities and citizens' groups has resulted in significant progress toward restoration.

This ongoing collaborative effort has resulted in many reports and initiatives that were reviewed as part of this current delisting effort. The reference list included with this report details the documents that were reviewed as part of this project including, but not limited to, the 1989 Sheboygan River Stage I RAP and the 1995 Stage II RAP Update. These documents and other documents pertaining to contaminated sediments, health impacts, habitat impacts, and fish and wildlife consumption guidelines provided valuable site specific information to support the development of meaningful restoration endpoints.

The process of developing delisting targets for the Sheboygan River AOC included substantial input from technical experts, stakeholders and the public. Several earlier drafts of this report were reviewed by subject area technical experts both within and outside of the WDNR, who provided valuable insights and suggestions that improved the quality of the final targets. Likewise, the preparation of the report included meetings and reviews by the Sheboygan River Basin Partnership AOC committee, who assisted in effectively communicating the role of the targets to the community at large. Finally, the WDNR and SRBP sponsored a public meeting on December 2, 2008 to present the delisting targets, gather comments and establish the groundwork for future AOC restoration efforts. This public meeting is summarized in Appendix B of this report.

While this current effort to develop delisting targets for the Sheboygan River AOC is a significant milestone, the effort can only be effective when incorporated into a larger strategy and plan for restoration of the AOC. Given the significant progress to date and the level of enthusiasm among Sheboygan River stakeholders, the prospects appear good for achieving these delisting targets and ultimately delisting the AOC.

3.0 SHEBOYGAN RIVER ENVIRONMENTAL CONDITIONS

3.1 HISTORICAL BACKGROUND

Note: information for this section was summarized and condensed from the Sheboygan River RAP (WDNR, 1995) the State of the Sheboygan River Basin (WDNR, 2001), and the U.S. EPA Great Lakes Areas of Concern website (http://www.epa.gov/glnpo/aoc/sheboygan.html).

> The Sheboygan River Area of Concern (AOC) encompasses the lower Sheboygan River downstream from the Sheboygan Falls Dam, including the entire harbor and near shore waters of Lake Michigan (see Figure 1). The AOC serves as a sink for pollutants carried from three watersheds: the Sheboygan River, Mullet River, and Onion River. Pollutants of concern, both conventional and toxic, have been identified as suspended solids, fecal coliform bacteria, phosphorus, nitrogen, polychlorinated biphenyls (PCBs), Polynuclear Aromatic Hydrocarbons (PAHs) and heavy metals. The Sheboygan River Basin is located in portions of five counties. Industrial, agricultural and residential areas line the rivers of the basin. Agriculture is the dominant land use in the area, totaling 67%. The Sheboygan, Onion and Mullet River Basins contain three cities, eleven villages and seven towns. The cities of Sheboygan and Sheboygan Falls and the Village of Kohler are all located within the AOC.
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> The Sheboygan River and Harbor Superfund Site includes the lower 14 miles of the river from the Sheboygan Falls Dam downstream to, and including, the Inner Harbor. For purposes of remediation, the U.S. EPA divided the river into three sections. The Upper River extends from the Sheboygan Falls Dam downstream four miles to the Waelderhaus Dam in Kohler. The Middle River extends seven miles from the Waelderhaus Dam to the former Chicago & Northwestern (C&NW) railroad bridge. The Lower River extends three miles from the C&NW Bridge to the Pennsylvania Avenue Bridge in Sheboygan. The Inner Harbor includes the section from the Pennsylvania Avenue Bridge to the river's outlet to the Outer Harbor.
>
> - from: *http://www.epa.gov/glnpo/aoc/sheboygan.html*

The Sheboygan River's current status as a Great Lakes AOC is only fully understood in the context of the area's history. The historical practices and land use of the area inhabitants have shaped the current environmental conditions of the Sheboygan River, which was designated as an AOC in 1985. Native Americans in the 17th century were known to inhabit shorelines throughout the area, including those near the mouth of the Sheboygan River. Whole villages migrated to the area each spring to fish for whitefish that spawned in the lake shallows. The area was predominantly covered in dense virgin forests of pine and hardwoods, with significant marshes intermingled. European explorers began arriving around 1630 and the first fur-trading post was established in the area in 1795. In 1833, the lands on the western shore of Lake Michigan were ceded by the natives to the United States government, and significant permanent settlement soon followed. Americans of English descent, Germans, Hollanders, and Irish all came to the area in significant numbers in the 1830s through 1850s.

Agriculture and lumbering were the major industries of the new settlers during the 1800s, along with dairy and cheese making, furniture making, fishing and shipping. The change in the landscape from predominantly forest to agriculture during this time frame likely affected the rate of sedimentation and

habitat of the Sheboygan River. The first harbor improvements were constructed in 1852 and the first dredging occurred in 1867, providing a 12 foot deep channel. Shipping waned somewhat with the rise of the railroads in the 1870s, although various navigational improvements continued well into the 20th century.

The 20th century saw the growth and prosperity of various municipalities and industries in the area, including now-familiar names such as Borden, Johnsonville, Kohler, Mayline, and Tecumseh. Societal standards for waste disposal viewed river discharges as acceptable, and the increase in municipal and industrial effluent during the early to mid 20th century contributed further to the impairment of the river's natural resources. The use of synthetic organic chemicals such as polychlorinated biphenyls also increased in the mid-1900s.

The late 20th century brought an increasing awareness of the adverse environmental effects of agricultural, municipal and industrial practices. From the 1960s to present, significant initiatives have been introduced at the federal, state and local level to address pollution sources. Among these initiatives were the designation of the Sheboygan River as a Great Lakes Area of Concern and the concurrent designation of much of the river area as a Superfund site.

This rich natural resource history, extending from early settlement through today, provides not only an understanding of the significance of the region's plentiful resources to our daily lives, but also emphasizes the importance of sustainable natural resource management for generations to come.

3.2 LAND USES, TRANSFORMATIONS, AND POLLUTANT SOURCES

As made clear by the area's natural resource history, land uses and human practices have directly resulted in the impairments that define the Sheboygan River and harbor as a Great Lakes AOC. The main land uses and practices within the Sheboygan River basin that have contributed to adverse environmental conditions and the establishment of BUIs include agricultural and urban runoff, municipal and industrial discharges, wetland removal, and shoreline modification.

Runoff from agricultural and urban areas within the Sheboygan River basin contributes excess sediment and phosphorus, as compared to native land cover. Such sources of pollutants are generally considered "non-point" sources due to the widespread and diffuse nature of runoff. Approximately two-thirds of the land area of Sheboygan River basin is used for agricultural purposes such as crops, dairy and livestock (WDNR, 1995). Although only about 4 percent of the land area of the Sheboygan River basin is urban (WDNR, 2001), these areas tend to be concentrated in close proximity to the AOC, and include the Cities of Sheboygan and Sheboygan Falls and the Village of Kohler.

Excess phosphorus and sediment in runoff from both rural and urban areas has contributed to BUIs affecting the Sheboygan River AOC, including eutrophication and undesirable algae, degradation of fish and wildlife populations, degradation of benthos, loss of fish and wildlife habitat, and degradation of phytoplankton and zooplankton populations. Urban runoff may also contain metals and petroleum products that wash off of vehicles. Although a source of concern, these pollutants are considered less significant contributors to BUIs in the Sheboygan River AOC.

Point sources of pollutants, including discharges from municipal wastewater treatment plants and industries, have historically contributed to BUIs. Although greatly improved over the last several decades,

point discharges of municipal wastewater containing nutrients and carbonaceous matter have had an effect similar to that of non-point sources on beneficial uses within the AOC. Similar to municipal discharges, industrial sources of pollutants have been greatly reduced or eliminated over the years. Yet historically, such discharges have resulted in some of the most persistent pollutants within the AOC, including polychlorinated biphenyls (PCBs) and polynuclear aromatic hydrocarbons (PAHs), both of which remain in sediment and floodplain soils. Past industrial discharges of such persistent pollutants have contributed to all BUIs within the AOC except for eutrophication and undesirable algae.

Localized modifications to land forms can also have adverse effects on the beneficial uses within the watershed. Filling or draining wetlands is one such modification with severe negative consequences. These negative consequences include the loss of fish and wildlife habitat, nutrient removal capacity and flood storage capacity. Approximately 11 percent of the Sheboygan River watershed is currently covered by wetlands (WDNR, 2001). Other modifications to land forms, such as rechanneling of watercourses or armoring of embankments, also contribute to loss of habitat and can exacerbate flooding.

There are three dams remaining within the AOC, including the Sheboygan Falls dam (upstream end of the AOC), the River Bend Dam, and the Waelderhaus Dam. The Franklin Dam was removed in 2001. The remaining dams within the AOC and the tributary watershed affect the river hydraulics, passage of fish and other aquatic organisms, sediment quality and quantity, habitat, and water quality. Sediment that would normally be flushed from the system accumulates behind the dams in the impoundments, covering any natural habitat and intensifying areas where contaminated sediment can be accumulated more easily in the food chain. Impoundments behind dams tend to result in increased water temperatures and lower dissolved oxygen in the impounded stream both upstream and downstream of the dam. Dams prohibit the ability of fish and other aquatic organisms to travel upstream throughout the watershed limiting the productivity of the stream/river by reducing food availability and limiting access to upstream spawning and nursing habitat.

3.3 WATER QUALITY AND QUANTITY

Past land transformations and various pollutant sources impaired the stream's biological and water quality integrity. Urbanization in the area surrounding the lower river resulted in greater fluctuation in flow. Water quality was impaired by high stream turbidities, sedimentation, flow fluctuations, nutrient enrichment, dissolved oxygen fluctuations, loss of habitat, toxicity, PCB bioaccumulation and fish migration interference (WDNR, 2001a). Water quality conditions within the AOC are considered to be poor to fair. In-place contamination, including PCBs, metals and PAHs, remain the most significant limiting factor to water quality improvement. Recent progress and planned actions to remediate contaminated sediments (see Section 3.4) offer significant promise for future water quality improvement. This promise is supported by trend analysis for water quality parameters conducted by Galarneau (WDNR 2001a), which indicated improvements from samples collected at Esslingen Park. The study showed downward trends in total phosphorus, dissolved phosphorus, nitrate plus nitrite, and fecal coliform bacteria between 1977 and 1994. Among the parameters measured, only chloride showed an upward trend during the period.

3.4 SEDIMENT

In-place contamination in sediments, primarily from PCBs and PAHs, are linked to all BUIs within the AOC except Eutrophication and Undesirable Algae. Based on the results of several studies of sediments and contaminant sources beginning in the 1970s, the Sheboygan River and Harbor were added to the National Priorities List (NPL) in 1986. Tecumseh, a manufacturer of refrigeration and air conditioning compressors

and gasoline engines, located in Sheboygan Falls, was identified as a Potentially Responsible Party (PRP). The U.S. EPA Region 5 Superfund fact sheet summarizes the Sheboygan River and Harbor NPL activities as follows (http://www.epa.gov/region5/superfund/npl/wisconsin/WID980996367.htm):

> In 1986, the United States Environmental Protection Agency (U.S. EPA) and the state signed a Consent Order with the PRP, requiring the PRP to conduct an investigation at the site to determine the nature and extent of contamination. From 1989 to 1990, the PRP dredged approximately 5,000 cubic yards of contaminated sediments from the upper Sheboygan River. The PRP stored the sediments in two containers onsite: a confined treatment facility (CTF) and a sediment management facility (SMF). The CTF was used for biodegradation studies to evaluate the feasibility of biodegradation of PCBs in place. The SMF was designed for temporary storage of the remaining dredged sediments until they could be disposed of properly. During the period between 1989 and 1990, eight other sediment deposits were "armored" in the upper Sheboygan River. These areas were covered with several layers of geotextile fabric, run of bank material, and cobble and wire cages, filled with rock (gabions), in order to prevent the PCB-contaminated sediment from moving downstream.
>
> The Record of Decision was signed on May 12, 2000, calling for the removal of approximately 21,000 cubic yards of PCB-contaminated sediment from the upper river, 50,000 cubic yards of PCB-contaminated sediment from the inner harbor, removal of PCB-contaminated soil from the floodplains adjacent to the river, long-term monitoring of sediment and fish for the entire river, and additional groundwater/preferential pathway/source investigations at the Tecumseh plant facility. The estimated cost of the remedy is $41 million.
>
> In fall 2001, Tecumseh Products Company under a separate agreement disposed of approximately 3,800 cubic yards of PCB-contaminated sediment that had been stored in the CTF and SMF. Offsite removal and disposal of these stored sediments comprised one of the components of the ROD, signed in May 2000.
>
> A consent decree with Tecumseh Product Company for development of the remedial design and implementation of the remedial action for the upper river sediment, floodplain soil, and facility investigations was completed. The PRPs finalized the remedial design for Phase 1 of the upper river. This portion of the remedy included removal and offsite disposal of PCB-contaminated soils present at the Tecumseh facility. It also included construction of a groundwater trench at the Tecumseh facility to deal with contaminated groundwater. Remedial action for Phase 1 upper river began in 2004.
>
> The Phase II Upper River work is being implemented by Pollution Risk Services, which bought the former Tecumseh facility. This work includes the near-shore areas, armored areas (river edges reinforced to prevent erosion) and soft sediments. Phase II work was initiated in June, 2006. Near shore sediments and armored areas were excavated and properly disposed of by October, 2006. Soft sediment dredging in the upper river continued through November 2006. Phase II Upper River soft sediment dredging operations were re-initiated May 2007 and went through October 2007. As of October 2007 sediment dredging in the Upper river was completed. Additionally, the PRP will initiate sample collection and re-characterization of soft sediment deposits for the middle river, lower river and Inner Harbor in the summer of 2008.

In addition to the ongoing Superfund activity being implemented by PRS, the U.S. EPA is working with Wisconsin Public Service Corporation to investigate and remediate the Camp Marina Manufactured Gas Plant Site located on the north shore of the river in the City of Sheboygan. The site included contamination with PAHs in both soils and sediments. The soil cleanup phase was implemented in 2001 and investigation is ongoing to evaluate and remediate sediment contamination. Cleanup actions at the Camp Marina site may be implemented in concert with PCB remediation actions.

See Figure 1 for graphic description of Superfund site, Upper River, Middle River, and Lower River segments.

3.5 FISH AND WILDLIFE

The section of the Sheboygan River within the AOC is classified as a warm water sport fish community. The fishery consists of smallmouth bass, walleye, northern pike, crappie, channel catfish, rock bass, and assorted panfish. Smallmouth bass dominate the sport fishery in this section of the river. Tolerant forage species include common carp, common shiner, sand shiner and bluntnose minnow. This segment also exhibits seasonal runs of salmon and trout.

An ecological risk assessment indicated potential reproductive effects in fish from PCBs, most markedly for smallmouth bass (EVS and NOAA, 1998). Potential effects from PAHs were less clear, perhaps due to collocation of PAH and PCB contamination. Anglers are advised not to eat any resident fish (e.g. smallmouth bass, walleye, carp or panfish) caught in the Sheboygan River, and to consult the Lake Michigan fish advisory about consumption of trout and salmon (WDNR, 2008). In response to concerns about PCB contamination of the fish, salmon stocking in the Sheboygan River was suspended in 1987. Based on the results of an experimental stocking study, trout and salmon stocking has been resumed on a limited basis (Eggold, et al, 1996). Fish health assessments were conducted by the Wisconsin Department of Natural Resources (WDNR) on white suckers in the AOC in 1994. The research concluded that white suckers residing in the lower Sheboygan River were exposed to and absorbed significant amounts of PCBs and PAH, and exhibited biochemical, histological and hematological alterations, suggesting impaired fish condition (Schrank, et al, 1997).

Despite impairments due to PCBs and other contaminants, fish community studies indicate that fish populations and habitat are generally good for the area (WDNR, 2001). Using a fish habitat rating model (FHR-R) the WDNR rated fish habitat from good to excellent.

There has been a series of studies of PCBs and other contaminants in wildlife species along the Sheboygan River and associated floodplains as described in the Sheboygan River Food Chain and Sediment Contaminant Assessment (Burzynski, 2000). The earliest was in fish-eating birds and wading birds collected along the river between 1976 and 1980 and reported by Heinz, et al 1984. This study documented carcass contamination levels between 23 and 218 ppm PCBs on a wet weight basis; these are levels associated with reproductive impairment in laboratory studies in some birds.

Between 1986 and 1989 a variety of edible and hunted wildlife species were collected along the riparian corridor of the Sheboygan River AOC. Mallards and Lesser Scaup carried PCB levels high enough to warrant an advisory on eating these species from the Sheboygan River and Sheboygan Harbor, respectively. The advisory is published in the Wisconsin Migratory Bird Regulations each year.

In 1993 a small mammal survey was conducted in the floodplains of the middle river segment of the Sheboygan River AOC (Seeley, 1993). Several terrestrial specimens were submitted for contaminant analysis and some were found to carry detectable levels of PCBs, indicating that the PCB contamination is also in the terrestrial food chain and floodplains of the AOC. In 1996 three resident Canada Geese were collected in the floodplains of the middle river segment and submitted for contaminant analysis. One of the

three collected had detectable levels of PCBs, again indicating contaminated floodplains. As part of the small mammal study in the AOC, the absence of mink sign was reported to help document the anecdotal reports of the absence of mink in the AOC. Many studies have documented that mink are one of the most sensitive wildlife species to PCB toxicity.

A study of nesting tree swallows was conducted during the 1990s in the Sheboygan River AOC. Results from the tree swallow study were written up for a poster session at the Society of Environmental Toxicology and Chemistry Annual Meeting - November 1996, Washington DC (Patnode, et al, 1996). The results indicate that PCBs may impact hatching success of eggs but not growth or development of nestlings. A recent study of sub-lethal effects of PCBs suggests behavioral impacts of PCB contamination in passerines (http://eco.confex.com/eco/2008/techprogram/P11719.HTM).

Between 1996 and 1998, a snapping turtle study was conducted in the Sheboygan River AOC. The results indicate the following: 1) liver enzyme activity in hatchling turtles was elevated in a dose-dependent manner by >1ppm PCB, while in juvenile turtles it was suppressed; 2) turtle responsiveness was impaired in a dose-dependent manner by >1ppm PCB in ovo exposure; and 3) hatching success was reduced in clutches with PCBs greater than 15 ppm. Results of this study were presented at both Society of Environmental Toxicology and Chemistry and The Wildlife Society Annual Meetings (Patnode, et al, 1998).

3.6 BENEFICIAL USE IMPAIRMENTS

The Sheboygan River was designated an Area of Concern (AOC) in 1985 because of pollutant loads that contributed toxic contaminants to the AOC and Lake Michigan. Sediments contaminated with PCBs, PAHs and heavy metals contribute to the most Beneficial Use Impairments (BUIs) within the AOC. Rural and urban runoff, along with municipal treatment discharges, have increased phosphorus loadings, resulting in increased eutrophication and undesirable algae. Through the RAP process, the WDNR, along with the help of citizen groups, has identified nine of the fourteen beneficial uses as impaired. The nine BUIs are:

- Restrictions on Fish & Wildlife Consumption
- Degradation of Fish & Wildlife Populations
- Fish Tumors or Other Deformities
- Bird or Animal Deformities or Reproductive Problems
- Degradation of Benthos
- Restrictions on Dredging Activities
- Eutrophication or Undesirable Algae
- Degradation of Phytoplankton & Zooplankton Populations
- Loss of Fish & Wildlife Habitat

3.7 PROGRESS TOWARD DELISTING

Sheboygan River Remedial Action Plan (RAP) Stage 1 report was completed in 1989. The WDNR was primarily responsible for RAP development. The Stage 2 RAP was completed in 1995 with 29 recommendations completed. The U.S. EPA's Great Lakes National Program Office (GLNPO) lists the following achievements and current activities as progress toward delisting as of April 2006 (http://www.epa.gov/glnpo/aoc/sheboygan.html).

Recent Progress and Achievements

- In 2006, Sheboygan County adopted an erosion control and stormwater management ordinance.
- In 2005, WDNR and the Sheboygan County Land and Water Conservation Department worked with a local farmer to relocate a barnyard and grazing area along the banks of Otter Creek. Otter Creek is a tributary to the Sheboygan River and is listed as a 303d impaired waterway primarily due to bacteria contamination. Grant dollars for the state portion came from Wisconsin's Environmental Damages Compensation Fund. The county and the landowner also shared in the cost of the project.
- In 2004, Pollution Risk Services (PRS) completed Phase I of the Sheboygan Superfund Site cleanup of the Upper River. All PCB hot spots on the upland portion of the riverbank at the former Tecumseh plant site have been remediated and a trench has been dug to intercept and test groundwater exiting the site.
- The Sheboygan County Planning and Resources Department and Bay-Lake Regional Planning Commission completed the Sheboygan County Natural Areas and Critical Resources Plan in 2004. This plan provides general background information on the issues and opportunities related to agricultural, natural and cultural resources and proposes future programs and policies for the county to pursue. These programs and policies were developed through a thorough process involving the public and various stakeholders in the county.
- The Sheboygan County Land and Water Conservation Department worked with WDNR and others on an update to the Sheboygan County Land and Water Resources Management Plan in 2004. This plan is required by the State of Wisconsin for the use of funds for the implementation of agricultural best management practices. The plan includes some joint strategies for implementing the state nonpoint pollution regulations and establishes priorities for agricultural runoff practices near impaired waters and outstanding or exceptional waters in the county.
- In 2004, municipal WPDES stormwater permits were issued for the Village of Kohler, Town of Sheboygan, and Town of Wilson. All of these communities are taking actions to control urban runoff in accordance with their permits.
- WDNR staff worked closely with the City of Sheboygan and their consultants on the redevelopment of the former C. Reiss Coal Peninsula on Lake Michigan and the Sheboygan River. Elements of the project, which was completed in 2004, included permitting for seawall reconstruction on the Sheboygan River, remedial action plan for site cleanup, site grading permit, review of Lake Michigan revetment plans and a dune re-creation project. The city installed engineered stormwater devices to treat runoff from the newly developed areas on the peninsula. The city received a grant through WDNR for a trail and fish cleaning station.
- In 2004, WDNR staff completed two Onion River trout stream restoration projects. They also completed trout population surveys at six locations on the Onion River and

its tributaries. Those surveys indicate that a newly instituted fishing regulation change on the Onion River has protected many fish from harvest. The hope is that more adult trout will be available to boost natural reproduction of trout in the system.

- WDNR staff completed a small wetland restoration in the Onion River watershed in 2004.
- A consent decree was signed by U.S. EPA, U.S. Department of Justice, and Tecumseh Products Company in 2003. This agreement requires Tecumseh to clean up the upper portion of the Sheboygan River Superfund site including ground water at the Tecumseh facility, floodplain soil, and river sediment.
- In 2003, WDNR staff conducted a stream monitoring workshop for the public that was concentrated on a small waterway named Willow Creek that is tributary to the Sheboygan River. The workshop included information on monitoring streams for habitat, water quality and biological community. This small stream supports a cool/cold water fishery including evidence of spawning by brook trout and Coho salmon from Lake Michigan. The watershed is located in an area that will likely experience rapid urban development within the next decade.
- A drawdown of the Sheboygan Marsh occurred in 2002. Sheboygan County and WDNR worked together to collect data during the drawdown including high quality color air photography before and after the drawdown. WDNR also worked with local conservation groups to establish a carp trap in the marsh.
- The *Broughton Sheboygan Marsh Strategic Management Plan 2001* was completed in 2001 and approved by the Sheboygan County Resources Committee in February 2002. This plan outlines mutually agreed upon responsibilities between the different units of government responsible for resource management throughout the marsh. A broad public process with representatives from local and county government, non-profit organizations, the WDNR and citizens at large were responsible for completing the plan.

Current Projects and Outlook

- In 2006, Pollution Risk Services (PRS) will complete Phase II of the Sheboygan Superfund Site clean up of the Upper River, including the removal, dewatering, and disposal of 35,000 cubic yards of PCB-contaminated sediment and armored materials.
- With support from the Great Lakes National Program Office (GLNPO), a research team led by the University of Illinois and the Northeast-Midwest Institute (NEMW) is collecting property transactions data and household information for a study of the economic benefits of remediation of the AOC. This study provides an opportunity to inform the public and galvanize community support for delisting the AOC.
- The soil cleanup phase of the Camp Marina Manufactured Gas Plant site along the Sheboygan River in the City of Sheboygan was implemented in 2001. Wisconsin Public Service Corporation and their consultant, Natural Resources Technology, continue to work with WDNR to develop the plan for the river cleanup phase.

- Since the removal of the Franklin Dam on the Sheboygan River in 2000, WDNR staff have been working with community members regarding the next dam downstream in Johnsonville. It was discovered that this dam did not have an established owner. Many local citizens are concerned about dam removal because they believe it prevents ice jams from forming downstream of their town.

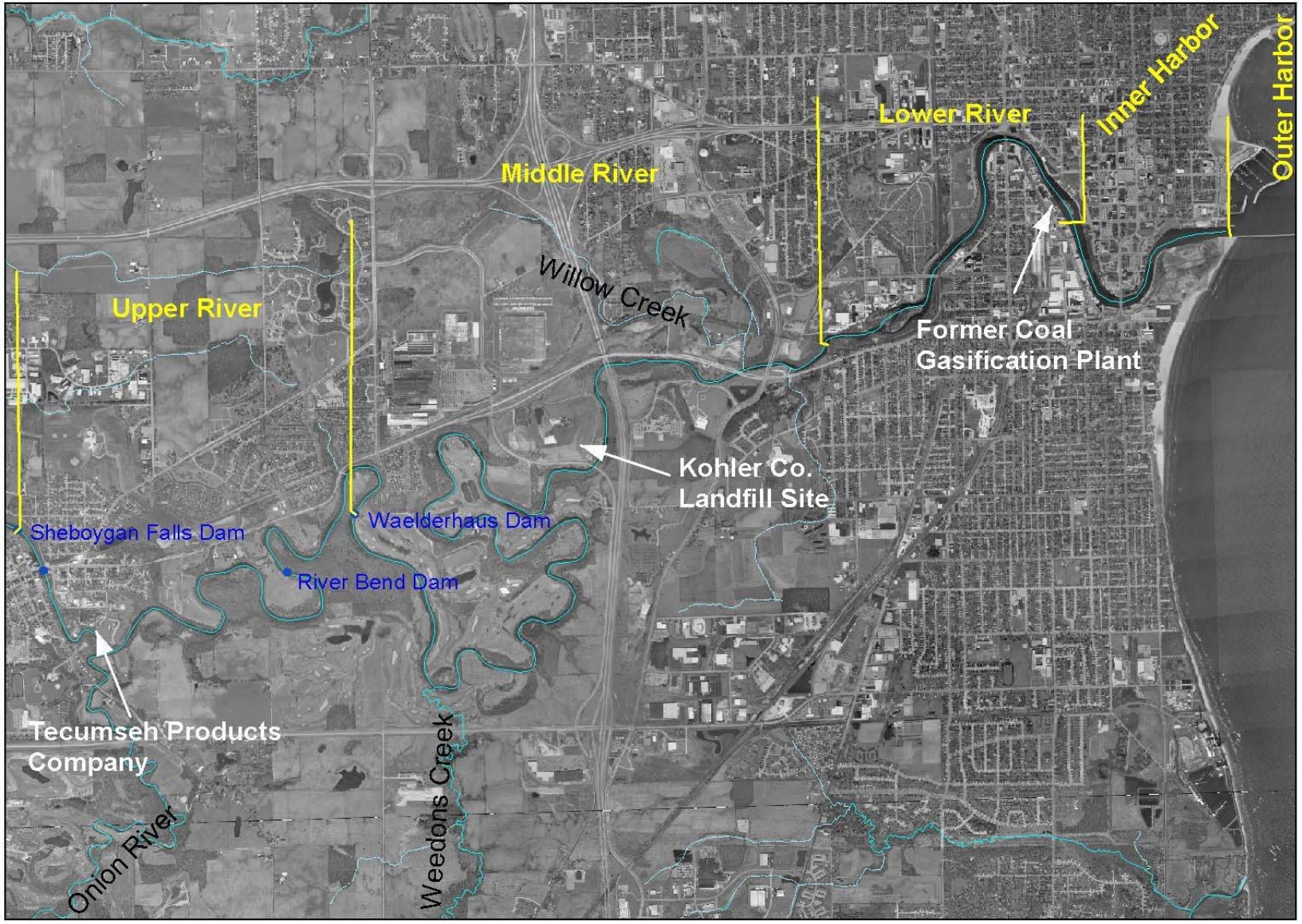
- The Sheboygan County Land and Water Conservation Department continues to implement their stream buffer program for water quality improvement. Since the project began in 2000, the Land and Water Conservation Department has contracted with 53 landowners and installed 95 acres of buffer strips that reduce the amount of sediment and agricultural runoff from entering streams.

- The Sheboygan River Basin Partnership (SRBP) has embarked with WDNR on an information gathering effort for Willow Creek. Willow Creek is a small tributary to the Sheboygan River that has its confluence in the AOC. The creek receives annual runs of trout and salmon from Lake Michigan. Recent fish surveys discovered the presence of young brook trout and salmon, which seemed to indicate at least some amount of natural reproduction. The stream has some remnant habitat areas that appear suitable for spawning. It is about five miles long and a fairly significant amount of this small watershed will likely be developed in the next decade. It appears that stream improvements are possible in some of the degraded sections. SRBP recently applied for a grant from the U.S. Fish & Wildlife Service. In addition, the partnership has started an information and education effort and has been meeting with landowners and local municipal officials.

In addition to the milestones listed on the most recent update to the U.S. EPA GLNPO Sheboygan River AOC website in 2006, other activities have been perfomed related to the Superfund project, Willow Creek, and the Kohler Company landfill.

- The main sources of polychlorinated biphenyls (PCBs) have been removed from the upper portion of this section of the river. The EPA is in the process of negotiating the remainder of the clean-up with the responsible parties. We expect that the sampling and characterization of the sediment deposits in the middle and lower portions and the inner harbor will be completed this fall or next spring. This information will be used to develop a plan for the clean-up of the rest of the lower river and harbor, which is scheduled to begin in 2009.
- The SRBP has been working to inform local communities of the value of the creek and to trigger interest in a regional stormwater planning effort that will address best management stormwater practices of the entire Willow Creek watershed. In spring 2009, three education signs will be installed along Willow Creek. Also, the WDNR has classified the creek as a class II trout stream from I-43 to its confluence with the Sheboygan River.
- The Kohler Company Landfill, which had an approved final remedy installed in 1996, was the subject of a Superfund five-year review in September 2007. This review found that the final remedy, which intercepts contaminated groundwater for treatment at the City of Sheboygan publicly owned treatment works, continues to be protective of human health and the environment (U.S. EPA, April 2008).

Figure 1. Overview of the Sheboygan River and Harbor Area of Concern, showing Superfund Site segments.



4.0 DELISTING TARGETS FOR SHEBOYGAN RIVER AOC

This section presents delisting targets for each beneficial use impairment present in the Sheboygan River AOC, and describes the rationale behind these targets. The targets presented below for each BUI were developed considering local conditions, applicable regulations and guidelines, and the experience of other AOCs across the Great Lakes region. For additional background on the general development of delisting targets at other AOCs, the reader is directed to Appendix A - *Delisting Targets: Applicability and Status in Other AOCs*.

4.1 DEGRADATION OF BENTHOS

The degradation of benthos BUI in the Sheboygan River AOC is demonstrated by a lack of biodiversity, a dominance of pollution tolerant species, a low number of individuals, and a dominance of Tubificidae and Oligochaeta. The degradation is predominantly caused by suspension of contaminated harbor sediments due to prop wash and high organic contaminant concentrations. The November 1998 Sheboygan River and Harbor Aquatic Ecological Risk Assessment concluded that taxonomy results indicated clear dominance of the class Oligochaeta, with more than 90% oligochaetes at most stations, and extremely low diversity within this class throughout the study area, despite changes in sediment types and habitats (EVS and NOAA, 1998). Mean oligochaete densities ranged from 4,240 to 7,200 individuals/m^2 at the reference stations and 10,500 to 45,500 individuals/m^2 at site-related stations, with the exception of T07, which had a density of only 400 individuals/m^2. The oligochaete populations were composed almost exclusively of immature individuals.

Further investigation indicated that all oligochaetes were represented by the single family Tubificidae. A limited number of stations were selected to qualitatively assess oligochaete species composition in an attempt to assign immature individuals to discreet species based on the presence of a few mature individuals as is routinely done in the literature. Only two species, *Limnodrilus hoffmeisteri* and *Limnodrilus cervix*, both members of the family Tubificidae, were present. Because both species of *Limnodrilus* were present at most of the stations examined, it was not possible to assign immature individuals to a particular species.

Because physical conditions within the Sheboygan AOC are very diverse, different targets may be required for different habitat types within the AOC. For example, the free-flowing reaches of the Sheboygan River watershed will have the capacity to harbor a more diverse benthic community than the slow-moving, sediment-laden depositional areas comprising the Sheboygan Harbor. The difficulty in evaluating this impairment lies with determining the factors leading to the impairment. Because some sediments within the Sheboygan AOC are known to be contaminated with a variety of pollutants, including PCBs, PAHs, and heavy metals, one can assume they are having an effect on the biological environment. Urban watersheds like those comprising the Sheboygan AOC tend to have benthic macroinvertebrates that are tolerant to pollution. Because we lack studies comparing these water bodies to less contaminated reference conditions, the factors leading to the degradation are not well understood. Without use of reference conditions, it is not possible to determine for sure if the impairments are from physical habitat limitations, water quality, or sediment chemistry.

This delisting target is to be based on benthic community health and the impacts of chemical contaminants on that community. The anticipated benthic community quality must be established on a site-specific basis

considering conditions that cannot be changed and that impact the benthic community to assure that the endpoint comparison is consistent with the ability of the habitat and external impacts to support a viable benthic community. These conditions include dredging activity in navigation channels, wave-induced sediment resuspension, ice scour and prop wash. The end point comparison should allow one to assess habitat and external impacts, and determine how these two elements have an impact on a viable benthic community.

This BUI can be considered for delisting when

- Known contaminant sources contributing to sediment contamination and degraded benthos have been identified and control measures implemented; AND
- All remediation actions for contaminated sediments are completed and monitored according to the approved plan with consideration to using consensus based sediment quality guidelines and equilibrium partitioning sediment benchmarks; AND
- The benthic community within the site being evaluated is statistically similar to a reference site with similar habitat and minimal sediment contamination.

WDNR developed guidance for and recommends use of consensus based sediment quality guidelines (CBSQGs) and equilibrium partitioning sediment benchmarks (ESBs) for managing sediment throughout the state. Used alone, the CBSQGs suggest correlation between sediment contaminants and benthic macroinvertebrates, but do not measure causation. The methods used for calculating ESBs do take biological effects into account and therefore correspond to causation. The most comprehensive approach to using sediment data for examining benthic degradation would be to employ a combination of the two. Benthic community structure within the AOC is not well-defined, nor are there guidelines in Wisconsin for evaluating benthic community health in depositional river mouth areas. Therefore benthic community structure evaluations for delisting purposes should be conducted in comparison with “least impacted reference sites” with similar habitat conditions.

Actions

- Incorporate benthic macroinvertebrate evaluations into sediment management actions within the AOC.
- Determine suitable reference sites for the different habitat areas within the AOC in conjunction with the WDNR. For some areas this may mean evaluating upstream sites within the same water bodies. For the depositional areas this may mean looking for other sites with similar characteristics but limited sediment contamination.
- Determine appropriate sampling locations within the AOC based on historical sampling locations and sites of known impact.

4.2 DEGRADATION OF PHYTOPLANKTON & ZOOPLANKTON POPULATIONS

The first step toward delisting will be to establish a baseline condition for the AOC to evaluate the extent of this impairment. Phytoplankton and zooplankton community surveys should be conducted and compared to a physically similar non-impacted or minimally impacted reference site to set the baseline condition. If the community structure is statistically different from the reference conditions, this BUI should be considered impaired. If the BU is considered to be impaired then the factors leading to the impairment need to be identified. Ambient water chemistry sampling needs to be conducted to determine if nutrient

(phosphorus/nitrogen) enrichment is the main contributor and/or bioassays to determine if ambient water toxicity is causing the impairment.

This BUI can be considered for delisting when

- Sources causing nutrient enrichment to the outer harbor and near shore waters are identified and controlled if nutrients are the main contributor;

OR

- Sources resulting in ambient water toxicity in the outer harbor and near shore waters are identified and controlled if toxicity is the main contributor.

Additionally,

- Phytoplankton or zooplankton bioassays confirm no toxicity in ambient waters and the community structure is diverse and contains species indicative of clean water; and
- The phytoplankton and zooplankton communities within the site being evaluated are statistically similar to a reference site with similar habitat and minimal sediment contamination.

Actions

- Work with U.S. EPA on possibly establishing a reference site or reference sites for all Lake Michigan AOCs.
- Identify the appropriate species and community structure that should exist in the Sheboygan River AOC under non-impaired conditions.

4.3 LOSS OF FISH AND WILDLIFE HABITAT

It should be noted that this BUI is closely aligned with the Degradation of Fish and Wildlife Populations BUI and the delisting of these two BUIs will likely be addressed together.

This BUI can be considered for delisting when

- A local fish and wildlife habitat management and restoration/rehabilitation plan has been developed for the entire AOC that accomplishes the following:
  - Defines the causes of all habitat impairments within the AOC
  - Establishes site-specific habitat and population targets for fish and wildlife species within the AOC
  - Identifies primary and secondary habitat restoration goals, management activities, and projects that would adequately restore or rehabilitate fish and wildlife habitat within the Sheboygan River AOC; and
- All primary habitat restoration goals, management activities, and projects identified in the fish and wildlife management and restoration plan are implemented, and modified as needed to ensure continual improvement; and
- Waters within the Sheboygan River AOC are not listed as impaired due to aquatic toxicity in the most recent Clean Water Act 303(d) and 305(b) Wisconsin Water Quality Report to Congress (submitted to U.S. EPA every two years)

Actions

- Form Sheboygan River AOC fish and wildlife habitat committee that includes key stakeholders such as WDNR, US Fish and Wildlife Service, local fish and wildlife groups, and other partners/stakeholders.
- Committee decides on an approach and process to establish a fish and wildlife habitat management and restoration/rehabilitation plan including timetable, decision making, obtaining planning funds, and plan adoption.
- Implement primary projects and actions identified in the plan.
- Monitor and evaluate for established habitat goals.

4.4 RESTRICTIONS ON FISH AND WILDLIFE CONSUMPTION

There are two approaches that can be used for setting delisting/restoration targets based on the overall goals of the AOC. If the primary goal is "delisting," then the target for restrictions on fish and wildlife consumption should be based strictly on advisories and comparison to other similar or control sites if an advisory still exists in the AOC. If the goal is "restoration," then the primary target should be based on the contaminant concentration in the fish/wildlife within the AOC. Assuming that the Sheboygan River AOC goal is for restoration, the delisting targets for restrictions on fish and wildlife consumption should be similar to those proposed for the St. Louis River and Milwaukee Estuary AOCs.

This BUI can be considered for delisting when

Fish Consumption

- The Superfund PCB cleanup and Manufactured Gas Plant cleanup have been implemented; and
- All other known sources of bioaccumulative contaminants of concern (PCBs, mercury, pesticides, and PAHs) have been identified and controlled or eliminated; and
- Waters within the Sheboygan River AOC are no longer listed as impaired due to PCB fish consumption advisories in the most recent Impaired Waters (303(d)) list.

Wildlife Consumption

- The floodplain cleanup action that is part of the Superfund Cleanup is implemented; and
- All other known sources of bioaccumulative contaminants of concern (PCBS, mercury, pesticides, and PAHs) have been identified and controlled or eliminated; and
- Waters within the Sheboygan River AOC are no longer listed as impaired due to wildlife consumption advisories listed in the annual Wisconsin Migratory Bird Regulations.

Actions

- Implement monitoring program to determine trends in contaminant concentrations in fish/wildlife within the AOC as cleanup programs are initiated/completed

4.5 RESTRICTIONS ON DREDGING ACTIVITY

It should be noted that the Sheboygan River AOC is also a National Priority List (NPL) Superfund Site due to elevated PCB concentrations in the sediment. The selected remedy under the Superfund project has a soft sediment surface weighted average concentration (SWAC) for residual PCB of 0.5 ppm. As indicated in the EPA Superfund Record of Decision (WID980996367 05/12/2000), "this remedy will result in hazardous

substances remaining on site at levels preventing unlimited exposure and unrestricted use." Delisting of this BUI will be based on attainment of the target indicated below and is independent of implementation/completion of the selected Superfund alternative which may, or may not, attain the delisting target.

The Restriction on dredging BUI relates to special or additional handling and disposal requirements related to dredging contaminated sediment within the AOC, regardless of navigational dredging requirements. Additional handling means more than is required at minimally impacted reference site(s) without known sediment contamination sources. Additional sediment management activities become necessary when there is a potential human health or ecological risk (e.g. degradation of benthos BUI) associated with disturbing contaminated sediment. Examples of Restrictions on Dredging include the following:

- Additional sediment sampling costs (e.g. as required by Chapter NR 347, Wisconsin Administrative Codes).
- Additional sediment management costs during the dredging action, such as specific equipment, dewatering, wastewater treatment to remove contaminants and contaminant monitoring costs, contaminated material transport, confirmation monitoring.
- Additional disposal costs due to contamination levels.
- Additional consulting expertise (costs) or training, sediment fate and transport modeling, risk assessments, contaminated sediment handling.

Contaminated sediments are recognized as one of the primary sources of pollution in the Sheboygan River AOC. Implementation actions to remediate contaminated sediment sites need to be implemented and demonstrated to have met the remedial goals. Upon completion of the remedial action it is recommended that a sediment management plan be developed for the AOC. While sediment remediation is an important component in meeting RAP goals, an effective sediment strategy has a balance of pollution prevention activities and enhanced nonpoint source control in addition to clean-up of strategic sediment hot spots.

Delisting of this BUI can occur when

- All remediation actions for contaminated sediments are completed and monitored according to the approved remediation plans; and
- A dredging alternatives plan is developed that includes an evaluation of the following:
  - Restrictions that must remain in place to protect human health and the environment
  - Restrictions that must remain in place due to Superfund or RCRA requirements that are based upon state and federal law
  - Priority areas for navigational use
  - Priority areas where dredging is needed for other purposes (i.e. utilities)
  - Costs associated with removing dredging restrictions in priority areas
  - Funding available to address removing dredging restrictions in priority areas

Actions

- Determine the degree of contamination in the sediment and track trends in the level of contamination as remediation efforts proceed throughout the AOC.
- To the extent feasible, planning and implementation steps to meet this delisting target should be coordinated with Superfund remediation planning and implementation efforts.

4.6 EUTROPHICATION OR UNDESIRABLE ALGAE

The WDNR is developing criteria for total phosphorous concentrations within Wisconsin streams which will be the basis for this target.

Delisting of this BUI can occur when

- In-river total phosphorous concentrations meet Wisconsin criteria when promulgated; and
- There are no violations of the minimum dissolved oxygen concentrations established in NR 102 within the AOC due to excessive sediment deposition or algae growth; and
- No water bodies within the AOC are included on the list of impaired waters due to nutrients or excessive algal growths in the most recent Wisconsin Impaired Waters list submitted to U.S. EPA every two years.

Actions

- Develop a scientifically based monitoring program to establish when targets have been met.

4.7 DEGRADATION OF FISH AND WILDLIFE POPULATIONS

It should be noted that this BUI is closely aligned with the Loss of Fish and Wildlife Habitat BUI and the delisting of these two BUIs will likely be addressed together.

This BUI can be delisted when

- Approved remedial actions (Superfund and RCRA) for contaminated sediment and floodplains have been fully implemented; and
- A local fish and wildlife management and restoration plan has been developed for the entire AOC that
  - Defines the causes of all population impairments within the AOC.
  - Establishes site specific local population targets for native indicator fish and wildlife species within the AOC.
  - Identifies all fish and wildlife population restoration programs/activities within the AOC and establishes a mechanism to assure coordination among all these programs/activities including identification of lead and coordinative agencies.
  - Establishes a time table, funding mechanism, and lead agency responsibility for all fish and wildlife population restoration activities needed within the AOC.
- The programs necessary to accomplish the recommendations of the fish and wildlife management and restoration plan are implemented.
- Populations of native indicator fish/wildlife species are statistically similar to populations in reference sites with similar habitat but little to no contamination.

Actions

- Determine population trends for native fish/wildlife species in the AOC.
- Determine the extent of improvement that can be achieved within the areas of the AOC that were historically or currently modified and dredged for commercial navigation.

4.8 FISH TUMORS AND OTHER DEFORMITIES

The first step toward delisting this suspected impairment is to determine if this use in the AOC is impaired. If surveys totaling at least 50 fish do not show a tumor incidence of greater than 5% of the population surveyed, this use can be considered not impaired. If the use is considered impaired, comparisons to non-impacted reference sites should be conducted to see if the occurrences of tumors are significantly higher than the reference sites. In all cases, and regardless of the extent of the impairment, source control for PAHs is an important long-term and ongoing step.

This BUI can be considered for delisting when

- All known sources of PAHs and chlorinated organic compounds within the AOC and tributary watershed have been controlled through issuance of the appropriate regulatory control document or eliminated; and
- The Superfund PCB cleanup and Manufactured Gas Plant cleanup have been implemented; and
- There have been no reports of external Deformities, Lesions, and Tumors (DLTs) or internal organ/system impacts that have been verified by qualified WDNR personnel to have been caused by chemical contaminants for a period of five years; and
- A fish health survey of resident benthic fish species such as white suckers finds incidences of tumors or other deformities at an incidence rate of less than 5 percent.

OR, in cases where any tumors have been reported:

- A comparison study of resident benthic fish (e.g., brown bullhead or white suckers) of comparable age and at maturity (3 years), or of fish species which have historically been associated with this BUI, in the AOC and a non-impacted control site indicates that there is no statistically significant difference (with a 95% confidence interval) in the incidence of liver tumors or deformities.

Actions

- Work with U.S. EPA on possibly establishing a reference site or reference sites for all Lake Michigan AOCs
- Determine baseline for existence of BUI
- Establish routine monitoring for this BUI
- Establish a complaint/report receipt and tracking process/procedure
- Determine species that will be used for studies and comparison studies
- Establish comparison site(s) if needed
- Track changes in tumor/deformity incidents over time
- Track contaminant levels in sediment for related chemicals

4.9 BIRD AND ANIMAL DEFORMITIES OR REPRODUCTIVE PROBLEMS

Insufficient data are available to show if these problems exist with birds or other animals within the AOC. Because contaminants like PCBs and heavy metals that are found in AOC sediments have the potential to impair reproduction and development in wildlife, this BU is likely impacted/impaired within the AOC. However, before delisting can move forward in the AOC, sufficient studies must be conducted to determine if this beneficial use is truly impaired. The delisting targets identified below should be reviewed following completion of the studies and modified in accordance with the findings of those studies.

This BUI can be considered for delisting when

- Superfund and RCRA sediment and floodplain remedial actions have been implemented; and
- Studies conducted in the AOC indicate that the beneficial use should not be considered impaired; or
- If studies conducted in the AOC determine that this use is impaired, then two approaches can be considered for delisting:

  - Approach 1 – Observational Data and Direct Measurements of Birds and other Wildlife

    - Evaluate observational data of bird and 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 from 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 delisted. If the rates are statistically different from the reference site, it may indicate a source from either within or outside the AOC. Therefore, if the rates are statistically different or the data are insufficient for analysis, then
    - 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 and are not statistically different from those at minimally impacted reference sites (at a 95% confidence interval), then the BUI can be delisted;

Where data from direct observation of wildlife and wildlife tissue data are not available, the following approach should be used:

- Approach 2 – Fish Tissue Contaminant Levels as an Indicator of Deformities or Reproductive Problems

  - If fish tissue concentrations of contaminants of concern 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 of concern identified in the AOC are not statistically different from those found in Lake Michigan (at 95% confidence interval), then the BUI can be delisted. Fish of a size and species considered prey for the wildlife species under consideration must be used for the tissue data.

Actions

- Determine appropriate indicator species
- Determine appropriate comparison site(s) if necessary
- Design sampling/observation program

5.0 PATHWAY TO RESTORATION – BASIC IMPLEMENTATION CONCEPTS

Setting Restoration Goals

This project is a first step toward establishing delisting targets that are locally derived and measurable and meet the criteria for the frequency and longevity of monitoring that is consistent with federal and state regulations & GLWQA Annex 2. These goals should focus both on the overall AOC and any appropriate sub areas defined within the AOC.

Evaluate Delisting on the Basis of Outside or Natural Factors

BUIs should be evaluated for factors outside the watershed. If restoration of a BUI is not possible because of factors outside the AOC, or is typical of lake-wide or region-wide conditions, recommend delisting on this basis and refer BUI to Lakewide Management Plan (LaMP). If the BUI is due to natural causes, not human sources, recommend delisting on this basis.

Implementing Restoration Goals

Implementation of the delisting/restoration efforts within the AOC will ultimately rely upon development of an overall strategy for restoring the AOC. This overall strategy will rely upon the delisting targets, will help identify and prioritize BUIs that can be most easily delisted and will identify the steps necessary to work towards implementing restoration of all BUIs. This overall restoration strategy will incorporate a work plan that must include the following:

- Establishment of a realistic restoration budget
- Selection of reference sites where needed
- Establishment of a timeline for implementation including such major milestones as the following:
  - contaminant removal
  - point source pollution monitoring and prevention
  - non-point source BMP implementation
  - habitat restoration
- Development of long term funding sources and agreements
- Establishment of necessary monitoring networks to create baseline data and measure progress in achieving delisting targets
- Establishment of implementation alternatives such as evaluation of low level, widespread contamination for feasibility of natural attenuation as a restoration alternative

Once it has been established that delisting targets have been met or that progress is moving extensively towards delisting goals, the BUI can be recommended for delisting or placement in the “recovery” stage. A restoration implementation committee, working in consultation with the public and stakeholders, would then submit a recommendation to delist the AOC, or portions thereof, to U.S. EPA and WDNR. The recommendation spells out the roles and responsibilities for implementation of the restoration work plan.

Formal Request to have AOC Delisted

A long-term monitoring plan must be written. Restoration must be completed or well underway and meeting restoration goals at all sites before an AOC can be delisted. Resources are needed for long-term monitoring and protection must be in place to prevent future degradation from occurring.

Timeline for Implementation

The overall strategy for restoring the AOC must include the development of a timeline for implementation. Essential restoration activities and milestones that should be included on that timeline include the following:

- Adoption of proposed delisting targets for the Sheboygan River AOC.
- Completion of an overall restoration strategy and workplan for the AOC.
- Development of a baseline monitoring network.
- Begin implementation of all BUI restoration programs within the AOC.
- Establish goals for completion of delisting/restoration for each BUI (e.g. - restore one BUI annually beginning in year 2012).

6.0 CONCLUSION AND RECOMMENDATIONS

Delisting targets have been developed to address the nine BUIs within the Sheboygan River AOC. The targets were reviewed and adopted by the WDNR and the project steering committee. These targets were developed specifically for the Sheboygan River AOC.

Recommendations:

- The delisting targets should be incorporated into the process of developing a strategy for restoration of the AOC and tributary areas.
- Specific actions necessary to implement the delisting targets have been identified for the nine Sheboygan River AOC BUIs. Many of these actions relate to the identification of target species for tracking trends, the establishment of control sites or the establishment of baseline conditions. The appropriate agencies and/or organizations should be identified to best carry out these actions and allow for the tracking and monitoring necessary to apply the delisting target.
- The overall restoration strategy for the AOC should utilize and incorporate the delisting targets in its goals and action plans.
- The AOC Committee should periodically review the status of restoration efforts within the watershed and determine the degree of progress toward attainment of the delisting targets.

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APPENDIX A
DELISTING TARGETS: APPLICABILITY AND STATUS IN OTHER AOCs

A. DELISTING TARGETS: APPLICABILITY AND STATUS IN OTHER AOCS

This Appendix describes the status of delisting targets in other Great Lakes AOCs and how the targets have been applied. By understanding how others have approached delisting targets, stakeholders to the Sheboygan AOC can incorporate lessons learned and view the Sheboygan AOC targets within the larger context of Great Lakes restoration efforts.

A.1 APPLICABILITY OF STATE WATER QUALITY STANDARDS TO DELISTING TARGETS

The State of Wisconsin has adopted Water Quality Standards (WQSs) that are applicable to all surface water bodies in the state. Although the BUIs are technically based on the IJC criteria established in Annex 2 of the 1987 Amendment to the Great Lakes Water Quality Agreement that established the Area of Concern program, many are also related to the Wisconsin WQSs/Designated Uses and/or fish contaminant advisories.

The Sheboygan River AOC can be considered for delisting when there are no significant controllable impairments to the beneficial uses caused by human activities. The relationship of Sheboygan River BUIs and Wisconsin designated uses and water quality criteria (NR 104 and 102) is presented in Table A-1.

Table A-1 Sheboygan River AOC BUIs and Wisconsin Designated Uses

BENEFICIAL USE IMPAIRMENT	WISCONSIN DESIGNATED USE
Restrictions on fish and wildlife consumption	• Fish and Other Aquatic Life Waters • Waters protected for Public Health and Welfare
Degraded fish and wildlife populations	• Fish and Other Aquatic Life Waters • Wildlife Use Waters
Fish tumors and deformities	• Fish and Other Aquatic Life Waters • Waters Protected for Public Health and Welfare
Bird or animal deformities or reproductive problems	• NA
Degradation of benthos	• Fish and Other Aquatic Life Waters
Restrictions on dredging activities	• NA
Eutrophication or undesirable algae	• Recreational Use Waters • Waters Protected for Public Health and Welfare
Degradation of Phytoplankton and Zooplankton populations	• Fish and Other Aquatic Life Waters
Loss of fish and wildlife habitat	• Fish and Other Aquatic Life Waters • Wildlife Use Waters

The WDNR Water Division Monitoring Strategy (WDNR, 2006) clarifies which monitoring efforts are used to meet federal Clean Water Act, Fisheries, and Public Trust Doctrine Objectives and prioritizes where future efforts will be focused. The strategy covers all monitoring done under the three WDNR Water Division Bureaus: Fisheries Management, Watershed Management, and Drinking Water and Groundwater.

The Wisconsin Water Quality Report to Congress is prepared every two years to summarize water quality conditions in the state. The state must also provide electronic data reporting of water body assessments on an annual basis. Additionally, every two years the state is required to submit a list of "impaired waters" to the U.S. EPA. The Sheboygan River AOC is currently listed as impaired due to PCB contamination. The AOC is also listed in current fish consumption advisories.

Targets for fish tissue ranges associated with recommended meal frequencies and acceptable contaminant levels in fish and wildlife are established by the Wisconsin Department of Health and Family Services, Division of Public Health, in conjunction with the Wisconsin Department of Natural Resources. These contaminant levels are used in conjunction with measured contaminant levels from the Wisconsin fish monitoring program to establish fish consumption advisories that result in the Restrictions on Fish and Wildlife Consumption BUI. Fish Consumption Advisories are presented in Choose Wisely - A Health Guide for Eating Fish in Wisconsin (WDNR, 2008). Wildlife Consumption advisories are presented in the annual Migratory Waterfowl Regulations. Elevated contaminant levels can be caused by "food chain biomagnification" through exposure to contaminants in the water column and sediments.

Although there are goals and management programs available from the WDNR that can be used to determine how various factors impact the fish and wildlife populations, there are no promulgated standards directly related to Degraded Fish and Wildlife Populations. Wisconsin's Comprehensive Management Plan to Prevent Further Introductions and Control Existing Populations of Aquatic Invasive Species (WDNR,et al, 2003) presents an example of programs in place and references various State regulations that are indirectly related to this BUI.

The incidence of Fish Tumors or Other Deformities is indirectly related to the Wisconsin WQS under NR 105. Although NR 105 refers to acute and chronic toxicity effects as an endpoint indictor, many of the chemicals listed under the rule also could contribute to the incidence of fish tumors and other deformities. This BUI is generally impacted by contaminated sediments and industrial/municipal wastewater discharges. For the Sheboygan River AOC, this BUI was originally listed based on sediment contaminant concentrations that have been observed to correlate to tumors or deformities, rather than on actual observation of tumors and deformities.

Research on swallows and mink within the Sheboygan AOC support listing Bird or Animal Deformities or Reproductive Problems as a BUI. This BUI is generally impacted by contaminated sediments through biomagnification, but may also be affected by terrestrial factors. No Wisconsin WQS directly relates to this impairment.

Degradation of Benthos is another BUI that is measured by guidance used by the WDNR but is not directly related to established WQSs. The BUI is normally a result of excessive and/or contaminated sediment within the watershed and/or deteriorated water quality which can be evaluated through the use of

WQSs but is more a correlative relationship than a direct standards comparison. The Consensus Based Sediment Quality Guidelines - Interim Guidance (WDNR, 2003) includes probable effects concentrations (PECs) for several chemicals.

Specific determinations on handling of navigation channel maintenance dredge spoils are made by the U.S. Army Corps of Engineers and the WDNR at the time of dredging. Restrictions on Dredging Activities is considered to be a BUI when dredge spoils must be handled in a special manner or disposed of at a confined disposal facility due to the level of contaminants in the sediment. The WDNR has published the approval process for dredging of commercial ports, which outlines the sampling and disposal protocols for dredged materials. These protocols reflect state regulations found in Ch. NR 347, WI Admin. Code and Ch. NR 00-520, WI Admin. Code. The WDNR administrative codes also apply to dredging to remediate contaminated sediments.

While the Eutrophication or Undesirable Algae BUI is not directly evaluated by application of a WWQS, interference with "designated uses" established under NR102 and unacceptably depressed dissolved oxygen concentrations compared to NR102.04 can be used to determine if undesirable algae growths are evident in the watershed. The presence of specific algal species is also indicative of a BUI. This BUI results from excessive nutrient discharges associated with storm water runoff (both point and non point sources), agricultural sources, point source discharges from municipal Wastewater Treatment Plants (WWTPs), nutrient release from contaminated sediments, and low base flows resulting in extended detention times in the watershed.

Degradation of Phytoplankton and Zooplankton populations is not directly evaluated by application of a Wisconsin Water Quality Standard (WQS). This BUI may result from changes in the food chain caused by other impairments, including temperature changes or excessive nutrient discharges associated with storm water runoff (both point and non point sources), point source discharges from WWTPs, nutrient release from contaminated sediments, and low base flows resulting in extended detention times in the watershed.

Loss of Fish and Wildlife Habitat is not measured by a Wisconsin WQS. However, it can be evaluated and comparatively ranked by goals and management programs developed by the WDNR. Poor land use planning, failure to protect wetland areas, erosion, high stream flows, and low base flows all contribute to the degradation of this BUI.

A.2 SUMMARY OF DELISTING TARGETS ADOPTED IN OTHER AREAS OF CONCERN AND THEIR RELEVANCE TO SHEBOYGAN RIVER AOC

Delisting targets developed and/or proposed in other AOCs were reviewed for relevance to the Sheboygan River AOC during development of the recommended restoration/delisting targets for the watershed. Harbors are special situations with regard to establishing targets because they are a dredged environment and uniquely different from flowing stream and more traditional "watershed" AOCs. The River Raisin (Michigan), Milwaukee (Wisconsin), Waukegan Harbor (Illinois), and Grand Calumet (Indiana) AOC targets and respective delisting target processes would be of significant interest with respect to the Sheboygan River AOC as these areas also contain active commercial harbor AOCs. In addition, these AOCs have legacy pollutants associated with contaminated sediments that are routinely disturbed by shipping and

dredging activities. They also share the need to evaluate realistic potentials for habitat/benthos restoration due to the need for routine maintenance dredging.
Review of the delisting targets developed for the St. Louis River AOC and the Milwaukee Estuary AOC is also particularly relevant to the Sheboygan River AOC as these two AOCs are in Wisconsin and uniformity of delisting criteria would make implementation more administratively easy with regard to the state agencies involved.

The Sheboygan River AOC encompasses all three environments associated with AOCs in that there are flowing stream, harbor, and large lake portions associated with it. While some of these other AOCs may not be specifically germane to the Sheboygan River situation, it is still useful to review the targets established for those AOCs and look for similarities and differences. These targets from other AOCs are summarized in this section of the report. Progress toward delisting has been made in the following AOCs:

In the United States:

- Oswego AOC on Lake Ontario in New York has been delisted. It is the first U.S. AOC to be delisted.
- Presque Isle Bay AOC in Pennsylvania is in recovery stage.
- Clinton River, White Lake, and Saginaw AOCs in Michigan and the St. Louis River and Milwaukee Estuary AOC in Wisconsin have developed delisting criteria/targets and/or milestones.
- Torch Lake AOC, Michigan, has a well-defined restoration design with appropriate goals, indicators, and a long-term monitoring strategy.
- Kalamazoo AOC in Michigan is close to finalizing its delisting targets and has established baseline inventories of habitat and wildlife, but needs to develop a long-term monitoring plan.
- The U.S. side of the Detroit River AOC, as well as the Rouge River, River Raisin, and St. Clair River AOCs, is progressing toward finalization of delisting targets.
- The Degradation of Benthos BUI for the Manistique River has been recommended for delisting by the Michigan Department of Environmental Quality (MDEQ).

In Canada:

- Collingwood Harbour AOC and Severn Sound AOC have been delisted.
- Spanish Harbour AOC is in recovery.
- Detroit River AOC on the Canadian side has developed delisting targets that have been approved by the Canadian side PAC. The targets report has been endorsed by the Canadian PAC as the Canadian delisting targets for the Detroit River until bi-national delisting targets can be developed.

Although Torch Lake AOC is a single issue AOC focusing specifically on mine tailing waste, it is also a Superfund Site and may be relevant to the Sheboygan River situation due to the remediation sites associated with this AOC.

Legacy pollutants associated with contaminated sediments (mainly PCBs, metals, and PAHs) are a major problem in the Sheboygan River AOC. Pollutants in sediments affect BUIs related to the restrictions on fish and wildlife consumption, degradation of benthos, and restrictions on dredging activities. Kalamazoo River

in the Kalamazoo AOC (Michigan) is a site similar to portions of the Sheboygan River AOC with restoration activities focused primarily on PCB contaminated sediment remediation. Temporary measures implemented to contain leaching of PCBs from landfill sites in the Kalamazoo AOC include installing sheet steel piling to slow erosion of PCB-contaminated soil into the river. A record of decision (ROD) for remediation has not yet been issued. "Lessons learned" from Kalamazoo that can benefit the Sheboygan River AOC are that delays can be costly and that all major stakeholders need to be involved in order to achieve progress.

The Presque Isle Bay AOC in Pennsylvania may be relevant to development of Sheboygan River AOC targets with respect to the contaminated sediment related BUIs, particularly if considering natural attenuation/monitoring as an implementation strategy in the areas that are not significantly contaminated with PCBs or where implementation may involve a combination of dredging coupled with natural attenuation. Presque Isle Bay, the only U.S. AOC in recovery stage, was listed as an AOC on the basis of fourteen BUIs, with the most severely impacted being fish tumors and restrictions on dredging. A review of the current sediment data indicated that the sediments were not as contaminated as initially believed in 1991 when the AOC was established. Natural attenuation appears to be working as a recovery process for contaminated sediments.

Although the St. Clair River AOC developed and adopted "yardstick" measurements of success early in the RAP process, they are now developing delisting targets for the nine BUIs in the AOC under the current process and guidance. The contaminated sediment related studies that have been conducted to assist in developing sediment related delisting guidelines are of specific interest. These studies have been conducted to evaluate surficial sediments that may impair benthos and that may help determine the feasibility of remediation.

Further details of information gathered from other AOCs and their relevance to specific BUIs are discussed below.

A.2.1 Degradation of Benthos

The degradation of benthos BUI in the Sheboygan River AOC is demonstrated by a lack of biodiversity, a dominance of pollution tolerant species, a low number of individuals, and a dominance of Tubificidae and Oligochaeta. The degradation is predominantly caused by suspension of contaminated harbor sediments due to prop wash and high organic contaminant concentrations. Thus, addressing contaminated sediments and nutrients will aid in the restoration.

The IJC delisting target for this BUI is when the benthic macroinvertebrate community structure does not significantly diverge from unimpacted control sites of comparable physical and chemical characteristics. Further, in the absence of community structure data, this use will be considered restored when toxicity of sediment-associated contaminants is not significantly higher than controls.

The MDEQ Guidance (2006) states that this BUI will be considered restored when "an assessment of benthic community, using either MDEQ's SWAS Procedure #51 for wadeable streams or MDEQ's pending rapid assessment procedure for non-wadeable rivers yields a score for the benthic metrics which meets the standards for aquatic life in any two successive monitoring cycles (as defined in the two procedures)" OR, in cases where MDEQ procedures are not applicable and benthic degradation is caused by contaminated

sediments, the BUI will be considered restored when "all remedial actions for known contaminated sediment sites with degraded benthos are completed (except minor repairs during operation and maintenance) and monitored according to the approved plan for the site." The MDEQ guidance further indicates that the BUI only applies to surficial sediments where organisms live.

Four Agency Framework recommends delisting based on similar benthic communities and species densities as those observed in unimpaired areas elsewhere in the Great Lakes basin, or upon comparison with upstream/downstream populations.

On the Canadian side of the Detroit River, the delisting target reflects a benthic community that contains none of the attributes that characterize a degraded community for four years, and toxicity of sediments from test sites should not be significantly higher than controls. The Canadian RAP specifies the criteria for evaluating if the benthic community is degraded.

In the Saginaw AOC, the delisting targets require that samples of mayfly nymphs collected in the open areas of Saginaw Bay exceed 30/m^2 for two consecutive years based on established sampling methods. Mayfly nymphs were used as an indicator organism because they are important to fisheries and their populations have been severely impacted since early 1950s.

Severn Sound also has as a partial delisting target, "to maintain and enhance presence of the mayfly Hexagenia as an indicator of ecosystem health."

The delisting target approach utilized for Hamilton Harbour, Ontario AOC could be considered relevant to Sheboygan River AOC. Specifically, these targets are: biomass estimates for mesotrophic conditions to range from 25 to 50 gram per cubic meter of wet weight of benthos; shift in oligochaete assemblages from indicators of eutrophic environments to mesotrophic indicators; an increase in the contribution of other species such as midges, fingernail clams, mayflies, and the amphipod Pontoporeia hoyi; reduction in oligochaete density from an average of 10,000 animals per square meter found in 1984 to between 2,000 and 3,000 per square meter in profundal sediments; appearance of crustaceans, such as freshwater shrimp in the deep water basin and the amphipod Pontoporeia hoyi in the surficial sediments throughout the hypolimnion; and absence of acute and chronic toxic effects attributable to trace metals or organics in benthic macroinvertebrates throughout the harbor.

The Manistique River in the Upper Peninsula of Michigan, which feeds into Lake Michigan, has been recommended for delisting and is awaiting final approval by U.S. EPA. The basis for delisting was mainly that sediments contaminated with PCBs and other chemicals have been remediated.

At Collingwood AOC, sediment monitoring in 1995 by Environment Canada found that benthic species were different from those in reference sites due to the assemblage of organisms present, which was reflective of nutrient conditions and not due to the presence of contaminants. Recommendations for further actions included repeating sediment toxicity tests and resampling of sites to determine if the benthic community was returning to reference conditions. This may be relevant to the Sheboygan river, which exceeds water quality standards in some instances for nitrogen and phosphorus. Rather than focus on expensive toxicity tests, though, restoration criteria for the Sheboygan River should focus on meeting water and sediment quality criteria which need to be met for several BUIs. In the Sheboygn River, it may not be

practical to return to historic population levels of all species due to widespread urbanization of the watershed. Protection and restoration of existing habitat should remain a high priority.
The Milwaukee Estuary AOC delisting target for this BUI indicates that delisting may occur if

- Known contaminant sources contributing to sediment contamination and degraded benthos have been identified and control measures implemented, and
- All remediation actions for contaminated sediments are completed and monitored according to the approved plan with consideration to using consensus based sediment quality guidelines and equilibrium partitioning sediment benchmarks; or
- The benthic community within the site being evaluated is statistically similar to a reference site with similar habitat and minimal sediment contamination.

The St. Louis River AOC delisting targets addressed this BUI as follows:

- All remedial/restoration actions for specific impacted benthic communities are completed (except for minor repairs required during operations and maintenance) and monitored according to the approved plan, AND
- Known contaminant sources contributing to sediment contamination and degraded benthos have been identified and control measures implemented, AND
- The Benthic Index of Biotic Integrity (B-IBI) at all sampling sites is a minimum of "good," AND
- Acute sediment toxicity survival is at least 80% at all sampling locations, AND
- No sample locations show chronic toxicity, AND
- Mean probable effects concentration quotients (PEC-Q) for high habitat value areas are <0.1 and between 0.1 and 0.6 for the rest of the AOC below the Fond du Lac dam.

Since the Sheboygan River AOC has several BUIs related to contaminated sediments, the first priority is to move forward with the remediation of the known contaminated sites. Since most of the PCBs are in known areas, after these sites are remediated, PAHs and metals will be the next most important priorities. Some of the same sediments contaminated with PCBs are also ones high in metals. Historic sources are significant, but the potential for ongoing sources will have to be monitored. Reference sites for setting specific delisting targets such as was done for Hamilton Harbour should be identified and studied.

A.2.2 Degradation of Phytoplankton and Zooplankton Populations

Although the Sheboygan River AOC has increased concentrations of nutrients and sediment loadings that would imply that this BU is impaired within the AOC, the relevancy of this BUI to the AOC needs to be determined based on the results of initial studies.

In Michigan, the only AOC impacted by this BUI is Saginaw. The MDEQ Guidance (2006) states that this BUI will be considered restored when "the Statewide delisting targets for the Eutrophication or Undesirable Algae BUI have been met in Saginaw River/Bay/AOC."

Other AOCs impacted besides the Sheboygan River AOC and Saginaw are the Rochester Embayment, (New York), Cuyahoga River (Ohio), the Milwaukee River Estuary (Wisconsin), Waukegan Harbor (Illinois) and the Grand Calumet River AOC (Indiana).

For the Rochester Embayment, the delisting target is "Ninety percent of ambient water samples (collected monthly for one year), compared to a control, cause no chronic toxicity to Ceriodaphnia dubia."
The Grand Calumet River AOC delisting target is "Phytoplankton or zooplankton bioassays confirm no toxicity in ambient waters and the community structure is diverse and contains species indicative of clean water; and Waters within the Grand Calumet River AOC are not listed as impaired due to degradation of phytoplankton or zooplankton in the most recent Indiana Integrated Water Monitoring and Assessment Report (submitted to U.S. EPA every two years) and/or the most recent Indiana Fish Consumption Advisory."

The State of Ohio's delisting target is "Phytoplankton or zooplankton bioassays (e.g. Ceriodaphnia, algal fractionation bioassays) confirm no toxicity in ambient waters and/or community structure is diverse and contains species indicative of clean water."

The St. Louis River AOC does not have this BUI listed as impaired. However, the Milwaukee Estuary AOC does list this BUI as impaired and has developed a delisting target utilizing a stepped approach where

1. The first step toward delisting will be to establish a baseline condition for the estuary to evaluate the extent of this impairment. Phytoplankton and zooplankton community surveys should be conducted and compared to a non-impacted or minimally impacted reference site to set the baseline condition. If the community structure is statistically different from the reference conditions, this BUI should be considered impaired.

2. Identify the factors leading to this impairment.

    a) Ambient water chemistry sampling should be conducted to determine if nutrient enrichment is the main contributor. If nutrients are the main contributor, sources causing nutrient enrichment to the outer harbor and near shore waters are identified and controlled, or

    b) If nutrient enrichment is not considered the cause of the impairment, conduct bioassays to determine if ambient water toxicity is causing impairment, and

3. The Milwaukee Estuary AOC is not listed as impaired due to phytoplankton and/or zooplankton toxicity in the most recent Wisconsin Impaired Waters list (submitted to U.S. EPA every two years).

A.2.3 Loss of Fish and Wildlife Habitat

This BUI and the Fish and Wildlife Population BUI are closely related to each other in the Sheboygan River AOC, as exhibited in most of the AOCs. Although historic studies have indicated that the population and the community tend to be rated as good to excellent, there is also evidence of chemical contamination within the fish and wildlife population sufficient to list this BU as impaired. This chemical contamination within the fish and wildlife is linked to habitat impairments and sources within the AOC.

The Michigan guidance for this BUI is the same as the BUI for Degradation of Fish and Wildlife populations. Water quality standards must be met, and if not, sources of water quality contamination be controlled. A restoration plan must be developed and implemented which includes: (1) a short narrative on the historical fish and wildlife population loss and degradation in the AOC, including how habitat has been impaired by water quality; (2) a description of the impairment and location for at least one critical habitat site or for

multiple sites where determined appropriate at the local level; (3) a locally derived restoration goal/target for each habitat site; (4) a list of all other ongoing habitat restoration planning processes in the AOC and a description of their relationship to the restoration projects proposed in the plan; and (5) a work plan including:

- Specific habitat restoration action(s) to be completed
- Timetable
- Funding
- Responsible entities
- Indicators and monitoring
- Public involvement

A specific plan for reporting on habitat restoration implementation action(s) to the MDEQ must be included. Fish and wildlife populations need not be fully restored before delisting the habitat BUI.

The Ohio guidance (2005) delisting targets are as follows:

- For Fisheries Habitat: For mainstem and tributaries, habitat quality shall average a QHEI score of 60 or better throughout the freeflowing stream stretches of the AOC *and* Ohio Aquatic Life Water Quality Standards are met OR Fish and Wildlife officials do not identify loss of or poor quality habitat as cause for nonattainment with fishery goals.
- For Wildlife Habitat: Forested buffers exist on 50% of residential tributaries and 25% of urban tributaries *and* for headwater streams, HHEI habitat quality shall average a score of 30 for warm water streams and 70 for cold water streams OR For headwater streams and wetlands, State Aquatic Life Water Quality Standards are met OR Wildlife officials do not identify loss of or poor quality habitat as cause for non-attainment with wildlife goals.

The Ohio milestones include the following:

- Buffers, conservation easements, riparian setback ordinances or other protective mechanisms are in place on more than 80% of the streams and tributaries
- over 10% of major watershed and over 6% of sub-watershed is high quality wetland habitat
- over 75% of the stream length is naturally vegetated
- less than 15% of watershed is impervious
- over 30% of the watershed is in forest cover

The Detroit River on the Canadian side set delisting criteria that state, “The amount of habitat required to meet applicable fish and wildlife management goals has been achieved. Loss of productive fish and wildlife habitat has ceased, and existing quality habitat is protected. At a minimum, twelve percent of the AOC watershed should be comprised of quality natural cover, and a buffer of natural riparian vegetation should border 75 percent of all First-to-Third Order streams and virtually all wetlands.”

The Saginaw AOC developed the following delisting criteria for this BUI:

- Dissolved oxygen criteria: 5 mg/L during summer
- Protection of coastal marsh

- Targeted restoration: documentation of natural reproduction of Lake Sturgeon in Saginaw River, abundance measures for Yellow Perch and Walleye.

River Raisin is currently considering "Meet delisting criteria for Degradation of Fish & Wildlife Populations BUI and complete the identified habitat restoration projects" as their delisting targets for this BUI.

Both the Milwaukee Estuary and the St. Louis River AOCs utilize a philosophy in their delisting targets for this BUI similar to those in the Michigan Guidance where the BUI can be considered for delisting if:

Milwaukee Estuary AOC

A local fish and wildlife habitat management and restoration/rehabilitation plan has been developed for the entire AOC that:

- Defines the causes of all habitat impairments within the AOC;
- Establishes site-specific habitat and population targets for fish and wildlife species within the AOC;
- Identifies all fish and wildlife habitat restoration programs and activities within the AOC and establishes a mechanism to assure coordination among the programs/activities including identification of lead agencies;
- Establishes a timetable, funding mechanisms, and lead agency responsibility for all fish and wildlife habitat restoration activities within the AOC.
- The programs and actions necessary to accomplish the recommendations identified in the fish and wildlife management and restoration plan are implemented, and modified as needed to ensure continual improvement.

St. Louis River AOC

- Habitat indicator metrics associated with implementation of the Lower St. Louis River Habitat Plan (SLRCAC, 2002) and the Strategies Implementation Planning Worksheets demonstrate that native fish and wildlife populations are being rehabilitated, maintained, and protected; and
- waters within the St. Louis River AOC are not listed as impaired due aquatic toxicity in the most recent Clean Water Act 303(d) and 305(b) Wisconsin Water Quality Report to Congress (submitted to U.S. EPA every two years).

Although not an AOC, the Paoli Rail Superfund site in Pennsylvania can be used as an example of an approach that can be used to address remediation and habitat restoration in a contaminated floodplain.

A.2.4 Restrictions on Fish and Wildlife Consumption

Fish and wildlife studies within the Sheboygan River AOC have shown concentration levels consistently exceeding acceptable guidelines for consumption of fish and wildlife obtained within the AOC. This BUI pertains to both the river/harbor area and the adjacent floodplain areas.

IJC recommends that this BUI is restored "when contaminant levels in fish and wildlife populations do not exceed current standards, objectives or guidelines and no public health advisories are in effect for human consumption of fish and wildlife. Contaminant levels in fish and wildlife must not be due to contaminant

input from the watershed." The limitation to using this criterion is that contaminants in other sites can be transported to the AOC by atmospheric deposition, and thus will stay in the food chain. A potentially more rational approach is reflected in the Delisting Targets for Ohio AOCs document (2005) that bases this delisting target on "no fish and wildlife consumption advisories attributed to sources within the AOC." Additionally, the proposed milestones include not only tracking changes in fish tissues and advisories, but also set fish tissue contaminant maximums for PCBs (50 ppb), mercury (50 ppb) and lead (86 ppb).

The Four Agency Framework (U.S. EPA, et al, 2000) recommends basing delisting targets for this BUI on appropriate assessment programs and reporting for a suite of most at risk chemicals and consumption guidelines (on the most current and restrictive guidelines).

The Michigan Guidance (2006) is silent with respect to wildlife consumption because there are no AOCs in Michigan with advisories for wildlife. The fish advisories are set by the Michigan Department of Community Health (MDCH). The Michigan guidance states that the BUI is considered restored when "the fish consumption advisories in the AOC are the same or less restrictive than the associated Great Lake or appropriate control site" OR, if the advisory is more stringent than its associated Great Lake or control site, "a comparison study of fish tissue contaminant levels demonstrates that there is no statistically significant difference in fish tissue concentrations of contaminants causing fish consumption advisories in the AOC compared to a control site" OR, if a comparison study is not feasible because of the lack of a suitable control site: "analysis of trend data (if available) for fish with consumption advisories shows similar trends to other appropriate Great Lakes trend sites." In addition, more details are given as to how to conduct the comparison, including choosing the same species as in control site, controlling for variables that affect contaminant concentrations in tissues, comparing data between the AOC and control site collected within a year of each other, and testing statistically significant differences between AOC and the control site. Michigan AOCs impacted by this BUI include Detroit River, Rouge River, River Raisin, St. Clair River, Torch Lake, Deer Lake and Carp Creek, St. Mary's River, Saginaw River, Kalamazoo River, Muskegon Lake, White Lake, and Manistique River.

In the Saginaw River AOC (Michigan) fish contaminant delisting targets are based on a comparison of contaminant (PCBs and dioxin) levels in other areas of the Great Lakes that are not listed as AOCs and on indications from caged fish studies that PCBs sources have been controlled. Comparison to a reference site should be considered in the Sheboygan River AOC. However, reference sites have to be carefully chosen and agreed upon by the WDNR, U.S. EPA and stakeholders.

The St. Louis River AOC does not list this BUI as impaired. The Milwaukee Estuary AOC has proposed the following delisting target:

- 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
- A statistically valid sampling program demonstrates that the edible portion of fish tissues do not contain man-made BCOCs at levels exceeding fish consumption advisories for unrestricted consumption (currently identified as 0.05 ppm PCBs, and 10 ppt dioxin and furan congeners – as TCDD toxicity equivalent concentrations); and

- 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 U.S. EPA every two years); and
- Waters within the Milwaukee Estuary AOC do not have special fish consumption advisories due to mercury in the Healthy Guide for Eating Fish in Wisconsin for two document cycles.

Or if the above is not achievable within 10 years:

- All known man-made sources BCOCs (including PCBs, mercury, dioxins, and furans) within the AOC and tributary watershed have been controlled or eliminated; and
- 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.

A.2.5 Restrictions on Dredging Activities

Sampling surveys within the Sheboygan River AOC have shown extensive sediment contamination throughout the AOC from the NPL sites within it. The occurrence of these NPL sites tends to make the Sheboygan River AOC different from many of the other AOCs, but review of the approach used in these other AOCs is still relevant with regard to approaches to corrective actions that can be utilized within the AOC. Remediation activities at these sites need to be completed as part of the delisting considerations but may not completely satisfy the delisting targets.

The Michigan Guidance (2006) states that the BUI is considered to be restored when "there have been no restrictions on routine commercial or recreational navigational channel dredging by the US Army Corps of Engineers, based on the most recent dredging cycle, such that special handling or use of a confined disposal facility is required for dredge spoils due to chemical contamination" OR, in cases where dredging restrictions exist, "a comparison of sediment contaminant data from the commercial or recreational navigation channel (at the time of proposed dredging) in the AOC indicates that contaminant levels are not statistically different from other comparable, non-AOC commercial or recreational navigation channels."

The Canadian Detroit River AOC delisting targets are based on contaminants in sediments not exceeding applicable standards, criteria, or guidelines. As such, there would be no restrictions on dredging or disposal activities.

The Presque Isle Bay AOC depends on natural attenuation rather than formal remedial action to alleviate contaminated sediment and be delisted.

The other Wisconsin AOCs have addressed this BUI as follows:

Milwaukee Estuary AOC

- Contaminated sediment hot spots within and upstream from the AOC have been identified.
- 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 delisting is possible.

- There are no restrictions on routine navigational dredging done by the U.S. Army Corps of Engineers and/or private dredging companies due to contamination originating from controllable sources within the AOC.

St. Louis River AOC

- Over a five year timeframe, there have been no restrictions on routine commercial or recreational navigational channel dredging by the Federal or State regulatory agencies (USACE, USCG, State of Wisconsin, State of Minnesota), such that special handling or use of confined disposal facilities is required for dredge spoils due to chemical contamination; and
- No dredged sediment will have a beneficial use restriction due to chemical contamination; and
- At the time of delisting, the existing sediment data indicates there will not be restrictions on planned dredge areas.

A.2.6 Eutrophication or Undesirable Algae

The Sheboygan River AOC has elevated nutrients concentrations that result in this BUI. The delisting target for the Sheboygan River AOC is dependent on the nutrient guidance that will be adopted by the WDNR in the future; however, the numeric guidance adopted in other AOCs is useful in providing possible direction for consideration by the WDNR in adopting their future guidance/standards.

The Ohio delisting target for this BUI is "when waters meet the minimum dissolved oxygen criteria listed in the Ohio Water Quality Standards (WQS) AND no nuisance growths of algae, such as filamentous *Cladophora*, or blooms of blue-green algae exist. There are no nuisance growths of aquatic weeds that may be hindering recreational use or contact with the water body."

The MDEQ Guidance (2006) states that this BUI will be considered restored when "no water bodies within the AOC are included on the list of impaired waters due to nutrients or excessive algal growths in the most recent *Clean Water Act Water Quality and Pollution Control in Michigan: Section 303(d) and 305(b) Integrated Report*, which is submitted to U.S. EPA every two years." In addition, MDEQ is in the process of developing nutrient criteria for surface waters that will be adopted by Michigan's Water Quality Standards.

Targets used for delisting the Oswego AOC are based on survey results indicating phosphorus concentrations and loadings, chlorophyll, ammonia, water clarity, dissolved oxygen and other ambient water quality levels are consistently better than standards, criteria, and guidelines. The observation of algal blooms in the AOC or downstream needs to be evaluated as to the cause, the undesirable nature, and any proposed remedial action. Suggested thresholds for ambient water quality comparisons in the AOC include the following lake parameters and values: phosphorus concentration < 20 ug/l (lake), Secchi disc transparency > 1.2 meters, dissolved oxygen > 6 mg/l, unionized NH3 < 0.02 mg/l.

The relevant delisting targets for the Muskegon Lake AOC (MI) are:

Table A-2: Muskegon Lake and Bear Lake Delisting Targets for Eutrophication or Undesirable Algae

INDICATOR	TARGET FOR AVERAGE ANNUAL CONCENTRATIONS	REASONING
Surface Total Phosphorus Concentration	30 ug/l	MDEQ guidance
Chlorophyll *a*	10 ug/l	U.S. EPA
Secchi Disk depth	~ 2.0 m	Pentwater Lake as reference
Trophic Status Index	50-55	Pentwater Lake as reference

The following AOCs also have specific measures for delisting this BUI. Collingwood Harbour used the specific delisting targets of: all harbour waters have persistent phosphorus concentrations of less than 0.02 mg/L, a Secchi disc transparency of greater than 1.2 meters, dissolved oxygen at saturation, chlorophyll concentrations of less than 10 ug/L, unionized ammonia of less than 0.02 mg/L, and phosphorus load from the sewage treatment plant of less than 2760 kilograms per year. Saginaw River/Bay used the delisting targets of: the average concentration of total phosphorus is 15 ug/L or less, in accordance with the supplement to Annex 3 of the 1978 Great Lakes Water Quality Agreement (as amended). The Rochester Embayment targets were: total phosphorus concentrations for near (11 to 12-meters) and near shore (1-meter) are less than or equal to 15 parts per billion and 20 parts per billion, respectively; and chlorophyll *a* concentrations for the near (11 to 12-meters) and near-nearshore (1 meter) are less than or equal to 3.8 parts per billion and 5 parts per billion, respectively; and Secchi disk measurements in the nearshore (12-meters) are greater than or equal to 4 meters.

The St. Louis River AOC has changed this BUI to Excessive Loading of Nutrients and Sediment and has established a delisting target indicating that delisting may occur if:

- Nutrient TMDLs have been established within the AOC including the necessary implementation programs addressing both non-point sources and storm water; and
- Total phosphorus concentrations within the St Louis River portion of AOC do not exceed 0.030 mg/l (upper limit of mesotrophic range); and
- Total phosphorus concentrations in the Lake Superior portion of the AOC do not exceed 0.010 mg/l (upper limit of oligotrophic range); and
- Nutrient and sediment levels in the St. Louis River estuary do not result in excessive loadings to Lake Superior; and
- Nutrient and sediment levels do not impair habitat, and do not restrict recreation, including fishing, boating or body contact recreation in the estuary and within western Lake Superior; and
- There are no violations of the minimum dissolved oxygen concentrations established in NR 102 in the AOC due to excessive sediment or algal growths; and
- There are no violations of the minimum dissolved oxygen concentrations established in NR 102 in the western basin of Lake Superior due to excessive sediment or algal growths attributed to loadings from the St. Louis River; and

- All point source discharges in the AOC are in compliance with the nutrient and total suspended solids effluent requirements in their discharge permits.

The Milwaukee Estuary AOC has taken a similar approach and utilizes the following delisting targets for this BUI:

- Total phosphorus concentrations within the AOC rivers do not exceed 0.05 mg/l *OR* in-river total phosphorus concentrations meet Wisconsin criteria when promulgated.
- Total phosphorus concentrations in the inner and outer harbor areas do not exceed 0.02 mg/l OR total phosphorus concentrations meet Wisconsin criteria when promulgated.
- Total phosphorus concentrations in near shore waters do not exceed 0.01 mg/l OR total phosphorus concentrations meet Wisconsin criteria when promulgated.
- There are no violations of the minimum dissolved oxygen concentrations established in Chapter NR 102, Wisconsin Administrative Code within the AOC due to excessive sediment deposition or algae growth.
- Chlorophyll *a* concentrations within the AOC lake and impoundment areas do not exceed 4.0 ug/l.
- No water bodies within the AOC are included on the list of impaired waters due to nutrients or excessive algal growths in the most recent Wisconsin Impaired Waters list submitted to U.S. EPA every two years.
- There are no beach closures in the AOC due to excessive nuisance algae growths.

A.2.7 Degradation of Fish and Wildlife Populations

This BUI is closely related to the Fish and Wildlife Habitat BUI and the relevancy to the AOC is consistent with the relevancy of that BUI.

The MDEQ guidance (2006) states that the one universal criterion for delisting this BUI, if water quality criteria are not met, is that sources of water quality contamination be controlled before fish and wildlife remediation is conducted. Following remediation, a restoration plan must be developed and implemented as described in MDEQ (2006). Since the restoration goals may take a long time to achieve, the guidance states that fish and wildlife populations need not be fully restored before delisting. The MDEQ guidance was derived, in part, from the IJC recommendation that delisting criteria be based on historic data of fish and wildlife populations, or in the absence of such data, toxicity bioassays to show no significant toxicity from water column or sediment contaminants.

Ohio guidance (2005) sets delisting targets for fish on biological indices for lakes and nearshore; and for wildlife, healthy reproducing populations of sentinel species. In addition, restoration goals and management objectives must be met. The process, which could be applied in the Sheboygan River AOC, would include selecting sentinel species and tracking changes in populations of wildlife and tracking fish community surveys, achieving water quality standards and meeting ecoregional biocriteria.

The Canadian side of the Detroit River AOC has set delisting criteria based on the following:

- Environmental conditions should sustain healthy and genetically diverse communities of most sensitive indicator species at levels of abundance and biodiversity that would be expected from the amount and quality of suitable physical, chemical and biological habitat present. The

objective should be consistent with the Great Lakes ecosystem objectives and Great Lakes Fishery Commission's fish community goals for adjoining waters and the conservation vision for the lower Detroit River.

- Scientifically defensible fish and wildlife bioassays must confirm that there is no significant toxicity from water column or sediment contaminants.
- As much as possible for connecting channels, programs should be in place to discourage further proliferation of existing non-native species and prevention of future introductions.

Note that in the Detroit AOC, the number of bald eagles was low, but lake sturgeon and river otters are returning and could therefore be used as indicator species for the Detroit River. A similar assessment and approach could be used for the Sheboygan River in determining sentinel species.

Oswego AOC had an issue of a dam that prevented stream flow. This is somewhat relevant to the Sheboygan River since fish populations are affected by water levels, and water levels are an issue that needs to be addressed for restoration of the AOC.

Milwaukee Estuary has proposed the following delisting target for this BUI, similar to the approach used in the Michigan Guidance:

- A local fish and wildlife management and restoration plan has been developed for the entire AOC that:
  - Defines the causes of all population impairments within the AOC
  - Establishes site specific local population targets for native indicator fish and wildlife species within the AOC
  - Identifies all fish and wildlife population restoration programs/activities within the AOC and establishes a mechanism to assure coordination among all these programs/activities, including identification of lead and coordinative agencies
  - Establishes a time table, funding mechanism, and lead agency responsibility for all fish and wildlife population restoration activities needed within the AOC.
- The programs necessary to accomplish the recommendations of the fish and wildlife management and restoration plan are implemented.
- Populations for native indicator fish species are statistically similar to populations in reference sites with similar habitat but little to no contamination.

The St. Louis River AOC approach to this BUI is essentially the same as the approach used in the Loss of Fish and Wildlife Habitat BUI with some minor changes in wording to reflect the two different BUIs.

- Population indicator metrics associated with implementation of the Lower St. Louis River Habitat Plan (SLRCAC, 2002) and the Strategies Implementation Planning Worksheets demonstrate that native fish and wildlife populations are being rehabilitated, maintained, and protected; and
- Waters within the St. Louis River AOC are not listed as impaired due to aquatic toxicity in the most recent Clean Water Act 303(d) and 305(b) Wisconsin Water Quality Report to Congress (submitted to U.S. EPA every two years).

A.2.8 Fish Tumors and Other Deformities

About half the AOCs (including the fourteen US/binational) have fish tumors/deformities as a BUI. Most AOCs report declines in the incidence of tumors due to natural attenuation of contaminated sediments and the addressing of source reduction. For example, Presque Isle Bay in Pennsylvania, a U.S. AOC in the recovery stage, addressed contaminants with a $100 million sewage treatment expansion and a pollution prevention plan. The class of chemicals thought to contribute the most to tumors and deformities are polyaromatic hydrocarbons (PAHs) and related compounds such as nitro-PAHs and nitrosamines that are found in urban runoff from the combustion of fossil fuels. PCBs and dioxins can also be a cause for this BUI.

The major limitation to delisting is the lack of data needed to substantiate tumor rates and compare them to an appropriate background rate in a reference site. This BUI was considered to be impaired based on limited fish observation data within the Sheboygan River AOC and the potential for fish tumors associated with observed concentrations of PAHs in sediments. Niagara River AOC used the same approach of coupling the existence of PAHs with observed data on fish tumors. The approach of evaluating sediments for contaminants related to fish tumor and deformities incidence is a good first round screening tool until funds become available to do a more extensive survey, if appropriate. Fish tissue data are better indicators of potential effects than developing relationships based on sediment concentrations of PAHs, but are one step from the complete fish survey recommended by the Pennsylvania Sea Grant study.

If sediments are found or known to be contaminated above most sediment quality guidelines for PAHs, it may not be worth spending the money on a fish tumor/deformity study until the contaminated sediment issue is resolved and sources are controlled. A standardized approach for evaluating and monitoring fish tumors and other deformities was developed by Penn State and others under a Pennsylvania Sea Grant. The standard approach takes into account the species of fish to be considered, the age of the fish, and how to identify tumors including histology and other criteria. A final document has not been published, but a manual for identifying tumors has been recently released. A drawback to this approach is that it requires a significant level of expertise and a statistically meaningful study could be extremely costly.

The IJC Delisting Target reads, “When the incidence rates of fish tumors or other deformities do not exceed rates at unimpacted control sites and when survey data confirm the absence of neoplastic or preneoplastic liver tumors in bullheads or suckers.”

The Ohio Delisting Target is “DELT (deformities, eroded fins, lesions and tumors) levels in fish do not exceed 0.5%.” An optional criterion noted in the delisting document is that “low tumor prevalence is documented in brown bullhead age three years and older over a series of years. Current guidelines suggest that a 5% incidence of liver tumors and a 12% incidence of external tumors are acceptable to consider the area to be in recovery. Great Lakes regional final targets are under development but will be less than 5% liver tumors and 12% overall external tumors.”

The MDEQ guidance considers the BUI restored when “no reports of fish tumors or deformities due to chemical contaminants have been verified through observation and analysis by the MDNR or MDEQ for a period of 5 years” OR, in the cases where any tumors have been reported, “a comparison study of resident benthic fish (e.g., brown bullhead) of comparable age and at maturity (3 years), or of fish species which have historically been associated with this BUI, in this AOC and a non-impacted control site, indicates that

there is no statistically significant difference (with a 95% confidence interval) in the incidence of liver tumors or deformities."

The Detroit River's delisting target is that the incidence rates of fish tumors or other deformities do not exceed rates at non-impacted control sites for a minimum of three sampling periods spaced two to three years apart, and should demonstrate a downward trend. At a minimum, no more than 5% of 3-year old Detroit River brown bullhead fish should have liver tumors, and less than 12% should have external tumors or lesions.

The St. Mary's River AOC delisting target is that concentrations of persistent toxic substances in fish will be below no observable adverse effect concentration (NOAEC) for reproductive, population, and teratogenic effects. Any noted effects will be the same as control populations from unaffected areas that may include Lakes Superior and Huron.

A recent workshop in Ohio hosted by the Great Lakes National Program Office was convened for the purpose of discussing the fish tumor targets. Two important recommendations coming out of the workshop were that a Great Lake-wide reference condition for fish tumors in brown bullheads should be developed and that DELT should not be used as part of the Fish Tumor and Deformities BUI delisting. The DELT was felt to be more appropriate for evaluation of the Degradation of Fish and Wildlife Populations.

There is insufficient data currently available within the St. Louis River AOC to determine if this BUI is impaired so the first step in the delisting process is to collect sufficient data to determine the status of the BUI. If the data shows that the BU is impaired then delisting may occur if

- All known sources of PAHs and chlorinated organic compounds within the AOC and tributary watershed have been controlled or eliminated; and
- There have been no reports of external DLTs or internal organ/system impacts due to chemical contaminants which have been verified through observation and analysis by the WDNR or MPCA for a period of five years; or
- A comparison study of resident non-benthic fish of comparable age and at maturity in the AOC and a non-impacted control site indicates that there is no statistically significant difference (with a 90% confidence interval) in the incidence of contaminant related external DLTs

OR, if any tumors have been reported

- A comparison study of resident benthic fish (e.g., brown bullhead or white suckers) of comparable age and at maturity (3 years), in the AOC and a non-impacted control site indicates that there is no statistically significant difference (with a 90% confidence interval) in the incidence of liver tumors or skin tumors (neoplasms).

A similar approach is shown in the Milwaukee Estuary AOC where there are also insufficient data currently to determine if this BU is impaired. If the initial data review indicates that the use is impaired, then delisting may be considered if

- All known major sources of PAHs and chlorinated organic compounds within the AOC and tributary watershed have been controlled or eliminated.
- A fish health survey of resident benthic fish species such as white suckers finds incidences of tumors or other deformities at an incidence rate of less than 5 percent.

OR, in cases where tumors have been reported

- 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 non-impacted reference sites, indicate that there is no statistically significant difference (with 95% confidence) in the incidence of liver tumors or deformities.
- A comparison study of resident non-benthic fish of comparable age and maturity in the AOC and non-impacted reference sites indicate that there is no statistically significant difference (with 95% confidence) in the incidence of external deformities, lesions and tumors related to contaminant exposure

A.2.9 Bird or Animal Deformities or Reproduction Problems

This BUI is relevant to the Sheboygan River AOC because contaminants like PCBs and heavy metals that are found in AOC sediments have the potential to impair reproduction and development in wildlife. Insufficient data are currently available to show if these problems exist with birds or other animals within the AOC, and before delisting can move forward in the AOC sufficient studies must be conducted to determine if this beneficial use is truly impaired.

River Raisin, St. Clair River, Detroit River, Saginaw River, St. Mary's River, Deer Lake, and Kalamazoo River in Michigan list this BUI as being either impaired or "unknown status." Some of these AOC listings are based on historic data and observations of crossed bills and eggshell thinning. In most cases, recent studies of bird/animal deformities or reproductive problems have not been done. Michigan is using two approaches for determining when this BUI can be considered to be restored/delisted based primarily on availability of data specific to the AOC. In general, the first approach evaluates restoration based on existing MDEQ or other State-approved bird and wildlife data, while the second approach, when direct bird and animal data are not available, is to compare tissue residue data with known effect concentrations. If fish tissue residues in the AOC are not statistically significantly different from their associated Great Lake residues (at the 95% CI), then the AOC is considered restored according to MDEQ (2006).

In Kalamazoo, the delisting target is to "remediate contaminated sediments so that there are no reproductive or other negative health effects on wildlife or benthos." In River Raisin, the proposed delisting criterion (RRPAC, 2002) is "reduce bird deformities due to causes within the Area of Concern." In the Saginaw AOC, the delisting target is "for bald eagles - the reproductive success of bald eagles in the Saginaw Bay area is equivalent to that found in other Lake Huron coastal areas in Michigan and, for herring gulls, PCB levels in eggs taken from Saginaw Bay area nest sites are not significantly higher than those found in other Lake Huron sampling locations." According to a 1999 survey, PCBs in the affected site are about five times higher than the reference site. This survey is cited in a report for The Partnership for Saginaw Bay Watershed (Public Sector Consultants Inc., 2000).

In New York, the Rochester Embayment set the delisting targets as "Representative samples of water do not exceed NYSDEC ambient water quality standards for the protection of aquatic life and/or for protection of wildlife, and mink are present and are reproducing, or levels of PCBs, dioxin/furans, mirex and mercury measured in the tissue of resident prey are below those known to be associated with mink reproductive failure."

This is another BU where there are insufficient data available currently to determine if it is impaired for the Milwaukee Estuary AOC. The delisting target report proposes the following approach:

- The BU can be considered for delisting if studies conducted in the AOC indicate that the beneficial use should not be considered impaired, or
- If studies conducted in the AOC determine that this use is impaired, then two approaches can be considered for delisting:
  - Approach 1 – Observational Data and Direct Measurements of Birds and other Wildlife
    - Evaluate observational data of bird and 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 from 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 delisted. If the rates are statistically different from the reference site it may indicate a source from either within or outside the AOC. Therefore, if the rates are statistically different or the data are insufficient for analysis, then
    - 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 and are not statistically different from those at minimally impacted reference sites (at a 95% confidence interval), then the BUI can be delisted.

Where direct observation of wildlife and wildlife tissue data are not available, the following approach should be used:

- Approach 2 – Fish Tissue Contaminant Levels as an Indicator of Deformities or Reproductive Problems
  - If fish tissue concentrations of contaminants of concern 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 of concern identified in the AOC are not statistically different from Lake Michigan (at 95% confidence interval), then the BUI can be delisted. Fish of a size and species considered prey for the wildlife species under consideration must be used for the tissue data.

The Ohio AOCs do not have this BUI nor does the St. Louis River AOC in Wisconsin.

A.3 APPENDIX A REFERENCES

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APPENDIX B
SUMMARY OF PUBLIC INFORMATIONAL MEETING
December 2, 2008

Contents:

- You are invited -

PUBLIC INPUT SESSION

SHEBOYGAN RIVER AND HARBOR AREA OF CONCERN RESTORATION GOALS

6:30-8:30 pm, December 2nd, 2008
Wombat Room, UW-Sheboygan

The Sheboygan River Basin Partnership and Wisconsin Department of Natural Resources would like to personally invite you to a public input session on the Restoration Goals (Delisting Targets) for the Sheboygan River and Harbor Area of Concern (AOC). Besides providing an opportunity for you to learn more about the draft delisting targets for the Sheboygan River and Harbor AOC, we hope that the meeting will provide a venue for open discussion about future remediation and the possible next steps. Input received from you at this session will be included in the Sheboygan River AOC delisting targets report that will be finalized near the end of 2008. Please consider attending this session to learn more about the Restoration Goals for our Sheboygan River and Harbor and provide your input.

The session will include informational displays. Experts will be on hand to discuss the AOC impairments and restoration goals for the following problem areas:

- Fish habitat and populations
- Wildlife habitat, communities, health and consumption
- Fish consumption, fish tumors, river bottom dwelling plants and animals
- Restrictions on dredging
- Nutrient pollution, undesirable algae and impacts to plankton

The lower 14 miles of the Sheboygan River and Harbor (below the Sheboygan Falls Dam) were designated a Great Lakes Area of Concern (AOC) in 1985. A Great Lakes AOC is an area where contaminated sediment, poor water quality or habitat problems affect the use of the waterway such that it needs priority attention. The end goal is for all of the AOCs to be restored and protected so that they can be "delisted," or removed from the list of Great Lakes AOCs. Goals or targets must be set and then met for each of the problem areas listed above so that the AOC can be considered cleaned up. The process takes time and commitment, and like most of the other AOCs, ours is still in progress. Of the 43 Great Lakes AOCs designated in the United States and Canada, only three have been delisted and two more are considered to be in recovery.

More information on this upcoming Public Input Session can be found at http://sheboyganrivers.org/shebarea.html. For more information on the Sheboygan River and Harbor AOC, please see http://www.glc.org/raptest/sheboygan.html. For general information on AOCs and the RAP process please see http://www.ijc.org/en/activities/raps.htm.

For more information or to RSVP, contact Laurel Last at (920) 892-8756 ext.3022 or laurel.last@wisconsin.gov.

PUBLIC INPUT SESSION
SHEBOYGAN RIVER AND HARBOR AREA OF CONCERN
RESTORATION GOALS

6:30 - 8:30 PM
December 2nd, 2008
Wombat Room, UW-Sheboygan

Agenda

6:30 – 6:45	**Open House – Visit Table Stations**
6:45 – 7:00	**Presentation – Table Instructions**
7:00 – 7:15	**Table Session 1**
7:15 – 7:30	**Table Session 2**
7:30 – 7:45	**Table Session 3**
7:45 – 8:15	**Comment summary and group discussion**
8:15 – 8:30	**Concluding Remarks**

WISCONSIN DEPT. OF NATURAL RESOURCES

Sheboygan River Basin PARTNERSHIP

Sheboygan River and Harbor Area of Concern Restoration Goals

Beneficial Use Impairments of the Sheboygan River Area of Concern

- Restrictions on fish and wildlife consumption
- Degraded fish and wildlife populations
- Fish tumors and deformities
- Bird or animal deformities or reproduction problems
- Degradation of benthos
- Restrictions on dredging activities
- Eutrophication or undesirable algae
- Degradation of phytoplankton and zooplankton populations
- Loss of fish and wildlife habitat

The list above describes the 9 beneficial use impairments of the Sheboygan River Area of Concern (AOC), which are listed by the International Joint Commission (IJC). The session will describe these impairments in detail and discuss the restoration goals that can lead to improved river conditions and possible delisting of the Sheboygan River as a Great Lakes AOC. A primary focus of this meeting is to obtain your input on the proposed delisting targets and next steps. Comments and suggestions will be included within a final report on the proposed Sheboygan River AOC delisting targets (restoration goals).

Objectives of Meeting:

- To educate the public about the beneficial use impairments of the Sheboygan River.
- To provide an opportunity for the public to ask questions, express their opinions on draft restoration goals, and help prioritize which goals should be addressed first.
- To encourage the public to become river stewards by joining the Sheboygan River Basin Partnership.

Background

The Sheboygan River Area of Concern (AOC) encompasses the lower 14 miles of the Sheboygan River downstream from the Sheboygan Falls Dam, including the harbor and near-shore waters of Lake Michigan. The AOC serves as a sink for pollutants carried from three watersheds: the Sheboygan River, Mullet River, and Onion River. These watersheds cover 446 square miles. Past industrial uses along the river have resulted in contamination of river sediments.

Pollutants of concern:

- Suspended solids
- Fecal coliform bacteria
- Phosphorus
- Nitrogen
- Polychlorinated biphenyls (PCBs)
- Polynuclear Aromatic Hydrocarbons (PAHs)
- Heavy metals

Restoration of the AOC will provide numerous benefits, including the following:

- A potential increase in property values within the AOC following restoration
- Increased desirability of the AOC for investment and development following elimination of the AOC designation
- Increased public use and enjoyment of the Sheboygan River AOC associated with increased active recreational uses such as fishing and swimming
- Increased public use and enjoyment of the Sheboygan River AOC associated with increased non-active recreational uses such as wildlife viewing and the general ability to "connect with nature" as aesthetics improve in the AOC

The development of delisting targets for the BUIs within the AOC is an essential part of the next Remedial Action Plan (RAP) update. These targets will be utilized to specify measurable endpoints that will enable the WDNR and associated stakeholders to know when the remediation in the AOC has accomplished specified goals and can be delisted as a Great Lakes Area of Concern.

TABLE 1

Excess Nutrient Pollution, Undesirable Algae, and Impacts to Plankton Community

WHAT are the Problems Concerning the AOC?

- Excess nutrients can cause algae blooms and dense plant growth
- More algae and plants can lead to low oxygen levels, fish kills, obstructions, or odors
- Nutrients can shift aquatic communities toward more tolerant species
- Plankton (tiny floating plants and animals) may be affected by nutrients and/or toxins

WHAT are OUR GOALS?

- River does not exceed WI water quality standards for phosphorus
- River meets WI water quality standards for dissolved oxygen or algae
- River is not on the WI impaired water list due to excess nutrients
- Plankton communities are similar to those in non-impacted waterways
- Water in AOC is not toxic to plankton

Notes & Questions

WHAT ARE POSSIBLE NEXT STEPS?

- Wisconsin adopts a water quality standard for phosphorus (DNR)
- Review or conduct additional water quality monitoring of river
- Assess water quality in AOC and compare it to WI water quality standards
- If river meets standards, we can de-list eutrophication (excess nutrients) impairment
- If river does not meet standards, consider possible solutions
- Study plankton community compared to those in non-impacted waterways
- Monitor water in AOC to see if it is toxic to plankton

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TABLE 2

Impacts to Fish Habitat and Fish Populations

WHAT are the Problems Concerning the AOC?

- Loss and degradation of fish habitat have occurred due to development, dams, and sedimentation
- Loss of good fish habitat can result in fewer fish or fewer species of fish
- Contaminants can decrease the number and quality of fish
- Contaminants can shift fish communities toward more pollution-tolerant species

WHAT are OUR GOALS?

- All Superfund contaminated sediment clean-up actions are completed
- Other known sources of contaminants are identified and controlled
- A fish and wildlife habitat management and restoration plan is developed
- All primary habitat restoration projects and actions in plan are implemented
- River meets fish habitat and populations goals established in restoration plan
- The river is not on WI impaired water list
- Fish communities are similar to those in non-impacted waterways

Notes & Questions

WHAT ARE POSSIBLE NEXT STEPS?

- Implement Superfund and other contaminated sediment clean-up projects (EPA lead)
- Form fish and wildlife habitat committee
- Develop a fish and wildlife habitat management and restoration plan
- Implement primary projects and actions identified in plan
- Monitor AOC fish habitat restoration and compare to goals
- Study fish communities compared to those in non-impacted waterways

Check Out SheboyganRivers.org for More Information!

TABLE 3

Impacts to Wildlife Habitat, Communities, Health, and Consumption Restrictions

WHAT are the Problems Concerning the AOC?

- Loss and degradation of wildlife habitat have occurred due to development
- Loss of good wildlife habitat can result in fewer animals or fewer types of animals
- Contaminants an decrease the total number, types, and health of wildlife
- Some birds and wildlife, such as mink, are likely suffering from reproductive problems due to PCB contamination in the AOC
- Contaminants can shift wildlife communities toward more pollution-tolerant species
- Mallard ducks and lesser scaup (bluebills) have consumption advisories due to contaminants

Notes & Questions

WHAT are the GOALS?

- All Superfund contaminated sediment and floodplain clean-up actions are completed
- Other known sources of contaminants are identified and controlled
- River is not on WI impaired water list because of toxicity
- Wildlife communities are relatively similar to those in non-impacted waterways
- Wildlife deformities and reproductive problems are relatively similar to those in non-impacted waterways
- A fish and wildlife habitat management and restoration plan is developed
- All primary habitat restoration projects and actions are implemented
- River is not listed as impaired due to wildlife consumption restrictions

WHAT ARE POSSIBLE NEXT STEPS?

- Implement Superfund and other contaminated sediment clean-up projects (EPA lead)
- Study wildlife communities compared to those in non-impacted waterways
- Study wildlife health problems compared to those in non-impacted waterways
- Monitor wildlife contaminant levels to determine when consumption advisories can be removed
- Form fish and wildlife habitat committee
- Develop a fish and wildlife habitat management and restoration plan
- Implement primary projects and actions identified in plan
- Monitor wildlife habitat restoration and compare to goals

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TABLE 4

Fish Consumption Restrictions, Fish Tumors, and Impacts to Benthos

WHAT are the Problems Concerning the AOC?

- Resident fish cannot be consumed due to PCBs
- Because of contamination, there may be a higher number of fish with tumors
- Benthos (river bottom plants and animals) and food chain may be impacted because of river bottom contamination
- Contaminants can shift benthic (river bottom) communities toward more pollution-tolerant species

WHAT are OUR GOALS?

- All Superfund and other contaminated sediment clean-up actions are completed
- Other known sources of contaminants are identified and controlled
- River is not on WI impaired water list because of PCBs
- Fish tumors in AOC are relatively similar to those in non-impacted waterways
- Benthos (river bottom animals and plants) are relatively similar to those in non-impacted waterways

Notes & Questions

WHAT ARE POSSIBLE NEXT STEPS?

- Implement Superfund and other contaminated sediment clean-up projects (EPA lead)
- Study fish communities for accumulation of toxic substances and compare to non-impacted waterways
- Study fish tumors in AOC and to compare to waterways that are not impacted by PCBs
- Study benthos (river bottom animals and plants) to see if they are relatively similar to those in non-impacted waterways

Check Out SheboyganRivers.org for More Information!

TABLE 5
Restrictions on Dredging

WHAT are the Problems Concerning the AOC?

- Dredging within AOC is restricted due to contaminated sediments
- Navigational areas in river are reduced because of accumulation of sediments
- Repair or installation of infrastructure (such as bridges, water and sewer pipes, seawalls) can be more costly due to contaminated sediment

WHAT are OUR GOALS?

- All Superfund and other contaminated sediment clean-up actions are completed
- Alternatives have been studied for additional dredging beyond Superfund project

WHAT ARE POSSIBLE NEXT STEPS?

- Implement Superfund and other contaminated sediment clean-up projects (EPA lead)
- Create map that shows dredging restriction areas
- Develop a dredging alternatives plan that includes an evaluation of the following:
  1) Restrictions that must remain in place to protect human health and the environment
  2) Restrictions that must remain in place due to Superfund or RCRA requirements that are based upon state and federal law
  3) Priority areas for navigational use
  4) Priority areas where dredging is needed for other purposes (i.e. utilities)
  5) Costs associated with removing dredging restrictions in priority areas
  6) Funding available to address removing dredging restrictions in priority areas

Notes & Questions

Be a River Steward and Join the Sheboygan River Basin Partnership!

Sheboygan River AOC Meeting
Tuesday, December 2, 2008, 6:30 pm to 8:30 pm
UW Sheboygan, Wombat Room

The meeting started at 6:35 pm.

Jon Gumtow (Sheboygan River Basin Partnership) welcomed the audience and discussed the purpose of the meeting. Doug Bach (SEH consulting firm) gave an overview presentation on the AOC process and a very short discussion of the proposed Beneficial Use Impairment (BUI) Delisting Targets for this AOC. Vic Pappas (WDNR) explained that the audience should visit the various tables to receive more background on the BUI delisting targets. However, there was a request from the audience that Vic provide more information on the status of the Superfund dredging project and how that work connects with this AOC work. That impromptu discussion lasted nearly 15 minutes.

Approximately 43 persons attended of which 7 to 8 said that this was their first meeting.

Room Set-up: There were five tables placed around the room which were hosted by WDNR staff. An additional table had general information about the AOC as well as materials about the Sheboygan River Basin Partnership. The tables contained the following information that related to the BUI delisting targets:

1. Excess nutrient pollution, undesirable algae and impacts to plankton community;
2. Impacts to fish habitat and fish populations;
3. Impacts to wildlife habitat, communities, health and consumption restrictions;
4. Fish consumption restrictions, fish tumors and impacts to benthos;
5. Restrictions on dredging, and
6. Sheboygan River Basin Partnership and general information (this table was not staffed).

At this point the audience dispersed to the five different tables. In order that the audience could visit up to three of the tables and be involved in substantive discussions, Jon Gumtow announced the transition times. Overall, the small group discussions were very robust and the audience members were asking good questions. It also appeared that the group was asking a number of clarifying questions but they were not ready to offer any specific comments on the BUI delisting targets at this point.

At 8:15, Jon asked the groups to stop their discussions. Each of the WDNR table leaders then reported out on what their tables covered.

Table 1: Excess nutrient pollution, undesirable algae and impacts to plankton community

- The groups discussed how to control nutrients as opposed to setting targets;
- The Town of Wilson was used as an example of how to control Phosphorous runoff through local land use planning (question on how to engage townships to undertake this kind of work)

- Emphasize that buffers can reduce nutrient runoff
- Should there be stricter WPDES permits??
- CAFOs and factory farms were discussed as a source of nutrient runoff and impacts on waterways

Table 2: Impacts to fish habitat and fish populations

The discussion centered on what are impacts of dredging project on habitats. The suggestion was that we should take advantage of dredging projects to enhance the habitat that is disturbed. These were some of the desired outcomes or ecological issues that should be addressed when looking at this BUI:

- Plan for a multi-species fishery;
- Encourage habitat restoration work;
- Ask what is the impact of dredging on the river bottom, and
- Have a buffer zone when doing habitat work.

Table 3: Impacts to wildlife habitat, communities, health and consumption restrictions

- How is Willow Creek related to AOC goals and next steps?
- Will the Tecumseh site itself be restored to be used by wildlife?
- Once the clean-up is finished, we should provide access and opportunity for wildlife-related recreation.
- How will the next steps actually get funded?
- Consider growing mushrooms to remove PCBs from floodplain soils.

Table 4: Fish consumption restrictions, fish tumors and impacts to benthos

- Once the dredging is completed, how soon will the fish consumption advisories be lifted?
- Have fish tumors been documented in Sheboygan River?
- Once sediments are removed, will the benthic invertebrates recover?

Table 5: Restrictions on dredging

This was by far the best attended table and there was much concern that the Superfund project is only looking at human health impacts and their dredging plan is not going to look at environmental dredging. The question was how does the AOC work with SF to develop targets for this site? There was some frustration among the group that SF may not address this issue. Specific comments included:

- Superfund project may not in fact potentially address recreational needs for deeper dredging depths
- What about the areas outside of human health issues? We still can't use the river because there is still contamination in it.
- If someone developed a plan that would go above and beyond the scope of the SF project, how would it be implemented? Who would take the lead in pursuing an alternatives dredging plan?
- WI DNR was asked if they should take the lead in developing an alternatives dredging plan and possibly use state recreational boating funds. Vic Pappas

responded that DNR could provide technical assistance but would need to retain some objectivity due to their regulatory role with respect to dredging. In addition, he suggested that the city and the local partner or citizen groups may be better at working with elected officials or others regarding funding for this perceived local need.

- We should create a plan to develop priority areas and the needed restrictions--what are the extra amounts and where would the funding come from??
- Goal should be to develop some mapping and to develop an alternative plan.

Jon Gumtow concluded the meeting by saying that:

- Things are getting lined up and the Partnership needs to determine their next steps to build off of this meeting and the momentum that it is providing. He also said that the Partnership is active yet the numbers are dwindling but that his meeting can help us get moving.
- He would like the City to be engaged even more than they are now.
- WDNR is a catalyst and they are here to solve the problem with the community.
- The Partnership should set a goal to accomplish the targets and then determine what resources and how much time is needed to meet those targets.
- Money is available to help make this happen and it is the goal of the Partnership to help get that money and use it wisely.

The meeting adjourned at 8:30 pm.

Minutes recorded by John Perrecone, USEPA, 312/353-1149, perrecone.john@epa.gov

Summary of Comments for 12-02-08 Sheboygan AOC public input session (from Comment Forms)

Table 1

Suggestions for decreasing nutrient pollution and algae growth in the river included the following:

1. Improve mechanism to enforce / implement nutrient reduction goals.
2. Adopt water quality standards for phosphorus and nitrogen.
3. Offer financial assistance to small farms to dispose of pollutants.
4. Provide land-use planning tools to local governments for expanding community knowledge of excess nutrient issues.
5. Implement program similar to DNR's Priority Watershed Program.
6. Include entire watershed in plan or program, since issue goes well beyond limits of AOC.
7. Use vegetative buffers and wetlands to control non-point pollutants.
8. Control pollutants from stormwater outfalls.
9. Stop barnyard runoff.

Table 2

Suggestions for improving fish habitat and fish populations included the following:

1. Dynamite holes in river bottoms for fish.
2. Plant buffer zones with large, overhanging trees to cool water, help abate algae blooms, and provide more cover for all species.
3. Improve and vegetate river banks to increase fish habitat.
4. Introduce cabbage weed to promote panfishing.

Another suggestion: It might be less expensive to eradicate carp every few years than to declare a reach "impaired." *It appears that this person believes the river is listed as impaired because of the presence of carp.*

Table 3

Suggestions for improving wildlife-related issues included the following:

1. Superfund clean-up and monitoring of toxicity are imperative in the floodplains as well as the river.
2. Set aside designated areas of floodplain for restoration and special use by public. (Once the clean-up is completed, provide access and opportunities for wildlife related recreation.)

There was also concern about the availability of overland access to the river for dredging.

Table 4

Suggestions for improving the contaminated sediment-related issues (fish tumors, fish advisories, benthos) included the following:

1. Consider creation of new benthic habitat where areas may be targeted and isolated for restoration.
2. Identify riparian areas that could be restored or created as wetland areas for benthic communities and spawning areas.
3. Just dredge the whole mess out and get rid of it. Let the fish clean themselves through regeneration.

Other comments:

1. Aside from the sediment clean-up, the only plan seems to be to do a lot of monitoring. There should be more action.
2. Fish tissue tests should reflect what fisher persons actually keep to eat, not just carp. Panfish should be in sample. *It appears that this person thinks the consumption advisories are based on carp, rather than sport fish.*

Table 5

Suggestions related to dredging restrictions:

1. It is critical that the Sheboygan Harbor and River up to the 14th St. Bridge are dredged deep enough for navigation and recreation by deeper draft boats, not just deep enough to meet the requirements of the Superfund project. *Many comments referred to this issue. One person suggested dredging to 8 feet deep up to the Pennsylvania Bridge.*
2. Dredging plan should factor in the continuous sediment loads that will continue after sediments are dredged (plan for future dredging).
3. Form committee consisting of WDNR, Corps, EPA, City of Sheboygan, other government entities if necessary based on interests, interested persons—river stakeholders, SRBP, etc. to discuss funding, studies, coordination of dredging with Superfund project and alternative dredging plan, etc.
4. Work on earmarks for funding.

General / Other

1. Would dam removal help restoration efforts of river habitat?
2. This has been talked about, planned, and studied to death for 30 years. It's way past time to simply do the work.
3. Excellent information from all participants.
4. Well run input session! Thanks
5. We (WI Naval Ship Association) are looking at bringing a naval historic ship just upstream of the Eighth Street Bridge by the Keopsell Building / Highland House. The draft of the ship is expected to be 6 feet or less. The ship has a length of 165 feet and a beam of 24 feet.


Protect
Improve
Restore
Sheboygan River Basin
Lake Michigan
Mission Statement
Vision for the SRBP group