Lower Green Bay And Fox River Area Of Concern Beneficial Use Impairment Removal Recommendation: Restrictions On Drinking Water Consumption Or Taste And Odor Problems

Submitted to:

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By:

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The Wisconsin Department of Natural Resources would like to acknowledge the support provided by the Lower Green Bay and Fox River Area of Concern (AOC) stakeholders in the development of the Restrictions on Drinking Water Consumption or Taste and Odor Problems Beneficial Use Impairment Removal Recommendation Document. The local input, data and research assistance and longstanding efforts to restore this AOC are an invaluable part of the process to remove beneficial use impairments and reflect the incredible ongoing efforts that will enable us to continue forging the path to delisting.

Disclaimer

The Great Lakes Water Quality Agreement (GLWQA) is a non-regulatory agreement between the United States and Canada and criteria developed under its auspices are non-regulatory. The actions identified in this document were needed to meet beneficial use impairment removal targets leading to the delisting of the AOC. These actions are not subject to enforcement or regulation activities.

Executive Summary

The Lower Green Bay and Fox River was designated as an Area of Concern (AOC) under the Great Lakes Water Quality Agreement (GLWQA) in 1987, encompassing the last seven miles of the lower Fox River and 21 square miles of the lower bay of Green Bay. The designation was due to the existence of severely contaminated sediments and water quality issues that emanated from municipal and industrial effluents, as well as nutrients from the watershed, creating an aquatic environment toxic to human, fish, and wildlife health.

In the 1993 Remedial Action Plan (RAP), eleven confirmed and two suspected Beneficial Use Impairments (BUIs) were identified in the AOC. Restrictions on Drinking Water Consumption or Taste and Odor Problems was listed as a confirmed BUI due to unknown risks of toxic substances to human health and the health risks of exposure to the multitude of chemicals suspected to exist in the AOC. However, the city of Green Bay obtained drinking water resources from groundwater until the 1950s when concerns around supply and natural radium concentrations in groundwater resulted in the construction of a pipeline to Manitowoc in 1957 to obtain drinking water resources from Lake Michigan surface waters. A second pipeline was constructed to Kewaunee in 2007 to obtain more drinking water resources from Lake Michigan surface waters for AOC-adjacent communities. While AOC surface waters have never been utilized as a public drinking water source, the BUI was still confirmed due to concerns that if AOC surface waters were ever treated it would require higher costs for appropriate treatment methods and to garner additional support for sediment remediation to reduce the risk of pollutant transport to other communities using Green Bay and Lake Michigan as a drinking water source.

A BUI removal target was established in 2009, stipulating that treated AOC surface waters: 1) do not contain densities of disease-causing organisms or concentrations of hazardous or toxic chemicals or radioactive substances don’t exceed human health standards, objectives or guidelines; 2) that taste and odor problems are not present; and 3) that treatment and costs needed to make raw water suitable for drinking is the standard treatment used in comparable portions of the Great Lakes which are not degraded, specifically disinfection, coagulation, sedimentation and filtration.

Because AOC surface waters have not been treated for drinking water consumption since the AOC designation in 1988, it is not possible to evaluate this BUI against its removal criteria. Therefore, this BUI removal recommendation focuses on the review of policy and management actions to improve sediment and water quality in the AOC.

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Purpose

The purpose of this document is to recommend the removal of the Restrictions on Drinking Water Consumption or Taste and Odor Problems Beneficial Use Impairment (BUI) in the Lower Green Bay and Fox River Area of Concern (AOC). This document provides a list of policy and management actions that have improved sediment and water quality in the AOC.

Rationale for AOC Designation and BUI List

The Lower Green Bay and Fox River was designated as an AOC under the GLWQA in 1987 due to the presence of legacy contaminants and degraded water quality resulting from human activities at the local level, culminating in a loss of several beneficial uses provided by the aquatic and nearshore resources (DNR, 1988). Legacy contaminant sources included discharges from untreated municipal and industrial wastewater, and water quality was further degraded by excessive nutrient input from point and nonpoint sources. While much of the Fox River and bay of Green Bay were impacted by legacy issues, the last seven miles of the Fox River downstream of the De Pere Dam and a 21 square mile area of the lower bay of Green Bay were considered extremely degraded as a result of these activities and encompass the AOC boundary (Figure 1). In 1993, the Remedial Action Plan (RAP) Update (DNR, 1993) identified thirteen BUIs in the AOC, eleven of which were confirmed, and two designated as suspected impairments. The following list shows the current status of the thirteen BUIs originally identified in the 1993 RAP.

Confirmed

- Restrictions on Fish and Wildlife Consumption
- Degradation of Fish and Wildlife Populations
- Bird or Animal Deformities or Reproductive Problems
- Degradation of Benthos
- Restrictions on Dredging Activities
- Eutrophication or Undesirable Algae
- Restrictions on Drinking Water Consumption or Taste and Odor Problems
- Beach Closings
- Degradation of Phytoplankton and Zooplankton Populations
- Loss of Fish and Wildlife Habitat

Suspected

- Fish Tumors or Other Deformities

Removed

- Tainting of Fish and Wildlife Flavor
- Restrictions on Dredging Activities
- Degradation of Aesthetics

AOC Boundary

The AOC includes the last seven miles of the Fox River from the De Pere Dam to the mouth of the river and extends into lower a 21 square mile area of Green Bay from Long Tail Point to Point au Sable.

Figure 1. Lower Green Bay and Fox River Area of Concern Map.

Background, Rationale for BUI Confirmation and BUI Removal Criteria

Background

Much of the historical point source pollution that was generated within and/or transported to the AOC stemmed from unchecked industrial and municipal sewerage discharge effluents prior to establishment of Clean Water Act requirements (DNR, 1988). The papermaking industry peaked around 1870 in the region, with the 39 mile stretch of the Lower Fox River said to house one of the highest concentrations of paper mills in the world, 34 of which were located at one time along or adjacent to the river (Kraft, 2009). These paper mills released several organic and inorganic environmental contaminants into the river which were then transported to the lower bay of Green Bay (Sullivan & Delfino, 1982) (Figure 2). Decades of uncontrolled effluents and municipal sewage contributed to severely degraded water quality, with dissolved oxygen levels often historically observed below the aquatic life threshold of 2 mg/L. Degraded water quality led to observations of major declines in populations of fish and other desirable aquatic organisms and a shift in the aquatic community to prevalence of pollution tolerant species.

Figure 2. 1970's air photo of paper mill operations resulting in white pulp waste being discharged to the Fox River.

For decades, communities in the Fox Valley and Green Bay turned away from the water. A report by the Federal Water Pollution Control Administration in 1968 cited the following:

> *"Of all the major tributaries discharging directly into Green Bay, the Fox River exhibited the most degraded water quality. This river was found to carry more nutrients into the Green Bay than all other tributaries combined. The gross*

pollution evident in this river has been found to have a pronounced influence on the southern reaches of Green Bay."

The presence of persistent toxic chemicals in sediments of the Fox River and bay of Green Bay was one of the most serious problems in terms of impacts to human health, fish and wildlife, economic impacts, and recovery efforts. The primary pollutant of concern was the release of polychlorinated biphenyls (PCBs) to the river via the papermaking industry, whereby some paper production facilities manufactured carbonless copy paper. Production of this paper required that microcapsules of a waxy material enclosed a colorless dye dissolved in PCBs (ROD, 2003). The initial production and recycling of this carbonless copy paper resulted in an estimated 690,000 pounds of PCBs discharged from 1954 to 1971. Production was discontinued after 1971 due to emerging concerns about PCBs in the environment.

The passage of the Clean Water Act in 1972 and subsequent amendments allowed the state of Wisconsin to develop the Wisconsin Pollution Discharge Elimination System (WPDES) to regulate pollutant discharge to all waters of the state, including oxygen-consuming compounds, PCBs and other toxic chemicals plaguing the Fox River and bay of Green Bay. In 1972, the Great Lakes Water Quality Agreement was signed by both the United States and Canadian governments. The agreement committed both countries to working cooperatively to protect the chemical, physical and biological integrity of the Great Lakes System, with its first iteration focusing primarily on reduction of excessive nutrient loading from point source dischargers. Additionally, in 1979 U.S. Environmental Protection Agency (USEPA) placed a ban on PCB production, and local industries and municipalities invested millions of dollars in pollution control technology through the 1980's. These and other landmark bi-national, national, state, and local policies and initiatives resulted in significant improvements to water quality in the Fox River. This included drastic reductions to biological oxygen demand loads that allowed a world-class walleye fishery to largely become re-established by the 1980's.

However, the legacy sediment, water quality, and fish and wildlife impacts that continued even after these regulations took effect were primary reasons why the AOC was designated. The first RAP published in 1988 described continued environmental problems and established a shared vision for a desired future state of the AOC which included a suite of sediment, water quality, and fish and wildlife goals under 16 key actions (DNR, 1988). With regard to drinking water, the RAP included a report by the Toxic Substances Management Technical Advisory Committee (TAC) that indicated the following:

"Existing and potential use of the Bay and Lake Michigan as a drinking water source should be protected by maintaining and improving Fox River water quality. At present, the Fox River is not suitable for drinking water because of the unknown risk of substances toxic to human health, taste and odor problems, suspended solids, bacteria and viruses, color, low flow effect on water quality and high cost of water treatment."

Rationale for BUI Confirmation

While the initial RAP did not include potable water supplies sourced from the AOC as a goal, the Citizens Advisory Committee included as part of the desired future state that local water quality would provide for drinkable water after standard treatment. However, surface waters in the AOC have never been treated for use in public water systems.

Prior to the 1950s, the city of Green Bay obtained drinking water resources from groundwater, though elevated radium levels in groundwater wells and concerns regarding long-term supply caused communities adjacent to the city to create the Central Brown County Water Authority which considered and identified an alternative primary source of drinking water. In 1954, the bay of Green Bay was evaluated by the Green Bay Water Utility as a potential source of drinking water (Donahue and Associates, 1976). The study determined that a water intake had to be constructed at least seven miles into Green Bay to reach an adequate depth for obtaining drinking water, as prolific algae and bacteria in shallower areas of the bay would significantly increase the cost to treat water. When comparing the total cost of obtaining and treating water sourced from the bay of Green Bay to Lake Michigan, the study determined that Lake Michigan was a better alternative, prompting the city of Green Bay and other AOC-adjacent communities to obtain source water via pipeline from Kewaunee in 1957.

In 1976, the Brown County Planning Commission developed the Brown County Water Plan (Donahue and Associates, 1976), which evaluated more drinking water resources for AOC-adjacent communities and provided recommendation for where and how to obtain drinking water resources in the long-term for Brown County. As part of this study, the Fox River and Green Bay were evaluated as potential sources. The study recommended that the Fox River never be utilized as a source of drinking water even if significant pollution abatement was implemented, as the risk of chemical spills or accidental discharges from the high concentration of industry precluded it from being a suitable municipal water source. Regarding Green Bay, the plan indicated that communities utilizing water 45 miles and farther north of the Fox River mouth had all reported experiencing severe taste and odor problems, and that no communities within 45 miles obtained their drinking water from the bay due to poor water quality. The plan cited the 1954 study, describing that pollution in the bay of Green Bay had become far more extensive as of 1976, and that a water intake would need to be located at least 15 to 25 miles from the mouth of the Fox River to reach adequate depths where pollution impacts were decreased. Taken in whole, the study determined that there were no economic advantages to using water from either the Fox River or bay of Green Bay, and that Lake Michigan would continue to be the most appropriate source of drinking water for Brown County.

In 1991, the International Joint Commission (IJC) approved listing and delisting criteria for BUIs to serve as a reference for assessing progress toward RAPs. The *Restrictions on Drinking Water Consumption, or Taste and Odor Problems* BUI listing and delisting criteria focused on impacts to <u>treated</u> drinking water, and not <u>raw/untreated</u> surface waters:

> *Listing Guideline:*
>
> *When treated drinking water supplies are impacted to the extent that: 1) densities of disease-causing organisms or concentrations of hazardous or toxic chemicals or radioactive substances exceed human health standards, objectives, or*

guidelines; 2) taste and odor problems are present; or 3) treatment needed to make raw water suitable for drinking is beyond the standard treatment used in comparable portions of the Great Lakes which are not degraded (i.e. settling, coagulation, disinfection).

Delisting Guideline:

For treated drinking water supplies: 1) when densities of disease-causing organisms or concentrations of hazardous or toxic chemicals or radioactive substances do not exceed human health objectives, standards, or guidelines; 2) when taste and odor problems are absent; and 3) when treatment needed to make raw water suitable for drinking does not exceed the standard treatment used in comparable portions of the Great Lakes which are not degraded (i.e., settling, coagulation, disinfection).

Following the 1991 listing/delisting guidelines, the 1993 RAP confirmed the Restrictions on Drinking Water Consumption or Taste and Odor Problems BUI based upon:

- Unknown risks of substances toxic to human health in sediments and surface waters;
- Taste and odor problems attributed to industrial effluents prior to CWA requirements;
- Suspended solids, bacteria and viruses, color, and low flow effect on water quality;
- Assumed high cost of potential future drinking water treatment resulting from these issues.

While the 1993 RAP acknowledged drinking water was unlikely to be obtained from within the AOC boundaries, the confirmed BUI listing provided additional justification for remediation of contaminated sediments to limit contaminant transport from the AOC to upper Green Bay and Lake Michigan, which are a drinking water source, as well as nutrient reduction practices and policy within the Lower Fox River watershed (DNR, 1993).

In 2007, a second pipeline was constructed from the city of Green Bay to Manitowoc to access additional Lake Michigan source water for AOC-adjacent communities. As of 2024, there are no current plans from the AOC-adjacent communities to re-evaluate the Fox River and/or bay of Green Bay surface water as a treated drinking water source.

BUI Removal Criteria

Closely following the IJC recommended listing/delisting guidelines, the following BUI removal targets were established with stakeholders in 2009 (WDNR, 2009).

The Restrictions on Drinking Water Consumption, or Taste and Odor Problems impairment can be delisted when treated drinking water supplies meet all of the following:

- *Densities of disease-causing organisms or concentrations of hazardous or toxic chemicals or radioactive substances do not exceed human health standards, objectives, or guidelines; and*

- *Taste and odor problems are not present; and*

- *Treatment and costs needed to make raw water suitable for drinking is the standard treatment used in comparable portions of the Great Lakes which are not degraded, specifically disinfection, coagulation, sedimentation, and filtration.*

BUI Removal Request

The BUI removal criteria are based on treated drinking water. The DNR's Drinking and Groundwater Program evaluates drinking water standards after the water treatment process for public water sources and from locations within the distribution system to determine if public water suppliers are meeting drinking water standards. The AOC was not used as a drinking water source at the time the BUI was listed and is not currently used for drinking water, and therefore, is not treated. The DNR is requesting that the BUI be removed because the removal criteria cannot be meaningfully addressed. The following section provides indirect supporting information regarding Clean Water Act regulations and other sediment and water quality improvements that have taken place since the AOC was designated.

Clean Water Act Regulations in Place to Improve Water Quality in AOC Surface Waters

The Federal Water Pollution Control Act of 1948 was amended in 1972 and became commonly referred to as the "Clean Water Act" (CWA). The 1972 amendments established the basic structure for regulating discharges of pollutants into the waters of the United States and quality standards for surface waters, including:

- Setting industrial wastewater standards;
- Requiring water quality standards to be in place or developed for all contaminants in surface waters;
- Required any entity to obtain a permit to discharge any pollutant from a point source into navigable waters;
- Funded the construction of sewage treatment plants;
- Acknowledged the need for planning to address nonpoint source pollution.

Following the 1972 CWA amendments, Wisconsin developed the Wisconsin Pollutant Discharge Elimination System (WPDES) program, and it was once of the first programs authorized by the USEPA in 1974. Wisconsin was also the first in the nation to require secondary treatment at wastewater treatment plants and among the first to develop statewide phosphorus criteria and thermal standards for surface waters. More recently, Wisconsin has developed innovative strategies such as water quality trading and adaptive management to effectively address nutrient pollution from both point and nonpoint sources (DNR, 2022).

Additionally, the Great Lakes Water Quality Agreement (GLWQA) was established between the U.S. and Canada with a primary goal of restoring and protecting surface waters of the Great Lakes system. The GLWQA includes 10 Annexes that the U.S. and Canada implement actions across, including Areas of Concern, Lakewide Management, Chemicals of Mutual Concern, Nutrients, Discharges from Vessels, Aquatic Invasive Species, Habitat and Species, Groundwater, Climate Change Impacts and Science. In 1990, Title I of the Great Lakes Critical Programs Act put into place some of the goals established in the GLWQA. More specifically, it

required the USEPA to establish water quality criteria protective of human, wildlife, and aquatic health for 29 toxic pollutants in the Great Lakes and to work with the Great Lakes states on plans, such as AOC RAPs and Lakewide Action Management Plans (LAMPs), to implement remedial and restorative actions to achieve these criteria (USEPA, 2022).

Management Actions to Improve Sediment and Water Quality in the AOC

One of the three primary reasons the AOC designation was made for the Lower Fox River and Bay of Green Bay was the significant sediment contamination present as a result of industrial operations. Several studies were completed throughout the latter half of the 20th century that documented over 100 hazardous chemicals in the sediments and waters of the AOC, though PCBs and polycyclic aromatic hydrocarbons (PAHs) were the primary pollutants of concern. A key remedial action recommended by the Toxic Substances AOC Technical Committee was to determine the mass and availability of PCBs and other contaminants in the AOC and broader Green Bay region, prompting the Green Bay Mass Balance Study (GBMBS, 1989; Manchester-Neesvig et al., 1996). The study identified over 50 contaminated sediment deposits and was used to confirm several BUIs in the 1993 RAP Update, including the Restrictions on Drinking Water Consumption or Taste and Odor Problems BUI.

From 1999 to 2002, the USEPA and DNR worked together to produce a proposed Remedial Action Plan for operating units (OUs; see Figure 3) with options for cleanup based on the results of several demonstration projects and public input (DNR, 2020). In 2002 and 2003, the USEPA and DNR issued a Record of Decision (ROD) for OUs 1-2 and 3-5, respectively. These documents outlined the following Remedial Action Objectives (RAOs) necessary for achieving a remedial action sediment concentration goal of less than 1 part per million (ppm) PCBs in OUs 2-5 and a surface weighted average concentration (SWAC) of less than 0.25 ppm PCBs in OU1:

- RAO 1: Achieve, to the extent practicable, surface water quality criteria for PCBs throughout the Lower Fox River and Green Bay.
- RAO 2: Protect humans who consume fish from exposure to contaminants that exceed protective levels (achieve safe exposure for recreational and high-intake fish consumers).
- RAO 3: Protect ecological receptors from exposure to contaminants above protective levels (achieve safe ecological thresholds for fish-eating birds and mammals within 30 years following remedy completion).
- RAO 4: Reduce transport of PCBs from the Lower Fox River into Green Bay and Lake Michigan (reduce loading to Green Bay and Lake Michigan comparable to loading from other Lake Michigan tributaries).

The USEPA and DNR approved an amended ROD for OUs 2-5 in 2007 and OU1 in 2008 that allowed alternate remedial approaches such as engineered capping, a combination of dredging and capping or sand covering without dredging in certain areas. These OU-specific remedies would allow all the remedial objectives to be met more quickly, efficiently and cost-effectively.

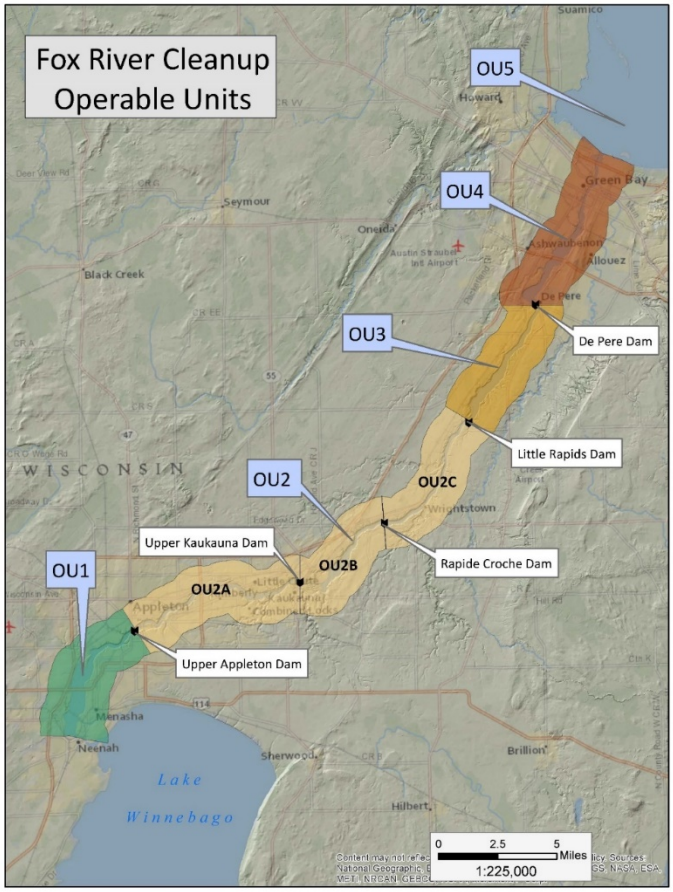

Figure 3. The Lower Green Bay Fox River contaminated sediments and operating units map.

As a result, the Lower Fox River PCB Cleanup Project was initiated in 2008 to reduce risk to human health and the environment due to the presence of PCBs in the bottom sediments of the Lower Fox River. The project was a substantial multi-year effort that included dredging, capping and sand covering activities across a 13-mile stretch of the Lower Fox River, with contaminated sediment remediation completed in Operating Units (OU) 1-3 (from Little Lake Butte des Morts to the De Pere Dam) in 2011, and operations complete in OU 4-5 (below the De Pere Dam and lower Green Bay) in 2020 (Figure 3). A detailed description of these remedies was presented in the Restrictions on Dredging Activities BUI Removal Package and the following summarizes outcomes of this work.

Active remediation operations occurred in OU1 from 2004 to 2009 to ensure that upstream PCB source loads would be addressed first. A total of 372,000 cubic yards of PCB-contaminated sediment was removed, dewatered in geotubes and sent to landfill; 114 acres of river bottom were capped. As described in the annual completion reports that are available on the DNR's Lower Fox River PCB Cleanup website, post-dredge confirmation sampling confirmed that RAO goals were met.

Monitored natural recovery (MNR) was the primary authorized remedial action for most OUs 2 and 5, with the exception of an area dredged in 1997 in OU2 (Deposit N) as part of a demonstration project and a semi-circular arc extending 1,200 feet from the mouth of the Fox River and into Green Bay in OU5 in 2020.

A combination of dredging, capping and sand covering was the authorized remedy for OUs 3 and 4, though most of the contaminated sediment dredged and removed from the river was in OU4 (Fox River portion of the AOC). This work was completed in 2020 following over 6 million

cubic yards of sediment dredged and removed from the river bottom and approximately 800 acres capped or sand covered. The Remedial Action Certification of Completion Report was submitted on behalf of the Fox River Group of Companies to the Agency/Oversight Team in December 2020 and was finalized in July 2022. This report demonstrates that the remedial activities for OUs 2-5 have met the remedial action sediment goal of less than 1 ppm PCB in both the river and at the upland sediment processing facility site.

A Long-Term Monitoring (LTM) plan was finalized in 2009 which describes the program in which monitoring of sediment, surface water and fish tissue will continue to track post-remediation recovery and progress toward achieving the broader, long-term RAOs listed previously, as well as the physical integrity of capped areas. LTM sampling began in OU1 in 2010, in OUs 2 and 3 in 2012, and in OUs 4 and 5 in 2021. Starting in 2022, all OUs will be sampled in one event and then every five years thereafter to be on the same monitoring schedule through the system to coordinate with the USEPA's Five Year Review cycle.

The 2018 LTM Summary showed that PCB concentrations in water have decreased, on average, 90% across OUs 1-3 (Table 1).

Table 1. 2018 LTM summary data for PCB surface water concentrations across OUs 1-3 following sediment remediation.

	OU1	**OU2A**	**OU2B**	**OU2C**	**OU3**
2018 Decrease in Concentration from 2006 – 2007 OU Baseline	90%	90%	89%	89%	91%
95% Confidence Interval	80-95%	85-93%	84-93%	84-93%	88-94%

While the 2021 surface water data from OUs 4 and 5 is still being reviewed, given that the authorized remedy for OUs 1, 2 and 3 follow the same remedies for OUs 4 and 5, similar results in terms of significant PCB concentration reductions from baseline are anticipated. Going forward, results from the LTM plan will continue to be summarized and updated on the DNR's Lower Fox River PCB Cleanup Project website and monitoring is expected to continue for several decades or until the Response Agencies (DNR and USEPA) determine that all four of these RAOs have been met.

Additionally, as defined in the USEPA's 2005 Contaminated Sediment Remediation Guidance for Hazardous Waste Sites, institutional controls are non-engineered methods implemented to ensure the long-term integrity of remedial actions. The 2007 ROD Amendment requires the implementation of institutional controls in OUs 2-5 to supplement existing methods of maintaining the long-term protection of engineered caps and reduction of potential exposure in MNR areas where residual contamination will remain after completion of remedial actions. As such, a 2009 Institutional Control Implementation and Assurance Plan (ICIAP) was finalized as part of the Lower Fox River Remedial Design Final Design Report and can be found in

Appendix C of the Restrictions on Dredging Activities BUI Removal Report. Implementation of these institutional controls will be ongoing for decades as progress toward RAOs is assessed through long-term monitoring.

Clean Water Act Regulations to Reduce Taste and Odor Causing Substances in AOC Surface Waters

Taste and odor problems in drinking water have not been reported in the AOC, as adjacent communities do not obtain source water for drinking water treatment from AOC surface waters. However, some taste and odor problems in walleye harvested by anglers were reported in the Lower Fox River in the 1980s. The various pulp-manufacturing processes may have been responsible for these complaints, as industrial operations released large amounts of spent sulfite waste such as phenols, resins and fatty acids prior to state and federal regulations, compounds that were later understood to cause organoleptic (taste and odor) effects on water and aquatic organisms (Sullivan and Delfino, 1982; DNR, 1983; USEPA, 1986).

Establishment of the CWA gave the USEPA and states authority to limit discharges of organoleptic (e.g., taste and odor-causing) compounds. In 1986, USEPA published the Quality Criteria for Water "Gold Book" which established recommended water quality criteria for organoleptic effects pursuant to Section 304(a) of the CWA. Following these recommendations, NR 102.14 Wis. Adm. Code was established in 1989 which regulates thresholds concentrations for organoleptic substances in waters and aquatic organisms. DNR also worked with the paper industry between 1985 and 1990 to identify and reduce discharges of organoleptic compounds into Wisconsin surface waters (see Appendix E of the Tainting of Fish and Wildlife Flavor BUI Removal Recommendation report for more information).

Comparison of Public Water System Treatment Methods in the AOC to Comparable Portions of the Great Lakes

Because AOC surface waters have not been used as a treated drinking water source, a comparison of treatment methods and costs to other comparable portions of the Great lakes is impossible. As a result, DNR determined that evaluating this portion of the BUI target is inappropriate.

BUI Removal Process and Stakeholder Engagement

An initial recommendation to remove this BUI was presented to the Lower Green Bay and Fox River AOC stakeholder group at the public 2019 RAP Update meeting held on May 7, 2020. During the RAP Update meeting, participants were polled on a recommendation to remove this BUI, with 57% of respondents indicating support for removal (20 individuals), 10% indicating other considerations needed to be made prior to removal (3 individuals), and 34% neutral (12 individuals). One comment following the RAP Update meeting was received that recommended the BUI status to be updated to "monitoring and natural recovery" rather than removal; the full comment can be found in Appendix C.

An updated rationale to support the removal recommendation was presented in the 2020-2021 RAP Update and no comments were received regarding this BUI in the publicly noticed comment period.

A public review and comment period for the BUI removal recommendation is underway from Nov. 20 to Dec. 30, 2024. All comments and responses will be included in Appendix C of the final document.

Conclusion

As set forth in Annex 2 of the 1987 and Annex 1 of the 2012 Amendments of the GLWQA, the BUI addressed in this document is “Restrictions on Drinking Water Consumption or Taste and Odor Problems.” This removal recommendation outlines the rationale for listing the BUI as confirmed, actions taken that have resulted in improved sediment and water quality in the AOC, and existing environmental protections in place for AOC surface waters.

Removal Statement

The DNR Office of Great Waters recommends the removal of the Restrictions on Drinking Water Consumption or Taste and Odor Problems BUI from the Lower Green Bay and Fox River Area of Concern. This decision is based on a review of policy and management actions to improve sediment and water quality in the AOC and support by local stakeholders.

Unlinked References

Donahue & Associates, Inc. 1976. Brown County Water Plan. 15 pp.

DNR, United States Geological Survey, U.S. Fish and Wildlife Service, U.S. EPA-Region V, University of Wisconsin-Madison Department of Water Chemistry. 1983. Final Report of the Toxic Substances Task Force on the Lower Fox River System. 70 pp.

Kraft, M.E. 2009. “Cleaning Wisconsin’s Waters,” in Toward Sustainable Communities: Transition and Transformations in Environmental Policy, 2nd Edition. Massachusetts Institute of Technology. 365 pp.

Miller, T. et al. 2023. Lower Green Bay Area of Concern Cyanobacterial Harmful Algal Bloom Study 2016 – 2020. 75 pp.

Sullivan, J.R. and J.J. Delfino. 1982. Select Inventory of Chemicals Used in Wisconsin’s Lower Fox River. University of Wisconsin Sea Grant Institute. WIS-SG-82-238.

List of Appendices

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Appendix A - List of Acronyms

AOC	Area of Concern
BUI	Beneficial Use Impairment
CCL	Contaminant Candidate List
CWA	Clean Water Act
DNR	Wisconsin Department of Natural Resources
GBMBS	Green Bay Mass Balance Study
GLRI	Great Lakes Restoration Initiative
GLWQA	Great Lakes Water Quality Agreement
ICIAP	Institutional Control Implementation and Assurance Plan
IJC	International Joint Commission
LAMP	Lakewide Action Management Plan
LGBFR	Lower Green Bay and Fox River
LTM	Long Term Monitoring
MNR	Monitored Natural Recovery
OU	Operating Unit
PAHs	Polychlorinated Biphenyls
PCBs	Polycyclic Aromatic Hydrocarbons
RAO	Remedial Action Objective
RAP	Remedial Action Plan
ROD	Record of Decision
SWAC	Surface Weighted Average Concentration
TAC	Technical Advisory Committee
USEPA	U.S. Environmental Protection Agency
WPDES	Wisconsin Pollutant Discharge Elimination System

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Appendix B - Definitions

Area of Concern

A region where legacy pollution— from industrial, agricultural and urban sources—severely interferes with the public's use of water resources for activities such as swimming and fishing. Defined by Annex 2 of the 1987 Protocol to the U.S.-Canada Great Lakes Water Quality Agreement as "geographic areas that fail to meet the general or specific objectives of the Agreement where such failure has caused or is likely to cause impairment of beneficial use of the area's ability to support aquatic life." These areas are the "most contaminated" areas of the Great lakes, and the goal of the AOC program is to bring these areas to a point at which they are not environmentally degraded more than other comparable areas of the Great Lakes. When that point has been reached, the AOC can be removed from the list of AOCs in the Annex, or "delisted."

Beneficial Use Impairment

A "beneficial use" is any way that a waterbody can improve the quality of life for humans or for fish and wildlife (for example, providing fish that are safe to eat). If the beneficial use is unavailable due to environmental problems (for example if it is unsafe to eat the fish because of contamination) then that use is impaired. The International Joint Commission provided a list of 14 possible beneficial use impairments in the 1987 Great Lakes Water Quality Agreement amendment.

Removal Target

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

Remedial Action Plan

According to the 1987 Protocol to the U.S.-Canada Great Lakes Water Quality Agreement, a Remedial Action Plan (RAP) is a document that provides "a systematic and comprehensive ecosystem approach to restoring and protecting beneficial uses in Areas of Concern…" RAPs are required to be submitted to the International Joint Commission at three stages: Stage 1: problem definition, Stage 2: when remedial and regulatory measures are selected, and Stage 3: when monitoring indicates that identified beneficial uses have been restored. Note that a renegotiated Great Lakes Water Quality Agreement was signed in 2012 by the U.S. and Canada which removed the "stage" terminology from the AOC Annex, and simply requires Remedial Action Plans to be "developed, periodically updated, and implemented for each AOC."

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Appendix C – Responsiveness Summary for BUI Removal Recommendation

Below is a summary of comments received during the public notice period for the 2019 RAP Update and BUI Removal Recommendation. Thank you to those who took the time to provide thoughtful comments and feedback.

1. Initial recommendation to move forward with BUI removal
    a. Received via email following 2019 RAP Update meeting held on May 7, 2020, via Zoom by B. Kupsky in which a recommendation to remove this BUI was made to AOC stakeholders:

Comment:

May 7, 2020: It's very understandable that the DNR wants to retire as many BUI's as possible. But for this issue it's a bit complicated. Various RAP committees talked about this during development of the original RAP, and later for the BUI lists. It was pointed out during those discussions that nobody currently alive has ever tapped the AOC for drinking water, due to the visible pollution. But the point here is that without human influence the waterway would historically have been considered "drinkable". If we drop the BUI now, anyone looking at it in six months or so will think, "Well, they solved the problem."; which is not accurate.

I realize this is problematic from the DNR perspective. If possible, I would prefer that the BUI be categorized as something akin to, “monitoring and natural recovery", rather than removed from the list.

Response:

As presented in this document, AOC surface waters have never been treated for public water system distribution before or after the AOC designation. There are no current plans to re-evaluate the Lower Fox River or bay of Green Bay as a drinking water source.