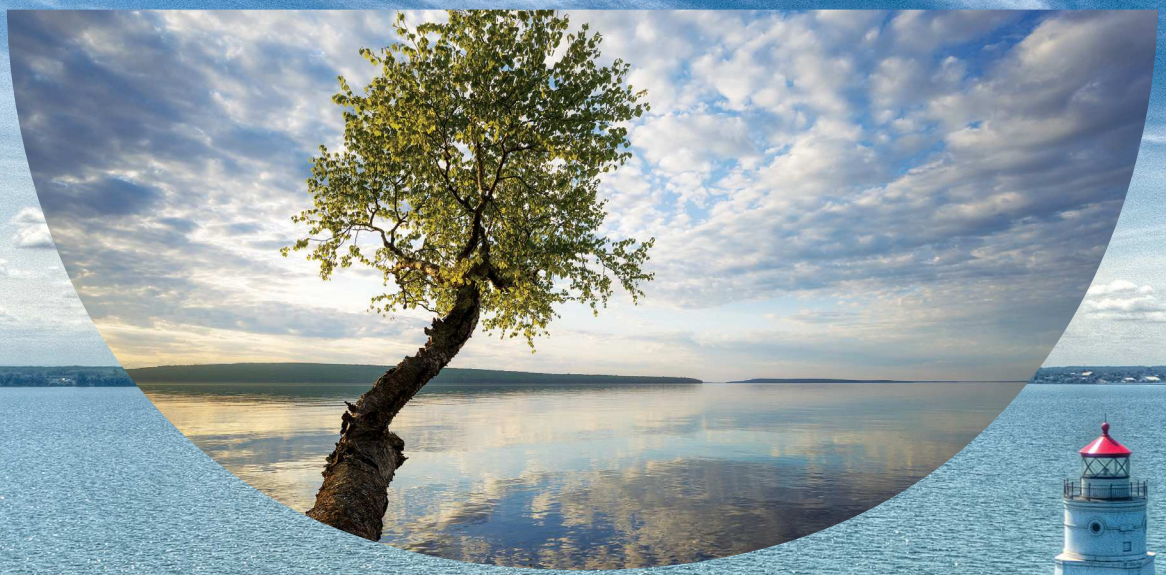
SPECIAL REPORT

WISCONSIN'S GREAT LAKES

Vital assets to cherish and champion



MARC PONTO

Ours to protect and restore

Bradford Beach, Milwaukee

DNR and partners work together to support the Great Lakes, a treasured resource for Wisconsin

• *KENDRA AXNESS*

Lake Superior and Lake Michigan shape Wisconsin's culture and economy in important ways.

They provide vital water supply for drinking and manufacturing, support a $3 billion tourism industry in lakeshore counties, and connect the state to maritime transportation networks that generate 8,800 jobs and $2.4 billion in economic activity.

Wisconsinites also relish recreational opportunities the lakes offer. We love them for their beauty and for their vastness — for the opportunity to rest our eyes on a boundless watery horizon.

But despite this love, we have not always treated them well. The Great Lakes in Wisconsin and throughout the region face many problems stemming from a history of unchecked industrial, urban and agricultural land uses. Toxic pollutants, algae blooms and invasive species are harming the lakes' ecosystems and in turn impairing our ability to use and enjoy them.

There is hope for a bright future, however. Through a combination of regulatory programs, Great Lakes Water Quality Agreement programs and the federal Great Lakes Restoration Initiative, Wisconsin is doing its part to protect and restore the lakes.

The Great Lakes Restoration Initiative — glri.us — is a federal program that provides funding to accelerate restoration efforts on the five Great Lakes. It's guided by an action plan with goals and accountability standards in five focus areas; read more at glri.us/documents#actionplan.

More than $405 million of GLRI funding has been invested in Wisconsin since 2010, leading to environmental improvements and boosting the state's economy.

The following pages highlight the many ways the Department of Natural Resources and partners are working together to ensure healthy lakes for future generations.

Kendra Axness is a policy coordinator for the DNR's Office of Great Waters, focusing on Areas of Concern and Lakewide Action and Management Plan issues.

LEARN MORE

AREAS OF CONCERN: AOCs are sites along the Great Lakes with the most severe environmental damage stemming from pollutants. Forty-three AOCs were designated under the 1987 Great Lakes Water Quality Agreement, including five in Wisconsin; dnr.wi.gov/topic/GreatLakes/aoc.html.

GREAT LAKES WATER QUALITY AGREEMENT: This agreement between the U.S. and Canada commits each country to restoring the Great Lakes. Originally signed in 1972, it was updated in 1978, 1987 and 2012, with the 1987 agreement creating AOCs; ijc.org/en/what/glwqa-ijc.

BENEFICIAL USE IMPAIRMENT: The International Joint Commission, an agency created by a U.S. and Canadian treaty to resolve disputes over waters along the shared border, provided a list of 14 possible environmental problems, called beneficial use impairments, to designate AOCs. Once restoration goals are met for an AOC's designated impairments, it can be removed from the AOC list; epa.gov/great-lakes-aocs.

SHEBOYGAN RIVER
AREA OF CONCERN

Signs of healing: From 'black eye' to vision of hope

JANNA SOERENS

Bird surveys are part of the citizen science work conducted along the revitalized Sheboygan River.

STACY HRON

Dredging of the Sheboygan River was completed in 2013, spurring renewed interest in riverfront development projects.

CHAD PELISHEK

• *SUSAN TESARIK*

The Sheboygan River Area of Concern is healing after a decade of concerted efforts by local, state and federal partners to clean up historical pollution.

The lower 14 miles of the Sheboygan River and harbor were listed as a Great Lakes Area of Concern due to past industrial contamination and habitat degradation. Contaminants included polychlorinated biphenyls and polycyclic aromatic hydrocarbons — PCBs and PAHs.

Several projects removed these polluted sediments and restored fish and wildlife habitats, providing a better economy and quality of life for this community.

"The AOC projects have been an economic driver for the city of Sheboygan," said Chad Pelishek, director of planning and development for the city. "Developments along the Sheboygan River since dredging was completed in 2013 have led to approximately $90 million in new investment along a river that once was the black eye of the community."

After the dredging project happened, Pelishek said, numerous developers "wanted to be near the water and have had a renewed interest in the Sheboygan River."

Along with economic success stories, people also are embracing the water. Sheboygan County's planning and conservation department director, Aaron Brault, noted renewed interest in recreational activities as environmental problems are resolved.

"There are a lot more kayakers, (paddle boarders) and canoers using the river than in the past," Brault said. "Volunteer groups also continue to complete monitoring activities to hopefully show the health of the river keeps improving.

"The river is starting to be celebrated rather than having backs turned on it."

VOLUNTEERS PLAY A BIG ROLE

On the volunteer front, Sarah DeZwarte has been recruiting and training people for the past 10 years to collect data to assess the health of the Sheboygan River AOC. Her work as education director for Camp Y-Koda Outdoor Skills and Education is a collaborative effort with the DNR and municipalities.

"Our citizen scientists look for the presence of frogs, toads, mussels, bats, birds and invasive species in and around the Sheboygan River," she said.

These species can indicate how the environment is responding to pollution cleanup and restoration actions.

While community members have helped gather needed data, their understanding of the science behind the AOC project also has deepened, DeZwarte said.

"I think the most important outcome is that we see our citizen scientists actively engaged in local, real-life, hands-on science," she said. "Through evaluation surveys, we learned that citizen scientists felt they gained a deeper understanding of river ecosystems. They also commented that they began to feel comfortable asking science-related questions, which led them to further science exploration.

"They observed species of wildlife they hadn't before, and they have become overall stewards of our local environment."

Volunteers have even started to form their own groups for stewardship activities, DeZwarte noted, including beach cleanup outings and invasive species removal. "It has been a truly amazing experience to watch these volunteers blossom."

With community members so actively engaged, the Sheboygan River and harbor is sure to remain in good hands well beyond the AOC program.

Susan Tesarik is communications and outreach coordinator for the DNR's Office of Great Waters.

SHEBOYGAN RIVER AOC

Three of the nine environmental problems listed for the Sheboygan River Area of Concern have been addressed: restrictions on dredging activities, undesirable algae and degraded bottom-dwelling organisms. The remaining impairments are being evaluated as the environment continues to heal. To learn more, visit dnr.wi.gov/topic/GreatLakes/Sheboygan.html.

For details about Camp Y-Koda Outdoor Skills and Education programs and to get involved, visit sheboygancountyymca.org/camp-y-koda. To learn more about city of Sheboygan cleanup initiatives, check sheboyganwi.gov under the "History & Info" tab.

And for a case study assessing the economic impact of the Great Lakes Restoration Initiative in Sheboygan, go to the Great Lakes Commission website, glc.org, and search "Sheboygan."

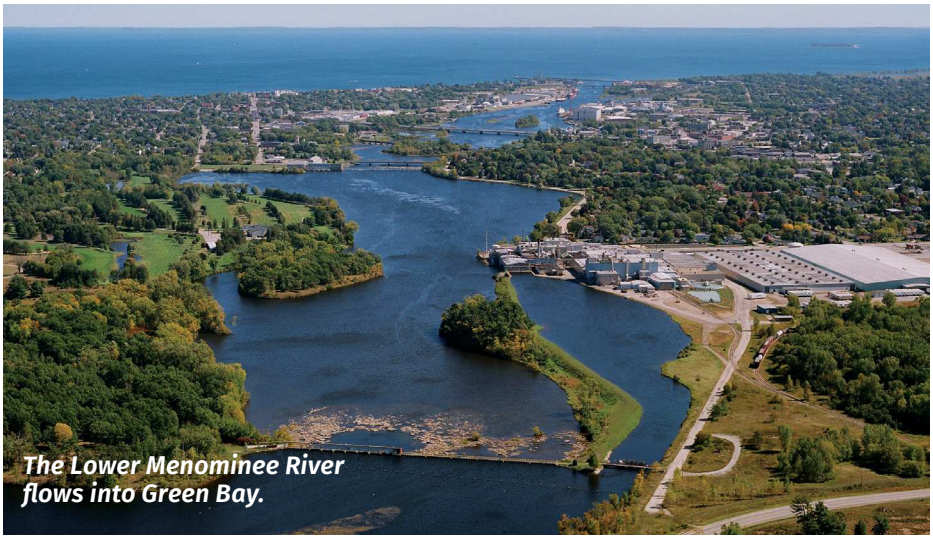
LOWER MENOMINEE RIVER
AREA OF CONCERN

Removing polluted sediments from Menekaunee Harbor has allowed for restoration of fish and wildlife habitat.

CHERYL BOUGIE

Success story: Removed from AOC list, Lower Menominee shines as source of pride

• *ALLISON VOGLESONG ZEJNATI*



The Lower Menominee River flows into Green Bay.

BRIAN HOLBROOK

Just before it spills out into northwestern Lake Michigan's Green Bay, the Lower Menominee River defines the boundary between the Wisconsin port city of Marinette and its Michigan neighbor, the city of Menominee.

What used to be a heavily polluted river is now a cleaner waterway that binds the two cities as a shared point of pride.

As of August 2020, and after more than 30 years of effort, the Lower Menominee River is no longer on a binational list of pollution hotspots around the Great Lakes.

"It's something we can be really proud of, that we've made the river part of the community again," said Keith West, co-chair of the Lower Menominee River Area of Concern Citizens Advisory Committee and associate professor of geoscience at UW-Green Bay's Marinette campus.

The International Joint Commission, the agency created by a U.S. and Canadian treaty to resolve disputes over waters along the shared border, included the Lower Menominee River on its list of 43 pollution hotspots, or Areas of Concern, in the Great Lakes basin in 1987.

For decades, industrial development at the slow-flowing river mouth meant contaminants dumped in the waters — such as arsenic, coal tar and paint sludge — settled nearby, coating the river bottom.

"I used to take my students out to Menekaunee Harbor on the river because it provided a great example of how to ruin an aquatic ecosystem," West said.

When the AOC was first listed, the Wisconsin and Michigan departments of natural resources began to cooperate with a Citizens Advisory Committee. The committee assists state and federal agencies with different aspects of Remedial Action Plans for AOCs.

Trygve Rhude, a resident of the Menominee region, serves alongside West as committee co-chair.

"I got involved from day one," Rhude said. "I've worked on this for more than half of my life."

CHECKING OFF THE LIST

To remove an Area of Concern from the list of hotspots, state agencies — along with federal and local partners — first identify the causes of specific ecological problems.

Then they take actions to address the impairments, and finally use monitoring and data to demonstrate the ecosystem is no longer impaired so people and wildlife can once again enjoy the benefits of clean water.

Of 14 possible problems, the Remedial Action Plan for the Lower Menominee River listed six beneficial use impairments. As of 2019, all have been addressed. Here's the original list and the year each was removed:

- Beach closings or restrictions on recreational contact with the water — 2011
- Restrictions on dredging activities for navigation or commerce — 2017
- Communities of bottom dwelling organisms are degraded — 2017
- Restrictions on eating fish and wildlife — 2018
- Loss of fish and wildlife habitat — 2019
- Degraded fish and wildlife populations — 2019

"The main focus of the AOC was eliminating the arsenic, and just accomplishing that one feat is a huge success story," Rhude said.

"But we also had issues like loss of habitat and degraded fish populations on our list, and because of that we were able to do more than just scoop out the polluted sediment in the river."

Although the action plan for the Lower Menominee identified several remediation goals, for many years there was slow progress due to a lack of funding, while waiting on legal processes to unfold.

Launched in 2010, the Great Lakes Restoration Initiative began to provide an infusion of federal funding to help put plans into action.

"Being an AOC was a blessing in disguise in that we were able to leverage that money to restore habitat and do really visible projects that benefit our community and the environment, like the Menekaunee Harbor," Rhude said. "That would have never happened if we weren't an AOC."

FIRST FOR WISCONSIN

Benefits to sturgeon were particularly noticeable once restoration progressed, said Stephanie Swart, Michigan Department of Environment, Great Lakes and Energy AOC coordinator for the Lower Menominee River.

"The amount of sturgeon habitat we were able to restore in the Lower Menominee River is truly remarkable," she said.

For Brie Kupsky, the Wisconsin DNR's Office of Great Waters AOC coordinator for the river, the most important success story is how much was accomplished from 2014 to 2019 because of funding from the Great Lakes Restoration Initiative.

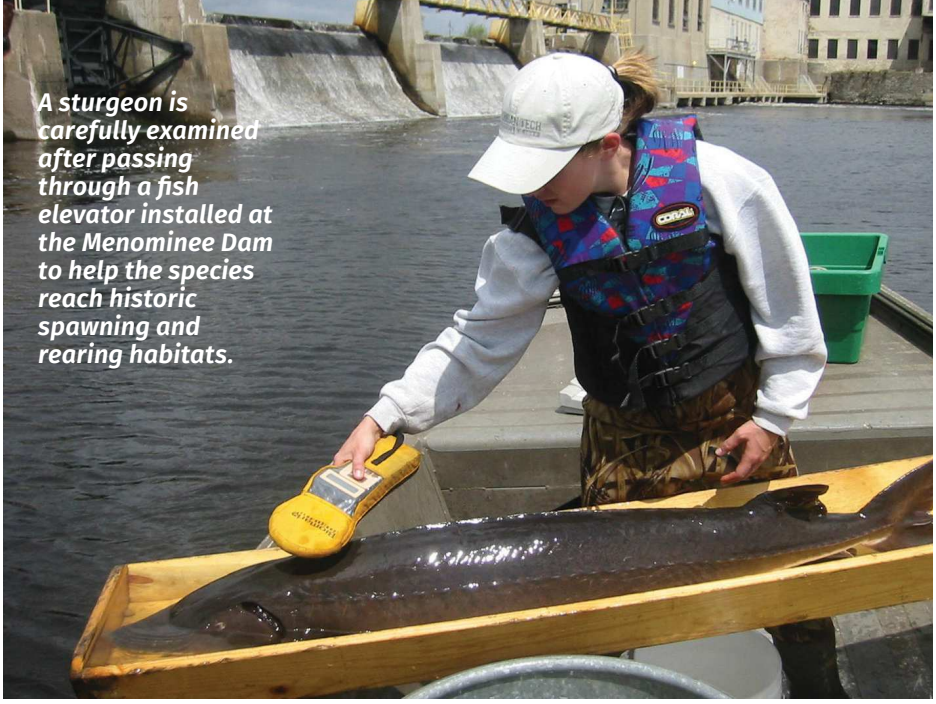
Since 1985, $71.1 million in public funding has gone to clean up the AOC, with $41.1 million from the GLRI. Once the GLRI funding came, work could get started right away because the area was "shovel ready" with complete remedial action plans agreed upon.

Out of 43 AOCs around the Great Lakes, the Lower Menominee River is the eighth to delist. It is the fifth in the U.S., the third in Michigan and the first in Wisconsin.

Although it is delisted, the need remains for community members to be involved with protecting the river.

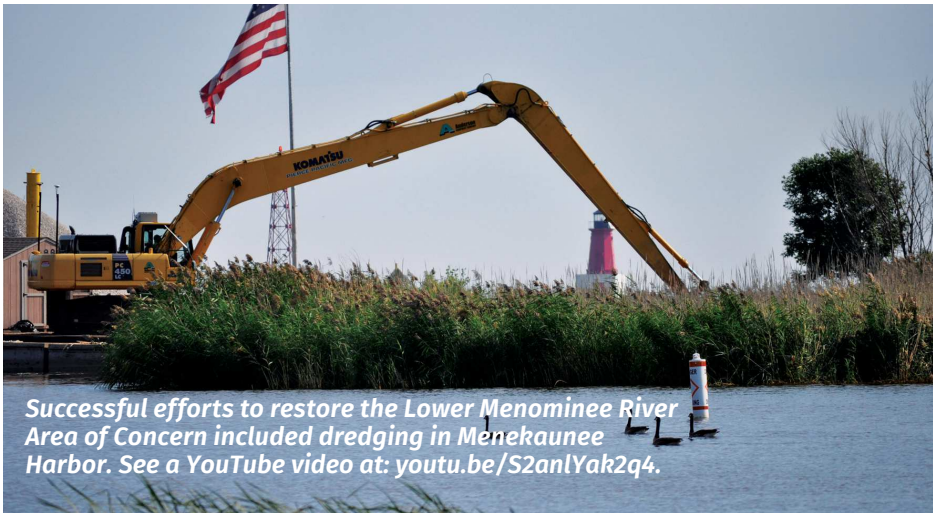
"If you can get people to value the water, they'll protect it," West said. "And I think the cleanup of the river through the AOC succeeded in that."

Allison Voglesong Zejnati is a public affairs specialist (contractor) with the International Joint Commission, Great Lakes Regional Office.



A sturgeon is carefully examined after passing through a fish elevator installed at the Menominee Dam to help the species reach historic spawning and rearing habitats.

ROB ELLIOT



Successful efforts to restore the Lower Menominee River Area of Concern included dredging in Menekaunee Harbor. See a YouTube video at: youtu.be/S2anlYak2q4.

DNR FILES

LOWER MENOMINEE RIVER AOC

To learn more about the Lower Menominee River Area of Concern and efforts that led to its delisting, visit dnr.wi.gov/topic/GreatLakes/Menominee.html. To get involved in stewardship opportunities, follow the Lower Menominee River AOC Citizens Advisory Committee on Facebook: facebook.com/menominеeriveraoc.

This story first appeared in the International Joint Commission's Great Lakes Connection December 2020 newsletter and was adapted with permission from the author. To see the original article and other newsletters and information from the IJC, go to ijc.org and search under Library. For more about the IJC's work on the Great Lakes visit ijc.org/en/what/glwq.

LOWER GREEN BAY AND FOX RIVER
AREA OF CONCERN

Cleanup completed: Momentum continues to restore habitats, water quality

A revitalized river and bay boosts the local economy and enjoyment of area waters through outdoor recreation and events in recent years like a concert on the city dock in downtown Green Bay.

CHRISTOPHER RAND

• *KENDRA AXNESS*

The global pandemic made 2020 a difficult year, but for the residents of northeast Wisconsin there was a big reason to feel hopeful that better days are ahead: the completion of the Lower Fox River PCB cleanup project.

With these toxic pollutants now fully remediated, habitat and watershed restoration initiatives can gain the full attention of the many dedicated partners working to restore the Green Bay ecosystem.

DNR Office of Great Waters Director Steve Galarneau has seen the cleanup of these polychlorinated biphenyls unfold over the course of his 27-year career with the DNR.

"It took a lot of persistence and hard work to get here, and we celebrate this huge achievement with all of the partners who contributed to this success," he said. "At the same time, we know we have more to do to restore this AOC, and we're excited to keep the momentum going."

The Lower Green Bay and Fox River Area of Concern spans 7 miles of the Lower Fox River — downstream from the De Pere Dam to the mouth — and approximately 22 square miles of southern Green Bay.

These waters were designated an AOC in the late 1980s due to the presence of PCBs, habitat loss and degradation, and excessive algae.

These problems limit the ability of residents and visitors to consume fish and waterfowl and to enjoy recreational activities. They also harm fish and wildlife populations. The presence of toxic pollutants in river and bay sediments also led to restrictions on dredging activities, causing problems for shipping and recreational boating.

MAJOR ACCOMPLISHMENT

Completing the Lower Fox River PCB cleanup was a necessary step to address these problems. PCBs are toxic chemicals that were produced during the production and recycling of carbonless copy paper in the 1950s through 1970s.

One of the largest known PCB cleanups of its kind in the world, the 17-year effort in northeast Wisconsin followed decades of scientific investigation and included dredging, capping and sand covering.

The project was designed to reduce risk to human health and the environment due to the presence of PCBs in river sediment from Little Lake Butte des Morts to the river mouth at Green Bay and beyond.

The cleaner, deeper river and bay ensure the continued vitality of the

Dredging operations in the Lower Fox River have been completed, marking a major milestone in AOC remediation work.

J.F. BRENNAN

Port of Green Bay. According to the most recent Port of Green Bay Economic Impact Study, the port contributes $147 million to the economy while supporting 1,289 jobs.

That represents a $64 million increase since the previous economic study in 2010. A healthy port will continue to sustain and grow jobs, income and business.

HABITAT WORK POISED TO TAKE OFF

For Brie Kupsky, the DNR's Lower Green Bay and Fox River AOC coordinator, finishing the PCB cleanup is a game-changer.

"While we were able to start some important projects like the Cat Island Chain restoration, there's a lot of AOC habitat work that had to wait until the cleanup was done," Kupsky said. "I'm thrilled that we are now able to begin moving more of our AOC habitat restoration projects into the limelight."

Kupsky has worked with partners from UW-Green Bay, the U.S. Fish and Wildlife Service, The Nature Conservancy and many others to develop a list of 18 AOC habitat projects that, once implemented, will result in achieving the desired goals for fish and wildlife habitat and populations.

Projects will enhance habitat for shorebirds, waterfowl, fish, turtles and other animals. Most of the funding for the projects is anticipated to come from the Great Lakes Restoration Initiative — GLRI — and the Natural Resource Damage Assessment.

The NRDA is the avenue for the public to be compensated for the environmental damage caused by the PCBs. It funds projects to restore habitat and provide recreational access.

"The collaboration with the NRDA Trustees is a unique opportunity in this AOC," Kupsky said. "We can leverage those funds with GLRI funds and find efficiencies for achieving the goals of multiple partners and programs."

SUSTAINED EFFORT REQUIRED

The sediment and habitat problems, while challenging, are in some ways easier for the AOC program because they are localized issues that can be addressed by working directly within or adjacent to the Lower Green Bay and Lower Fox River. Addressing poor water quality within AOC waters is a different story.

During rainstorm and snowmelt events, excess fertilizer and sediment is carried from the land to local waterways in runoff water. In the 6,400-square-mile Fox-Wolf watershed, this runoff eventually flows into Green Bay.

That means activities on land far away from the AOC boundaries are contributing to issues in the AOC, such as algae blooms in Green Bay. The scale of this problem means the AOC program can do some, but not all, the work needed to address this issue.

Kupsky and many local partners are exploring ways for the AOC program to help address these larger water quality problems as part of the Lower Fox River Water Quality Management Plan.

This planning effort brings together partners including the DNR's watershed managers, Fox Wolf Watershed Alliance, county governments, UW-Green Bay, Alliance for the Great Lakes, area legislators and others to describe the nutrient and sediment reducing actions needed in the Lower Fox Watershed, develop strategies to meet those needs and identify potential funding sources.

Kupsky is optimistic the AOC waters will continue to get better with time.

"There is such passion for these waters in northeastern Wisconsin," she said. "So many amazing people have dedicated their careers to solving the problems that we've had in the river and bay.

"Thanks to them, we've come a long way — and the success of the PCB cleanup is proof that it's possible to do big things."

Kendra Axness is a policy coordinator for the DNR's Office of Great Waters, focusing on Areas of Concern and Lakewide Action and Management Plan issues.

Volunteers help to record data along the Lower Fox River at a monitoring event for the Area of Concern.

BRIE KUPSKY

CLEANUP CALCULATIONS

Here are some of the notable numbers from the Lower Fox River PCB cleanup.

- **Dredged sediment total: 6.5 million cubic yards**
- **Area of river bottom capped: 275 acres**
- **Area of river bottom sand covered: 780 acres**
- **Processed sediment sent to landfill: 4 million tons**
- **Treated water returned to river: 10 billion gallons**
- **PCB reductions since 2006: 90% in river water; 80-90% in sediment**
- **Average PCBs in walleye: 65% lower since 2006**

LOWER GREEN BAY AND FOX RIVER AOC

To learn more about the Lower Green Bay and Fox River AOC, visit dnr.wi.gov/topic/GreatLakes/GreenBay.html. For more on the Lower Fox River PCB cleanup project, see dnr.wi.gov/topic/foxriver.

Find details on the most recent Port of Green Bay Economic Impact Study at portofgreenbay.com/economic-impact-study. And watch two DNR videos on habitat restoration work on YouTube:

- **"Cat Island – Rebirth of an Environment" — youtu.be/BZnMQ9cQ_J4**
- **"Plovers Are Back in Green Bay" — youtu.be/luSqpRUWo84**

MILWAUKEE ESTUARY
AREA OF CONCERN

Environmental reckoning:
Milwaukee addresses past mistakes to create more promising future

McKinley Marina, on Lake Michigan in Milwaukee

• *JOHN GURDA*

Milwaukee's rivers have played multiple roles over the centuries — as canoe routes for Native Americans, channels of commerce for early urbanites, sources of ice for local beer barons and corridors of recreation for tired factory workers.

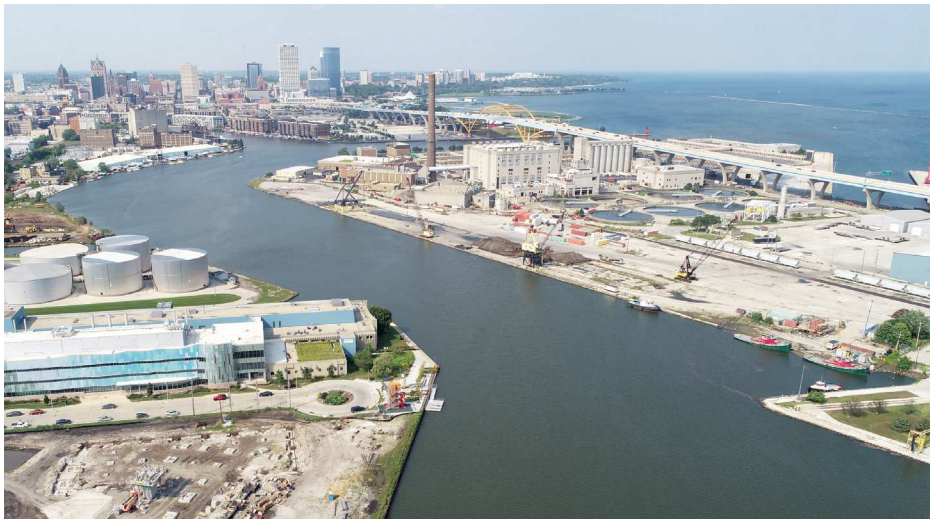
All of those incarnations have evaporated with time, but a darker legacy of the past is still very much present: a thick layer of polluted sediment deposited during Milwaukee's industrial heyday.

That toxic legacy is a threat to human health, a killer of aquatic life and an aesthetic disaster, but its days may be numbered.

Milwaukee is poised to launch the biggest cleanup project in the history of the Great Lakes. The effort would cost somewhere north of $350 million, 65% coming in federal funds and the rest from local sources.

That would make it one of the largest public works projects in Milwaukee's recent history. For comparison, $350 million would fund the city's entire library system for almost 20 years.

The work is decidedly unglamorous but entirely necessary. The tall figures of Milwaukee's past may have been hard workers and visionary thinkers, but from an environmental standpoint, the results of their work have been a disaster.



SIGMA GROUP

The trio of rivers flowing into Lake Michigan in Milwaukee — the Menomonee, Kinnickinnic and Milwaukee — are included in the Area of Concern because of the historical pollution that contaminated them.

Lacking both the technology and the understanding to protect local rivers, the city turned them into open sewers.

By 1878, when Milwaukee's population had surged past the 100,000 mark, the community had nearly 75 miles of sewer pipe under its streets. The system's sole function was to carry human, animal and industrial waste, mixed with stormwater, to the nearest river.

There it sat until the next heavy rain pushed it out into Lake Michigan — the source of the city's drinking water.

An 1881 visitor described the Milwaukee River as "a currentless and yellowish murky stream, with water like oil, and an odor combined of the effluvia of a hundred sewers."

GROWING INDUSTRIES, DYING WATERS

Household sewage and horse manure were the worst of it in the short term. They consumed nearly all the available oxygen in the rivers, making them uninhabitable for native aquatic life.

In the long run, however, the greater menace was the steady stream of contaminants from local industries. For generations, Milwaukee's machine shops, tanneries, packing houses, breweries and manufactured gas plants simply dumped their waste products — oil and grease, coal tar, hide scrapings, heavy metals and compounds such as PCBs and PAHs — into the nearest stream.

Human and animal waste dissipated over time, but industrial pollutants became the gift that kept on giving. In 1987, the Milwaukee estuary — the inner harbor and the rivers that feed it — was designated an official Area of Concern, one of 43 hot spots on the Great Lakes.

The AOCs are a club no one wants to join. But membership need not be permanent.

Since the establishment of the Environmental Protection Agency in 1970 and passage of the Clean Water Act two years later, the federal government has played a leading role in America's cleanup efforts, including several in Milwaukee.

Federally supported remediation projects have been going on for decades in the Milwaukee River, the Little Menomonee, the Kinnickinnic, the Menomonee Valley, Cedar Creek and Lincoln Creek.

JON MATTRISCH

Milwaukee's Pierhead Lighthouse

KRISTINE HINRICHS

The next step is the big one. Milwaukee has a generational opportunity to solve one of its longest-standing problems, not piecemeal but all at once.

The EPA has declared the Milwaukee estuary a priority AOC, one of 10 on the Great Lakes, making it a prime candidate for funding to remove all the toxic sediment. Milwaukee, in turn, has assembled a united front of agencies — city, county, state and nonprofit — to coordinate the cleanup.

Money is already flowing through the pipeline. The EPA has agreed to fund 65% of the preliminary work, which is projected to cost $29.3 million, and efforts are underway to raise the local match.

SUCK THE MUCK

Although the details are still being worked out, the general outline of the proposed AOC cleanup is clear. Giant vacuum hoses would suck up the contaminated muck from approximately 7 miles on the Milwaukee River, 3 miles on the Menomonee and 2 miles on the Kinnickinnic, including the inner harbor where all three streams meet.

The most toxic material would be trucked to out-of-state landfills, but the greater part would be piped to a new containment facility on the east side of Jones Island, adjoining an older fill site north of the Lake Express ferry dock.

Most of Jones Island is already "made land" deposited over the last century. The disposal facility, engineered to keep 1.9 million cubic yards of waste where it belongs, would create another 42 acres, giving the Port of Milwaukee new docking space or the public a new park.

Nowhere on the Great Lakes has such a massive cleanup been attempted under a single agreement involving so many players with such an aggressive timeline. Excitement is building as the project moves forward.

"I've been calling our region the Fresh Coast for years," Milwaukee Mayor Tom Barrett said. "And to live up to that name, we need to maximize recreation and wildlife along our waterways. Cleaning up the AOC would give us a history-making fresh start."

TURNING AROUND A TOXIC PAST

It might be more accurate to say the project would unmake history, although there is no ironclad guarantee Milwaukee will get the chance. The AOC project has generated significant momentum, but turning such ambitious plans into freshwater realities presents a historic challenge.

DNR FILES

At a news conference in January 2020, partners including DNR Secretary Preston D. Cole, at podium, and Milwaukee Mayor Tom Barrett announce the signing of the Great Lakes Legacy Act Project Agreement. The agreement provides funding and a shared path forward to accelerate contaminated sediment cleanup in the Milwaukee Estuary AOC.

What will it take to keep the momentum building? A continued spirit of collaboration. Stable funding for the EPA's Great Lakes Restoration Initiative. And steadfast, demonstrated public support from throughout the region.

Past actions in Milwaukee have left a toxic legacy for the current generation. Today's residents can be the first in the region's history to leave their waterways in better shape than they found them — for all the generations still to come.

Writer and historian John Gurda is an eight-time winner of the Wisconsin Historical Society's Award of Merit. His book "The Making of Milwaukee" was turned into an Emmy Award-winning documentary series on Milwaukee PBS.

MILWAUKEE ESTUARY AOC

To learn more about the Milwaukee Estuary Area of Concern, visit dnr.wi.gov/topic/GreatLakes/Milwaukee.html. The following entities and organizations have committed money, time and energy to ensure the success of Milwaukee's current planned cleanup project:

- **U.S. Environmental Protection Agency**
- **Wisconsin Department of Natural Resources**
- **Milwaukee Metropolitan Sewerage District**
- **City of Milwaukee/Port Milwaukee**
- **Milwaukee County**
- **Ozaukee County**
- **We Energies**
- **Wisconsin Department of Transportation**
- **U.S. Army Corps of Engineers**
- **Milwaukee Metropolitan Association of Commerce**
- **Suburban municipalities**
- **Harbor District**
- **16th Street Community Health Centers**
- **Milwaukee Riverkeeper**
- **Fund for Lake Michigan**
- **Menomonee Valley Partners**
- **Milwaukee Water Commons**

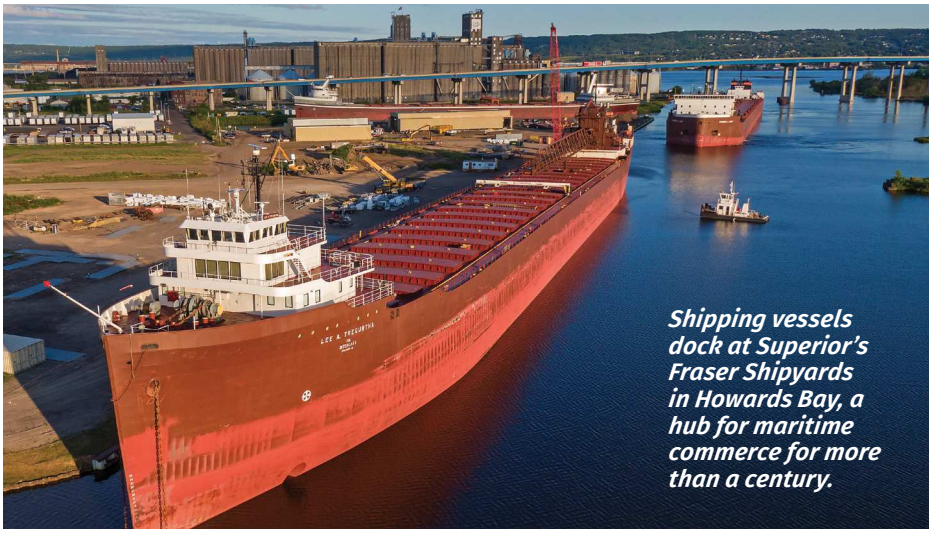
ST. LOUIS RIVER
AREA OF CONCERN

The city of Superior's Wisconsin Point Project protects sensitive dune habitats and historical sites while also improving public beach access with boardwalks. Parking areas are enhanced with pervious pavement to infiltrate stormwater and other measures to prevent erosion. See a YouTube video of the project at: youtu.be/5XZJPMOLqFk.

JENNIFER HAGEN

Partnerships spur progress:
Efforts pass halfway point to restore river, revitalize community

• *MATT STEIGER*



Shipping vessels dock at Superior's Fraser Shipyards in Howards Bay, a hub for maritime commerce for more than a century.

DAVID SCHAUER

The St. Louis River is a place where Northwoods beauty meets the industrial landscape of the largest freshwater port in the world, the Duluth-Superior harbor.

This border water is home to coastal wetlands, nursery habitat for Lake Superior fish species and the thriving waterfront communities of Superior, in Wisconsin, and neighboring Duluth, in Minnesota.

The St. Louis River is the second largest tributary to Lake Superior, flowing 179 miles through northeastern Minnesota and into the 12,000-acre freshwater estuary below the Fond du Lac Dam.

Past urban and industrial practices have permanently altered the river and its ability to meet the needs of wildlife and people. Many who grew up along the St. Louis River can remember fish kills, industrial dumping directly into the river and the lack of places to use the water for recreation.

But the health of the river is improving thanks to the efforts of many partners, including the states of Wisconsin and Minnesota, the Fond du Lac Band of Lake Superior Chippewa, local and federal governments, citizens groups and universities.

Aided by Great Lakes Restoration Initiative funding, these partners have successfully completed more than half of the necessary actions to restore the St. Louis AOC, including fish and wildlife habitat restoration projects, contaminated sediment cleanups and wild rice seeding activities.

The remaining projects are underway, with the goal to complete on-the-ground projects identified in the AOC plan by 2025.

RECOVERY INDICATORS

To determine what would be needed to reach AOC goals for fish and wildlife populations, scientists and natural resource managers selected key species as indicators of recovery including walleye, lake sturgeon, muskellunge, common tern, piping plover, great blue heron and bald eagle.

Based on the status of these indicator species, AOC partners identified actions to bolster populations that were still languishing. Two such actions were habitat projects for common tern and piping plover, both Wisconsin state endangered species.

In 2019, 14 acres of piping plover habitat were created on Wisconsin Point. In 2020, a similar project was undertaken on Interstate Island, one of the few common tern nesting sites left in western Lake Superior.

Both sites relied on shipping channel dredge material to build up the ideal habitat for these bird species. The dredge material was provided by the U.S. Army Corps of Engineers, an important partner in these and other restoration projects requiring sandy material to build habitat.

Projects like these yield triple ben-

efits of an improved shipping canal, cost-effective placement of clean dredge material and vital habitat for rare species.

MAJOR CLEANUP UNDERWAY

The Howards Bay sediment cleanup in Superior Harbor is a $19 million remediation project taking place on the site of an active shipyard that began by building unique whaleback ships in 1890. Due to historical industrial uses including shipbuilding, saw milling and grain transport, the sediment in the bay is polluted with mercury, tributyltin, PAHs (polycyclic aromatic hydrocarbons) and lead.

Following many years of planning and design, dredging began in 2020 and is expected to be completed in 2021. After cleanup, the bay will be dredged to the proper depth for vessels traveling to the shipyard, which also will provide habitat for musky and northern pike, plus space for migrating waterfowl.

Approximately 81,000 cubic yards of sediment will be dredged by completion of the project. Along with the environmental benefits, the project will create a new recreation area in the city and support local business.

Partners on this project include the DNR, U.S. Environmental Protection Agency, Fraser Shipyards, city of Superior and the Army Corps of Engineers. Great Lakes Legacy Act funds are covering a significant portion of the project cost.

Other slips in the harbor are being assessed to determine if they require remediation, and the goal is to clean up these sites by the end of 2024.

MANOOMIN'S RETURN

Manoomin, or wild rice, is a key wetland species important for AOC recovery. In the 1400s the Ojibwe nation migrated to the region because of manoomin's abundance. Poor water quality, physical habitat loss and landscape changes have reduced the abundance to only a few remnant stands.

The AOC partnership is restoring up to 275 acres in the estuary. The Fond du Lac Band of Lake Superior Chippewa is using their manoomin knowledge and expertise to guide the effort.

Tom Howes, the Natural Resources Program Manager for Fond du Lac who leads the seeding work said, "Since 2015, we've seeded around 53,000 pounds of manoomin in the estuary."

Bringing manoomin back to the wetlands in the estuary is as important to the people who live here as it is to the ecosystem.

"You'll hear Ojibwe people even say that if this goes away, so do we. We cease to exist as a unique cultural group because this is that central to our identity," Howes said of manoomin.

Staff of the Fond du Lac Band of Lake Superior Chippewa Natural Resources Department seed freshly picked manoomin, or wild rice, into the St. Louis River. Learn more about restoring wild rice in the St. Louis River Estuary on YouTube: youtu.be/qjgW7SVNrxg.

DNR FILES

The St. Louis River Alliance also is part of this partnership and restoration effort, seeding over 3,500 pounds of rice in the past five years. The alliance holds a yearly volunteer event to seed 10 acres of wetlands near Clough Island.

TRULY A COLLABORATION

Strong partnerships with local, state, tribal and federal entities are key to the success of AOC projects. The city of Superior has implemented multiple projects on city property and contributes in-kind services and funds to AOC projects.

For example, the city led projects to restore a swimming beach at Barker's Island, restore dune habitat and enhance public access on Wisconsin Point. The city also is contributing to the remediation of Howards Bay and the design for a habitat restoration project on the 9-acre Pickle Pond property.

City staff are enthusiastic about the benefits of these projects to the community.

"It has been exciting to witness how, through strong partnerships, the AOC projects and GLRI funding, that Superior has been given a fresh and safe way to reconnect to the waterfront," said Linda Cadotte, Superior's director of parks, recreation and forestry.

Such energy has helped to maintain momentum toward achieving AOC goals and is valued by AOC program managers.

"We simply could not be successful in the AOC without our partners," DNR's Lake Superior supervisor, Cherie Hagen, said. "It has been such an honor to work alongside many partners who share a common vision to restore the river and estuary, and we genuinely appreciate all partner efforts."

To date, three impairments have been removed in the St. Louis River AOC: degraded aesthetics, fish tumors and deformities, and excessive loading of sediments and nutrients into Lake Superior.

The degraded fish and wildlife populations impairment is likely next, as related projects will be completed in 2021. The remaining five impairments are expected to be evaluated for removal beginning in 2025.

The St. Louis River has come a long way since the days of fish kills and industrial dumping, and with local partners committed to staying the course, it has even better days ahead.

Matt Steiger is the St. Louis River Area of Concern coordinator for the DNR. Dara Fillmore, the Lake Superior water resources specialist in the DNR's Office of Great Waters, also contributed to this report.

ST. LOUIS RIVER AOC

To learn more about the St. Louis River Area of Concern, visit dnr.wi.gov/topic/GreatLakes/StLouis. html. And watch DNR YouTube videos on restoration work in the AOC:

- **Restoring wild rice: youtu.be/qjgW7SVNrxg**
- **Barker's Island beach restoration: youtu.be/LIfDDV9yIqg**
- **Wisconsin Point dunes and piping plover habitat restoration: youtu.be/5XZJPMOLqFk**

High water levels on Lake Michigan in 2020 made beach areas smaller and covered this dock in Sister Bay.

JENNIFER HAGEN

Lakes for the long run:
Working together to build resiliency

• MADELINE MAGEE

The Great Lakes ecosystem is regularly subject to short-term natural disturbances such as floods and droughts, historically returning to normal conditions. But new stressors such as habitat loss, pollution, invasive species and global climate change are reducing the ecosystem's ability to return to optimal conditions after these events.

Improving resiliency in the system ensures high-quality waters and ecosystem services remain in the face of these disturbances.

"Building resilience in the Great Lakes is important because it means the things we need from communities and nature will still be there despite stressors and disturbances," said Stacy Hron, the DNR's Lake Michigan program coordinator.

Climate change will be the largest factor in Great Lakes resilience in years to come. According to the Wisconsin Initiative on Climate Change Impacts, we can expect to see an air temperature increase of 3 to 9 degrees in Wisconsin over the next 40 years.

Warming temperatures will decrease ice cover, cause warmer water temperatures and impact where plants and animals can live — in water and on land. WICCI also projects an increase in extreme storm events and winter and spring precipitation.

Record-setting storms already have occurred in the Lake Superior basin in 2012, 2016 and 2018, causing millions of dollars in damage, including the destruction of Saxon Harbor in Iron County. These storms cause more than property damage, said Gina LaLiberte, the DNR's statewide blue-green algae coordinator.

"Since 2012, we've seen previously undocumented harmful algal blooms on Lake Superior linked to record storm events flushing nutrients and sediments into an increasingly warmer Lake Superior," she said.

This illustrates one of the most significant impacts of climate change: It worsens the impact of other major stressors.

WATER LEVEL WOES

Climate change also is to blame for extreme fluctuations in water levels in recent years. Water levels were at historic lows in 2012 and 2013 and swung significantly to record-high levels in 2019 and 2020.

Adam Bechle, coastal engineering specialist at Wisconsin Sea Grant, said these high water levels can have major impacts to the coast.

"High water levels allow erosive waves to reach higher elevations on the shore where they batter shoreline infrastructure and eat away at the base of bluffs and dunes," Bechle said.

But don't forget about impacts from low water levels as well, Bechle cautioned.

"The latest science indicates that rather than a clear trend in lake levels up or down, we might see both higher highs and lower lows with more rapid fluctuations than we've seen in the past," he said.

These low water levels can have major impacts to the coastal ecosystem, preventing fish from accessing spawning areas and leaving wetlands high and dry, unable to provide nutrient and flood protection.

"If we want to have a resilient coast," Bechle said, "we need to plan for both the highs and the lows."

This type of resiliency planning will require a team approach from partners throughout the basin, Hron noted.

"The scale of impact of climate change and other stressors is so large that no one entity or project can fix this on their own," Hron said. "I'm optimistic that through partnership, we can put projects on the ground that will help maintain resiliency in the Great Lakes."

Madeline Magee, Ph.D., is the DNR's Great Lakes and Mississippi River monitoring coordinator and manages the BEACH monitoring program. Dara Fillmore, the Lake Superior water resources specialist in the DNR's Office of Great Waters, also contributed to this report.

RESILIENCY IN PRACTICE

The city of Racine improved beach health and restored native habitats in the 11-acre Samuel Myers Park along the Lake Michigan shoreline.

JULIE KINZELMAN

Here are four examples highlighting how resiliency is incorporated in Great Lakes projects

SAMUEL MYERS PARK, RACINE

Samuel Myers Park along the Lake Michigan shoreline once had poor water quality due to stormwater runoff pollution, but the city of Racine completed projects to improve beach health and native habitats in the 11-acre park.

"In order to be resilient and have the capacity to recover, we needed to look at a wide range of options," said project leader Julie Kinzelman, Ph.D., retired laboratory division director at the city of Racine Public Health Department.

That included "engineered structures, green infrastructure, restoring or preserving natural capital and then planning and education," she said.

Green infrastructure additions capture and infiltrate stormwater runoff before it reaches Lake Michigan to improve water quality and hold flood waters during storm events.

The city also raised the height of a breakwater to protect the shore from storm damage and created flood storage areas to retain storm surges. These areas double as attractive public open spaces during times of low water.

Pollinator gardens, prairies and sand dunes host numerous native plants, making the park a vital stopover for migrating birds and butterflies.

"We wanted to maintain a balance between ecosystem function and utility, and install resiliency features that provide multiple co-benefits," Kinzelman said.

GREEN SCHOOLYARDS, MILWAUKEE

Green Schoolyard redevelopment projects are a collaboration between Milwaukee Public Schools and several partners, including the Milwaukee Metropolitan Sewerage District, the city of Milwaukee and Reflo, a nonprofit group — refloh2o.com/greenhealthyschools.

These projects create green space in school playgrounds by replacing asphalt with permeable surfaces, massive underground cisterns, native plants and bioswales to divert rainwater from local sewers and filter it before it goes into Lake Michigan.

The work reflects priorities from the city of Milwaukee's green infrastructure plan, calling for significant reductions in impervious surfaces to create a greener city and reduce impacts of climate change. Projects also include outdoor educational space, which research has shown can improve academic outcomes.

Six completed projects have removed over 85,000 square feet of asphalt and managed over 184,500 gallons of stormwater per rain event. Fifteen additional projects are in development.

• MADELINE MAGEE

MARENGO RIVER WATERSHED, ASHLAND COUNTY

Many streams flood easily in northern Wisconsin's Marengo River Watershed, damaging infrastructure and polluting the Bad River and Lake Superior during extreme rain events. The effects of large-scale flooding in 2016 and 2018 are still being felt in Ashland County.

"Climate adaptation strategies enable us to plan ahead, reduce risks and implement conservation practices that account for current and future extreme weather conditions," said Ashland County conservationist MaryJo Gingras.

Ashland County is one of the first in Wisconsin to incorporate climate change recommendations directly into implementation goals.

"We hope Ashland County's climate adaptation work inspires other communities," said Kyle Magyera of the Wisconsin Wetlands Association.

Actions upstream are key to slowing the flow of water during severe storms — reconnecting streams to floodplains and preventing wetlands high in the watershed from draining downstream, for example.

Bluff erosion stabilization, technical assistance and cost-sharing for runoff reduction, restoring wetland hydrologic functionality and diversifying forest age classes are among other actions identified in the plan.

LAKE SUPERIOR BASIN

More than 95 million black ash trees have been killed by the invasive emerald ash borer in the Lake Superior Basin since the destructive beetle appeared in Wisconsin in 2008.

Stands of black ash are found in lowlands and swamps where few other trees can thrive, providing benefits such as slowing flood waters and shading cold water brook trout streams. But loss of black ash is profoundly changing these forests, while climate change limits the ability of other trees to replace black ash.

Colleen Matula, DNR forest ecologist and silviculturist, lamented this double threat: "EAB is causing widespread ash mortality, and climate change is altering these wetland forested habitats by reducing diversity."

A project funded by the Great Lakes Restoration Initiative is studying how forests in the Lake Superior Basin will look in a warming climate absent of black ash trees. The DNR, U.S. Forest Service, county foresters, universities, Native American tribes, federal and nonprofit groups are evaluating adaptation strategies.

"This project helps further understanding of diverse black ash ecosystems and assists foresters in choosing a replacement species to maintain forest cover and hydrologic function," Matula said.

Tree species being used to replace black ash include pine, maple, spruce, tamarack, birch, oak, elm and cedar. More than 30,000 seedling trees have been planted on project sites so far.

• DARA FILLMORE

AQUATIC INVASIVE SPECIES

On guard against invasives:

DNR and partners collaborate to control harmful non-native species

Adult round goby

PAUL SKAWINSKI

• *AMANDA SMITH*

Aquatic invasive species have a long history in the Great Lakes region and continue to play a significant role in shaping the environment, culture and economy we know today.

The Wisconsin Aquatic Invasive Species Management Plan, updated in 2019 — dnr.wi.gov/lakes/invasives — outlines Wisconsin's approach to preventing and managing the undesirable impacts of aquatic invasive species.

The goals are to **prevent** new introductions of non-native nuisance species into Wisconsin, **contain** the spread of existing invasive species and **control** existing populations of invasive species to minimize harmful impacts.

Strong partnerships are key to the success of Wisconsin's AIS Program. The program is implemented by the Wisconsin AIS Partnership representing people from federal, state and local governments, tribes, universities, citizens groups and regional collaboratives that all work on AIS issues.

Led by University of Wisconsin-Extension Lakes and the DNR, the partnership implements AIS outreach and monitoring programs statewide such as Clean Boats Clean Waters and the Citizen Lake Monitoring Network, among others.

In 2010, the launch of new federal funding through the Great Lakes Restoration Initiative allowed Wisconsin to significantly expand its AIS program and direct resources to the state's Great Lakes Basins. This infusion of funding has allowed the DNR to:

- Expand its network of watercraft inspections on the Great Lakes and connected waters;
- Identify and respond to pioneer AIS populations;
- Implement a monitoring program to quantify the rate at which AIS are spreading across the state; and
- Expand outreach efforts on other invasion pathways beyond recreational boating.

SARA FOX

The Clean Boats Clean Waters program includes boat inspections to help boaters understand the vital role they play in preventing invasive species.

The Great Lakes experience the impact of numerous invasion pathways, but maritime commerce is of significant concern, particularly ballast water. It's how iconic invasive species like the round goby arrived.

Lake Superior and Lake Michigan also connect to many of Wisconsin's inland waters via river systems in their basins, which can function as invasion pathways themselves because of locks and dams that create an artificial connection to upstream habitat.

A key example is the Lake Winnebago System, Wisconsin's largest inland lake and the largest recreational fishery for the culturally important lake sturgeon. This system connects to Lake Michigan's Green Bay via the Lower Fox River, where the round goby and other invasive species are knocking at the door.

Amanda Smith is an aquatic invasive species specialist for the DNR.

STOP THE SPREAD

Non-native plants and animals that invade ecosystems beyond their natural historic range and cause harm to the environment, culture or economy are known as invasive species — including aquatic invasive species, or AIS, when related to water. To learn more about invasive species and ways to get involved in preventing their spread, visit dnr.wi.gov/topic/invasives.

Boaters and anglers on Wisconsin's waterways play a huge role in halting the spread of aquatic invasive species by following AIS laws.

- **INSPECT your boat, trailer and equipment.**
- **REMOVE any attached aquatic plants or animals (before launching, after loading and before transporting on a public highway).**
- **DRAIN all water from boats, motors and all equipment.**
- **NEVER MOVE live fish away from a waterbody.**
- **DISPOSE of unwanted bait in the trash.**
- **BUY minnows from a Wisconsin bait dealer; use leftover minnows only under certain conditions. (Use leftover minnows only on that same water, or on other waters only if no lake or river water or other fish were added to their container.)**

ROUND GOBY

Awareness helps keep round goby at bay and Lake Winnebago in the clear for now

View from High Cliff State Park on Lake Winnebago

BILL MCNEE

• *PETER JURICH*

The round goby has been established in the Great Lakes since 1994, but it wasn't until recently that the goby began knocking on the doorstep of Wisconsin's inland lakes and streams.

It was found in 2015 in Little Lake Butte des Morts, just northwest of Menasha. On the other side of Menasha is Lake Winnebago, a popular Wisconsin destination that provides over 130,000 acres of fishing and boating to visitors and is well known for its world class sturgeon fishery.

The two lakes are separated by a lock that would otherwise allow boaters in Lake Winnebago to travel into other parts of the Fox River system, and vice versa. However, the lock was closed following the discovery of gobies in Little Lake Butte des Morts to prevent further spread.

Round goby *(Neogobius melanostomus)* is a highly invasive, bottom-dwelling fish. They prefer living in the nooks and crannies of a rocky substrate and feed on the eggs of other fish, among other things. These two preferences could make them devastating to the sturgeon that breed on the substrate of the Lake Winnebago System.

Amanda Smith, an aquatic invasive species specialist with the DNR, said gobies can spawn up to six times per year, which in many cases is double the average for fish.

"In general, invasive species tend to displace native species by competing for food and habitat, reproducing rapidly and often, and becoming a nuisance," Smith said. "The round goby checks all of the boxes."

IDENTIFY INVASION PATHWAYS TO PREVENT SPREAD

The plan to close the Menasha lock is consistent with Wisconsin's Aquatic Invasive Species Management Plan. With invasion pathways as the focus, it identifies three keys: Prevent introduction of new species, contain the spread of existing species and control existing populations to minimize harmful impacts.

Invasion pathways are a way to categorize vectors, or the specific mechanisms responsible for the introduction and continued spread of invasive species. Recreational boating, for example, is one such invasion pathway through which AIS can spread.

"Humans are almost always the vector, at least for that initial or what AIS biologists call 'primary' spread," Smith said. "At the end of the day, the risk will always be there in some form or another, but it's up to us humans to do what we can to minimize it."

Gobies originate from the Caspian and Black Seas of Central Europe and most likely got to the Great Lakes through ballast water in shipping industry-related transfers. The threat to Lake Winnebago in large part focuses on that lake's sturgeon population, one of the largest in North America.

"There are few, if any, lakes where gobies and lake sturgeon are found together," said Jean Romback-Bartels, the DNR's northeastern secretary's director. "Because of the size and uniqueness of the Winnebago system, we don't know what the goby could do to the lake sturgeon population or future of the fishery in general."

The DNR is actively working to prevent the gobies' further spread upstream of Little Lake Butte des Morts into Lake Winnebago and the miles of river habitat that lead into that system of lakes.

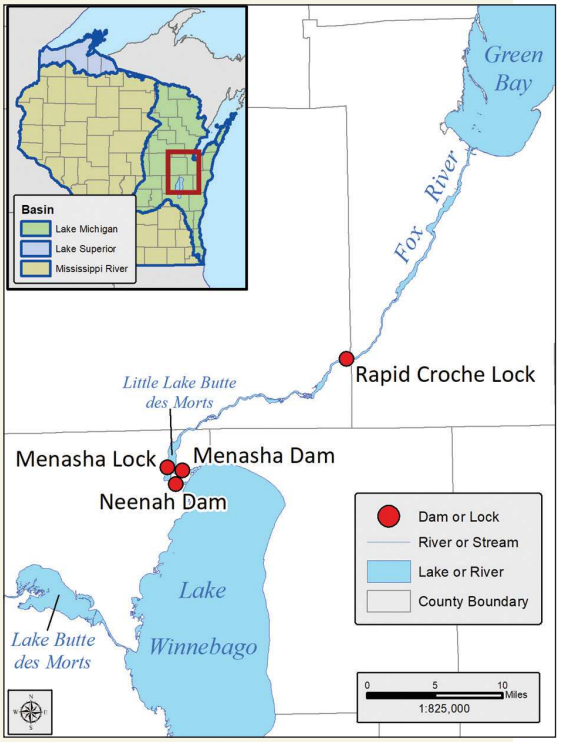
In addition, the agency is helping the Fox River Navigational System Authority determine whether an electrical barrier would prevent gobies from passing through, allowing the reopening of the lock at Menasha. Unfortunately, such a plan has presented many challenges and is far from realization.

"Overall, preventing the round goby from spreading further inland is not a 'one size fits all' solution," Smith said.

COMMUNICATION IS KEY

Romback-Bartels appreciates the frustration felt by boaters who want the lock open for recreation. Despite the challenges, she added, there's a success story here: more awareness of aquatic invasive species issues.

Through the DNR's partnerships with the Fox River Navigational System Authority, the Fox-Wolf Watershed Alliance, UW-Oshkosh and Wisconsin Sea Grant, communication efforts have been ramped up and anglers are taking notice.



"The only thing that keeps gobies from getting into Lake Winnebago is people being aware that would be a bad thing," Romback-Bartels said.

Proof of the DNR's successful communications efforts is seen in how the goby came to be discovered in Wisconsin in the first place, she noted — "the fact that it was a young man who was part of a school fishing club who caught that first goby and did the right thing by calling us."

"That has really elevated the importance of everybody's voice."

More awareness has been a key to keeping the goby in check, for now. "Nearly six years later, we can still say we don't have gobies in Lake Winnebago," Romback-Bartels said.

"We really have to do our best to protect the natural environment we've got here in our own back yard and not to take it for granted because, in a blink of an eye, things can change."

Peter Jurich is a science writer for UW-Madison's Waisman Center.

RESTORING WISCONSIN'S GREAT LAKES

- **ABOUT THE TEXT:** Stories for this Special Report were coordinated and edited by Susan Tesarik, communications and outreach coordinator for the DNR's Office of Great Waters. Additional editing and proofreading by Andrea Zani and Kathryn A. Kahler, *Wisconsin Natural Resources* magazine.
- **ABOUT THE PHOTOGRAPHY:** Several of the images used in this special section are past entries in the "Wisconsin's Great Waters" photo and writing contest, sponsored each year by the DNR's Office of Great Waters. Selected entries are used in the program's annual calendar highlighting Lake Michigan, Lake Superior and the Mississippi River. For information, visit dnr.wi.gov/topic/greatlakes/contest.html.

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To learn more about the DNR'S Office of Great Waters, visit dnr.wi.gov/topic/greatlakes.

Great Lakes RESTORATION

To learn more about the Great Lakes Restoration Initiative, visit glri.us.

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Front cover photos: Ashland Breakwater Lighthouse, Lake Superior, by Brian Taylor; splashing at Cave Point County Park, Lake Michigan, by Bill McClenahan; kites over Lake Michigan at Two Rivers, by Bill Pohlmann; Apostle Islands National Lakeshore tree, Lake Superior, by Michael DeWitt.

Back cover photo: Cave Point County Park on Lake Michigan, Door County, by Michael Knapstein.

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