Wisconsin Water Quality

Report to Congress

2024

WISCONSIN
DEPT. OF NATURAL RESOURCES

WISCONSIN WATER QUALITY REPORT TO CONGRESS 2024

Wisconsin Department of Natural Resources

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Division of Environmental Management

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Water Quality Bureau

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101 S Webster Street,
PO Box 7921,
Madison, WI
53707-7921

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Wisconsin's Water Quality Report

The Federal Clean Water Act (CWA) requires all states to prepare a Water Quality Report to Congress every two years. This "Integrated Report" combines the CWA sections 305(b), 303(d), and 314. The report contains an overall summary of water quality conditions in the State and an updated Impaired Waters List. Wisconsin data are also provided electronically to the United States Environmental Protection Agency (EPA) as part of the Integrated Reporting Process.

Wisconsin's 2024 Wisconsin Water Quality Report to Congress summarizes assessment progress and activities related to water quality protection during the past two years. This document is an online publication only that can be accessed at the Wisconsin Department of Natural Resources (WDNR) website: dnr.wisconsin.gov.

Cover photo:
Avocets on Migration
by Paulette Marzahl, 2022

Previous reports were published in 2022, 2020, 2018, 2016, 2014, 2012, 2010, 2008 (data submittal only), 2006, 2004, 2002, 2000, 1996, 1994, 1992, 1990, 1988, 1987, and earlier. WDNR's earlier documents, prior to 2000, are available for review at the GEF II building, 101 S. Webster Street, Madison. Later versions are available electronically.

Editors

Ashley Beranek, Kristi Minahan

Authors and contributors to this report

Tim Asplund, Jim Amrhein, Kendra Axness, Noah Balgooyen, Ashley Beranek, Dave Bolha, Katy Bradford, Camille Bruhn, Heidi Bunk, Lisa Bushby, Matt Claucherty, Jacob Dickmann, Laura Dietrich, Donalea Dinsmore, Brennan Dow, Rae-Ann Eifert, Mary Gansberg, Kevin Gauthier, Shawn Giblin, Pat Gorski, Mark Hazuga, Emily Heald, Katie Hein, Craig Helker, Eric Hettler, Andy Hudak, Jennifer Jefferson, Ted Johnson, Maureen Kalscheur, Kevin Kirsch, Jon Kleist, Jim Killian, Amy Kretlow, Kim Kuber, Jodi Lepsch, Madeline Magee, Kristi Minahan, Abigale Nicholson, Brenda Nordin, Patrick Oldenburg, Diane Packett, Randal Piette, Rachel Sabre, Jeanne Scherer, Becky Scott, Mike Shupryt, Paul Skawinski, Alex Smith, Mike Sorge, Adrian Stocks, Casey Sweeney, Pam Toshner, Scott Van Egeren, and all Water Quality Biologists, Water Resources Specialists, and Water Program Managers.

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Appendix B – 2024 Waters In Restoration List

Appendix C – 2024 Proposed Listings

Appendix D – 2024 Proposed Listing Removals

Appendix E – 2024 Waters Attaining Standards List

Common Acronyms

AU – Assessment Unit; segment of a waterbody used for assessment.

CLMN – Citizen Lake Monitoring Network

CWA – Clean Water Act

EPA – United States Environmental Protection Agency

TMDL – Total Maximum Daily Load

TSS – Total Suspended Solids

WAV – Water Action Volunteers

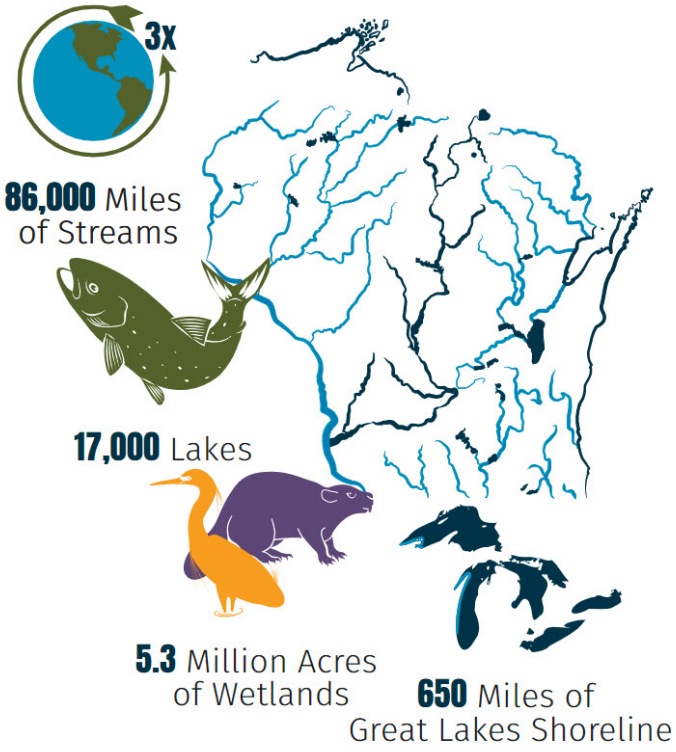
WDNR – Wisconsin Department of Natural Resources

WisCALM – Wisconsin Consolidated Assessment and Listing Methodology

Introduction

Anderson Dock Sunset, *Lake Michigan, Door County* *Photo: Lisa and Paul Schultz 2017*

Wisconsin is a state bountiful with natural resources, including many and varied lakes, streams, wetlands, aquifers, and springs. Every other year, the Wisconsin Department of Natural Resources (WDNR) provides reports on the quality of the State's water resources to the United States Environmental Protection Agency (EPA), which in turn, shares this information with the United States Congress. The information provided may be considered as a tool for rule making, budget appropriations, and program evaluation by federal legislators.



Key Findings

- 82% of evaluated waters are healthy, by waterbody/ assessment unit (AU) count (Figure 2).
- 85 listings on 83 waters were added to the Impaired Waters List and Restoration Waters List.
- Top four newly listed pollutants: phosphorus (43%), aquatic plants (19%), E. coli (12%), and PFOS (11%).
- 38 listings were removed; 88 prior listings and 3 new listings were covered by the newly approved Northeast Lakeshore TMDL.

Sign up for GovDelivery emails for real-time updates via email or text message. The topic 'Water Quality Standards and Assessments' under 'Water' will provide information regarding standards, changes to water quality condition, WisCALM updates, and general TMDL updates. https://public.govdelivery.com/accounts/WIDNR/subscriber/new.

WISCONSIN'S WATER QUALITY

Fisher Lake, Florence County *Photo: Luke Ernster 2018*

Total Waters

There are over five and a half million people in Wisconsin that share the state's bountiful water resources. Wisconsin has approximately 1.2 million lake and impoundment acres and approximately 88,000 river and stream miles. Despite the abundance of water resources in Wisconsin, many are threatened by human-induced stressors.

Data Used for Assessments

Waters were assessed using quality-assured data originating from WDNR's monitoring program, county and state partners, university partners, and the public. All data used for assessment met WDNR's quality assurance requirements and local WDNR staff determined whether available data were representative of a water's condition.

WDNR Data

Chemistry data collected by staff, volunteers, and grant recipients, among others, go to the State Lab of Hygiene (SLOH), which sends its data to the SWIMS database through the Laboratory Data Entry System (LDES). Data in the Surface Water Integrated Monitoring System (SWIMS) database are considered readily available and were used in assessments when they met assessment requirements. Data in SWIMS were assessed using automated assessment packages that are programmed to follow assessment protocols outlined in *Wisconsin Consolidated Assessment and Listing Methodology* (WisCALM).

Public Data

In addition to WDNR's monitoring data described above, public data were gathered and considered for use in assessments through an active data solicitation process. Every two years, the WDNR requests that citizens and interested groups submit their surface water data (biological, chemical, and physical). Data meeting specified requirements were evaluated, along with WDNR-collected data, to assess the quality of the state's water resources. Data were accepted from the public from January 18 – February 24, 2023, and the WDNR received information/data submittals from four entities.

Taylor County Land Conservation Department (LCD)

Staff at Taylor County LCD submitted total phosphorus and metals data for 2021 – 2022. Collection and analytical methods met WDNR data requirements, and these data were included in 2024 assessments. These data were formatted and uploaded to SWIMS.

Milwaukee Riverkeepers

The Milwaukee Riverkeepers has a Community Science Monitoring Program for E. coli; data from this project was submitted to WDNR along with sampling methods. The sampling methods are in review; the submitted data was for 2023 and will be used in the next assessment cycle.

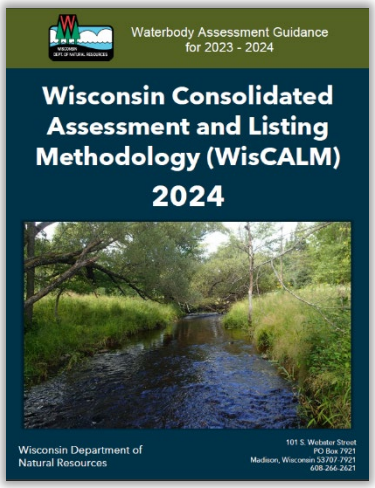
Friends of Hika Bay (FOHB)

Friends of Hika Bay (FOHB) is a citizen-based group in southern Manitowoc County who collaborate with the Lakeshore Water Institute at UWGB-Manitowoc. Water quality data on Centerville, Fischer, Point, Pine, and Calvin Creeks were sent to WDNR for this assessment period.

Courte Oreilles Lake Association (COLA)

Every year a member of COLA submits water quality data for Lac Courte Oreilles in Hayward, WI. Parameters include phosphorus, temperature, and dissolved oxygen, among others. These data were formatted and uploaded to SWIMS after the automated packages were run; these assessments were done manually to include the new data.

Assessment Methodology



WDNR's water quality assessment goal is to use clearly defined, publicly accessible methods for collection and analysis of data to ensure defensible assessment decisions. To this end, the WDNR built upon its 2022 assessment methodology work by creating a revised *Wisconsin Consolidated Assessment and Listing Methodology* (WisCALM) to conduct assessments in 2024 for determining the attainment of designated uses.

The most significant updates were:

- Changed the "Healthy Waters" list to "Waters Attaining Standards".
- Changed the "Restoration Waters" list title to "Waters In Restoration".
- Surface water thresholds for PFOS and PFOA; published August 2022.
- Biological assessment thresholds; published October 2022.

Statewide Water Quality

Assessed Parameters

Trophic State Index (TSI) is the single most assessed parameter across the state (Figure 1); this is made possible by the combination of multi-year satellite lake image processing and volunteer clarity sampling (secchi and chlorophyll-*a*). The high percentage of assessed lakes can be in part attributed to general assessments based on TSI.

Combined bioassessments of fish and macroinvertebrate ('bug') communities account for the most evaluated parameters in rivers and streams. The number of AUs with these parameters meeting criteria far outweighs those where they did not meet criteria (Degraded Biology, Figure 1).

Total phosphorus is the most evaluated chemical parameter. WDNR released its Nutrient Reduction Strategy in 2013 and the numeric water quality criteria for assessments were established in 2010. The combination of focus and benchmarks allowed for many AUs to be evaluated for phosphorus, with about half not meeting criteria.

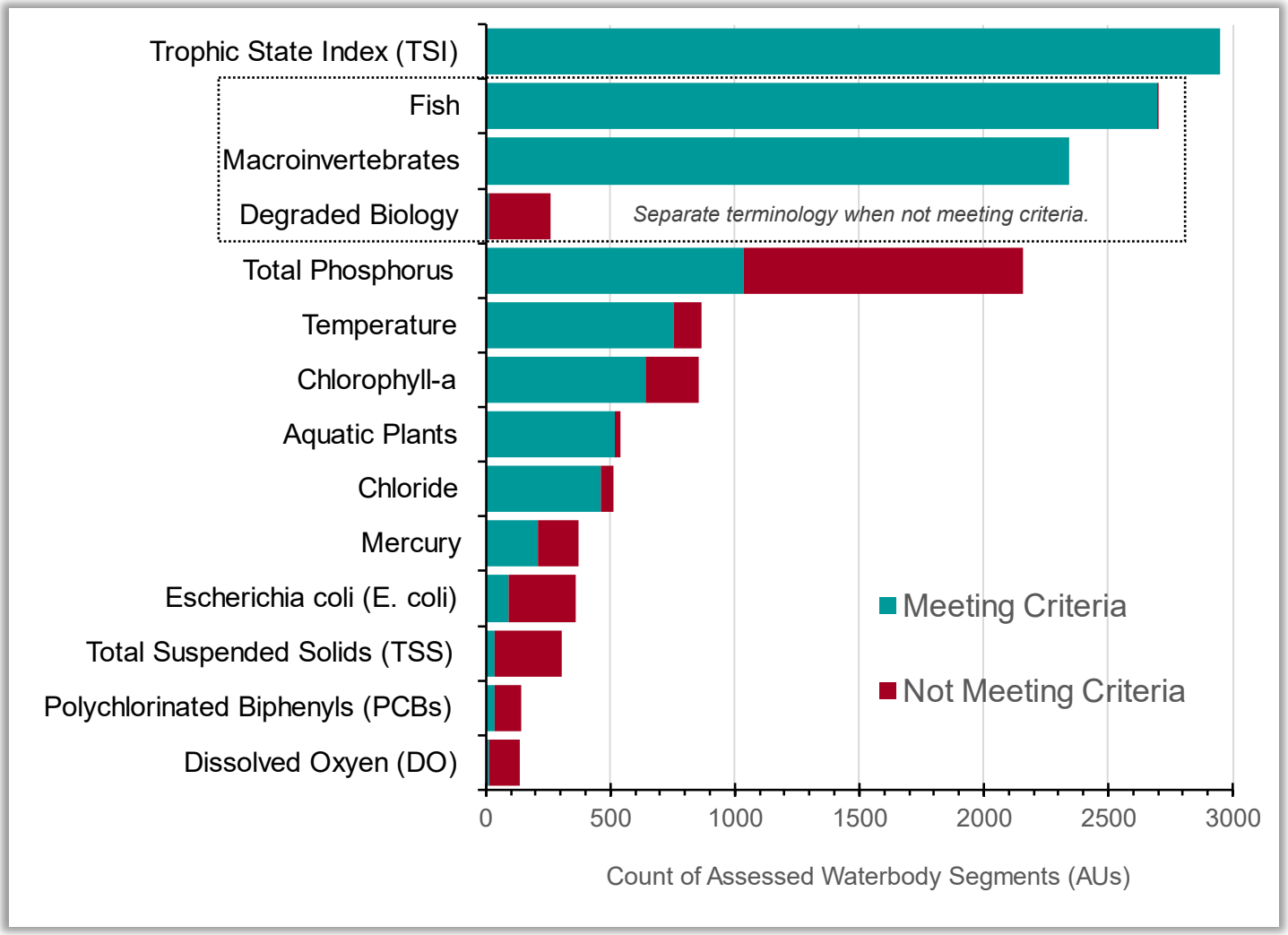


Figure 1. The most assessed parameters by count of assessment units (AU); only showing those with more than 100 AUs. These parameters were largely assessed over the course of five cycles (2014 – 2024); unless new information is collected a parameter's status determination is kept cycle to cycle. Parameters not meeting criteria have assessments back to the 1998 cycle. Degraded Biology is a listing term used for fish and/or macroinvertebrate bioassessments that did not meet criteria.

2024 Water Condition Lists

These Water Condition Lists serve as a record of water quality across the state and are a starting point for water resource management. Changes in the Water Condition Lists are the result of restoration planning work, advances in monitoring and assessment technology, additional monitoring data, and water quality restorations.

In the 2024 cycle the list with the greatest net increase was the Waters Attaining Standards List (Table 1). General assessments of biology on newly sampled waters contributed to this increase. The majority of AUs, 82%, are on the Waters Attaining Standards List (Figure 2). This cycle the official Impaired Waters List (CWA 303(d) List) had a net decrease in AUs and listings. This shift is mainly due to the approval of a large basin TMDL, moving many waters and listings to the Waters In Restoration List. The percentage of listed AUs with a TMDL increased by 3% between the 2022 and 2024 cycles.

2024 Water Condition List	# Waters *Net Change*	# Listings *Net Change*
Attaining	7,934 *+197*	*NA*
Impaired	1,264 *-36*	1,490 *-52*
In Restoration	445 *+68*	672 *+104*

Table 1. Summary of AU (# Waters) and listing counts on each of the Water Condition Lists.

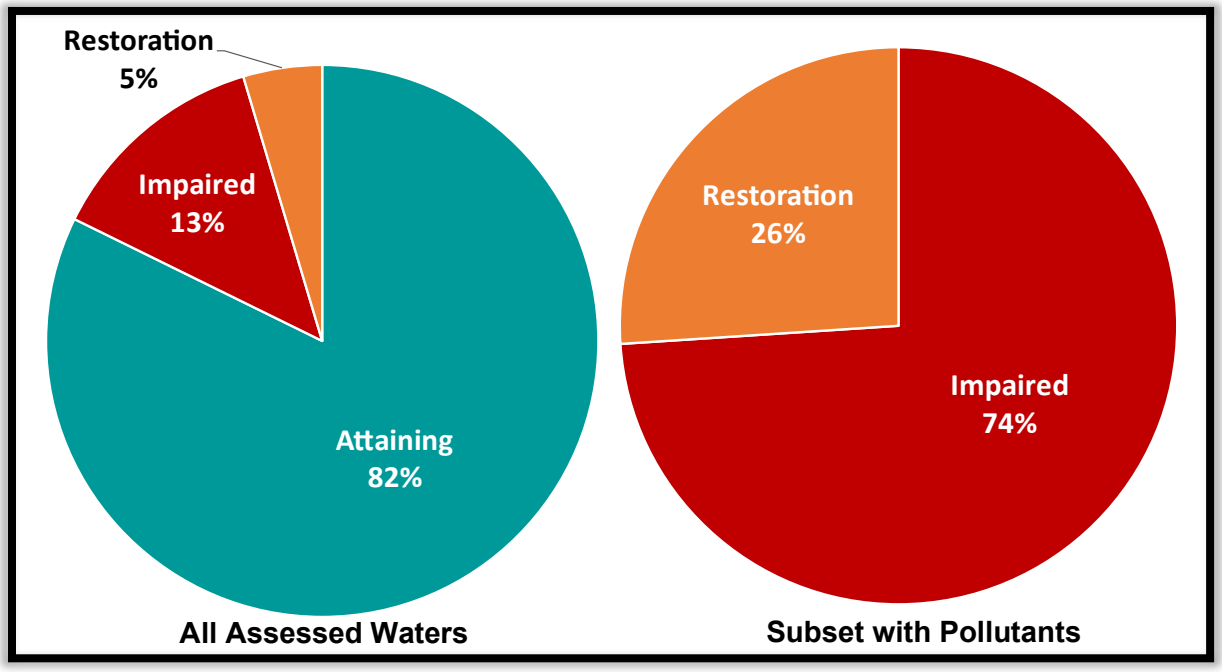


Figure 2. Percentage of assessed AUs on each list. Of the AUs with a pollutant listing, 26% have a restoration plan.

Lists by Waterbody Type

When summarizing the Water Condition Lists an AU count is most often used because it works across all waterbody types. AU count summaries do not account for size differences, which can be informative. Figure 3 shows the percentage of assessed waters on each list based on AU count (top) and size (bottom) for four waterbody types. In this assessment cycle the waterbody type Reservoir was added to the primary list of waterbody types; in past cycles Reservoir was a subtype of Lakes and Impoundments.

Differences between AU count and waterbody size are starkest for Lakes, Reservoirs, and Impoundments because a single AU can range from 1 acre to over 131,000 acres (lakes average 209 acres and median 33 acres; reservoirs average 455 acres and median 84 acres; impoundments average of 296 acres and median 68 acres). For rivers and streams the sizes range from less than a mile to over 70 miles (average of 6 miles; median 4 miles).

Figure 3. Water Condition List breakdown in percentages by waterbody type, size, and count.

Waters Attaining Standards List

The Waters Attaining Standards List (formerly named Healthy Waters List) contains 82% of assessed waters. A total of 230 waters were newly assessed and determined to be on the attaining standards. There were 205 river and stream segments evaluated with biotic indices, phosphorus, chloride, or temperature data. There were 24 lakes, reservoirs, and impoundments evaluated for multiple parameters and 1 beach evaluated for *E. coli*.

The full list of Waters Attaining Standards can be found in Appendix E.

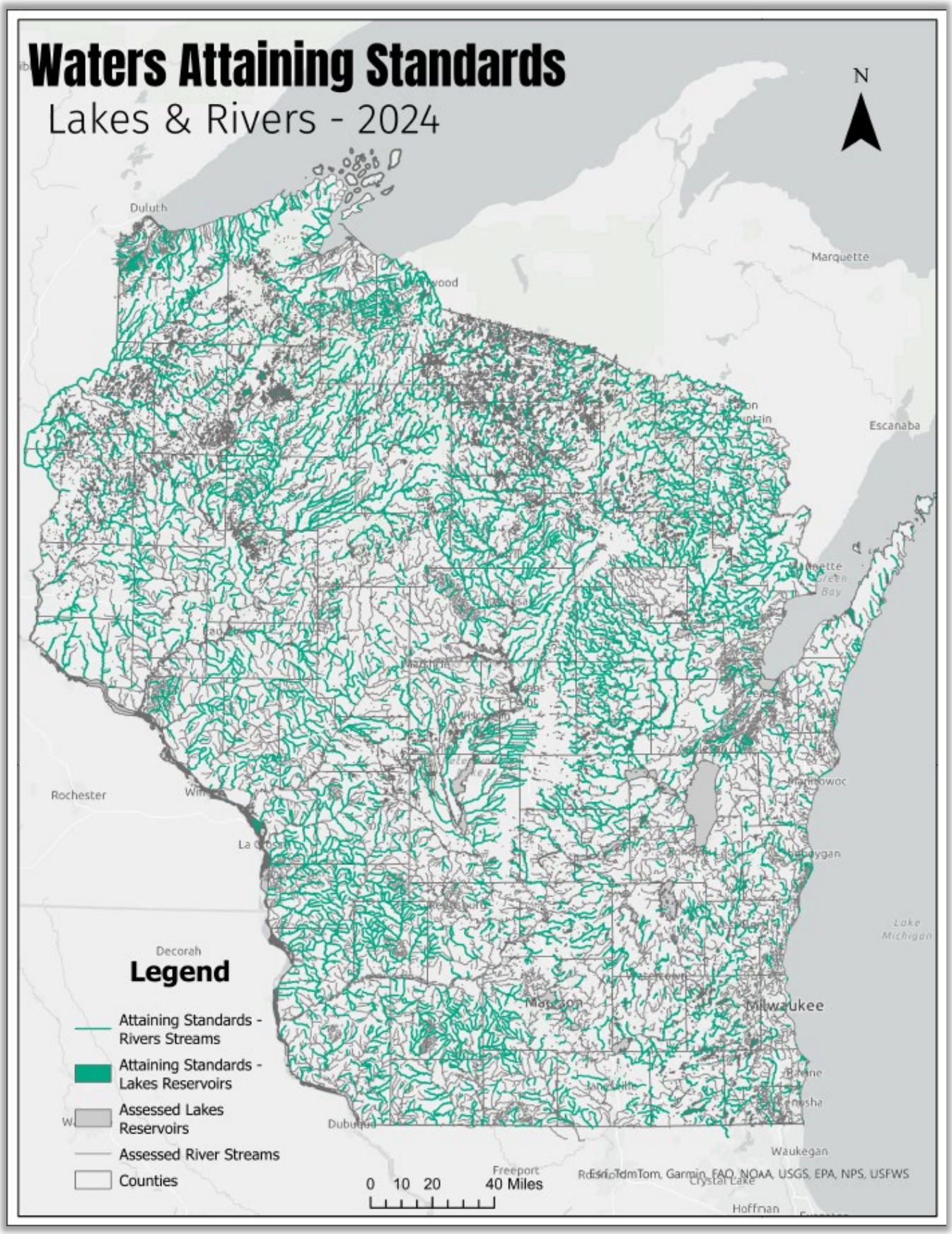


Figure 4. Location of all waters on the Waters Attaining Standards List across the state of Wisconsin.

Impaired Waters List

The majority of pollutant listings, nearly 50%, are for phosphorus (Nutrients in Figure 5). This corresponds with the state's focus on nutrient reduction in our waterways (see Wisconsin's Nutrient Reduction Strategy). The full Impaired Waters List can be found in Appendix A.

Mercury and PCBs are at the next highly listed pollutants (Figure 6). The majority of these are based on fish consumption advisories.

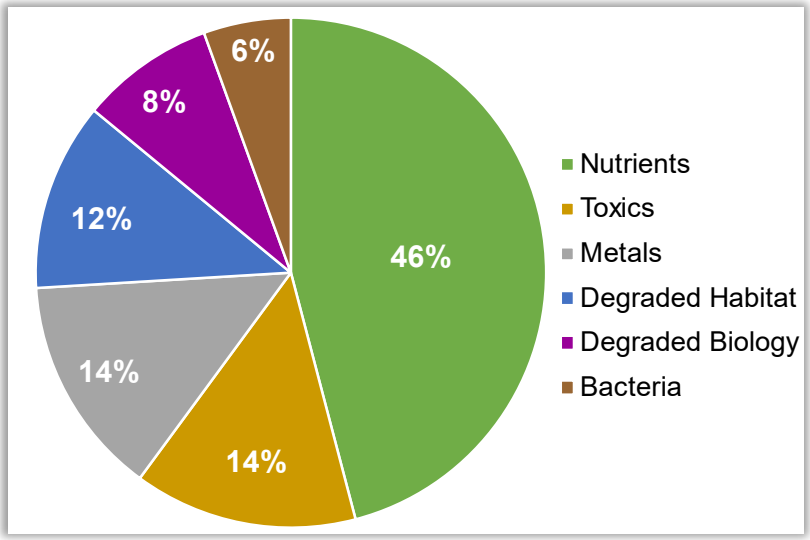


Figure 5. Types of listings on the 2024 Impaired Waters List.

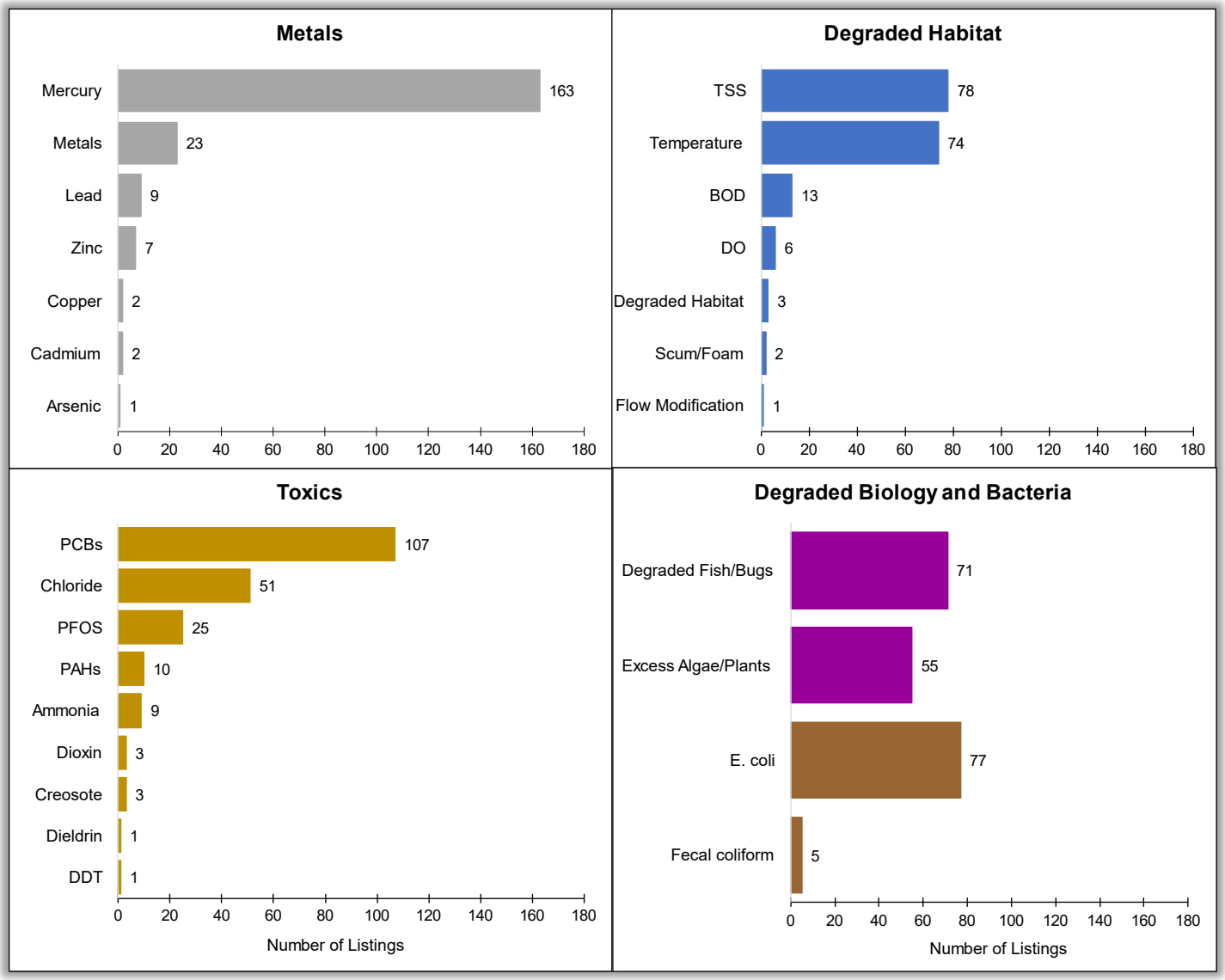


Figure 6. Breakdown of pollutants in each group on the 2024 Impaired Waters List. Degraded Biology listings are those with a Cause Unknown.

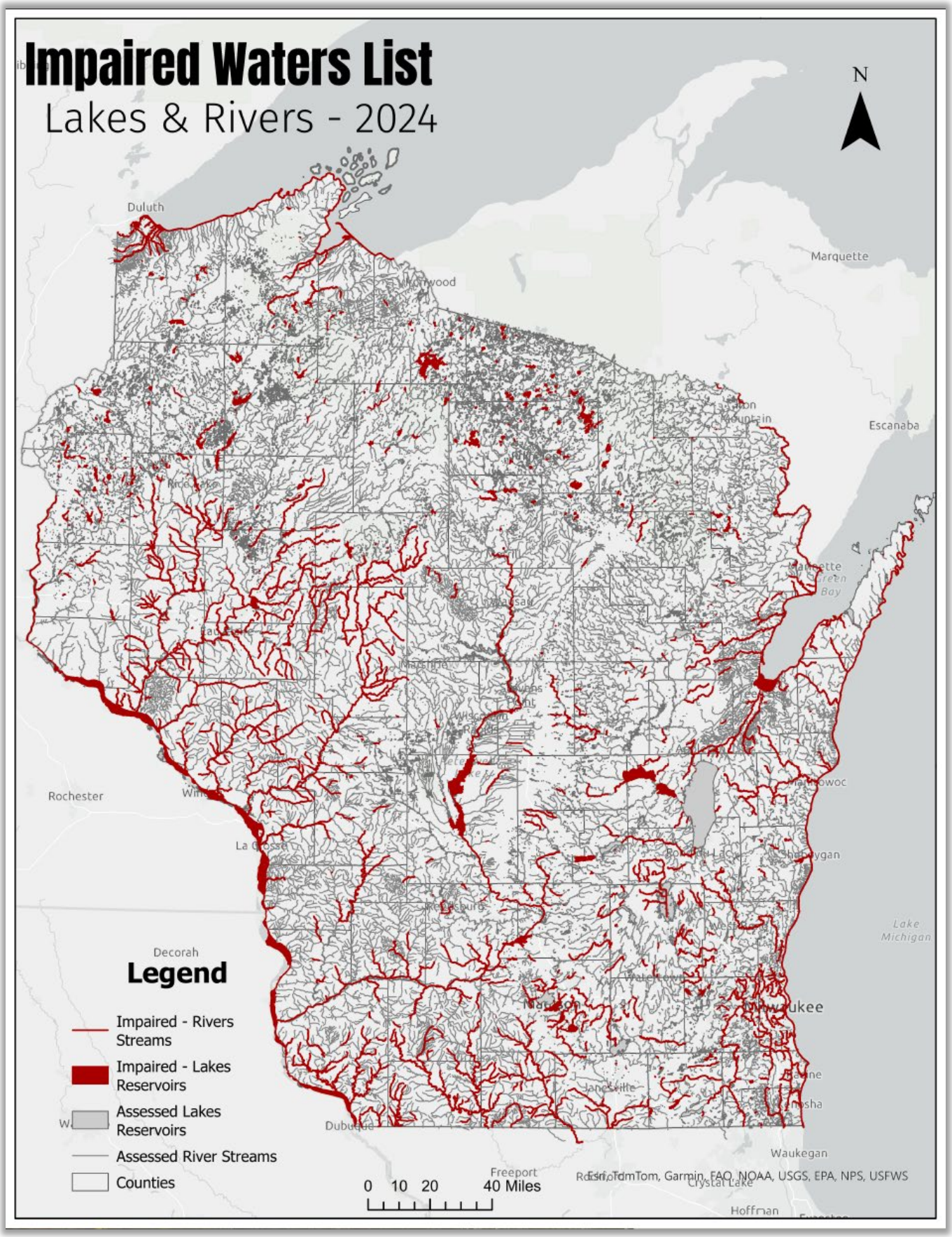


Figure 7. Location of impaired waters across the state in the 2024 cycle.

Waters In Restoration List

Phosphorus (Nutrients) and TSS (Degraded Habitat) make up the majority of parameters covered by TMDLs (Figure 8). The majority of additions to the Waters In Restoration List, 88 listings, were waters within the Northeast Lakeshore TMDL. Several new listings were added to three existing, and one recently approved, basin TMDLs: Milwaukee River Basin TMDL, Wisconsin River Basin TMDL, Fox-Wolf Basins TMDL, and Northeast Lakeshore TMDL.

The full Waters In Restoration List can be found in Appendix B.

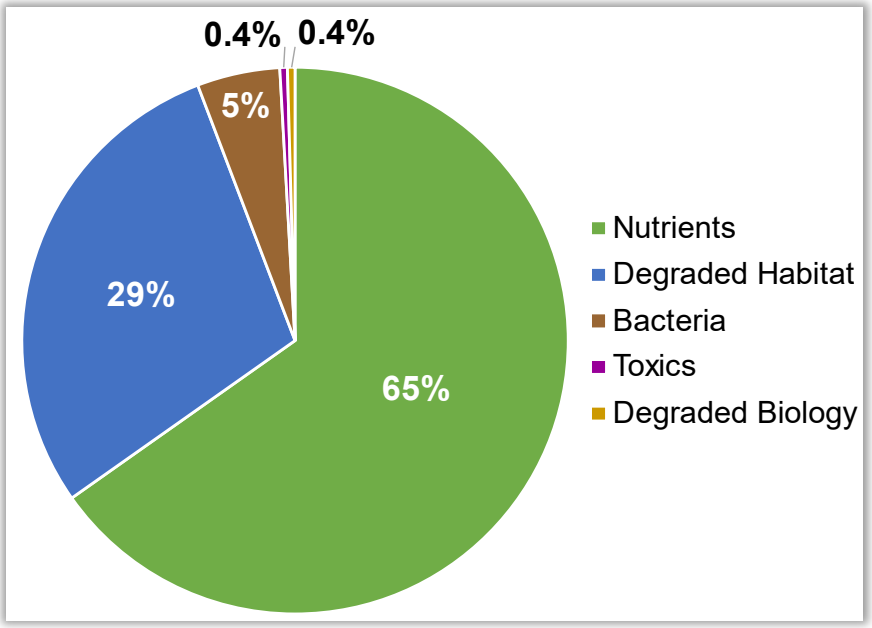


Figure 8. Types of listings on the 2024 Restoration Waters List.

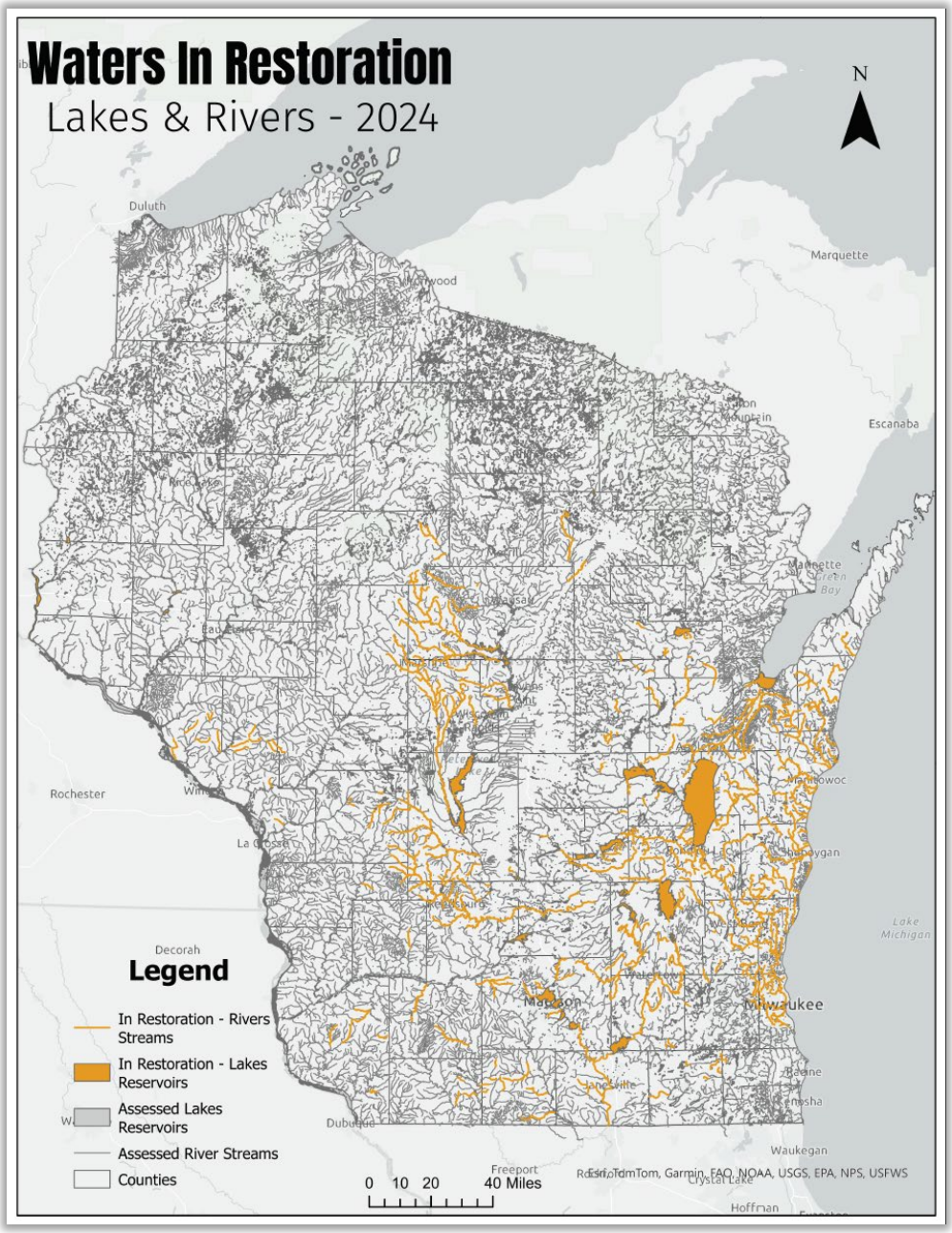


Figure 9. Location of waters on the Restoration Waters List across the state in the 2024 cycle.

New Pollutant Listings

In the 2024 assessment cycle there were 85 listings added to the Impaired and Restoration Waters Lists (Table 2). Figure 10 breaks down the listings by parameter and the available restoration plans (Nine Key Element Watershed Plan or a Total Maximum Daily Load (TMDL)). There were 8 listings with a Nine Key Element Plan, part of the Impaired Waters List. There were 16 listings that were part of existing TMDLs, making them part of the Waters In Restoration List.

The full list of new listings can be found in Appendix C.

Table 2. Number of new waterbodies and listings add during the 2024 assessment cycle.

2024 Water Condition List	# New Listings
Impaired	69
In Restoration	16

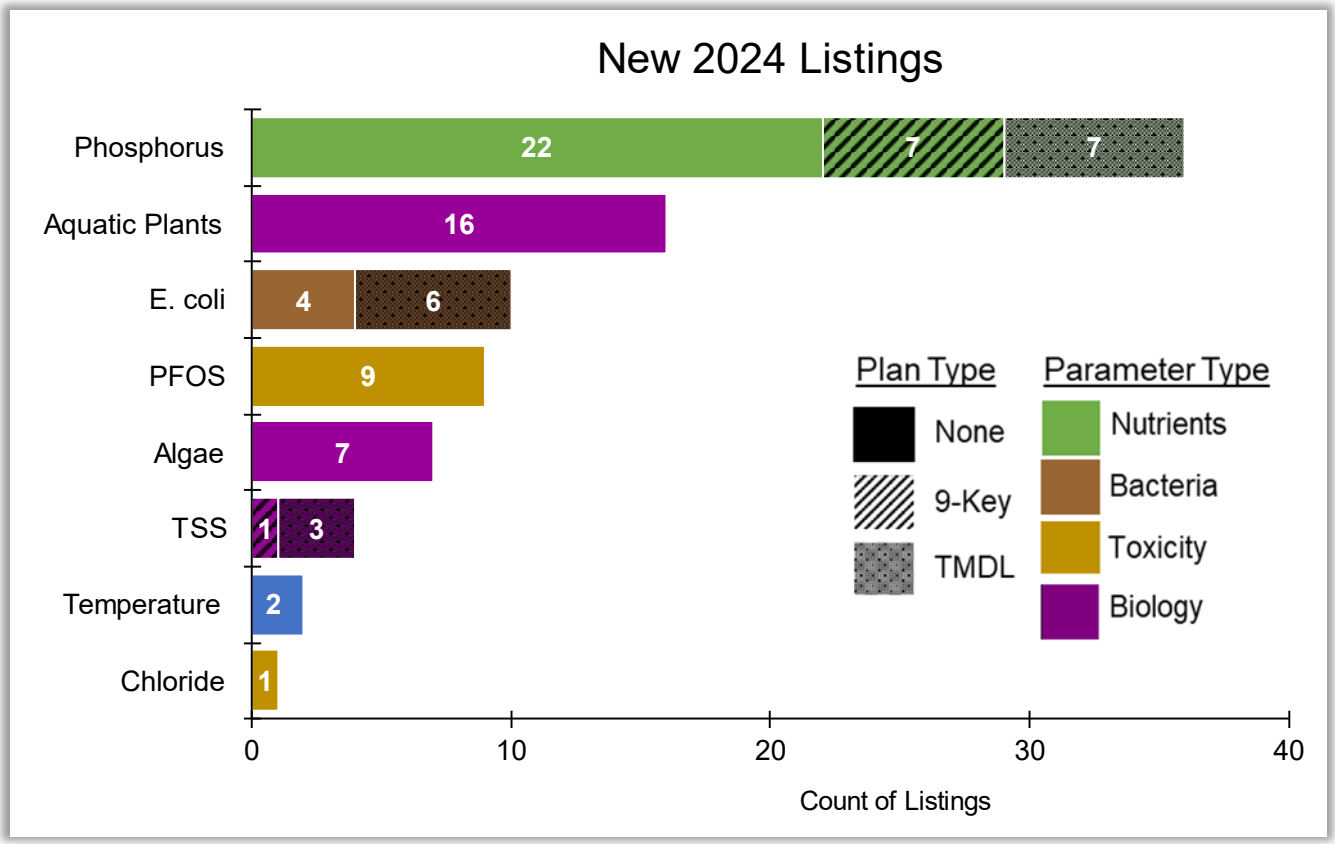


Figure 10. Number of new listings by parameter with available plan type applied.

New Listings in TMDL Areas

Sixteen of the new listings were in basins with TMDLs (Table 3). The four basin TMDLs where allocations were already sufficiently outlined for newly listed waters were the Milwaukee, Upper Fox-Wolf, Wisconsin, and the Northeast Lakeshore. Appendices were made for each basin TMDL, to outline which waters were now included and which allocations applied: Milwaukee River Basin TMDL, Wisconsin River Basin TMDL, Fox-Wolf Basins TMDL, and Northeast Lakeshore TMDL. These appendices were given to the public for comment prior to review and approval by EPA. This was the second assessment cycle where TMDL updates were included in the process.

Table 3. New 2024 listings within TMDL areas.

Waterbody Name	WBIC	WDNR AU ID	EPA AU ID	Pollutant	Impairment(s)	TMDL Basin
Kinnickinnic River	15100	9974	WI10008007	E. coli	Recreational Restrictions - Pathogens	Milwaukee River Basin
Kinnickinnic River	15100	3899425	WI10027436	E. coli	Recreational Restrictions - Pathogens	
Menomonee River	16000	6876527	WI6876528	Phosphorus	Degraded Fish Community	
Menomonee River	16000	10017	WI10026421	E. coli	Recreational Restrictions - Pathogens	
Menomonee River	16000	8104655	WI8104656	E. coli	Recreational Restrictions - Pathogens	
South 43rd Street Ditch	15900	9981	WI10000209	E. coli	Recreational Restrictions - Pathogens	
Wilson Park Creek	15200	9975	WI10000203	E. coli	Recreational Restrictions - Pathogens	
Zablocki Park Creek	5036633	3987849	WI10028282	Phosphorus	Impairment Unknown	
Barr Creek	50200	18212	WI10006211	Phosphorus	High Phosphorus Levels	Northeast Lakeshore
Horseshoe Lake	64200	9853	WI10000119	Phosphorus	Impairment Unknown	
Stony Creek	96100	10219	WI10025681	Phosphorus	Impairment Unknown	
Unnamed	5026964	3992145	WI10028615	Phosphorus	Degraded Habitat, Degraded Biological Community	Upper Fox/Wolf River Basins
Unnamed	5026964	3992145	WI10028615	Total Suspended Solids (TSS)	Degraded Habitat	
Unnamed	147700	5476567	WI10030965	Total Suspended Solids (TSS)	Degraded Habitat	
Unnamed	146900	5476590	WI10030980	Total Suspended Solids (TSS)	Degraded Biological Community	
Webster Creek	1305700	13072	WI10008112	Phosphorus	Impairment Unknown	Wisconsin River Basin

PFOS

Across the state there were several PFOS based fish consumption advisories established based on recent fish tissue sampling (Figure 11). The majority of the new 9 listings were associated with the consumption advisories for Green Bay and its tributaries, issued in January 2022. The waters were added to the Impaired Waters List due to not meeting Fish Consumption use (Table 4).

The new surface water criteria for PFOS were used for assessments; elevated PFOS were identified in Lake Monona and two segments of Starkweather Creek. These waters were already listed for PFOS, but the use Public Health and Welfare was updated to 'Not Supporting'.

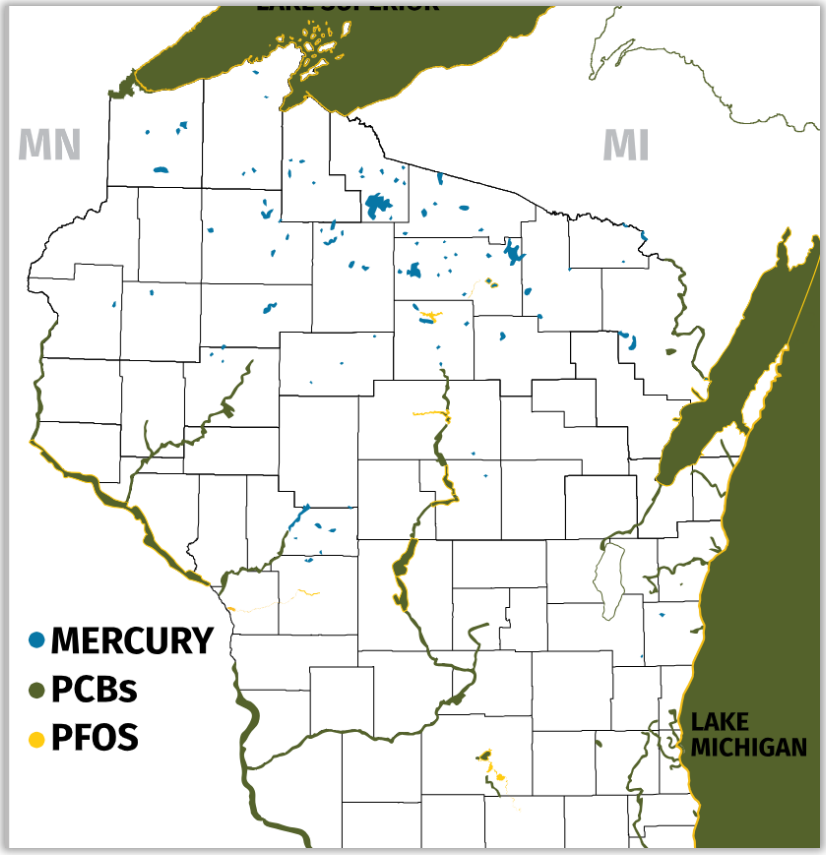


Figure 11. Fish consumption advisories for PFOS (yellow) from the 2024 – 2026 "Choose Wisely: A Health Guide for Eating Fish in Wisconsin".

Table 4. Waterbodies with new PFOS based fish consumption advisories and impairment listings.

Waterbody Name	Water Type	Counties	WBIC	WDNR AU ID	EPA AU ID
Angelo Pond	IMPOUNDMENT	Monroe	1660400	14028	WI10003029
Castle Rock Lake	RESERVOIR	Adams, Juneau	1345700	424081	WI10008631
Green Bay (GI Shoreline)	GREAT LAKES SHORELINE	Brown, Door, Kewaunee, Oconto, Marinette	70	483034	WI10008823
Oconto River	RIVER	Oconto	440200	10870	WI10000858
Oconto River	RIVER	Oconto	440200	884729	WI10008824
Peshtigo River	RIVER	Marinette	515500	884803	WI10008826
Menominee River	RIVER	Marinette	609000	12050	WI10026844
Green Bay (Inner Bay, AOC)	BAY/HARBOR	Brown	70	357876	WI10008497
Lake Mohawksin	IMPOUNDMENT	Lincoln	1515400	127977	WI10007160

Pollutant Removals

There were 38 listings removed during the 2024 cycle (Figure 12):

- Over half of the delistings were for phosphorus and the majority of those were lakes.
  - Nine lakes were delisted and placed on the Waters Attaining Standards List.
  - Five lakes remain listed for degraded biology (algae or plant community).
  - Four lakes only have a mercury listing remaining (5B).
  - One lake only has a PCBs listing remaining.
- Seven delistings were for lakes with excess algal growth without elevated phosphorus; all were added to the Waters Attaining Standards List.
- Four Great Lake Beaches, three on Lake Michigan and one on Lake Superior, met bacteria standards and were moved to the Waters Attaining Standards List.
- Two streams in the Milwaukee area were delisted for Chloride.
- One lake delisted for phosphorus was also delisted for mercury based on new fish tissue samples.

The full list of delistings is available in Appendix D.

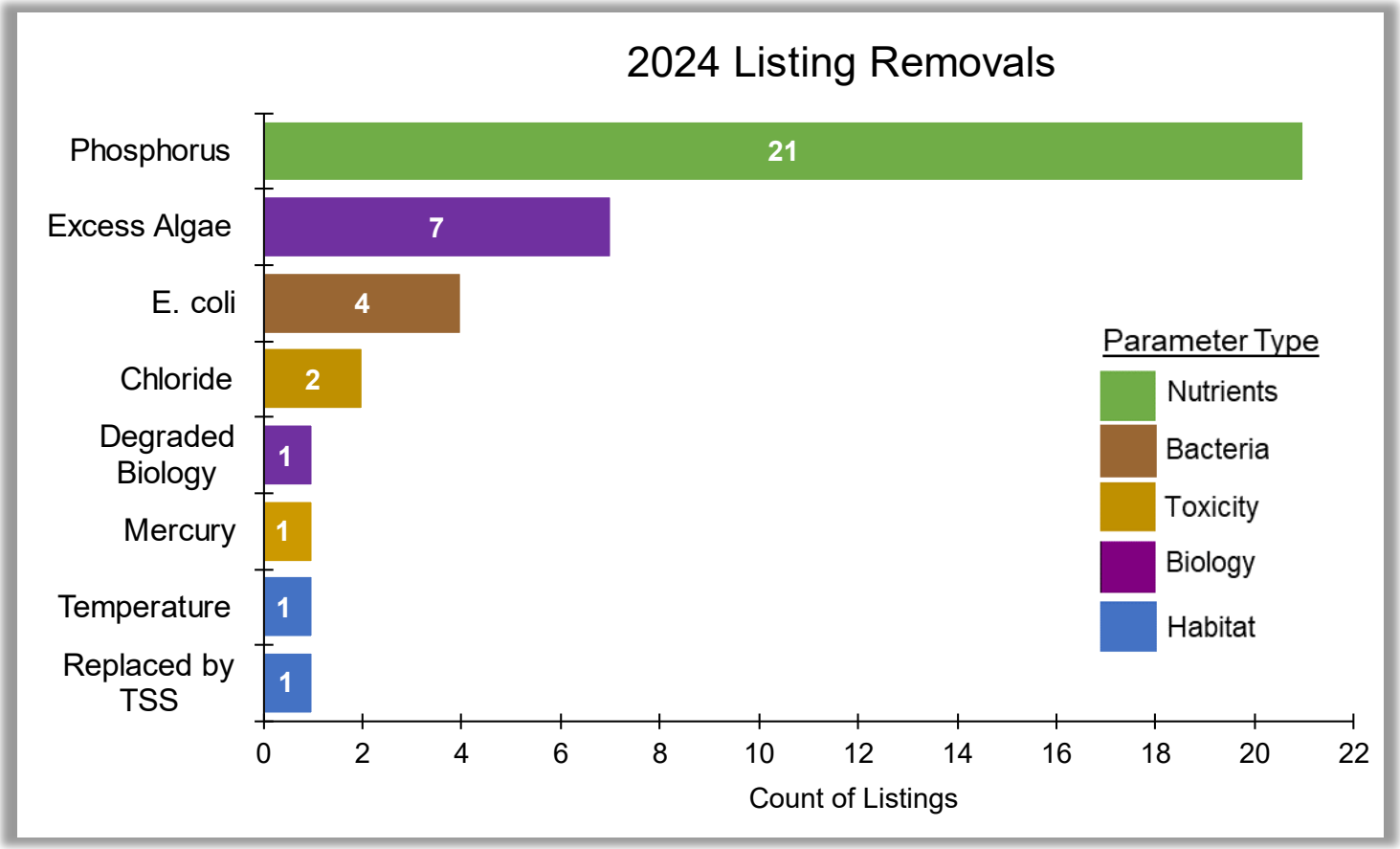


Figure 12. Listings removed in the 2024 cycle.

Dead Pike Lake, Vilas County

Dead Pike Lake (DPL) is a 308.6-acre lake in Vilas County in northern Wisconsin. The lake is bordered by private residences, the Powell Marsh State Wildlife Area (PMSWA) and Northern Highlands American Legion State Forest with state lands covering about 60% of the shoreline. Dead Pike Lake is managed through a partnership between the Dead Pike Lake Association (DPLA), the Town of Manitowish Waters, and the WDNR.

Dead Pike Lake, August 2013. Photo: Katie Hein

Dead Pike Lake was placed on the Impaired Waters List in 2016 for total phosphorus. The listing was confirmed in the 2018 cycle with even higher phosphorus levels. A management plan was finished in 2018, with the goal of reducing phosphorus and iron loading to the lake.

The mean phosphorus level has decreased since 2018, and phosphorus levels are now clearly below the criterion for the first time. Additionally, chlorophyll-a is consistently low and aquatic plant surveys from 2017, 2020, and 2021 showed plant communities in good condition. Oxygen and temperature profiles from 2020 and 2021 indicate sufficient habitat for cisco, a coldwater fish species in the lake. New water column mercury data from 2020 and 2021 and previous fish tissue data showed that mercury levels also attain criteria. Though high iron and manganese have been found in the lake, toxicity tests in 2017 did not find negative impacts on aquatic organisms.

Based on this new and existing information we can conclude that Dead Pike Lake is supporting all of its uses: Aquatic Life, Recreation, Public Health and Welfare, and Wildlife. The delisting of phosphorus and support of all uses changes the lake's categorization from 5A (Impaired Waters) to Category 1, the highest condition possible on the list of Waters Attaining Standards. Dead Pike Lake is the first to be placed in this category for the state.

Kentuck Lake, Forest and Vilas Counties

Kentuck Lake, in the Brule River Watershed, is a 1,001-acre lake that falls in Forest and Vilas Counties. Volunteers have been collecting annual water quality data since 1986 and WDNR's long term trend monitoring has been collecting data since 1988. Kentuck Lake was originally placed on the state's Impaired Waters List in 1998 due to mercury concentrations in fish tissue. Phosphorus and excess algal growth listings were added in 2014. The lake had elevated phosphorus every two-year assessment cycle from 2014 to 2022 stemming from poor water quality in 2011, 2013, 2015 and 2016. The Kentuck Lake Protection & Rehabilitation District, with a WDNR grant and a consultant group, created the Kentuck Lake Comprehensive Management Plan in 2015. The goal of the lake management group and the plan was to consider the resource as a whole ecosystem, rather than solely a recreation resource.

The lake has been in a clear water state and meeting phosphorus and chlorophyll water quality standards for aquatic life (AL) use since 2017. Along with lower phosphorus levels, the lake is being managed for a strong

walleye population under a joint WDNR-Tribal management plan. This has led to a food-web effect of increasing large Daphnia zooplankton in the lake, which graze on algae and thereby reduce algae levels. This has led to better water clarity and a great improvement and expansion of the aquatic plant community. Additionally, fish tissue samples taken in fall of 2023 had low enough mercury levels to warrant removal of the specific fish consumption guidance and delisting of the mercury impairment.

Kentuck Lake. Photo: http://www.kentucklakedistrict.org/index.php/photos/

As a result of these successful management efforts, in the 2024 cycle the impairment listings are being removed for phosphorus, eutrophication, excess algal growth, organic enrichments, mercury, and mercury in fish tissue. This moves it from Category 5A (Impaired Waters) to Category 2A, reflecting that it is attaining all the uses it has been assessed for (Aquatic Life, Recreation, and Public Health and Welfare). Ongoing monitoring will continue to document trends into the future.

Public Participation

Kayaking and canoeing with family, 2018

The Clean Water Act depends on public involvement and Wisconsin lakes and rivers are public resources, owned in common by all Wisconsin citizens. Throughout the process of assessing and addressing water quality problems there are many opportunities for public comment, including input on proposed water quality standards, updates to the impaired waters listings, and TMDL creation. In Wisconsin, citizen-based monitoring data are used in water quality assessments if minimum data requirements are met, and there are several opportunities for citizens to volunteer.

Monitoring

Citizens provide a vital resource for gathering water quality data all across the state of Wisconsin. There are multiple programs available for training and monitoring through the WDNR, University of Wisconsin, and environmental groups.

Citizen Lake Monitoring Network (CLMN)

Wisconsin's Citizen Lake Monitoring Network (CLMN) provides a bond between the Wisconsin Department of Natural Resources, University of Wisconsin Extension Lakes Program, and about 1,000 volunteer citizens. WDNR and Extension staff provide training, support and equipment, and cover the cost of laboratory analysis of water samples. CLMN volunteers enter their own data into a statewide database, which automatically generates public-facing, annual summary reports for each lake.

In 2023 volunteers gathered monitoring data for 1,031 distinct sites.

Starting with just over 100 volunteers in 1986, CLMN participants collected water clarity data on around 100 lakes. Participation has trended upward since then, and many additional parameters have been available to volunteers. Volunteer responsibilities range from simple bi-weekly water clarity readings to more frequent monitoring of clarity, total phosphorus, chlorophyll-*a*, water temperature profiles, dissolved oxygen, aquatic invasive species, and more.

In 2023, 862 CLMN volunteers had entered their data into the database as of December 4th, 2023. The Citizen Lake Monitoring Network requests that data be entered by November 1st,

but data tend to come in through early spring of the following year for various reasons. Data was entered for 1,031 distinct monitoring sites in 2023, with water clarity data being the most common. Over 500 volunteers also collected data on total phosphorus, chlorophyll-A, and temperature profiles. Wisconsin is very lucky to have such a devoted network of volunteers partnering with the WDNR to monitor conditions on our lakes to provide a wealth of assessment data.

CLMN chemistry volunteers (who collect phosphorus, chlorophyll-A, temperature, and clarity data) follow strict protocols to ensure consistency and high-quality data. About 10% of them are selected annually for extra Quality Assurance sampling. Through this robust QA/QC program, we are able to proudly demonstrate the impressive quality and reliability of our volunteers' work.

Sampling Wisconsin's waters.

The Citizen Lake Monitoring Network embraced the world of digital training media in 2022-2023, greatly expanding the creation of demonstration videos to recruit and train volunteers. The CLMN video series is available on YouTube and on our program website, and walks volunteers through everything from creating a database login name to collecting measurements and water samples to retrieving a data report to share with their friends and neighbors. In-person training on monitoring protocols is still the standard for new volunteers, but the video series is useful to refresh volunteers on protocols and details after a long winter season.

Table 5. 2022 and 2023 Citizen Lake Monitoring Network participation.

	Total Volunteers	Lakes	Sites	Clarity Volunteers	Chemistry Volunteers	AIS Volunteers	Ice Volunteers
2022	944	733	~1000	758	595	55	146
2023*	862	738	1,031	758	500	41	115
**Reported data still incomplete as of this report publication.							

Water Action Volunteers (WAV)

Volunteers monitor nearly 600 stream sites each year.

Participants in the Water Action Volunteers (WAV) volunteer stream monitoring program range far and wide across the state of Wisconsin. WAV is a collaboration of the WDNR and the University of Wisconsin–Madison Division of Extension. The participatory science program relies heavily on partnerships with local WAV coordinators at participating organizations to help recruit, train and support volunteers in their local area on the WAV methods. Since its founding in 1996, volunteers have collected data in all 72 counties. In 2023, WAV supported over 600 volunteers and 41 partner groups in stream monitoring statewide.

Sue Ristow assisting with WAV youth education.

Baseline Monitoring

Volunteers enter the WAV program by training to do baseline stream monitoring. Each year, baseline volunteers journey to their monitoring sites once per month from May to October to collect four baseline parameters: dissolved oxygen, instantaneous temperature, transparency, and streamflow. During at least two of these months (May/June and September/October), volunteers also collect macroinvertebrates to calculate a biotic index score. Once per season, some advanced volunteers also conduct a habitat assessment. In 2023, volunteers collected this baseline data at 489 unique monitoring sites.

Special Projects Monitoring

After at least one season of baseline monitoring, some WAV volunteers will support special projects monitoring. Special projects monitoring is designed to either use the same methods as WDNR professionals for data collection or to meet specific data needs. Recently these special projects have included monitoring with meters, aquatic invasive species monitoring, nutrient monitoring, and deploying continuous temperature monitors.

Nutrient monitoring is the most widespread of the special projects. Volunteers sample for total phosphorus concentrations in rivers and streams. In some instances, volunteers also collect suspended solids samples and/or nitrogen panels. These samples contribute to follow-up monitoring, Local Needs Projects, Nine Key Element Projects, TMDL area monitoring, and Targeted

Watershed Approach Projects. In 2023, volunteers coordinated by WAV and local partners collected nutrient samples at over 215 sites across the state. This monitoring included not only WDNR projects but also projects for businesses, watershed groups, and counties extending from Trempealeau to Waukesha and beyond.

Volunteers also assist in deploying continuous temperature monitors, called thermistors. Temperature affects oxygen availability and demand, and it can predict the types of organisms able to survive in a stream. Each season volunteers with WAV and partner organizations deploy and monitor thermistors at over 90 sites.

AIS Snapshot Day

University of Wisconsin-Madison Division of Extension, in partnership with UW Extension Lakes and WDNR, hosts a joint lake, stream, and wetland invasive species Snapshot Day. This event organizes citizen scientists around the state to monitor priority bridge-stream crossings, boat landings and roadsides/trails for AIS of concern on a given day in August.

In 2023, 145 participants visited 131 sites. Aquatic invasive species were reported at 83 (just over 63%) of those sites.

Volunteers are critical to many of WDNR's monitoring efforts, whether they participate for one day or several years!

Purple Loosestrife Biocontrol

Biocontrol of Purple Loosestrife (*Lythrum salicaria*) utilizing beetles of the *Galerucella* species has taken place in WI since 1994, resulting in major reductions in the populations of this invasive wetland plant across Wisconsin. The program is coordinated by UW Madison Extension's AIS Program under a WDNR contract. Each year, participants include private cooperators, non-profits and their volunteers, County AIS staff, and WDNR staff who rear 500,000-750,000 beetles and release them in wetlands, along riparian sites, and in disturbed wet locations, such as roadside ditches.

Galerucella *species beetle on the tip of a person's finger. Photo by Andrew Teal. 2023.*

Beetle rearing enclosures. Photo by Andrew Teal, 2023.

Lake Monitoring Protection Network for Aquatic Invasive Species

The Lake Monitoring Protection Network (LMPN) program was developed to provide stable funding to counties and ensure statewide coverage for AIS work. This program transformed an unpredictable, competitive grant process into a consistent funding model dividing approximately $1 million to the 72 counties of our state. Counties can now rely on non-competitive funding from year to year to perform core network activities.

A few of these activities include:

- Citizen Lake Monitoring Network (CLMN)
- Early detection monitoring for aquatic invasive species
- Participating in the Clean Boats, Clean Waters (CBCW) Program
- Participating in the Purple Loosestrife Biocontrol program
- Participating in other aquatic invasive species prevention campaigns and lake protection activities as approved by the Department

Wisconsin's Aquatic Invasive Species Management Plan takes a proactive prevention approach by addressing the "Pathways", which are the ways AIS can enter and move throughout the state. The LMPN partners are a major component in this type of work by educating dock service providers, monitoring pet stores, and reaching out to pond and wetland gardeners regarding AIS.

In the first year of LMPN (2021) approximately 40 counties participated, and in 2024 we have 69 counties involved. The LMPN model is evaluated each year to note what's working and what's not quite there, yet. The Department and program (CBCW, Snapshot Day, etc.) leads are examining the model to identify improvements and new tools that could increase program success. Input from our LMPN partners is also welcome and important to the process.

The LMPN partners have significantly and successfully increased AIS monitoring efforts throughout the state. Under the competitive grant model, we had counties where no one was performing AIS monitoring consistently. At that time the partners performed and led approximately 210 monitoring events, which included early detection monitoring and leading citizen monitoring through events such as AIS Snapshot Day. In 2023, through the LMPN program there was 90% statewide coverage, and incredibly the LMPN partners performed and led 547 monitoring events. That is half of the statewide monitoring events that occurred!

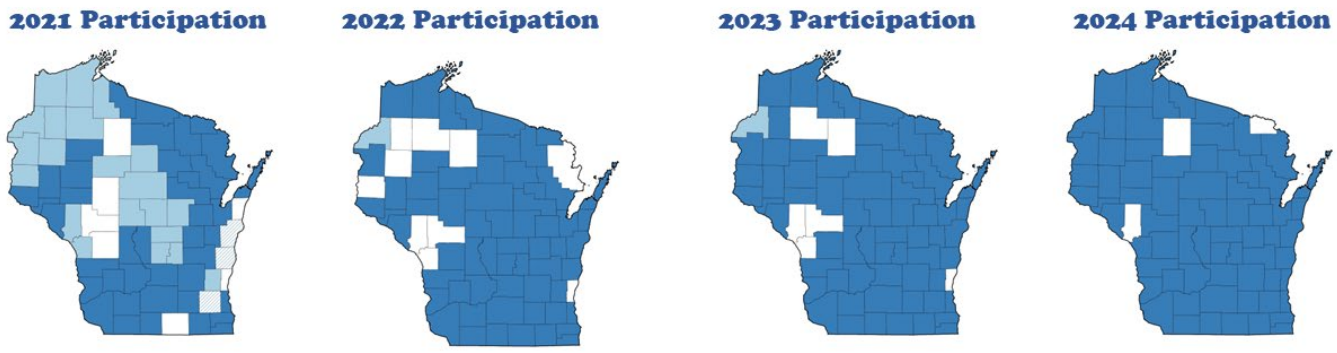


Figure 13. Maps showing the increased participation in the LMPN program from 2021 to 2024. Counties in dark blue are those participating in the LMPN program. Counties in light blue are those that participated in the previous grant program.

Public Data Solicitation

The Clean Water Act asks that all readily available data are used to assess a state's water quality. Before the assessments are done the WDNR sends out a request for water quality data. During the 2024 cycle there were four entities that submitted data (see Data Used for Assessments section for specifics):

- Taylor County Land Conservation Department (LCD)
- Milwaukee Riverkeeper
- Friends of Hika Bay (FOHB)
- Courte Oreilles Lake Association (COLA)

Collecting a dissolved oxygen sample. Photo: Toben Lafrancois, 2018

Public Comment Periods

Public comments were sought during multiple points of the assessment process. These included updated assessment methods, Wisconsin Consolidated Assessment & Listing Methodology (WisCALM) 2024 Draft, January 12 – February 24, 2023, and the draft 2024 water condition lists, November 6 – December 6, 2023. A full summary of list comments and WDNR responses can be found on the WDNR webpage (dnr.wi.gov).

The Department considers all comments received before it finalizes the waterbody assessments and listings.

Monitoring, Restoration & Protection

Indian Slough, Pool 4, Mississippi River *Photo: Sara Strassman 2020*

Monitoring and restoration work are on a continuous cycle. Monitoring and restoration for the 2024 cycle were guided by the:

- 2021 – 2025 Wisconsin Water Quality Monitoring Strategy;
- 2013 Nutrient Reduction Strategy and its progress reports; and the
- Draft 2022 – 2032 Water Quality Restoration and Protection Prioritization Framework

Total Maximum Daily Loads (TMDLs)

The most recently approved basin TMDL was the Northeast Lakeshore TMDL in October 2023. The listings associated with this TMDL were categorized as having a restoration plan (Category 4) in the 2024 Water Condition Lists. Work is ongoing on Wisconsin's next projects which include the Fox-Illinois Basin TMDL and the Lake Pepin TMDL and finalizing Wisconsin's draft 2022 – 2032 Water Quality Restoration and Protection Prioritization Framework (Vision 2.0).

Fox Illinois TMDL

Located in Southeast Wisconsin, this TMDL will cover TSS and phosphorus impairments in the Fox (IL) River, the Des Plaines River, and other smaller basins in the region. River, stream, and lake impairments will be addressed. A multi-year monitoring and data collection effort for the TMDL development process has been completed, and watershed modeling is underway. Stakeholder groups are currently being assembled to provide input and allow for a robust stakeholder process throughout the development process. In addition, the WDNR has evaluated the potential impact of downstream TMDLs located in Illinois immediately south of the Wisconsin border. The Fox River flows into a series of lakes in Illinois that are both listed as impaired for

Des Plaines River near Highway K crossing.

phosphorus and have criteria lower than that of the Fox River and thus must be factored into the TMDL analysis. WDNR is targeting the end of 2025 as a completion date for the TMDL.

Lake Pepin TMDL

Located along the Mississippi and above Lake Pepin, this TMDL will address sediment, TSS, and phosphorus reductions needed to meet water quality criteria for contributing waterbodies and targets for Lake Pepin itself. In reviewing the TMDL for Lake Pepin, recently submitted by Minnesota Pollution Control Agency (MPCA) and approved by EPA, WDNR found anomalies in allocations and loadings for the watersheds in Wisconsin that necessitate an update to the analysis. WDNR is incorporating the necessary wasteload allocations identified in the MPCA TMDL and refining the load allocations and reductions that are vaguely laid out in MPCA's TMDL to cover the Wisconsin portion of the Lake Pepin drainage basin. Currently, WDNR is working with an EPA funded contractor to refine the load allocations, develop edge of field targets to aid agricultural implementation, and identify critical areas and fields that could be prioritized for nonpoint implementation. It is expected that this work will be completed in 2023 with the goal of submitting a TMDL to the EPA in 2024 as part of Wisconsin's Bridge Metrics and Commitments to the EPA.

Lake Pepin at sunset.

St. Louis River Watershed and Estuary TMDL

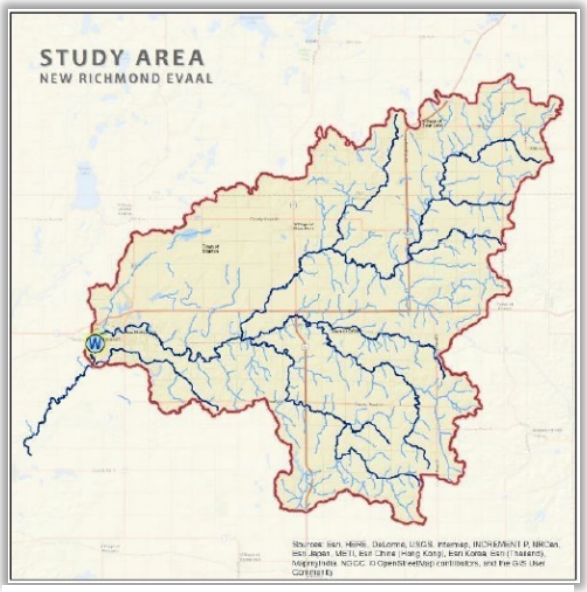
WDNR is providing technical support and modeling review to MPCA for the development of a mercury TMDL for the St. Louis River and Estuary. The TMDL will determine the mercury reductions needed for lakes and rivers in the St. Louis River watershed to meet the water quality standard for mercury and support healthy consumption of fish. Mercury is toxic to humans; people can be exposed when eating fish pulled from waters with mercury contamination. The MPCA is undertaking this TMDL study for many reasons, including the cultural and economic importance of fishing in the watershed and the exercise of tribal treaty rights. The St. Louis River forms part of the border between Minnesota and Wisconsin and both states have a shared interest in addressing the mercury impairments.

St. Louis River Estuary Source: St. Louis River Alliance

Adaptive Management

The new plan for New Richmond targets a total phosphorus reduction of 2,300 lbs/year.

Adaptive management is a phosphorus compliance option that allows point and nonpoint sources (e.g. agricultural producers, storm water utilities, developers) to work together to improve water quality in those waters not meeting phosphorus water quality standards. This option recognizes that the excess phosphorus accumulating in our lakes and rivers comes from a variety of sources, and that reductions in both point and nonpoint sources are frequently needed to achieve water quality goals. By working in their watershed with landowners, municipalities, and counties to target sources of phosphorus runoff, point sources can minimize their overall investment while helping achieve compliance with water quality-based criteria and improve water quality.



New Richmond's adaptive management action area encompassing the Willow River Watershed.

Throughout the 2022-2023 biennium, 21 Wisconsin Pollutant Discharge Elimination System (WPDES) permittees continued to implement adaptive management efforts in their local watersheds. WDNR approved one new adaptive management plan, in 2022, led by the City of New Richmond. The plan commits to a total phosphorus reduction of 2,300 pounds/year to be achieved within four WPDES permit terms. This magnitude of nonpoint source reduction is estimated to be sufficient to achieve the phosphorus criterion in the Willow River. Phosphorus reductions will be achieved via streambank stabilization, harvestable buffers, and barnyard practices installed at prioritized high-loading sites. Partners include the Saint Croix County Land Conservation Department, Trout Unlimited – Kiap TU Wish Chapter, and the Dry Run Farmer Led Group.

All permittees engaged in adaptive management monitor the receiving water to track implementation progress, which is reflected in monitoring requirements found in the WPDES permit. New partnerships between municipalities, agricultural producers, and environmental organizations have formed around adaptive management, as common restoration interests bring resources to the table to achieve common goals.

Water Quality Trading

A total of 13 plans were approved, many focusing on streambank stabilization.

Water Quality Trading (WQT) may be used by WPDES permit holders to demonstrate compliance with water quality based effluent limits . Generally, water quality trading involves a point source facing relatively high pollution reduction costs compensating another party to achieve a less costly pollution reduction with the same or greater water quality benefit. In other words, water quality trading provides point sources with

Cow in a state river.

the flexibility to acquire pollutant reductions from other sources in the watershed to offset their point source load so that they will comply with their own permit requirements. In Wisconsin, stringent phosphorus and TSS limits drive interest in WQT. Agricultural sources of phosphorus and TSS are prevalent in many Wisconsin watersheds. As such, the majority of trades involve nonpoint source pollutant reductions.

Statewide, WPDES permittees and their consultants are gaining experience in establishing relationships with credit generators, quantifying nonpoint source pollution offsets, and executing projects in tandem with permit deadlines. At the conclusion of 2023, over 70 permittees formally indicated that WQT will be used to comply with phosphorus limits. Of these, 59 permittees have submitted an approvable water quality trading plan to WDNR. During the 2022-2023 biennium, 13 new water quality trade plans were approved.

In March of 2023, the Wisconsin Department of Administration formally selected a third party to operate the state's first water quality trading clearinghouse, as authorized under s. 16.9685, Wis. Stats. The Clearinghouse is intended to serve as a hub for credit generators and buyers to facilitate water quality trading amongst more parties. The Clearinghouse entity, Wisconsin Clearinghouse LLC, has created an online portal to display available credits and handle transactions.

Nature Preserve. Photo: Katherine Murray, 2016

Projects designed to reduce nonpoint source pollution for WQT purposes provide several ancillary benefits. A commonly employed WQT practice, conversion of fields from high-intensity agriculture to perennial prairie vegetation, may also provide atmospheric carbon sequestration, habitat for insects and wildlife, and improve hydrology. Pollutants other than the traded pollutant, such as nitrogen and sediment, may also be kept from entering waterways. Projects occurring in years 2022 and 2023 restored hundreds of acres of perennial vegetation and resulted in adoption of lower-impact agricultural practices (e.g. cover crops, no-till, or nutrient management). Nine water quality trades restored eroding streambanks, stabilizing over three miles of streambank in total. In-stream habitat benefits also stem from WQT practices, particularly those that reduce sediment loading to waterways. Several WQT projects employed in-stream habitat restoration practices to further mitigate the effects of excess sediment in the system.

The provisions of all water quality trades are incorporated into the discharger's WPDES permit, with a monthly accounting process for the use of pollutant credits. All nonpoint source best management practices are inspected regularly and conform to a NRCS or WDNR performance standard. Many wastewater dischargers throughout Wisconsin look to WQT for long-term compliance solutions. These nonpoint source pollution control efforts leverage new partners and funding to address runoff issues.

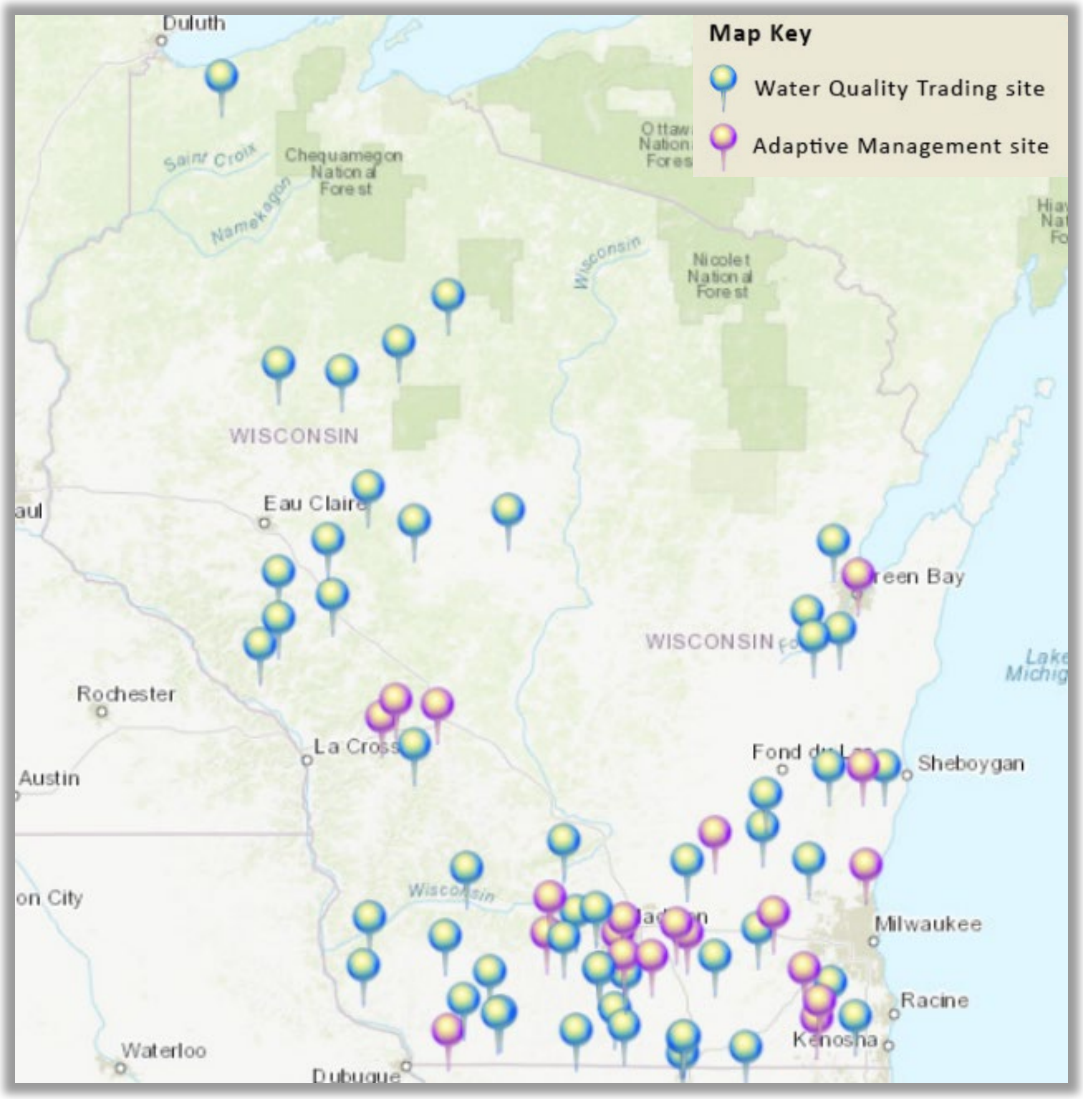


Figure 14. Locations of Adaptive Management Plans and Water Quality Trading sites across the state as of 2023.

Water Quality Management Planning & Watershed Assessments

Wisconsin's water quality management planning program continues the tradition of Clean Water Act plans from the early 1970s that identified priorities for federal funding under the State Revolving Grant Program. Local water quality planning is integrated with Targeted Watershed Assessment (TWA) monitoring projects and statewide initiatives like Healthy Watersheds, High-Quality Waters (HWHQW).

New in 2022: Healthy Watersheds, High-Quality Waters (HWHQW) – a statewide initiative to protect the Wonderful Waters of Wisconsin

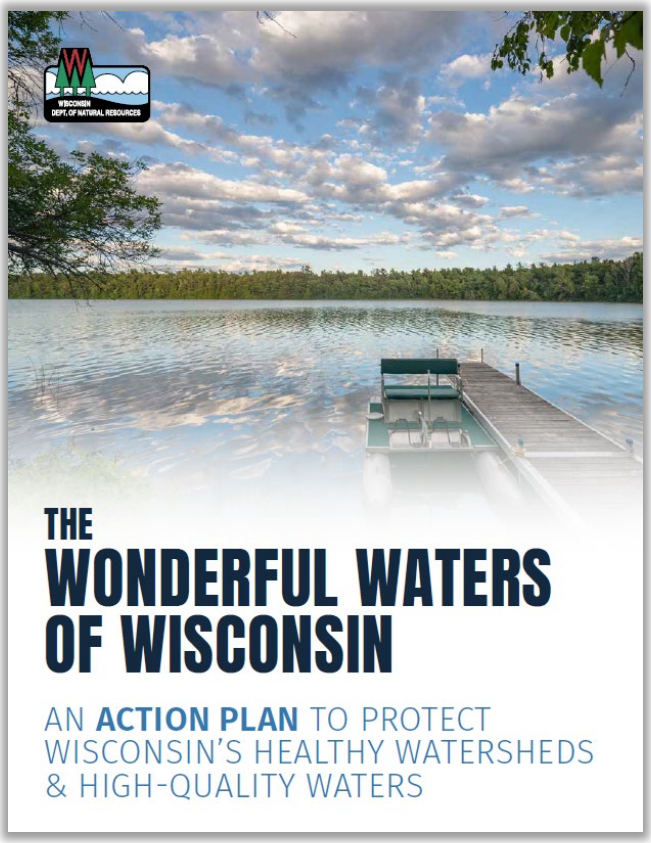
Targeted Watershed Assessments

Targeted Watershed Assessment Projects often inform regional Nine Key Element Plans and river and lake grant priorities. County conservation agencies and local coalitions work with the WDNR to identify areas with impaired waters, and in recent years, HWHQW watershed protection priorities. Areas with runoff grants that fund best management practices are a high priority for WDNR monitoring of pre- and post-installation of best management practices (BMPs) to provide science-based "snapshots" of resource condition before and after restoration activities. Water Quality Plans conducted pre-implementation may recommend specific BMPs that would address conditions found on the landscape.

Healthy Watersheds, High-Quality Waters

Healthy Watersheds, High-Quality Waters provides a road map for how to strike an improved balance between restoration and protection, all while emphasizing and celebrating the Wonderful Waters of Wisconsin. The Healthy Watersheds, High-Quality Waters Action Plan, launched in spring 2022, includes the actions suggested by a majority of partner groups, including businesses, lake, river, and watershed groups, local units of government, and fish and wildlife conservation organizations. Partners will work together through 2030 to implement specific strategies with a goal of keeping 100% of the watersheds prioritized for protection, and the high-quality waters within them, healthy.

The 2023 Progress Report describes accomplishments during year one of this exciting initiative. Ongoing Action Plan implementation efforts include linking HWHQW to monitoring projects and local and regional planning efforts, creating alternative watershed-based planning guidance for protection, and expanding grant funding eligibility and review/ranking criteria for HWHQW projects.



Wisconsin's Action Plan to keep 100% of the watersheds identified as priorities for protection--and the high-quality waters within them—healthy through 2030.

Great Lakes

In the WDNR Office of Great Waters (OGW) the Great Lakes team is responsible for implementing the Areas of Concern, Lakewide Action and Management Plans, and Beach programs. For a full review of the responsibilities and objectives for the Great Lakes see our Wisconsin's Great Lakes Strategy (PDF, 1.46 MB).

Trees on the Rocks, Big Bay State Park, Lake Superior. Photo: Norma Larrabee Gabriel 2017

Lakewide Action and Management Plans (LAMPs)

The development of Lakewide Action and Management Plans (LAMPs) is required under Annex 2 of the Great Lakes Water Quality Agreement Protocol of 2012, which is a commitment between the United States and Canada to restore and protect the waters of the Great Lakes. The LAMP provides the framework for prioritizing issues, defining lakewide objectives, and identifying actions for each of the five Great Lakes. The LAMP is comprehensive and Wisconsin's Great Lakes restoration and protection projects contribute to meeting LAMP goals for Lake Michigan and Lake Superior.

Wisconsin has made significant progress on LAMP goals thanks in part to resources available through GLRI. Through GLRI Focus Area 4 grant opportunities from EPA, the State of Wisconsin along with partners has secured over $10 million in grant funds since 2016 which is being used to protect or restore over 12,000 acres of coastal wetland and other critical habitat.

Lake Superior Management

Wisconsin is included in a partnership with the U.S. and Canada to share responsibility for Lake Superior management. WDNR's Lake Superior Binational Program Coordinator and other staff from WDNR's Office of Great Waters contributed to the development of the 2020 Lake Superior LAMP. An updated Lake Superior LAMP is anticipated to be released in the coming years.

A recently completed project on Interstate Island in the St. Louis River between Duluth and Superior restored critical nesting habitat for Common Terns and stopover habitat for Piping Plovers—helping to increase populations of these rare birds in the St. Louis River Area of Concern. Photo: J.F. Brennan Company, Inc.

The LAMP lays out a five-year binational strategy for taking action to restore and protect the Lake Superior ecosystem. This plan

supports the development and implementation of lake-specific strategies and initiatives including biodiversity, cooperative science and monitoring, and nutrient management strategies. For more information, also refer to the Lake Superior LAMP Annual Reports, which highlight accomplishments and progress in achieving LAMP goals during the past year.

Lake Michigan Management

The Lake Michigan LAMP is currently being developed and is anticipated to be released in the coming 1-2 years. Other current activities include assessing the state of the lake, measuring progress, and promoting action to address identified problems. For more details, see the Lake Michigan LAMP Annual Reports. They highlight accomplishments and progress in achieving LAMP goals during the past year and identify LAMP-related activities including outreach, monitoring, and protection and restoration actions.

Areas of Concern

Forty-three Areas of Concern (AOCs) were designated by the U.S. and Canada under the Great Lakes Water Quality Agreement in 1987. They are areas requiring special attention for cleanup and restoration due to contamination of sediments by toxic pollutants from past industrial practices or other pollution sources. In the Areas of Concern program, problems arising from toxic pollution are described as "beneficial use impairments" or BUIs.

Wisconsin had five AOCs at the time of designation: St. Louis River (shared with Minnesota), Lower Menominee River (shared with Michigan), Lower Green Bay and Fox River, Sheboygan River, and Milwaukee Estuary. Lower Menominee River was delisted in 2020 and now Wisconsin has four active AOCs. The WDNR's Office of Great Waters provides leadership for cleaning up these areas by:

- Developing policies and procedures for removing BUIs and delisting AOCs.
- Establishing Beneficial Use Impairment (BUI) delisting targets; assessing the status of the AOCs relative to the targets (e.g., evaluate data); and identifying and implementing actions that will lead to achievement of the targets if they have not yet been met.
- Engaging technical experts and citizens via communication, education, outreach, and/or advisory committees to ensure the consideration of diverse stakeholder perspectives in AOC decision-making.
- Ensuring that partners (internal and external) who are involved in sediment clean up, habitat restoration, and water quality and ecosystems monitoring for the AOCs are coordinating as needed to ensure proper sequencing of activities and taking advantage of efficiencies (e.g., sharing data) where possible.

WDNR has developed Remedial Action Plans for each of the active Wisconsin AOCs, and they are updated periodically. These plans describe the beneficial use impairments, the end goals for each impairment, the projects needed to achieve those goals, as well as current and future activities. Opportunities are provided for AOC stakeholders and partners to review drafts of the Remedial Action Plans and to provide feedback in the update process.

The OGW maintains webpages for each of the five AOCs containing background about each AOC, details on the status of beneficial use impairments, remedial action plans, community engagement, projects, maps, and resources. For detailed information about these AOCs, visit their webpages:

- Lower Green Bay and Fox River
- Lower Menominee River
- Milwaukee Estuary
- St. Louis River
- Sheboygan River

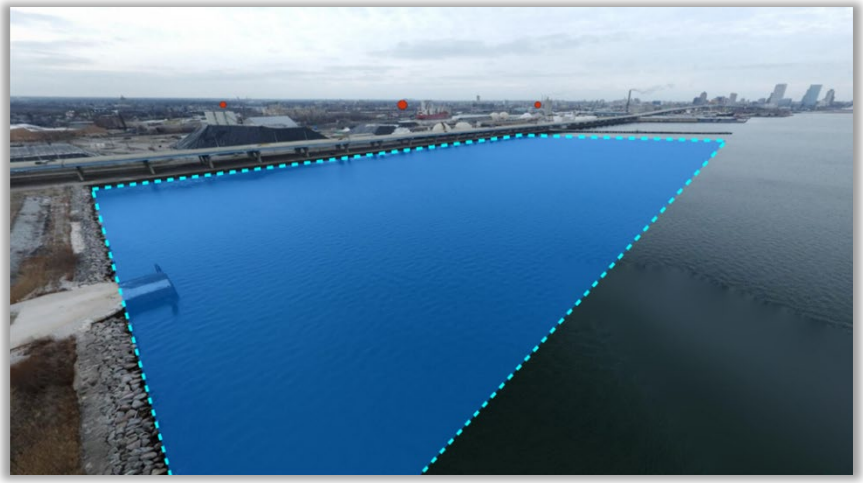
Notable accomplishments for the Great Lakes Areas of Concern in this reporting period include the following:

Fish monitoring collection on the Lower Fox River. Photo: The Boldt Co.

In 2022, the *degradation of aesthetics* BUI was removed in the **Lower Green Bay and Fox River AOC**. Furthermore, post-remedial long-term trend monitoring of the Lower Fox River indicates that measurable improvements are already being documented. Monitoring trends show water quality has greatly improved with over 80% reduction in PCB concentration in Little Lake Buttes de Morts, and sport fish have also shown significant reductions as well. Monitoring will continue until the sediment, water, and fish recovery goals have been met to ensure that all actions to address contamination in the river are protective. At this time, the entire lower river is trending towards recovery, and it is expected that future monitoring will continue to show measured improvements and risk reduction in the Lower Fox River ecosystem.

Remediation projects in the **Milwaukee Estuary AOC** are moving at unprecedented speed due to finalizing critical cost-share components necessary for the restoration of this AOC.

In spring of 2021, the non-federal project sponsors— the WDNR, Milwaukee Metropolitan Sewerage District (MMSD), the City of Milwaukee, Milwaukee County Parks (MCP), and We Energies (WEC)— executed the *NFS Funding Contribution Agreement* that define contributions, roles, and responsibilities for the NFS portion of the project agreement (PA) signed in early 2020. These financial commitments have paved the way for the full development and construction of a Dredged Material Management Facility (DMMF), the most critical component for a cost-effective sediment remedial strategy for the AOC. Construction of the DMMF is scheduled to begin in spring 2024 and will take an estimated two years to complete. This new facility will be located adjacent to the current dredge material disposal facility at Jones Island. The new DMMF will be 42-acres in size and is designed to hold roughly 1.9 million cubic yards of contaminated sediments from Milwaukee's waterways as part of the AOC cleanup. The proximity of this managed disposal facility to the river and harbor work zones will significantly reduce cleanup costs and reduce truck traffic, transport accident risk, and carbon emissions.



Dredged Material Management Facility Location & Footprint for the Milwaukee AOC. Photo: Ramboll & MMSD

In-river cleanup of manufactured gas plant (MGP) waste in Milwaukee's "Third Ward" area was led by We Energies and was completed in late 2023. This was the first project to be completed as part of the GLLA agreement. We Energies will be starting design in 2024 for remediation of coal tar waste in the Solvay Car Ferry Slip on the Kinnickinnic River.

Another successful project in the Milwaukee River AOC is the Kletzsch Dam Repair and Fish Passage project, which reached substantial completion in December 2023. The fishway is now open and will allow native fish species, such as Lake sturgeon, Northern Pike, and Smallmouth Bass to reach 25 miles of the river north of the dam, 29 miles of tributary streams that feed into the river and 2,400 acres of wetlands – reconnecting river habitats and allowing the fish to migrate throughout the region.

Not only are fish habitat and river connectivity being improved in the AOC, but also habitat for important wildlife focal species. Restoration work continues in portions of the Little Menomonee River Parkway, which totals roughly six miles of river and over hundreds of acres of Milwaukee County Parks property. This work will continue throughout the parkway for the foreseeable future.

Milwaukee River Third Ward MGP Cleanup Project.

Kletzsch Dam Repair and Fish Passage project. Photo: Resolution Studio, LLC

In 2023, the *degradation of fish and wildlife populations* BUI was removed from the **St. Louis River AOC**. Continued progress has led to 55 of 80 management actions complete and all of the remaining actions are underway. Notably, a bi-state remediation project was complete at Munger Landing in 2023 and included removal of over 100,000 cubic yards of contaminated sediment and improved public access to the St. Louis River Estuary. Wild rice restoration continued in 2022 and 2023 with over 20,000 pounds of rice seed planted. Wild rice restoration monitoring suggests that density and biomass indicators are increasing at restoration sites. The design of a bridge to replace a 220-ft derelict box culvert on the Gandy Dancer State Trail was completed in 2023 and construction will begin in 2024. This is the final aquatic and terrestrial barrier to be addressed on Little Balsam Creek and will lead to opening five miles of Class 1 trout waters. A total of four stream crossings will be improved by having structures replaced when the project is complete, benefiting terrestrial and aquatic species and increasing the resiliency of local infrastructure.

Additional sediment remediation in the AOC included The Pickle Pond restoration project in Superior, which began construction in 2023 and completed dredging and removal of over 16,000 cubic yards of contaminated sediment. In addition, approximately 22,000 cubic yards of clean material were dredged in other portions of the pond to create habitat diversity and accompanying wetland features. Final upland restoration and plantings will be completed in 2024.

David Grandmaison, WDNR's Wild Rice Restoration Coordinator for the St. Louis River, seeding wild rice in Allouez Bay, WI.

Replacement culvert for improved fish passage and flood water conveyance at Little Balsam Creek.

Remediation at Munger Landing, MN. Photo: MPCA

Beach Program

The Beach Program has funded monitoring at 106 coastal beaches.

The Wisconsin Beach Health Program manages the Beaches Environmental Assessment and Coastal Health (BEACH) Act funds from the EPA and collaborates with coastal communities and County Health Departments to carry out beach monitoring and restoration projects. Beaches are a vital resource for Wisconsin tourism and bring economic vitality to the communities in which they are located. The Beach program works to ensure continued safe use of public beaches that may be impacted by issues including bird waste, aging sewerage infrastructures, agricultural and urban runoff, weather events, and fluctuating water levels.

The Wisconsin Beach Health website lists up-to-date beach status and water quality data for monitored beaches and includes an interactive map of current beach status, including advisories, closures, and re-openings. This website shows beach advisories for Great Lakes Beaches as well as for the inland beaches that report their data to the website or for which water samples are analyzed by the Wisconsin State Lab of Hygiene (SLH). Current and historical water quality data for monitored beaches are accessible through a public portal to the Beach Health database. The website also includes a wide variety of information on beach monitoring, health and safety, and contacts for the public. Funding from the EPA under the federal BEACH Act supports beach water quality monitoring and posting of public health advisories on Great Lakes beaches. Funding for monitoring at State Park beaches and select inland beaches comes from the WDNR. More details on monitoring and program updates are available on the program's website.

Highlights of recent Beach Program activities include:

- Funded monitoring at 104 coastal beaches in 2022 and 106 in 2023.
- Funded EPA Freshwater Annual Sanitary Surveys at 85 coastal beaches in 2023.
- Sponsored the Great Lakes Beach Association Conference in 2023 and funded attendance by beach managers from 11 coastal counties.
- Enhanced the new Wisconsin Beach health database and website created by WDNR in 2020, after support by USGS ended. Improvements to database and user interface functionality include incorporation of harmful algal bloom observations and algal toxin test results.
- Expanded partner monitoring and use of the website for several additional inland beaches.
- Collaborated with Wisconsin Sea Grant to create all new training curriculum for Virtual

The beach at Barker's Island in the city of Superior now has cleaner water thanks to added native plants and improved access for people to enjoy the water through ecologically sound parking and beach upgrades. This project is part of the larger effort to restore the St. Louis River Area of Concern. To learn more watch: Restoring Barker's Island Beach in Superior.

Beach condition forecasting software, which will allow beach managers to predict conditions and post advisories when monitoring data is not available.
- Worked with WDNR staff on reprioritizing inland beach monitoring and funding allocation.
- Submitted the 2021 Annual Beach Monitoring Report to EPA and published it on the WDNR beach website.

Polar Dip, Port Washington, Lake Michigan. Photo: Joseph Eichers 2021

Monitoring

Data is needed to inform decision making for Great Lakes policy development and program implementation. The Office of Great Waters works closely with many other agency programs in areas of special concern to the Great Lakes including aquatic invasive species, fisheries management, and nutrient loading. OGW helps to oversee projects in support of Great Lakes management.

Highlights of Great Lakes Monitoring accomplishments for this reporting period include:

- Monitored approximately 55 miles of Lake Superior nearshore biweekly to describe water quality conditions and investigate drivers of harmful algal blooms on the lake. This effort occurred in both 2022 and 2023, adding to previous datasets to start indicating how changes in climate are impacting nearshore water quality conditions on Lake Superior.
- Assessed impairments in the Lake Michigan Areas of Concern by evaluating ambient water toxicity in Green Bay and Milwaukee, contaminant burden on fish-eating birds in Green Bay, and fish and wildlife consumption advisory data in multiple AOCs.
- In 2023, OGW staff began a study to determine ambient PFAS concentrations in water, sediment, and biota at 32 locations along Lake Michigan and Green Bay's shoreline.

Collaboration on Great Lakes Policies and Priorities

WDNR provides leadership for addressing important Great Lakes issues. Wisconsin and its partners integrate and implement priorities of the LAMP, Great Lakes Regional Collaboration, internal program priorities, and the priorities of internal and external Wisconsin Great Lakes partners. Wisconsin brings its voice to regional Great Lakes discussions by participating in Great Lakes Water Quality Agreement subcommittees as assigned and ensuring participation and engagement in regional activities related to the International Joint Commission, Great Lakes Commission, Council of Great Lakes Governors, the Great Lakes Protection Fund, and other Great Lakes forums to ensure Wisconsin's perspective is considered in regional policy-making.

The WDNR Office of Great Waters also manages Wisconsin's allocation of the Great Lakes Protection Fund, the Great Lakes Harbors and Bays funds, EPA grants for the Great Lakes, and other Great Lakes funds.

Zebra mussel on a decorative moss ball. U.S. Geological Survey.

Mississippi River

In the WDNR Office of Great Waters (OGW) the Mississippi River team is responsible for developing Upper Mississippi River policy, coordinating grant funds, monitoring, and research.

Harmful Algal Bloom/Cyanobacteria/Cyanotoxin Research and Monitoring

Harmful algal blooms dominated by cyanobacteria (commonly known as blue-green algae) are occurring in large river ecosystems and at the mouth of large rivers with increasing frequency. The Mississippi River can exhibit severe blooms of cyanobacteria that can produce toxins (microcystin and anatoxin-a) dangerous to people and pets. These blooms can also cause decreased water clarity, reduced macrophytes, diminished wildlife habitat, oxygen depletion, and fish kills. Ongoing research is contributing to our understanding of when and where these blooms are occurring and what restoration actions can be taken to reduce the severity of these blooms.

Harmful algal bloom at the Trempealeau National Wildlife Refuge on the Mississippi River

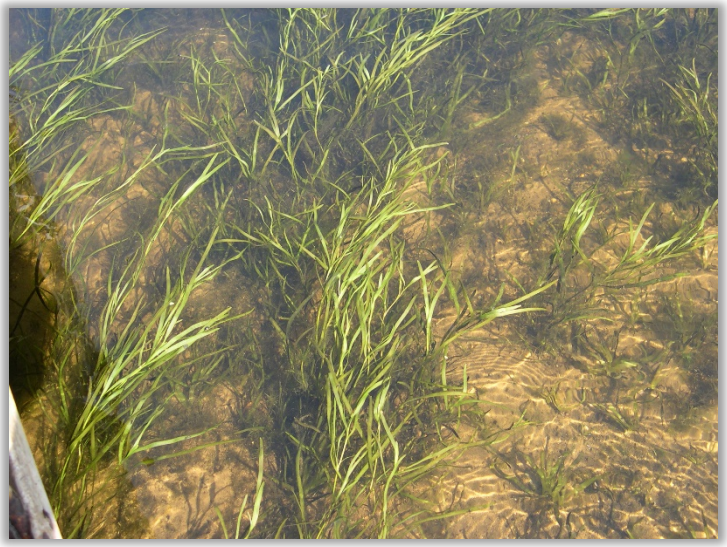
In research published in River Research and Applications, we sampled eight backwaters between Navigation Pools 5 and 8 to identify environmental drivers of variation in cyanobacterial abundance and toxicity. There are many hypotheses about the potential drivers of variation in cyanobacterial abundance and toxicity, but these hypotheses have rarely been considered in combination, and rarely been examined in large river ecosystems. We used monthly data from backwater habitats of the Upper Mississippi River (UMR) to evaluate associations between environmental conditions and cyanobacterial abundance and toxicity (microcystin and anatoxin-a) that would be expected based on several hypotheses. Backwaters in the Mississippi River vary in flushing rate, temperature, turbidity, nutrient availability, water depth, and vegetative cover. We found support for hypotheses that suggest physical conditions in backwaters (flushing rate, temperature, turbidity, rooted vegetation cover, and water depth) and nutrient availability influence cyanobacterial abundance and toxicity. We then used structural equation modeling to incorporate several hypotheses into a causal modeling framework. The modeling indicated that backwater connectivity (flushing) strongly influences cyanobacterial abundance via the regulation of water temperature, and that nutrient availability (the amount of phosphorus and the relative availability of nitrogen and phosphorus) strongly influences the presence of microcystin concentrations above our detection limit. The data suggest management of backwater connectivity could influence cyanobacterial abundance and

toxicity in UMR backwaters. Reconnecting backwaters (via alteration of levees) could serve as a local adaptation to minimize the effects of climate change and excessive nutrient loading.

This research demonstrates corrective actions and identifies water quality and habitat restoration measures that can be implemented to reduce harmful algal blooms. For example, isolated backwaters with high phosphorus, warm water temperature, limited rooted vegetation, shallow water depth, and low flushing rate are more susceptible to cyanobacterial dominance and the production of cyanotoxins. Addressing phosphorus stored in the sediments, reversing the loss of backwater depth, and optimizing water inflows to these areas could improve water quality conditions and restore ecological function in these Upper Mississippi River habitats. Habitat projects in conjunction with surface water nutrient reductions will be required to address these blooms on the Mississippi River to achieve protection of ecosystem health and recreational opportunities.

The Power of Ecosystem Restoration to Improve Water Quality and Ecosystem Function

Water clarity is a keystone variable in aquatic ecology. The positive relationship between water clarity and aquatic plants is well understood and the prevalence of aquatic plants drives a variety of ecological processes in aquatic ecosystems. Proliferation of aquatic plants has been shown to drive several feedback mechanisms, including reduced sediment resuspension and phytoplankton abundance, production of allelopathic substances, as well as increases in invertebrate biomass, refuge for zooplankton, denitrification, waterfowl abundance, and native fish abundance. The WDNR has collected underwater light data using a LI-COR underwater quantum sensor at Lock and Dam 8 and 9 since 1988. This dataset, summarized in a 2023 WDNR report, Seeing the Light: The Power of Ecosystem Restoration to Improve Water Quality and Ecosystem Function, is providing critical insights into ecosystem health and the efficacy of ongoing restoration actions.



Water clarity is key for aquatic vegetation growth, which provides critical habitat for many species along the Mississippi River. Photo: Shawn Giblin

Water clarity and aquatic plant abundance are among the major factors driving fish community characteristics across the Upper Mississippi River. Widespread landscape disturbance, resulting in increased sediment loading, has been identified as driving declines in aquatic plant abundance. This results in declines of backwater specialists and predators with plant-dependent life cycles. Clear, vegetated systems tend to be dominated by visual predators such as yellow perch (*Perca flavescens*), northern pike (*Esox lucious*), and largemouth bass (*Micropterus salmoides*). Predatory fishes such as northern pike, bowfin (Amia calva), largemouth bass, and longnose gar (Lepisosteus osseus) are often able to substantially reduce recruitment among planktivorous fishes. This reduction in planktivorous fish can alter food webs and result in further increases in aquatic vegetation and water clarity. Alternatively, benthivorous fish such as common carp (*Cyprinus carpio*) tend to be abundant in turbid systems and can keep these systems in a turbid state due to sediment resuspension during their feeding and spawning activities. Once substantial populations of common carp and other benthivore populations are high, establishing aquatic plants can become difficult due to poor water transparency.

Water clarity and aquatic plant abundance are also major factors driving invertebrate and waterfowl abundance and diversity. For example, invertebrate biomass and species richness tends to be higher in vegetated areas due to increased food availability and reduced predation pressure from fish. In addition, abundant food resources associated with vegetation beds tend to attract large numbers of migrating waterfowl that need to refuel for long flights.

The depth of one percent of surface light (photic zone depth) is generally viewed as the delineation between the photic and aphotic zones and represents the maximum depth at which photosynthesis can occur. The WDNR photic zone dataset provides a valuable look into the chronology of Mississippi River water clarity and quality since 1988. Valuable insights can be gained from this dataset: from the collapse of aquatic vegetation post-1988; to the nearly ten years it took the Mississippi River to reset back to a clearer ecosystem state; to the increased water clarity currently being measured. Since 2009, median water clarity has consistently met underwater light goals for Pools 8 and 9.

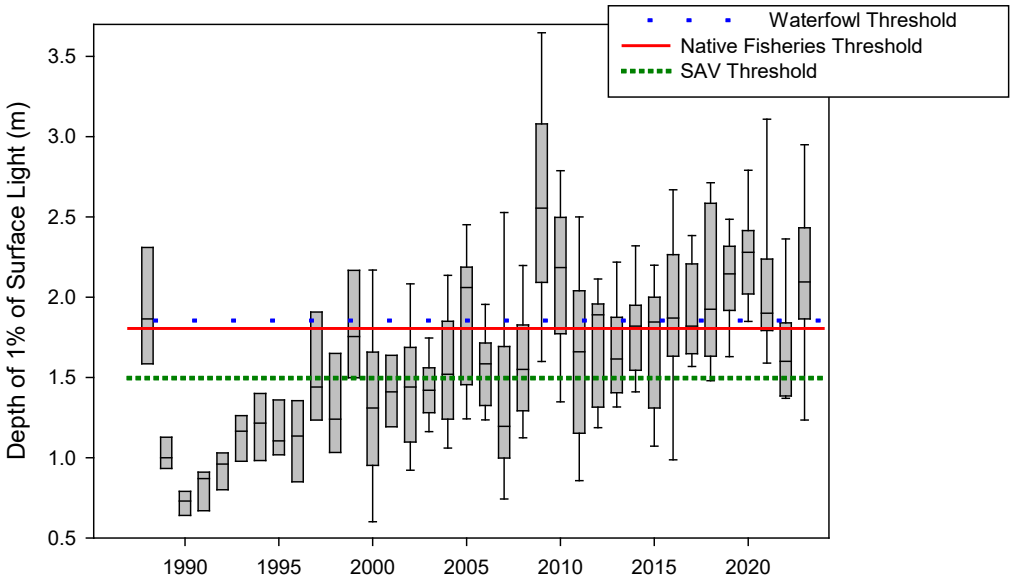


Figure 15. Long term trends in photic zone depth (one percent of surface light) at Lock and Dam 8 and 9. The blue dashed line indicates a tipping point for vegetation, waterfowl, and fish for Chesapeake Bay (Kemp et al. 2004). The red line indicates an observed threshold for Mississippi River native and recreational fish biomass (Giblin 2017). The green dotted line indicates an observed threshold for submersed aquatic vegetation establishment on the Mississippi River (Delaney and Larson 2023).

One of the defining features of the Mississippi River following the construction of the lock and dams is the loss of islands in the lower third of the pools due to wind and wave action stemming from inundation. A major thrust of ecosystem restoration has been to restore islands lost in these lower pool zones to improve water clarity. The major goals of restoring these islands are to restore ecosystem function by creating a diversity of water velocities for river fish and wildlife and reducing wind-induced sediment resuspension to promote the recolonization of rooted aquatic vegetation.

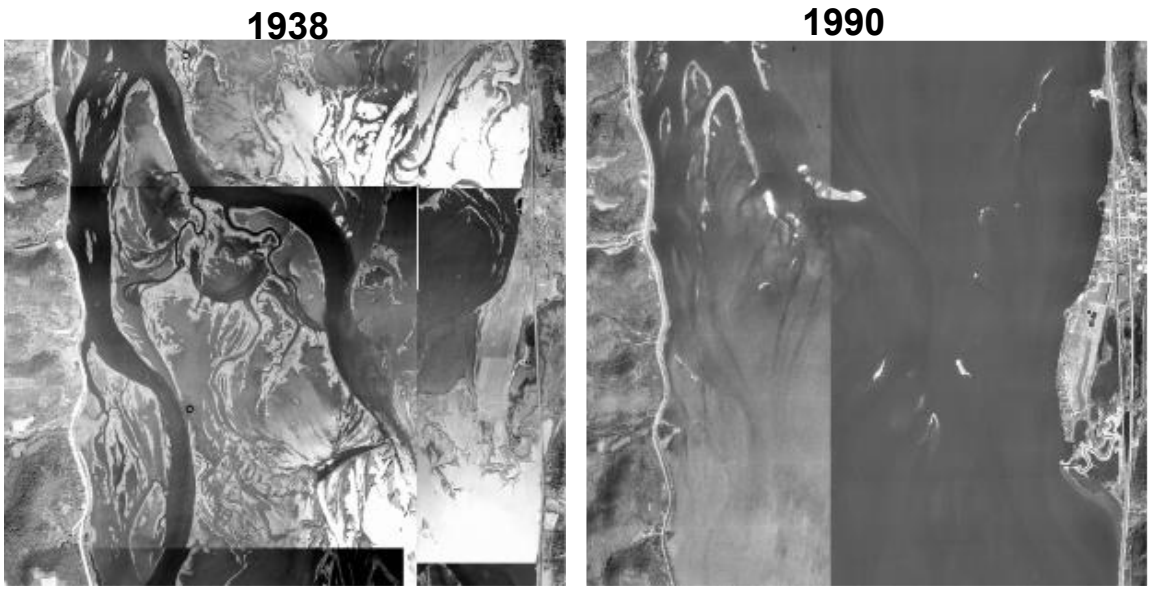


Figure 16. Mississippi River island loss due to wind and wave action resulting from inundation. Left Panel: Lower Pool 8 in 1938—one year following the completion of Lock and Dam 8. Right Panel: Lower Pool 8 in 1990—50+ years following the completion of Lock and Dam 8. Jeff Janvrin, WDNR.

The role of habitat restoration is important to consider as water quality improvements have occurred. When Phase 1 of the Pool 8 Habitat Rehabilitation and Enhancement Project (HREP) was completed, water clarity was similar but slightly lower in Pool 8 vs. Pool 9. Water clarity in Pool 8 dramatically improved, following initiation and completion of the three phases of Pool 8 HREPs, as islands lost to wind and wave action were restored, wind fetch was reduced, and aquatic vegetation recolonized. Similarly in Pool 9, following the completion of the Harpers Slough HREP in 2017, the degree of water clarity improvement increased to where underwater light goals for native fishes are now being met in Pool 9.

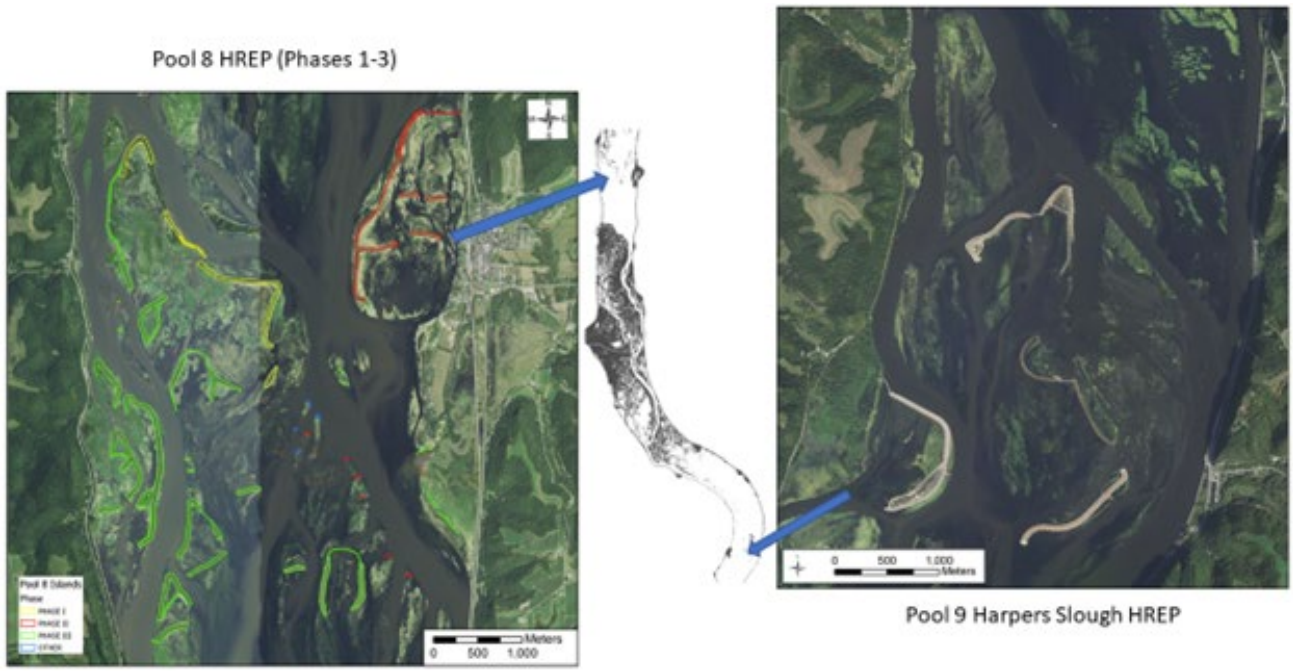


Figure 17. Island reconstruction. Left Panel: Pool 8 HREP Phases 1-3. The yellow islands are Phase 1, the red islands are phase 2, and the green islands are Phase 3. Right Panel: Pool 9 Harpers Slough HREP constructed islands are shown in light tan.

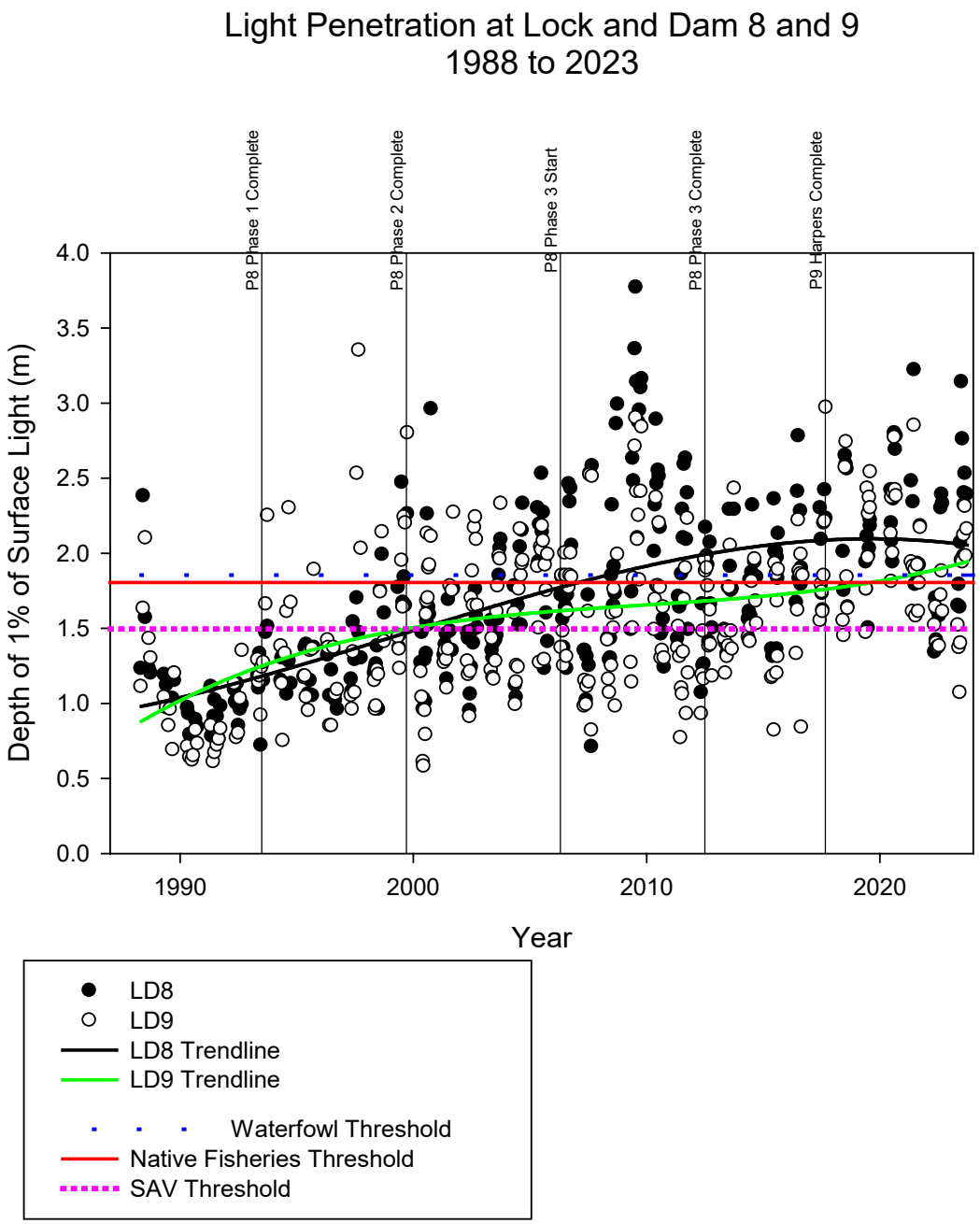


Figure 18. Long term trends in photic zone depth (one percent of surface light) at Lock and Dam 8 and 9. The black and green trendlines depict how water clarity in Pool 8 (black line) increased over Pool 9 (green line) following the completion of the Pool 8 habitat projects. Pool 9 later improved and converged with Pool 8 water clarity following the completion of the Pool 9 habitat projects. The blue dashed line indicates a tipping point for vegetation, waterfowl, and fish for Chesapeake Bay (Kemp et al. 2004). The red line indicates an observed threshold for Mississippi River native and recreational fish biomass (Giblin 2017). The pink dotted line indicates an observed threshold for submersed aquatic vegetation establishment on the Mississippi River (Delaney and Larson 2023).

The increase in median photic zone depth between 1990 and 2023 of 1.37 m (4.49 ft) has meaningful implications for ecosystem health and function. The estimated area of the pool where the photic zone reached the river bottom increased by 3,918 ha (15.13 square miles; 48% increase) in Pool 8 and by 5,728 ha (22.12 square miles; 50% increase) in Pool 9 between 1990 and 2023. These profound changes in water clarity have allowed aquatic vegetation to recover.

Figure 19. Visual depiction of the median photic zone depth in Pools 8 and 9. Upper Panel: 1990. Lower Panel: 2023.

This summary of light data shows the power of ecosystem restoration projects to achieve water quality and ecosystem goals following over 30 years of focused habitat restoration. Future projects to improve water clarity should focus on areas upstream of Lake Pepin and Pools 10 and 11. Fortunately, projects planned for Lower Pool 10, Lower Pool 11, and upstream of Lake Pepin will likely result in more river miles meeting water clarity goals in future years.

Mississippi River Long Term Sediment Contaminant Trends

Suspended sediment or particulate matter in river water plays a major role in the fate and transport of contaminants, especially in turbid rivers like the Mississippi River. Organic chemicals with low water solubility such as polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and organochlorine pesticides, as well as elements such as heavy metals, adsorb to fine-grained suspended sediment particles, especially those high in organic matter content. Besides direct point source discharge, sources of contaminants in the water column include runoff from urban and agricultural land use, deposition from coal and waste incineration, and resuspension of contaminated bed sediment.

The WDNR has been conducting long term monitoring of suspended sediment contaminant concentrations in the Mississippi River at Lock and Dam 3 (Red Wing, MN) and Lock and Dam 4 (Alma, WI) since 1987. Suspended sediment is collected passively through the deployment of glass jar sediment traps for roughly 60 days in a slack water area immediately upstream of both lock and dams during spring, summer, and fall. The primary purpose of this monitoring program has been to assess long term trends and to provide an estimate of whole-water particulate-phase concentrations.

Results from a recent WDNR report, Mississippi River Long Term Sediment Trap Contaminant Trends: Lock and Dam 3 and 4 (1987-2023), illustrate significant declines in particulate PCB and mercury (Hg) concentrations in suspended sediment at both monitoring sites between 1987 and 2023.

A suite of select metals of concern (cadmium-Cd, lead-Pb, chromium-Cr, manganese-Mn, copper-Cu, and zinc-Zn), of which reduced sampling has occurred during the past fifteen years, were sampled again in 2022. The sampling frequency for these parameters was reduced over the past fifteen years due to declining concentrations and funding constraints. However, it is important to revisit these parameters on a periodic basis to ensure that concentrations are continuing to decline. These parameters will be sampled every five years moving forward to ensure concentrations are continuing to decline or are stabilizing. The 2022 sampling confirmed continued declines or stable concentrations for all six parameters and is an encouraging result. The success of metals reductions in the Mississippi River is a potent reminder of the overwhelming success of pollution reduction policies in the United States since the passage of the Clean Water Act in 1972. The lessons of the past indicate that it is much better to be proactive rather than reactive in dealing with environmental contaminants. It is always more cost-effective to prevent environmental damage than it is to "clean up" environmental damage after it has occurred.

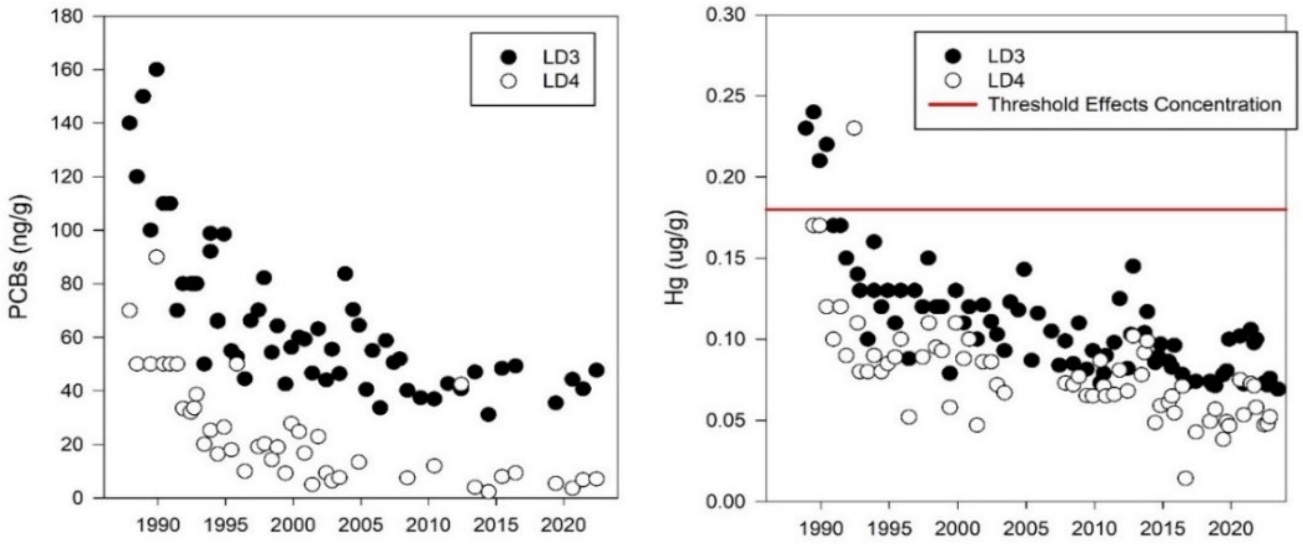


Figure 20. Long term sediment trap polychlorinated biphenyl (PCB) and mercury (Hg) trends at Lock and Dam 3 and 4 (1987-2023).

Temporal trends indicate a decrease in PCB and metal concentrations at both monitoring sites. PCB concentrations are presently 1/4 to 1/5 those observed in the late 1980s. Current Hg concentrations are less than one-half of concentrations measured during the late 1980s. Other metal concentrations have steadily declined since the 1980s. Current Cd, Pb, Cr, Cu, and Zn concentrations are roughly 1/2 to 1/3 that measured in the late 1980s. Pollution abatement efforts to reduce the use and discharge of these contaminants have led to these reductions. These findings underscore the need for the management community to pivot efforts toward non-point pollution reduction efforts while continuing to reduce legacy contaminants. Additional efforts should also be directed toward efforts to better understand and quantify emerging and less understood environmental contaminants such as PFAS, neonicotinoids (imidacloprid and clothianidin in particular), pyrethroids (bifenthrin in particular), microplastics, and estrogenic compounds.

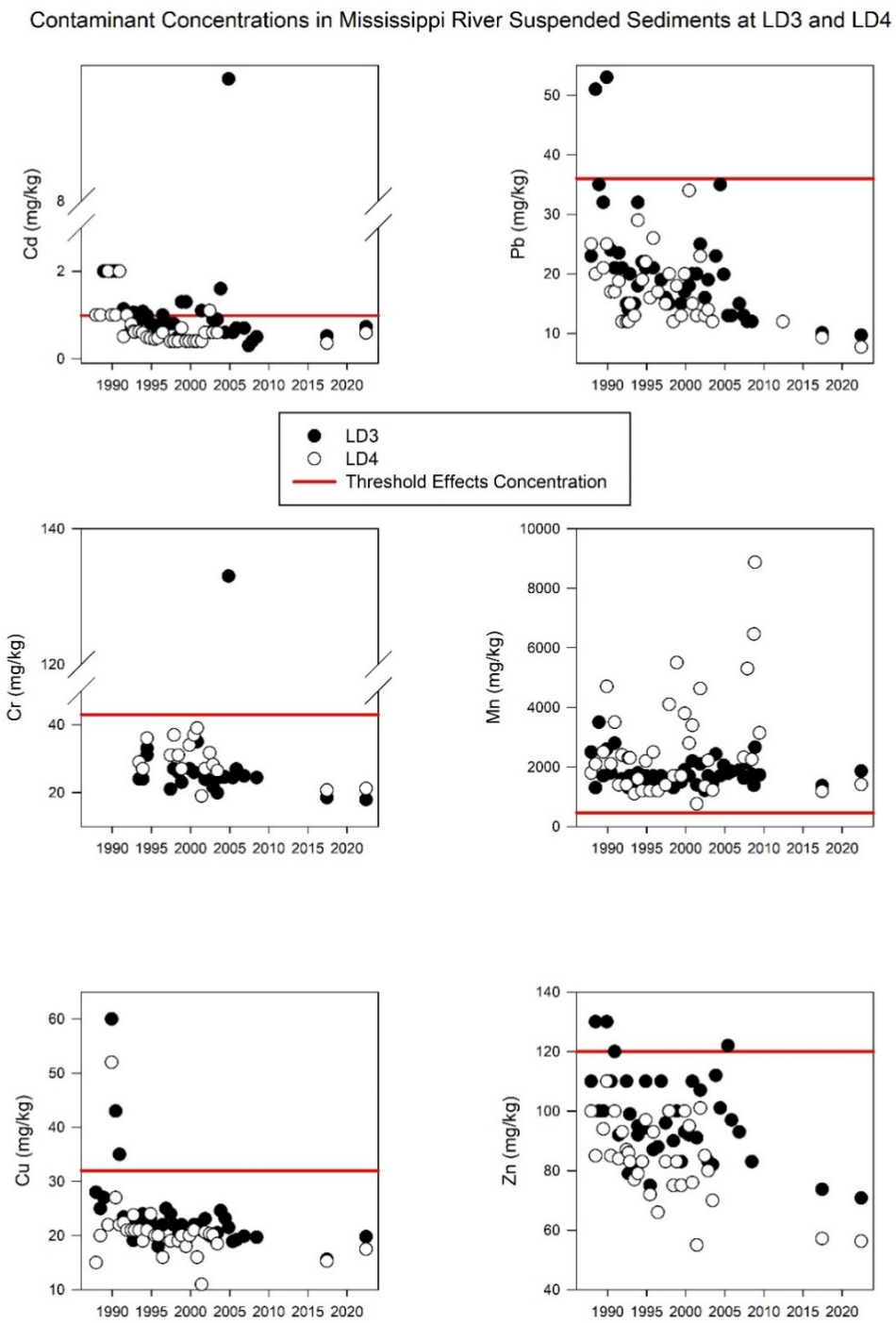


Figure 21. Long term sediment trap metals concentrations of cadmium (Cd), lead (Pb), chromium (Cr), manganese (Mn), copper (Cu) and zinc (Zn) from 1987-2023. The WDNR consensus-based sediment guidelines, threshold effects concentration, is denoted with the red line.

Understanding Constraints on Submersed Vegetation Distribution in the Mississippi River

Aquatic vegetation is a key component of large floodplain river ecosystems. In the Upper Mississippi River (UMR), there is a long-standing interest in restoring aquatic vegetation in areas where it has declined or disappeared. A recent publication, Understanding Constraints on Submersed Vegetation Distribution in a Large, Floodplain River: the Role of Water Level Fluctuations, Water Clarity and River Geomorphology, sought to better understand what constrains vegetation distribution in large river ecosystems and inform ongoing efforts to restore submersed aquatic vegetation (SAV). The study delineated areas in ~745 river miles of the UMR where the combined effects of water clarity, water level fluctuation, and bathymetry appeared suitable for establishment and persistence of SAV based on a 22-year dataset for total suspended solids (TSS), water surface elevation, and aquatic vegetation distribution. The study found a large increase in suitable area downstream from Lake Pepin, a natural riverine lake that functions as a sink for suspended sediment. Downstream from river mile 556 (Pool 13; Bellevue, IA), there was much less suitable area due to decreased water clarity from tributary input of suspended material, changes in river geomorphology, and increased water level fluctuation. A hypothetical scenario of 75% reduction in TSS resulted in only minor increases in suitable area in the southern portion of the UMR system, indicating limitations by water level fluctuation and/or bathymetry (i.e., limited shallow area). These results improve our understanding of the structure and function of large river systems by illustrating how water clarity, fluctuations in water level, and river geomorphology interact to create complex spatial patterns in habitat suitability for aquatic species and may help to identify locations most and least likely to benefit from management and restoration efforts.

Long Term Resource Monitoring and Habitat Restoration

The U.S. Army Corps of Engineers' Upper Mississippi River Restoration (UMRR) Program - Long Term Resource Monitoring (LTRM) element is implemented by the U.S. Geological Survey-Upper Midwest Environment Sciences Center (UMESC), in cooperation with the five Upper Mississippi River System (UMRS) states of Illinois, Iowa, Minnesota, Missouri, and Wisconsin. The U.S. Army Corps of Engineers (Corps) provides guidance and has overall Program responsibility. The UMRR-LTRM program has been collecting data since 1988 and assesses water quality, vegetation, fisheries, land-cover/land-use, and other resource information to determine the trends and ecological health of the UMR. The program utilizes stratified random sampling carried out within select trend pools of the UMR, and for water quality it also samples a network of fixed sites along the mainstem and tributaries. WDNR's LTRM field station at La Crosse, WI carries out this monitoring on navigation Pool 8 and tributaries to pools 7 – 9 of the Mississippi River.

The WDNR's LTRM 2022 Status Report provides a comprehensive summary of discharge, water quality, fisheries, and vegetation monitoring data collected by the WDNR LTRM field station for the years 1993 to 2022. The level of sampling effort and rigor in this program are unique to the Upper Mississippi

Children playing with mussel shells.
Photo: Shawn Giblin

River and allow for deeper examination of environmental drivers, a high degree of confidence in deriving trends, and an overall knowledge of ecological interactions.

This UMRR program provides a balanced combination of habitat restoration, monitoring, and research. The habitat restoration activities of the UMRR have improved critical fish and wildlife habitat on over 106,000 acres through 56 projects since 1986. Currently, the UMRR Program has 22 additional projects in various stages of construction and design. These projects will benefit another 65,000 acres of habitat when completed. These projects improve water quality and provide protection, nesting, and feeding areas for a highly diverse set of fish, birds, mussels, reptiles, amphibians, and mammals, including many rare and endangered species.

UMRR is a national leader and pioneer in large-river restoration, emulating natural processes, and restoring mosaics of wetlands, channels, and forests. UMRR's restoration techniques are tested and proven to address the most significant stressors to the ecosystem by:

- Protecting riverine wetlands and lakes from fluctuating water levels and high sedimentation.
- Recreating islands to provide refuge, food, and improved water quality for many species of fish and wildlife.
- Restoring the natural mosaic of water velocities and depths to improve fish and wildlife habitat.
- Restoring forest health and diversity, resulting in habitat for a variety of wildlife.

Large River Biological Monitoring

In 2016, the WDNR implemented a non-wadeable Rivers Monitoring Program to track long-term changes in biotic indices at selected reference sites across Wisconsin's large warmwater rivers. Large rivers are defined as having at least 1.9 miles of contiguous river channel too deep to be sampled effectively by wading. This generally coincides with 5th order stream size or greater (Figure 22). By this definition, Wisconsin has at least 46 large rivers with a combined length of over 2,500 miles. Large rivers are highly dynamic in nature and generally have complex heterogeneous habitat leading to high biodiversity in undisturbed reaches. As water quality and habitat begin to degrade due to anthropogenic disturbance, changes begin to occur in the fish and macroinvertebrate communities. Riverine specialist species and intolerant species begin to disappear while habitat generalists and tolerant species increase in abundance. The WDNR has been monitoring for various physical and chemical stressors on large rivers dating back to the 1970s and 1980s as part of the LTT monitoring program to assess water quality. More recently, Indices of Biotic

Figure 22. Large rivers across the state.

Integrity (IBIs) for fish and macroinvertebrates have been used to assess the health of riverine systems in addition to chemical parameters. The WDNR began a rotational basin approach to sampling large rivers statewide on a five-year cycle beginning in 2017. Two major river basins that correspond approximately to the HUC 6 level were intensively monitored each year for fish, macroinvertebrates, and mussels.

Multi-metric IBIs have used fish communities to assess the status of rivers relative to their impacts (Karr 1981, Fausch et al. 1990, Karr and Chu 1997) and have been modified and calibrated for Wisconsin's large rivers (Lyons et al. 2001). Regional modifications to the IBI help to strengthen the original IBI concept based on regional difference in the fish communities and geography (Miller et al. 1988). IBIs provide a quantitative bioassessment of the biotic community by which to gauge riverine health and compare across rivers of similar size. The overall goals of fish surveys were to determine the status of the existing riverine fish community and evaluate if there were any changes in the fish community that may be related to stressors on the riverine biological community.

Macroinvertebrates are a vital part of the aquatic food chain. Macroinvertebrates have been widely used to assess stream health in wadeable waters. Recently, indices have been developed for use on nonwadeable waters of Wisconsin (Weigel and Dimick 2011). There are several aspects of macroinvertebrates that make them a good choice for assessing ecological conditions of rivers. These include their limited migration patterns, sensitivity to human impacts, sensitivity to pollutants with a range of tolerance values, and broad range of habitat requirements. In addition, they can be sampled and identified with relative ease. Macroinvertebrate communities may respond differently than fish communities under different stressors, providing an additional component to evaluate river health.

Freshwater mussels are one of the most imperiled faunal groups on a national and global scale and play an important role in riverine ecosystems providing many ecological benefits. Freshwater mussels are sensitive to a variety of environmental disturbances and are a suitable indicator of ecosystem health (Grabarkiewicz and Davis 2008). Freshwater mussels are widespread, long-lived, sedentary filter feeders that can provide a historical record by the spent valves left behind. Most mussel species have an obligate fish host during their glochidia life phase and their presence within a river is dependent upon viable host populations inhabiting or having access to river reaches. Freshwater mussels are sensitive to physical habitat alterations, water quality and chemical contaminants during various life stages and have been found to be particularly sensitive to ammonia (Newton et al. 2003).

Fish

Non-wadeable fisheries data were collected in accordance with IBI sampling protocols established and calibrated for Wisconsin's large warmwater rivers by Lyons et al. (2001). In 2022, a total of 20 Large River IBI (LRIBI) samples were collected at or near LTT water quality sites and processed. Fish surveys captured 3,315 individual fish representing 66 fish species weighing a total of 2,395 lbs. The number of species captured per site ranged from 10 to 27 species with a mean of 17.5 species. The number of individuals captured per survey ranged from 69 to 349 fish with a mean of 166 fish. Large River IBI scores ranged from 25 to 100 and averaged 72 (**Error! Reference source not found.**). The median LRIBI score was 73 with 2 surveys rated as poor (10%), 3 fair (15%), 6 good (30%) and 9 excellent (45%). Based on fish community surveys, 25 percent of LTT sites were not meeting their biological potential, rating fair, poor or very poor. Comparing biological communities, the fish community rated much better (median score = 73) than the macroinvertebrate community (median score 45) at corresponding LTT sites in 2022 biological surveys. In 2023, fish surveys were conducted at 51 sites within the Menominee and Rock River HUC6 Basins, and 19 LTT sites. Summary and analysis of data collected in 2023 is currently in progress.

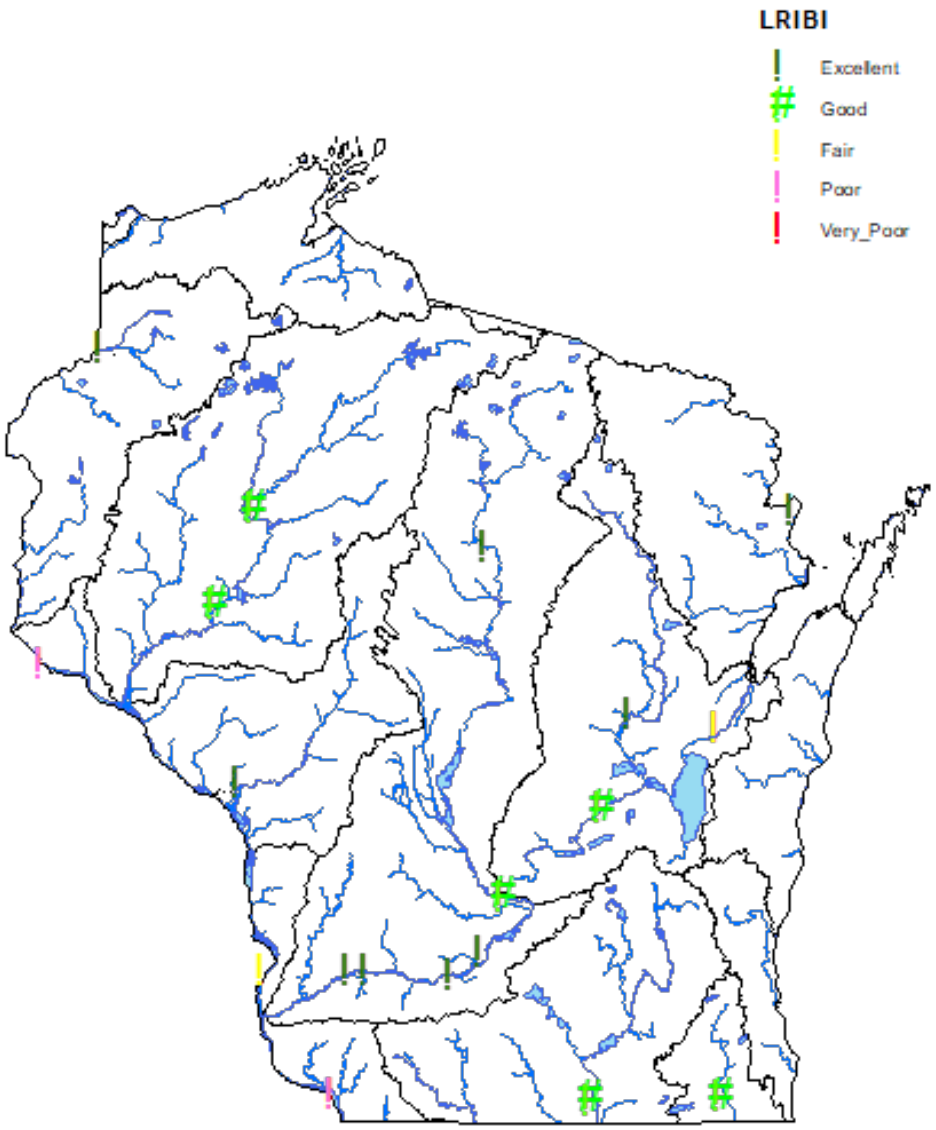


Figure 23. Large river fish IBI ratings for 2022 LTT monitoring sites.

Iconic Large River species surveyed in 2023, with WDNR Water Quality Biologists:

Left, top to bottom:
- Shovelnose sturgeon, Lower Wisconsin River, with Kimberly Kuber.
- Longnose gar, Black River, with Kurt Rasmussen.
- Flathead catfish, Rock River, with Camille Bruhn.

Right, top to bottom:
- Threatened Black Buffalo, Sugar River, with Kimberly Kuber.
- Mussels on the Chippewa River

Left: Endangered Crystal Darter, Lower Wisconsin River. Right: Threatened Gilt Darter, St. Croix River.

Macroinvertebrates

Nonwadeable macroinvertebrate data were collected in accordance with macroinvertebrate IBI (mIBI) sampling protocols established and calibrated for Wisconsin's large warmwater rivers by (Weigel and Dimick 2011) utilizing Hester-Dendy artificial substrate samplers. In 2022, a total of 19 mIBI samples were collected at or near LTT water quality sites and processed. Scores ranged from 10 to 95 and averaged 48.4. The median mIBI score was 45 with 1 survey rated as very poor (5%), 6 poor (32%), 5 fair (26%), 5 good (26%) and 2 excellent (11%). Based on macroinvertebrate community surveys, 63 percent of LTT sites were not meeting their biological potential, rating fair, poor or very poor. Macroinvertebrate IBI ratings generally rated lower than fish IBI ratings within the same river reaches indicating that macroinvertebrate communities were responding differently to water quality and habitat present within the reach (Figure 24). In 2023, macroinvertebrate surveys were conducted at 22 sites within the Menominee and Rock River HUC6 Basins. Summary and analysis of data collected in 2023 is currently in progress.

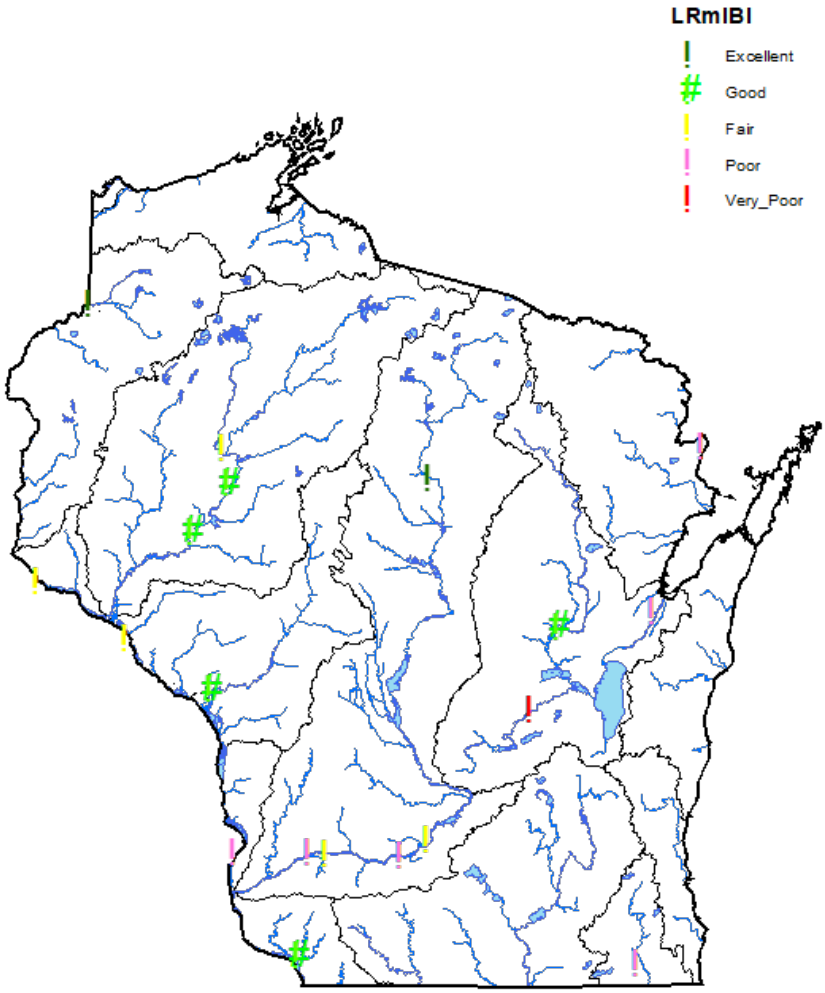


Figure 24. Large river macroinvertebrate IBI ratings for 2022 LTT monitoring sites.

Freshwater Mussels

Freshwater mussels were not surveyed in 2022. In 2023, mussel surveys were conducted at 19 sites within the Menominee and Rock River HUC6 Basins. Summary and analysis of data collected in 2023 is currently in progress.

Large River References:

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Grabarkiewicz, J and W. Davis. 2008. An introduction to freshwater mussels as biological indicators. EPA-260-R-08-015. U. S. Environmental Protection Agency, Office of Environmental Information, Washington, DC.

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Miller, D. L., R. M. Hughes, J. R. Karr, P. M. Leonard, P. B. Moyle, L. H. Schrader, B. A. Thompson, R. A. Daniels, K. D. Fausch, G. A. Fitzhugh, J. R. Gammon, D. B. Halliwell, P. L. Angermeier & D. J. Orth. 1988. Regional Applications of an Index of Biotic Integrity for Use in Water Resource Management. Fisheries, 13:5, 12-20.

Newton, T. J., J. W. Allran, J. A. O'Donnell, M. R. Bartsch, and W. B. Richardson. (2003). Effects of ammonia on juvenile unionid mussels (Lampsilis cardium) in laboratory sediment toxicity tests. Environmental Toxicology and Chemistry, 22: 2554–2560. doi:10.1897/02-342

Weigel, B. M. and J. J. Dimick. 2011. Development, validation, and application of a macroinvertebrate-based Index of Biotic Integrity for nonwadeable rivers of Wisconsin. Journal of the North American Benthological Society 30(3):665-679. 2011.

Aquatic Invasive Species

Wisconsin's aquatic ecosystems are experiencing impacts from aquatic invasive species (AIS) that are already present within the state, and the state's waters and cultural resources are balancing effects of continued introductions of regulated species. The introduction of AIS into the Great Lakes and inland state waters is a source of biological pollution that has altered natural resources, human health, recreational opportunities and other ecosystem services throughout the state and region.

To help mitigate these effects, *Wisconsin's AIS Management Plan* (Initially created in 2003) was updated and approved in 2019 to guide the implementation of activities to prevent, contain, and control the harmful impacts of AIS. The Wisconsin AIS Management Plan fulfills the requirements of the National Invasive Species Act (NISA) of 1996 which provides guidance for the development of state program documents. It makes Wisconsin eligible to request federal assistance for up to 75% of the cost incurred to implement the statewide AIS program. The plan also provides specific details regarding AIS to the overarching *Wisconsin Invasive Species Strategic Plan*, *Looking Forward: A Statewide Strategic Plan for Invasive Species*, that was drafted by the Wisconsin Invasive Species Council in 2013. This is a comprehensive document addressing WI's overall approach to invasive species prevention/management, both terrestrial and aquatic.

In addition to meeting new opportunities and fulfilling federal requirements, the *Wisconsin Aquatic Invasive Species Management Plan* is designed to provide guidance to all WDNR staff and partners working on AIS issues in Wisconsin. Following the plan increases efficiencies and reduces redundancies for everyone managing AIS on Wisconsin's more than 15,000 lakes, 13,500 miles of navigable streams and rivers, and approximately five million acres of wetlands. It also includes Wisconsin's border waters, which consist of more than 800 miles of Great Lakes coastline and nearly 200 miles of Mississippi River shoreline.

The plan includes three main goals:

GOAL 1: Prevent the introduction of new AIS into Wisconsin

GOAL 2: Contain the spread of AIS within Wisconsin

GOAL 3: Control existing populations of AIS to minimize harmful impacts

One important difference between the 2019 and 2003 plans is that the newer version organizes strategies and actions by invasion pathway. This new way of thinking aims to take a proactive approach by exploring specific pathways that are applicable to the state and then to provide guidance, outreach, and resources needed to close these gaps. The seven priority pathways identified in Wisconsin's plan include recreational activities and service providers, non-recreational fishing and aquaculture, organisms in trade, transportation and utility

corridors, state and federal agencies, maritime commerce, and canals, dams, and diversions. A complete description of these pathways and the WI AIS Management Plan can be found at https://apps.dnr.wi.gov/lakes/invasives/AquaticInvasive.aspx.

Sites targeted for Early Detection monitoring by Regional WDNR AIS Biologists on inland lakes, streams/rivers, and wetlands follow WDNR approved protocols. The sites will be selected using tools such as scientifically defensible suitability models and prioritization models that target high-risk recreational pathways (such as the *Where Boaters Have Been Tool* and popular fishing destinations) and proximity to new or recently found populations.

Pathway Work performed by Regional AIS Biologists in 2022/2023

Aquatic Surveying and Monitoring Activities

- Provided annual in-person training for WDNR and partners for early detection monitoring.
- Maintain public webpage Aquatic and Wetland Invasives Species Monitoring | | Wisconsin DNR with resources for identification, known AIS locations, reporting instructions, and protocols for citizens and staff.
- Provided resources and training to other WDNR staff on proper equipment decontamination and disinfection.
- Provided a public webpage with disinfection manual code and resources for Best Management Practices: Boat, Gear and Equipment Decontamination and Disinfection Manual Code 9183.1 | Best Management Practices | Wisconsin DNR.

Organisms in Trade (OIT)

- Led OIT Work Group consisting of both WDNR and partner staff, provide direction on statewide OIT Program efforts, development of protocols/guidance for partners, identification of future OIT pathway direction, policy recommendations, and collaboration between programs (Natural Heritage Conservation, Law Enforcement, AIS, etc.) to help prevent invasive species from entering WI and the Great Lakes Region.
- Developed and currently piloting a protocol for WDNR staff and partners to conduct OIT education and outreach, and to monitor for regulated species sales at pet stores to prevent invasive species entering the Great Lakes basin. Trained various partners on protocol implementation and recording/tracking findings.
- Visited pet stores to provide education and outreach, monitor for regulated species sales, and inform protocol development, as part of pilot project.
- Began exploring outreach for biological supply OIT sub-pathway, including newsletters to teacher organizations and preparing presentations for teacher conferences. There have been numerous instances in southeast Wisconsin where crayfish (including non-native crayfish) have continued to be used in classroom settings.
- Continue to work closely with Law Enforcement, providing ID assistance.
- Participate as a WI representative on a GLRI Interjurisdictional Crayfish Project led by Michigan State University.

2022 and 2023 AIS Early Detection Efforts

WDNR's AIS program works with a network of citizens, partners, and WDNR staff. Each year, we exceed the goal of monitoring 1,000 locations for AIS. In 2023, these efforts identified roughly 150* new AIS populations with common invasive species like mystery snails and purple loosestrife. Only a few new populations of rare AIS were detected, and they appear to be assimilating in systems that have healthy shorelines and robust native

communities. This demonstrates the resilience that our restoration efforts have provided to protect Wisconsin waters. All new verified aquatic invasive species can be viewed on the WDNR AIS tabular webpages for 2022 and 2023 findings, and spatial records can be viewed on the Lakes and Aquatic Invasive Species Mapping Tool.

We still have many unverified new detections of commonly reported species. In 2022 and 2023, we continued efforts to expand verification capacity by offering a virtual Do It Yourself testing opportunity. This allowed more collectors to be certified AIS verifiers, thus streamlining the verification process.

Additionally, the Surface Water Integrated Monitoring System (SWIMS) Team has been working hard and we now offer the ability for all collectors to attach photos when entering data. Understanding how difficult it can be to collect specimens and bring them to the local specialist, this new ability will help streamline the verification process. The AIS Monitoring Lead is working with Citizen Lake Monitoring Network Education and Water Action Volunteer Education to promote how to collect photos and submit them to the SWIMS database with fieldwork events.

**Data is still being processed/verified so these counts may be low.*

Table 6. Counts of fieldwork events conducted by citizens, partners, and WDNR during 2022 and 2023.

		2023		2022	
Group	**Project**	**Count of Fieldwork Events / Totals**		**Count of Fieldwork Events / Totals**	
Citizen	Citizen Lake Monitoring Network	122	**491**	172	**505**
	Water Action Volunteers	257		236	
	Project Riverine Early Detection	5		23	
	AIS Snapshot Day - Citizen	91		53	
	Incident Report - Citizen	16		15	
Partner	Early Detection – LMPN	344	**473**	239	**459**
	Project Riverine Early Detection	15		21	
	AIS Snapshot Day – LMPN	49		44	
	Incident Report - LMPN	65		155	
DNR	WDNR Early Detection/Response Monitoring	193	**229**	146	**185**
	Incident Report - WDNR	36		39	
	Annual Total	**1,193**		**1,149**	

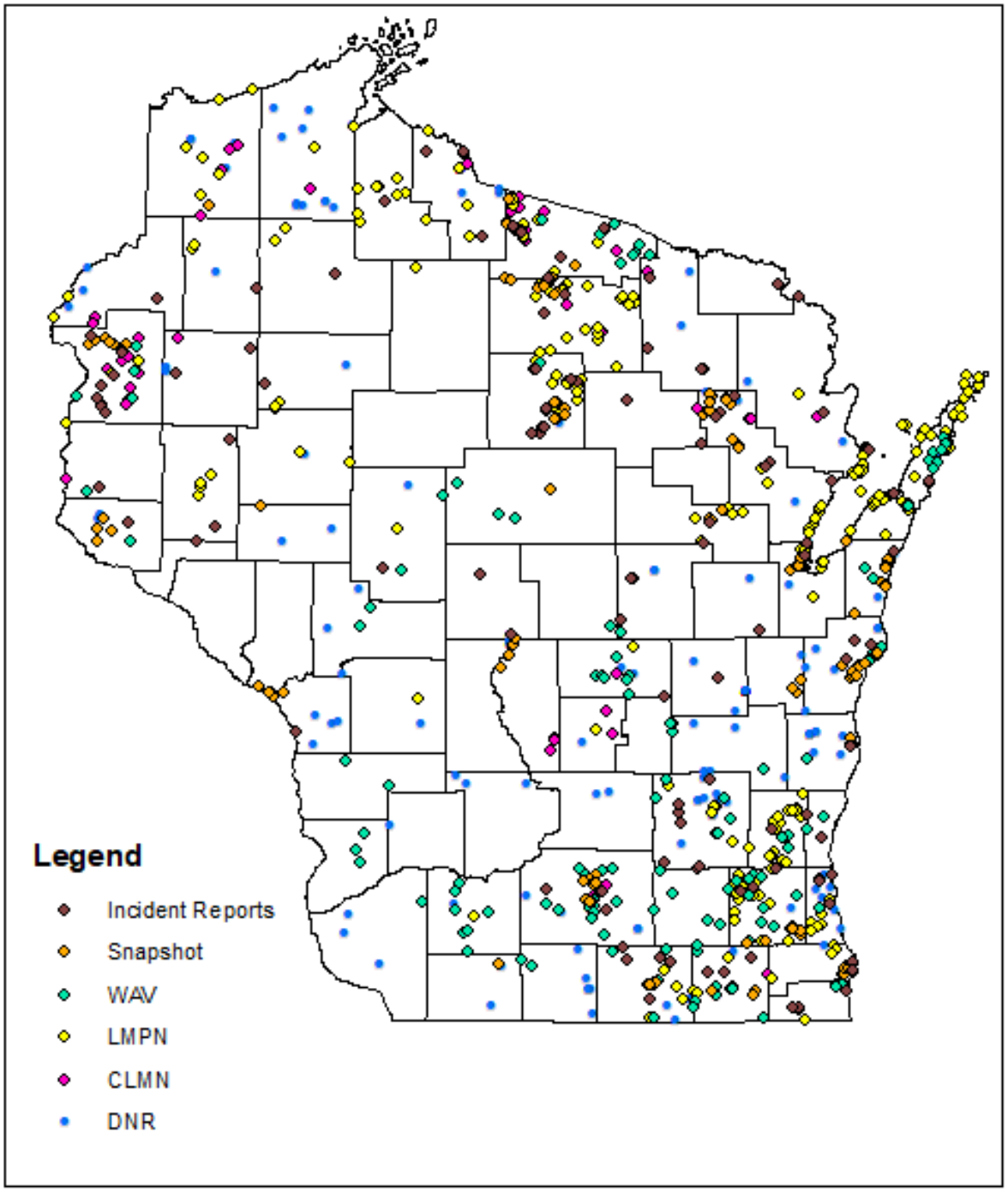


Figure 25. Locations of aquatic invasive species early detection and response monitoring efforts by citizens, partners, and WDNR in 2023.

Regional AIS Biologists also lead and coordinate all response efforts, which include monitoring, management, and communication, while implementing the Department's Invasive Species Response Framework [PDF]. Figure 26 ("*Wisconsin's AIS Efforts*") displays the numbers of Early Detection Monitoring and Response Efforts led by WDNR in 2022 and 2023. Figure 27 ("*Wisconsin's Species Response Efforts*") demonstrates some of the species that response efforts focused on.

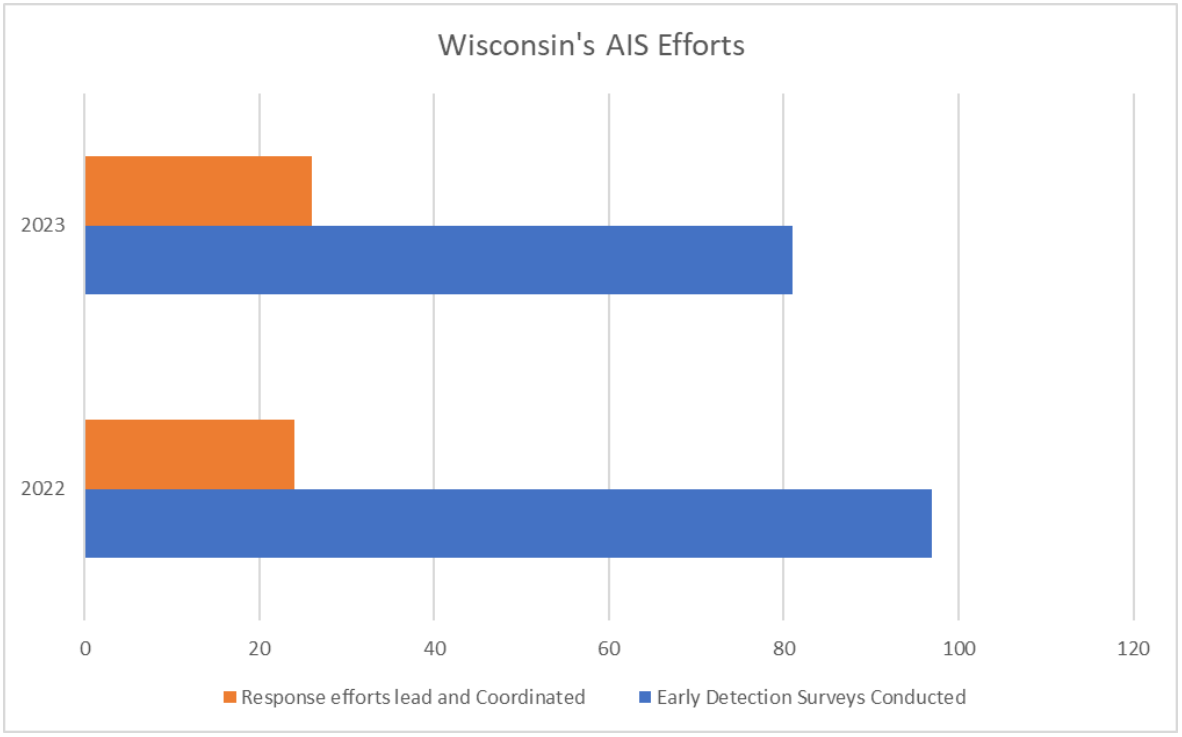


Figure 26. Number of aquatic invasive species early detection response and monitoring efforts conducted by Regional WDNR Biologists in 2022 and 2023.

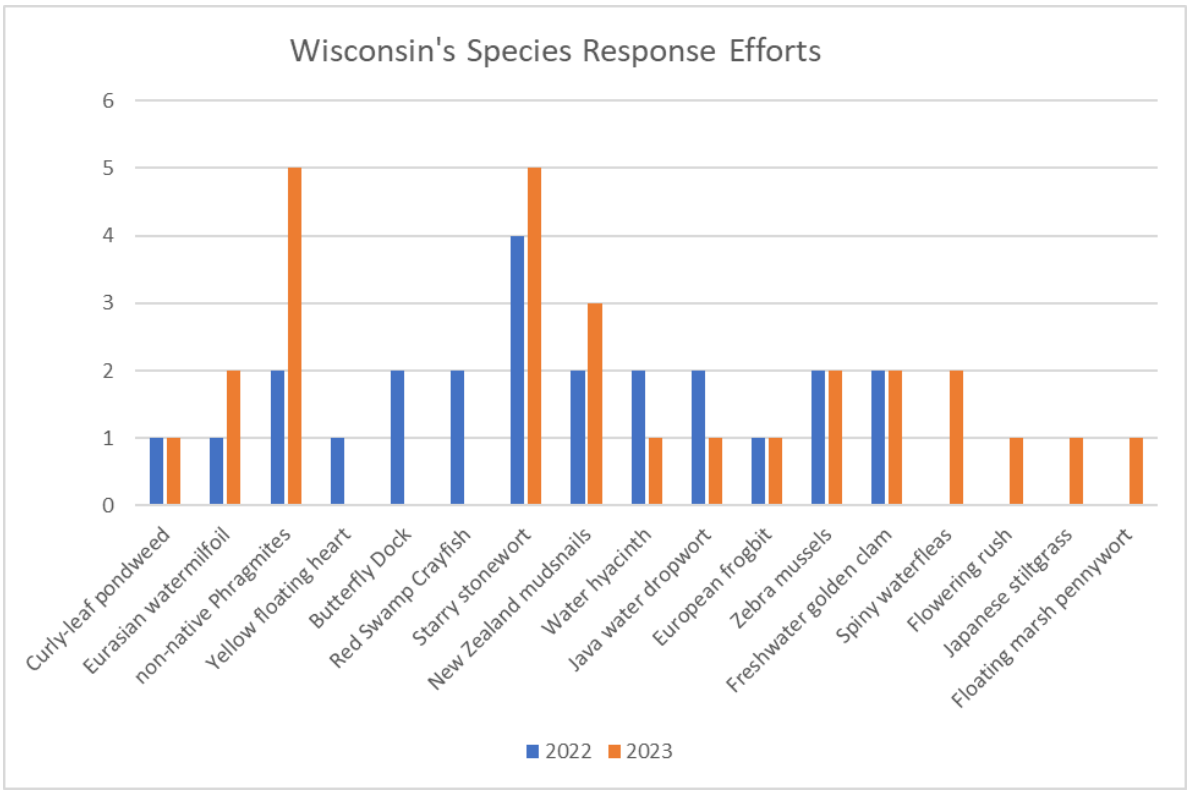


Figure 27. Count of aquatic invasive species responded to in 2022 and 2023.

Aquatic Invasive Species Rate of Spread

Since 2016, aquatic invasive species (AIS) monitoring has been integrated into the National Aquatic Resource Surveys on lakes, streams, and wetlands to assess AIS spread in Wisconsin. In 2022, 12 wetlands were surveyed for AIS during the National Wetland Condition Assessment, and 50 lakes were surveyed for AIS during the National Lake Assessment. In 2023, 49 stream sites were surveyed for AIS during the National Rivers and Streams Assessment. At least one AIS was detected at 64% of lakes, 66% of wetlands, and 69% of streams. Most detections were common species like reed canary grass, mystery snails, and Eurasian water milfoil.

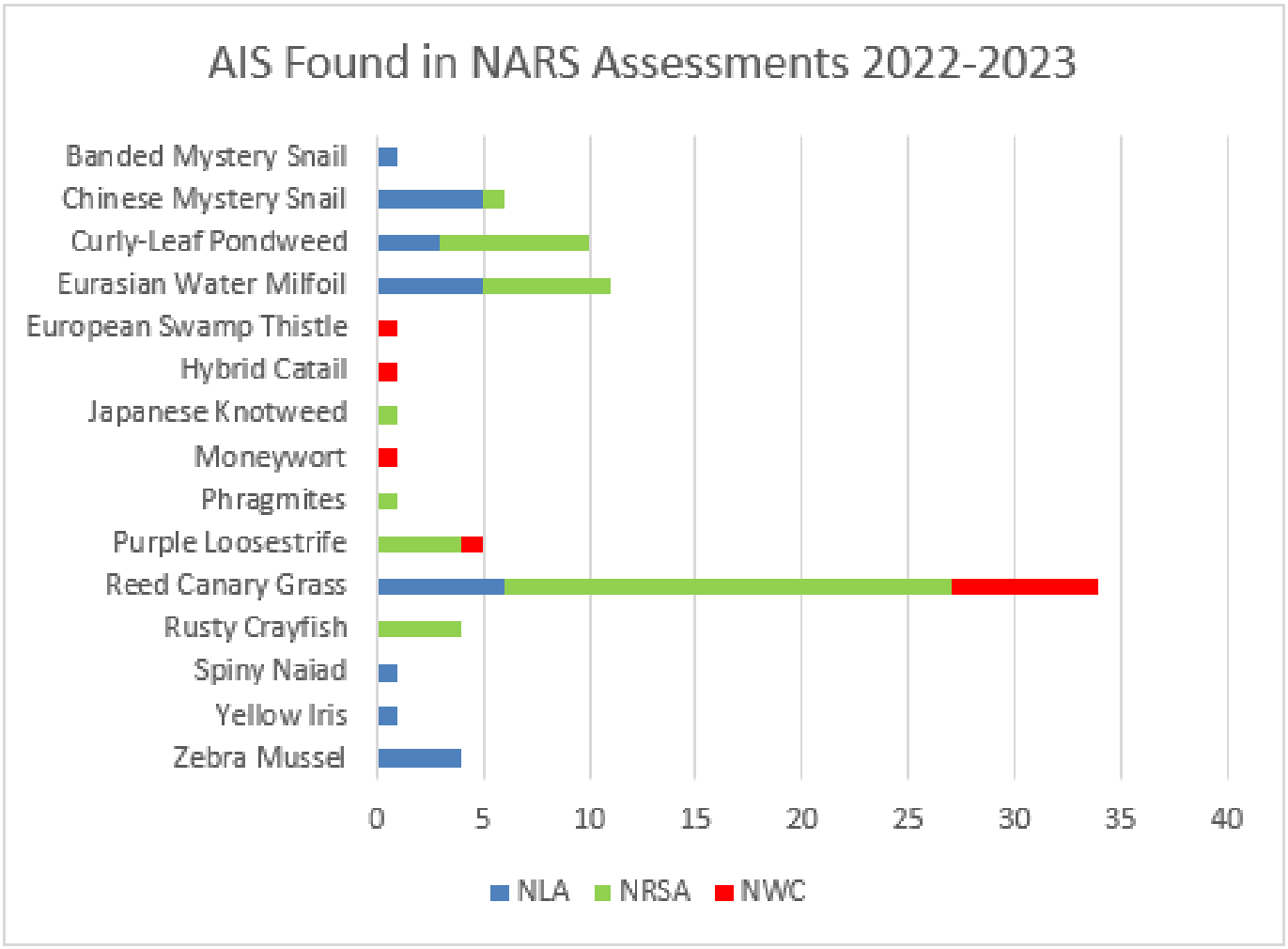


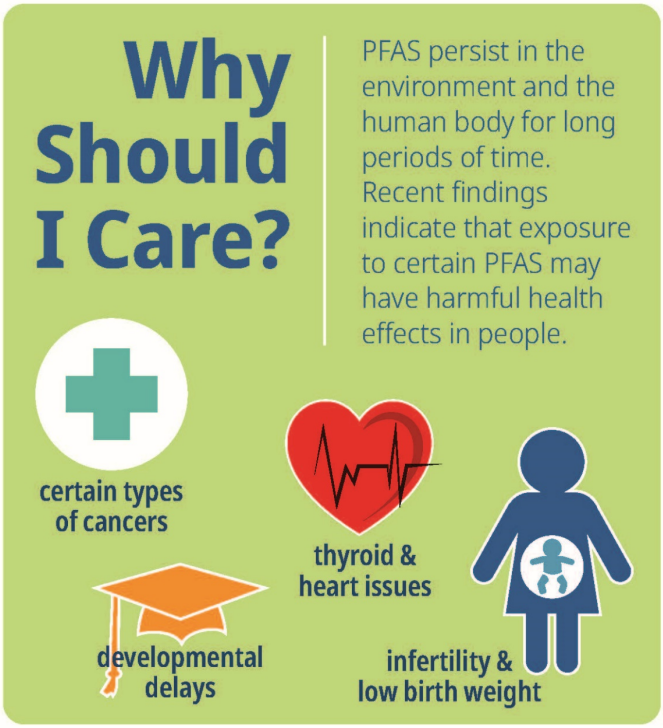
Figure 28. Number of aquatic invasive species detections in the 2022-2023 National Aquatic Resource Surveys (NLA=National Lakes Assessment; NRSA=National Stream Assessment; NWC=National Wetland Condition Assessment).

EMERGING CONTAMINANTS & WATER QUALITY STANDARDS

The hidden dangers in firefighting foam. Photo: U.S. Fire Administration

Perfluoroalkyl and polyfluoroalkyl substances (PFAS)

PFAS are human-made, organic compounds that have been manufactured for use in non-stick coatings, waterproof fabrics, firefighting foams, food packaging and many other applications since the 1940s. PFAS are highly resistant to degradation and have been detected globally in water, sediment, and wildlife. This global distribution is of concern as PFAS have documented toxicity to animals and because epidemiological studies have suggested probable links to several human health effects.



Surface Water Quality Criteria Promulgated

In 2022, surface water quality criteria were promulgated for two types of PFAS commonly known as PFOS and PFOA. See more information in the "Water Quality Standards" section below.

Monitoring

In 2020, WDNR collected water samples from 44 Long-term Trend sites, which are located on major river systems and whose water quality are routinely sampled each year. These sites have been purposefully selected to capture different geographic regions and the watersheds in this monitoring network collectively cover approximately 80% of the state. The WDNR also collected fish and water samples from 8 inland lakes in order to analyze patterns of PFAS accumulation.

In general, PFOS and PFOA were often non-detectable (37% and 19% of sites respectively), and when detectable PFOS concentrations were < 5.0 ng/L (1.4 ng/L average) for all sites and < 10 ng/L (2.2 ng/L average) for PFOA. Geographic areas that showed higher relative PFAS concentrations were the Wisconsin and

Mississippi Rivers and the Southeastern part of the state, whereas the Northwestern rivers were relatively lower, or non-detectable (Figure 29).

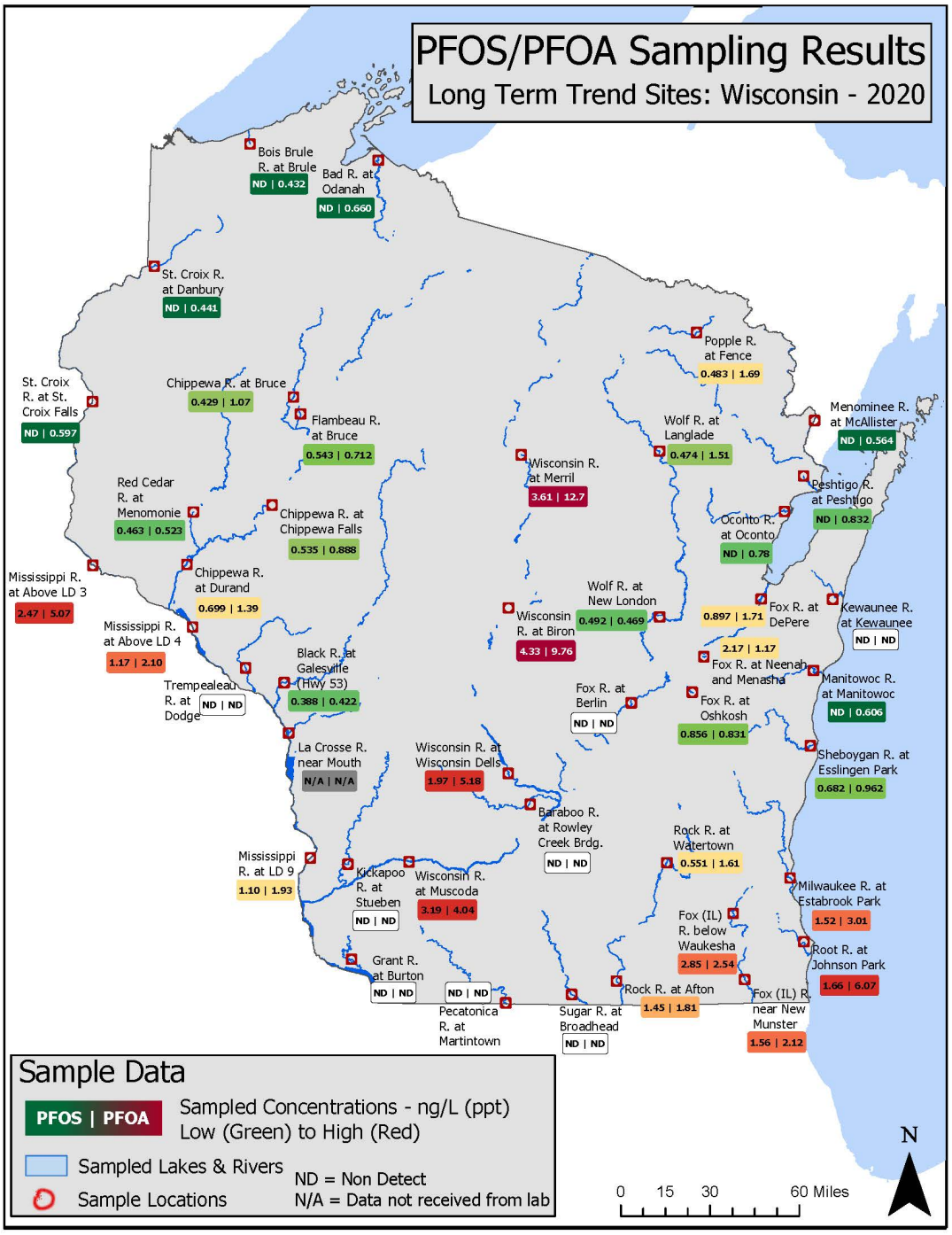


Figure 29. 2020 PFOS/PFOA sampling results at Long Term Trend monitoring sites across Wisconsin.

Since PFAS contamination was found in drinking water wells on French Island (near La Crosse on the Mississippi River), surface water from the Black River and areas around French Island were sampled in 2021. All sites were found to be lower than Wisconsin surface water standards of 8.0 ng/L PFOS and 95 ng/L PFOA. The PFOS concentrations in fish collected in these areas were like those in the Mississippi River. These findings suggest the PFAS-contaminated groundwater in French Island is not affecting the surrounding surface water or fish species.

Extensive sampling was done on Starkweather Creek and the Yahara River in 2019 and 2022. Water samples from the western branch of Starkweather Creek, which flows from the Dane County Airport/Truax Field, averaged 182 ng/L PFOS; Lake Monona PFOS was 9.0 ng/L; and PFOS remains elevated down the Yahara River to the confluence with the Rock River (PFOS average = 6.8 ng/L). This confirms findings in fish tissues and the need for the fish consumption advisory for this watershed. Note that since Lake Mendota is upstream of Starkweather Creek, it has very low PFAS concentrations (PFOS = 0.40 ng/L, PFOA = 0.69 ng/L in 2020).

In 2021, EPA Monitoring Initiative funding was secured to do in-depth PFAS sampling of Lake Monona starting in 2022 to study partitioning and distribution of PFAS. Some objectives were to:

- Measure the vertical and horizontal distribution of PFAS in the water to verify that we are monitoring PFAS in surface water appropriately.
- Develop a method to analyze PFAS in particulates filtered from the water.
- Analyze PFAS in lower-level food web organisms such as plankton, algae, aquatic insects, plants, and prey fish species to look at food web uptake of PFAS in sport fish.
- Measure PFAS in sediment and identify sediment characteristics associated with PFAS.

After Wisconsin issued a fish consumption advisory on smelt in Lake Superior, ten near-shore sites along the coast were sampled in 2021, and the PFAS concentrations (PFOA average = 0.18 ng/L, PFOS average = 0.19 ng/L) were far below surface water standards. Therefore, the cause of the high PFOS concentrations in smelt does not appear to be from the near-shore waters.

Surface waters from impoundments of the Wisconsin River have been sampled for PFAS since 2019. The Rainbow flowage in the far northern stretch of the Wisconsin River was below detection for PFAS, but concentrations increased south of Rhinelander. The southern-most site sampled was at Muscoda. Although the PFOS concentrations from most impoundments average 3 ng/L (less than the surface water standard), they are associated with fish consumption advisories, so this is an ongoing area of study.

In 2022, for the regular EPA National Lakes Assessment, staff collected PFAS in surface water in 23 inland lakes which were randomly chosen across the state. Like the 2020 Long Term Trends sampling of statewide rivers, the PFAS concentrations were very low. PFOS concentration averaged 0.26 ng/L and PFOA averaged 0.90 ng/L. Fish samples for PFAS were also collected in the same lakes and samples were submitted to EPA for analysis. Fish results are pending.

Wisconsin continues to sample PFAS statewide and recent results can be found on an interactive map that is routinely updated: https://dnr.wisconsin.gov/topic/PFAS/DataViewer.

Fish Consumption Advisories

Based on results of fish tissue sampling, WDNR and DHS issued new PFAS-based fish consumption advisories for:

- Angelo Pond in Monroe County on June 8, 2022. More details in the news release.
- Castle Rock Lake and Lake Mohawksin on October 11, 2022. More details in the news release.
- Green Bay shoreline, Area of Concern, and tributaries on January 18, 2022 (news release) and updated May 4, 2023 (news release). Tributaries included:
    - Menominee River
    - Oconto River
    - Peshtigo River

All the recent fish consumption advisories issued from 2022 – 2023 were used to list the waters found in Table 4.

Three waterbodies in Dane County that were previously listed as impaired due to elevated fish tissue concentrations were additionally listed as impaired because surface waters exceed the newly promulgated surface water quality criteria for PFOS. These are Lake Monona, Starkweather Creek, and West Branch of Starkweather Creek.

Water Quality Standards (WQS)

There are various criteria being created or revised through Department rulemaking efforts. Establishing WQS facilitates evaluations and listings. Updates are available on the Surface Water Quality Rule Update webpage.

Two WQS rule packages were passed in 2022.

PFOS and PFOA

In 2022, surface water quality criteria were promulgated for two toxic chemicals commonly known as PFOS and PFOA. These criteria define levels of public health significance for these two types of PFAS based on preventing adverse effects from contact with or ingestion of surface waters of the state, or from ingestion of fish taken from waters of the state.

- For PFOS, the level of public health significance is 8 ng/L for all waters except those that cannot naturally support fish and do not have downstream waters that support fish.
- For PFOA, the level of public health significance is 20 ng/L in waters classified as public water supplies under ch. NR 104, and 95 ng/L for other surface waters.

More information is available on the WDNR's PFAS webpage.

Assessing Waterbodies using Biological Metrics

Also in 2022, Wisconsin codified several of the biological assessment processes and thresholds used for assessing waterbody health. The new sections of the rule contain the following:

- An overview of the Department's obligations under the Clean Water Act to assess Wisconsin's waterbodies every two years and report to EPA.
- "Narrative biological assessment thresholds" that set expectations for the level of health of aquatic communities for any waterbody type.
- Algae thresholds to protect recreation and health of aquatic communities.
- Aquatic plant thresholds for lakes to protect healthy aquatic habitat.
- Criteria to protect lakes that have coldwater fish, based on the temperature and oxygen needs of these fish.
- Biological "phosphorus response indicators" for use in conjunction with phosphorus criteria to evaluate whether or not phosphorus-related impacts are occurring.

Antidegradation Policy and Implementation Procedures

In late 2023, WDNR submitted proposed updates to its Antidegradation policy and related implementation procedures to the Legislature. These are a required element of the Clean Water Act, with the goal of protecting state waters from degradation over time. The updates are necessary for consistency with revisions to federal antidegradation regulations that were enacted in 2015. This rule package is under consideration by the Legislature.

Financial Assistance to Meet Water Quality Goals

Lower Peshtigo River

Environmental Improvement Fund (EIF)

Wisconsin's Environmental Improvement Fund (EIF) consists of two separate financial assistance programs: the Clean Water Fund Program (CWFP) for wastewater treatment and urban runoff projects, and the Safe Drinking Water Loan Program (SDWLP) for drinking water projects. The programs are administered jointly by WDNR and the Department of Administration. Financial Assistance is provided by purchasing the general obligation or revenue bonds of municipal governments to finance eligible projects; these transactions are referred to as loans in this section of the report and in program informational materials. Funding sources for both programs are annual capitalization grants awarded by EPA, state match to the capitalization grants, and repayments from previous loans. In addition, both the CWFP and SDWLP are leveraged programs.

The EIF is an excellent tool for Wisconsin in meeting its responsibilities under both the Clean Water Act (CWA) and the Safe Drinking Water Act (SDWA). EIF programs provide financial assistance to local units of government in the form of subsidized loans and, in some cases principal forgiveness.

Clean Water Fund Program (CWFP)

The CWFP provides financial assistance to municipalities for planning, design, and construction of surface water and groundwater pollution abatement facilities to process municipalities' wastewater and urban runoff. Projects typically are constructed to maintain compliance with existing permit limits, but other eligible projects achieve compliance with new limits, or provide wastewater treatment in areas previously not served.

From 1991 through June 30, 2023, the CWFP entered into 1,293 financial assistance agreements with Wisconsin municipalities totaling $5.9 billion—$5.5 billion in loans and $364 million in grants and principal forgiveness. The amount of financial assistance provided for individual CWFP projects ranges from $18,851 to over $138 million. To be qualified for CWFP funding, a project must meet eligibility requirements as outlined in s. 281.58 (7) (b), Wis. Stats.

The CWFP provides financial assistance to municipalities in the form of loans at or below market interest rates. In addition, principal forgiveness is an additional subsidization that may be provided to disadvantaged municipalities. Repayments of principal and interest from CWFP loans will make up the primary source of funding for future CWFP projects.

Each CWFP project is prioritized using a system established by Wisconsin Administrative Code. The criteria used to evaluate projects are based on human health, regionalization, water quality impacts (based on a facility's discharge permit limit), and the financial need of the municipality served by the project. The priority system assigns a score to every project based on these criteria. Projects are ranked numerically, so in the event funding is not available for all requested projects in a given year, awards will be made by the order in which they are ranked. Historically, funding each biennium has been sufficient to fund all eligible CWFP projects. However, due to a record-breaking year in the number of applications submitted, in SFY24 the CWFP had to limit the number of supplemental applications (applications not competing for principal forgiveness) accepted due to loan capacity issues.

Safe Drinking Water Loan Program (SDWLP)

The SDWLP was enacted in 1997 to provide financial assistance to municipalities for the planning, design, construction, or modification of public water systems. The SDWLP uses funding from the capitalization grant authorized by the SDWA and repayments from previous loans.

From the beginning of the program in 1998 through June 30, 2023, the SDWLP entered into 659 financial assistance agreements with Wisconsin municipalities totaling $1.1 billion—$911 million in loans and $202 million in principal forgiveness. Projects must meet eligibility requirements as outlined in s. NR 166.06, Wis. Adm. Code, to qualify for SDWLP funding.

In 2016, a program component was added to target private lead service line replacements. Since December 2016, that program has entered into 201 financial assistance agreements to provide $101,928,508 of principal forgiveness funding.

The SDWLP provides financial assistance to municipalities in the form of loans below market interest rates. Since 2009 the SDWLP also provides principal forgiveness for a portion of the project costs to some municipalities; principle forgiveness methodology is detailed in Wisconsin's annual SDWLP Intended Use Plan.

Each SDWLP project is prioritized using a system established by Wisconsin Administrative Code. The criteria used to evaluate projects include risks to human health from acute and chronic contaminants, system compliance issues, system capacity issues, and financial need, among others.

The priority system assigns a score to every project based on the criteria. Projects are ranked numerically, so in the event funding is not available for all project applicants in a given year, awards will be made by the order in which the projects are ranked.

A State Lab of Hygiene employee demonstrates the proper procedure to collect a clean water sample. 2020

Surface Water Grants Program

The surface water grant program provides cost-sharing grants for surface water protection and restoration. Funding is available for education, planning, management plan implementation, and aquatic invasive species prevention and control activities. For the upcoming 2024 season the following totals were awarded:

- **Aquatic Invasive Species (total $3,665,995)**
  - Lake Monitoring and Protection Network: $957,683
  - Clean Boats Clean Waters: $807,938
  - AIS Education: $1,340
  - AIS Prevention: $181,021
  - AIS Planning: $486,617
  - AIS Comprehensive Planning: $50,000
  - AIS Early Detection and Response: $205,526
  - AIS Research & Demonstration: $185,937
  - AIS Large-Scale Population Control: $431,916
  - AIS Small-Scale Population Control: $563,544
- **Lakes (total $1,990,497)**
  - Lakes Education: $445,539
  - County Lakes: $99,357
  - Comprehensive Planning: $165,595
  - Lake Planning: $103,497
  - Lake Land Acquisition: $278,443
  - Ordinance Development: $0
  - Healthy Lakes & Rivers: $184,555
  - Lake Surface Water Restoration: $102,909
  - Lake Management Plan Implementation*: $1,010,607
- **Rivers (total $339,500)**
  - River Education: $14,475
  - River Planning: $57,900
  - River Surface Water Restoration: $67,125
  - River Management Plan Implementation*: $200,000

** Category includes Federal 319 funds*

Rice Lake in Barron County. The Rice Lake Protection and Rehabilitation District received a small-scale AIS population control grant.

Additional details can be found on the Surface Water Grant website.

Conclusions

Popple River, Jennings Falls, Florence County *Photo: Luke Ernster 2019*

With bountiful water resources, over 5 million residents, and up to 112 million annual visitors, the state of Wisconsin works diligently to protect water quality, biological integrity, and recreation opportunities. The Water Condition Lists are a first step in managing Wisconsin's waters, determining if protection or restoration is required. Monitoring was conducted across the state, resulting in new pollutant listings and delistings. The majority of new listings were for phosphorus and aquatic plants. There were 38 listing removals for seven different parameters. A total of 230 waters were newly assessed and determined to be on the Waters Attaining Standards List.

Many WDNR programs and partners continue to work together to manage the state's water resources; a significant amount of work was done during the 2024 reporting cycle. In 2023 volunteers gathered water quality data for over 1,000 lake sites (CLMN program) and over 600 stream sites (WAV program). WDNR staff collected long-term trend and project data across the state. Monitoring for the Fox Des-Plaines TMDL was completed and the Northeast Lakeshore TMDL was approved by the EPA. A new Adaptive Management plan targeted a total phosphorus reduction of 2,300 lbs/year and a total of 13 Water Quality Trading plans were approved, curtailing nonpoint source phosphorus loading. Two water quality criteria packages were passed and close to $6 million dollars in surface water grants were awarded. The full magnitude of monitoring, restoration, and protection work done in Wisconsin was briefly summarized in this report.

Sign up for GovDelivery emails for real-time updates via email or text message. The topic 'Water Quality Standards and Assessments' under 'Water' will provide information regarding standards, changes to water quality condition, WisCALM updates, and general TMDL updates.
https://public.govdelivery.com/accounts/WIDNR/subscriber/new.