

Michigan State of the Great Lakes

2016



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STATE OF MICHIGAN



DEPARTMENT OF ENVIRONMENTAL QUALITY



MICHIGAN OFFICE OF THE GREAT LAKES

Prepared by the Michigan Office of the Great Lakes
on behalf of the Office of the Governor

Introduction

The year 2016 was highlighted by significant events for Michigan's Great Lakes watershed. Communities, organizations, and state agencies partnered to implement innovative projects and kick off initiatives to protect and restore our state's unique water resources. Comprehensive works like the regional Maritime Strategy, the 21st Century Infrastructure Commission Report, and Michigan's Water Strategy will guide those efforts into the future.

Beginning this past summer, the four parts of Michigan's Water Strategy were released at events across the state, highlighting recommendations for the sustainable management of Michigan's water resources. At the kickoff event, the Office of the Great Lakes Director Jon W Allan and U.S. Representative Candice Miller joined me in speaking about the importance of stewardship and education on Michigan waters.

I am directing my administration to focus on five key Water Strategy priorities for the next two years: ensuring safe drinking water for all citizens; investing in commercial and recreational harbors; preventing new and controlling existing aquatic invasive species; reducing phosphorous loads to the western Lake Erie basin by 40 percent; and, developing and implementing Michigan's water trails system. These priorities continue efforts to improve public health, thriving aquatic ecosystems, and a strong blue economy in our state.

Implementation of the Water Strategy will require leadership from collaborators including governments, organizations, industries, academia, philanthropic groups, and individuals to achieve its vision.

Locally, the Office of the Great Lakes and its partners at the St. Marys, St. Clair, and Raisin Rivers celebrated great strides in revitalizing contaminated sites with groundbreaking cleanup projects and multiple restorations of beneficial uses.

Coastal communities around the state dug into projects to increase accessibility, coastal resiliency, and opportunities for people from near and far to enjoy an unmatched Great Lakes experience.

With these projects, we can look forward to cleaner beaches, superior research data, and increased public accessibility for those of all abilities.

A spirit of partnership and regional collaboration across national boundaries led to the finalization of a Lake Superior Lakewide Action Management Plan, and to the cooperative final decision of the Great Lakes –



St. Lawrence River Basin Compact Council to require the city of Waukesha, Wisconsin to meet high Compact standards and keep Great Lakes water within the Great Lakes basin.

Despite these successes, threats loom with the potential to impact the Great Lakes watershed. The New Zealand Mud Snail, an aquatic invasive species, was discovered to be spreading in Michigan this year. Michigan's aging maritime system, with the Soo Locks at its heart, is in great need of expansion and improvement, which I have advocated to Congress.

While work remains to be done, there are things everyone can do to contribute to the health of the Great Lakes. Show your love for Michigan's waters by joining in stewardship efforts. Adopt a beach, kayak a water trail, attend a monitoring event, or teach a child ways to reduce, reuse, and recycle.

Each effort may seem like a tiny drop of water in a vast lake, but the key is not to focus on the size of the effort, but to understand the ripple effect it can make in your local community and across the region.

Thank you,
Governor Rick Snyder

A handwritten signature in blue ink that reads "Rick Snyder". The signature is fluid and cursive, written in a professional style.

Director Allan's Message

Another year has passed, marked with a considerable focus on water in the state of Michigan. The mid-year release of the Michigan Water Strategy, end-of-year release of the 21st Century Infrastructure Commission Report, and upcoming focus on maritime systems and green infrastructure reflect amplified cognizance and thoughtfulness about Michigan's water resources. This 2016 issue of the State of the Great Lakes Report gives us a moment to reflect on a host of the year's accomplishments, note our connections to the Great Lakes, and highlight several of the challenges we must address to continue to be responsible water caretakers.



Before we delve into the details of these topics, I want to take a moment to reflect on some of the characterization of the Great Lakes region during the recent election, not in a political sense, but to note an aspect of the conversation related to the way the country still perceives the Great Lakes States. I heard, with disappointment, the term "rust belt state" used nearly every time one of the Great Lakes states was mentioned during the election coverage. Those who have worked toward the state's transformation through regional efforts in environmental protection, water-based recreation, and recognition of water as an essential part of our region's story share this frustration and feel that the state and region has moved well beyond this description.

Michigan is not a "rust belt" state; it is a blue water state.

We have and will continue to invest heavily in the restoration and management of our iconic lakes, streams, and rivers and are working to communicate the benefits of these investments to communities and the whole region. Trends in sediment contamination and water quality, access to water recreation, and the health of aquatic ecosystems continue to improve, and the national image of our Great Lakes States and the region needs consistent work to reveal this new narrative.

The work to wisely manage our water resources reflects ecological, financial, social and cultural values born from our Great Lakes heritage. This work needs to focus, too, on communicating the value of our investments to citizens of the state, the region and nation. People from across the world strive to find their way to our shores because we have a durable and healthy water resource. Showing the value of that resource through stewardship is an essential piece of protecting and preserving it. As people of the Great Lakes, we have the capability, tools, talent, knowledge and economic capacity to do no less than demonstrate leadership and continue to build our future on the thoughtful use and management of the Great Lakes.

Jon W Allan
Director
Michigan Office of the Great Lakes

A Year Of Significant Great Lakes Events



Michigan's Water Strategy is Released

Strategy will serve as roadmap for sustainable management of water resources

By: Emily Finnell, Chief Strategist, Michigan Office of the Great Lakes

Katerina Crowley, Michigan State University Glassen Scholar, Michigan Office of the Great Lakes

Michigan's freshwater resources are second to none. Our lakes, flowing rivers, and miles of picturesque coastline define our heritage and way of life.

This year, the Office of the Great Lakes released Michigan's first Water Strategy, a plan to sustainably manage these globally-significant resources. The Water Strategy will serve as a 30-year roadmap for the protection, wise use, and management of the largest freshwater system in the world. It includes nine key action areas and 75 recommendations including those to protect and restore aquatic ecosystems, invest in water infrastructure, support water-based recreation, and create vibrant waterfronts.

The Michigan Office of the Great Lakes spearheaded Water Strategy development at the request of Governor Snyder. The plan was collaboratively developed by multiple state agencies and refined with constructive input from nongovernmental organizations, environmental groups, communities, industry leaders, tribal governments, and others with a total of more than 750 individual comments.

From the final Strategy, Governor Snyder defined five top priorities on which he and his administration will focus:

Ensure safe drinking water for all Michiganders

Achieve a 40 percent phosphorous reduction in the Western Lake Erie basin

Prevent the introduction of new invasive species

Support investments in commercial and recreational harbors

Develop and implement Michigan's water trails system

State agencies developed implementation frameworks for each of the five priority areas including specific action steps. These frameworks emphasize the protection of public health and the sustainable use of our natural resources in order to enrich quality of life and economic vitality in local communities.

The Strategy was released in four parts to showcase the wide breadth of issues it addresses and highlight partners in implementation. Events were held across the state, with each event connecting to key aspects of the Water Strategy and efforts to implement its recommendations. The events recognized the critical role of watershed organizations, partnerships, and volunteer programs in contributing to citizen science, strengthening people's personal connection to water, and fostering stewardship of our water resources.

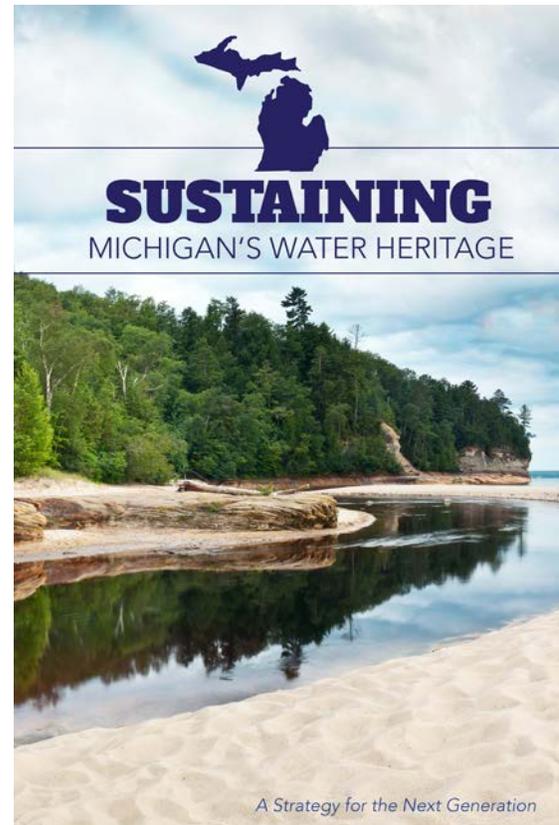
An interdepartmental Water Team has been formed to guide Strategy implementation, foster continued collaboration with partners, track efforts, and report progress. They will be advised by the Water Cabinet, a group of experts and stakeholders from across Michigan.



Governor Snyder and U.S. Congresswoman Miller participate in a Department of Natural Resources sturgeon sampling event highlighting the importance of Michigan's aquatic resources.

Implementation is already underway for several pieces of the Water Strategy:

- The Michigan Departments of Environmental Quality and Natural Resources have begun a wild rice initiative to be undertaken in partnership with Michigan's federally-recognized Native American tribes to protect and restore this ecologically and culturally significant wetland plant.
- The Michigan Design Council launched its first annual Design Prize, challenging students and industrial designers to create a physical product solution that allows people to safely enjoy Michigan's diverse water resources.
- Michigan State University has launched "Water Moves MSU," a university-wide initiative fostering scientific innovation and cultural and artistic expression inspired by water. In conjunction with this initiative, MSU and the Midland Research Institute for Value Chain Creation have proposed The Fountain Challenge – Hydration Innovation by Design. In the competition, MSU students will be challenged to imagine and design the drinking water fountain of the future.
- Water trails range from segments of inland streams to the entire Michigan Great Lakes shoreline. To support the development of a state designation system for water trails, the Michigan Department of Natural Resources has sought public input on a draft policy designed to help provide consistency to user expectations of water trails.
- Southeast Michigan Council of Governments, (SEMCOG), is using the Water Strategy to inform the development of a new Water Resources Plan for Southeast Michigan. SEMCOG has created a Water Resources Task Force to develop the plan to examine policies and strategies relating to the region's water resources.
- The Michigan Department of Environmental Quality has awarded \$158 million in low interest loans to local municipalities for infrastructure projects that improve water quality and protect public health.
- KPMG, a global professional services network, has developed an enterprise budget for water utilities to better understand the complex relationships between managing water, infrastructure needs, and funding to manage a long-term funding strategy.



Are you implementing a goal in the Water Strategy? Let us know! Contact Rachel Cromell in the Michigan Office of the Great Lakes at cromellr@michigan.gov.

Follow Water Strategy highlights, implementation efforts, and updates at www.michigan.gov/waterstrategy.

Waukesha's Application for Great Lakes Water

Michigan's review of the city of Waukesha's request for a Great Lakes public water supply

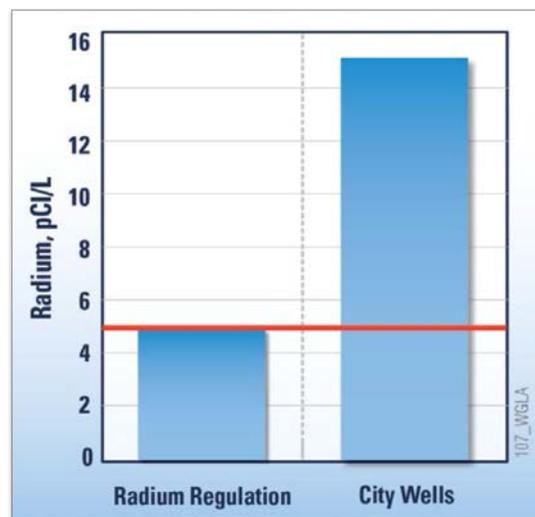
By: Rachel Cromell, Outreach Coordinator, Michigan Office of the Great Lakes

In January 2016, the city of Waukesha, Wisconsin submitted a request under the 2008 Great Lakes Compact Agreement to the Great Lakes Regional Body and Compact Council¹ to switch its drinking water source to Lake Michigan from its current groundwater aquifers. The city of Waukesha made the request to comply with a court order to address high and increasing levels of naturally-occurring radium, a carcinogen known to cause bone cancer and other health problems,² present within its drinking water supply.

The Great Lakes Water Resource Compact (Compact) is a legally-binding 2008 federal agreement signed by the eight Great Lakes states. It prohibits new or increased diversions of water outside the Great Lakes-St. Lawrence River basin with provisions made for a small number of straddling communities and communities within straddling counties, which must first meet strict criteria to obtain approval.³ These criteria to be adopted and demonstrated by an applicant include conservation efforts, a justified and allotted water volume, and a requirement 100 percent return flow to the Great Lakes basin.

The city of Waukesha is located within a county that straddles the Great Lakes basin, allowing it eligibility to apply for Lake Michigan water under the Great Lakes Compact. It is the first U.S. community in a straddling county to request a withdrawal of water from the Great Lakes Basin.

Michigan's review of the request involved evaluation by an interagency team of subject experts organized by the Michigan Office of the Great Lakes. The evaluation included a transparent, thorough public engagement and comment process and consultation with Michigan's 12 federally-recognized Native American tribes. The interagency review team held two live-streamed public hearings, activated an online comment box, regularly posted developments to a review website, and sent representatives to Compact Council-sponsored information sessions in Wisconsin. Questions to representatives from the city of Waukesha and the Wisconsin Department of Natural Resources were developed in advance, posed, and discussed in detail. All comments from members of the public, tribal governments, environmental groups, and others were categorized, summarized, and forwarded to the Regional Body and Compact Council for posting on their website.



Michigan's interagency review team initially determined that the diversion request did not meet Compact criteria as written. Staff proposed a series of changes and restrictions to bring the request into compliance with Compact requirements and uphold the integrity of Compact Law.

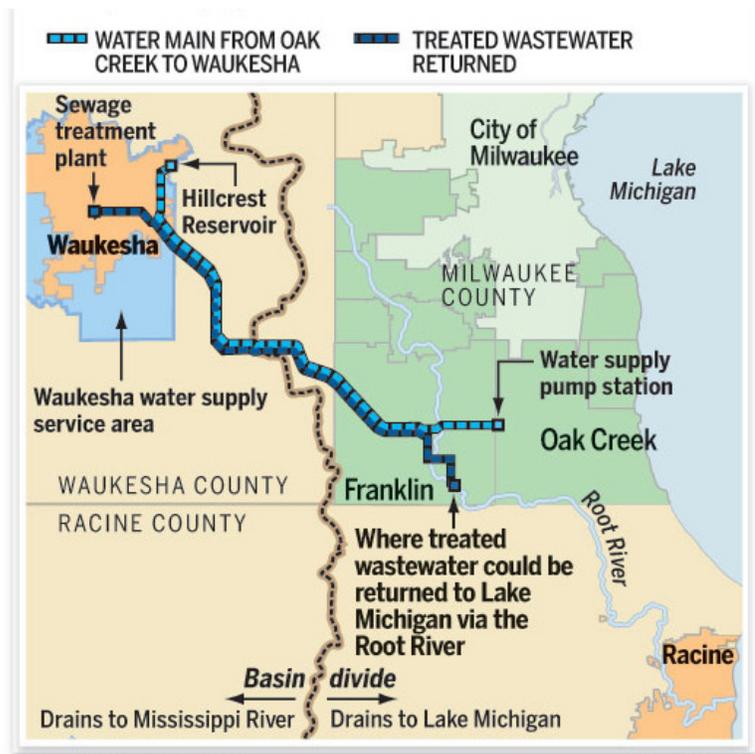
During the process, the review team also found evidence of a pre-existing water diversion from the Great Lakes basin. The unique hydrology of the Wisconsin groundwater system created a state where pumping water from Waukesha's drawn-down drinking water aquifer resulted in the pumping of Great Lakes-bound groundwater to the surface system, which was then discharged after treatment into the Mississippi River basin instead of the Great Lakes basin.

Michigan worked in conjunction with the other Great Lakes states and provinces to end the pre-existing diversion, create strict withdrawal conditions to safeguard the Great Lakes, take into account the concerns raised in the outreach process, and protect the health of Great Lakes citizens.

The conditions include:

- A reduction in the proposed service area size by 47 percent.
- Lowering the maximum withdrawal amount from 10.1 million gallons per day (MGD), as originally requested, to 8.2 MGD
- Wisconsin must avoid adverse impacts to surface waters and wetlands in both the Lake Michigan and Mississippi River watersheds.

- The city of Waukesha must cease extracting radium from its aquifer through drinking water wells and dispersing the waste product (concentrated sludges containing radium) into the environment.⁴
- The city of Waukesha must implement a collection-recycling program for pharmaceuticals and personal care products.
- The Wisconsin Department of Natural Resources must regularly report on and enforce implementation of the conditions.
- The pre-existing groundwater diversion without return flow to the Great Lakes basin must cease.
- The Compact Council and its member states retain full ability to review and ensure adherence to implementation of conditions according to Compact Law.



On May 18, 2016, the Regional Body voted to advise the Compact Council of its conditioned approval of the withdrawal. The Compact Council then unanimously voted to conditionally approve Waukesha's request on June 21, 2016.

Footnotes:

- Images: Waukesha Water Utility
1. The Great Lakes- St. Lawrence River Basin Regional Body is composed of representatives of the eight Great Lakes states and the Canadian provinces of Ontario and Quebec. The Regional Body is an advisory group to the Great Lakes-St. Lawrence River Basin Compact Council (Compact Council), a U.S. federally-defined voting entity made up of representatives of the eight Great Lakes States.
 2. Agency for Toxic Substances Disease Registry, www.atsdr.cdc.gov.
 3. The five pillars of Great Lakes Compact criteria include: water supply, return flow, alternatives analysis, impact assessment, and water conservation.
 4. Concentrated sludges from water and wastewater treatment plants containing radioactive radium material are routinely disposed of in municipal surface landfills.

Net Pen Aquaculture in the Great Lakes

Michigan's scientific review process and decision on Great Lakes net pen aquaculture

By: Tammy J. Newcomb Ph.D., Senior Water Policy Advisor, Michigan Department of Natural Resources
David Fiedler, Regulatory Affairs Officer, Michigan Department of Environmental Quality
Brad Deacon, Administrative Law Coordinator, Michigan Dept. of Agriculture and Rural Development

The Michigan Departments of Agriculture and Rural Development, Environmental Quality, and Natural Resources, collectively known as the Quality of Life (QOL) agencies, were approached in late 2014 with two proposals for establishing commercial aquaculture net pen operations in northern Lakes Huron and Michigan. While Ontario, Canada has established net pen operations in the North Channel and Georgian Bay of Lake Huron, there are no commercial net pen aquaculture operations in Michigan's open waters of the Great Lakes. The request constituted a new use for Michigan's bottomlands and Great Lakes waters and was viewed as a serious matter.

To give this precedent-setting issue the level of attention and deliberate evaluation that was required, the directors requested that the QOL's internal Commercial Aquaculture Workgroup develop a comprehensive ecosystem framework by considering scientifically-based environmental and ecological aspects, legal authorities, economic benefits or risks, and public input.

Using that approach, the Aquaculture Workgroup:

- Convened an independent, volunteer Science Panel of experts to evaluate the environmental and ecological considerations;
- Sought reports to develop an understanding of the economic aspects of commercial net pen development (product demand, processing, distribution, etc.);
- Established a sub-group to develop a paper on the existing legal authorities regarding the establishment of net pens including permitting and recognition of the Great Lakes Consent Decree with the tribal nations;
- Held a public forum to present the findings and take public input regarding the social aspects and community benefits.

The Science Panel provided several recommendations and cautions in the determination on commercial net-pen aquaculture. The Panel urged that if Michigan were to allow commercial net pens, it should be with great caution and use an agency-managed, scientifically structured adaptive management design to address and evaluate potential concerns as they arise. This view was affirmed by many who provided input.

Other provisions recommended by the Science Panel included:

1. Development of a tool to determine the best locations for commercial net pens as this would be critical to ensuring their safe operation in the Great Lakes.
2. Creation of a nutrient tracking modeling tool that would guide placement and understanding of the fate of nutrients contributed by net-pen operation given the inability to collect wastes.
3. Requirement to stock only Great Lakes fish species to avoid a new invasive species.
4. Use of sterile/triploid fish to prevent fish escapes from altering the genetics of wild fish in the Great Lakes.
5. Stocking of certified disease-free fish.
6. Careful monitoring of net pens by industry to manage for disease, proper use of feed, water quality, ice damage to net pens and over-all integrity of pen systems in the Great Lakes.
7. Significant added expertise and capacity from state agencies to monitor and manage Great Lakes commercial net pen aquaculture.

Based on current Michigan law, commercial net pens cannot legally operate in the Michigan portion of the Great Lakes. The Aquaculture Development Act, Public Act 199 of 1996, states that aquaculture facilities may only be registered by Michigan Department of Agriculture and Rural Development if they are operating in privately controlled waters, not the public waters of the Great Lakes. Other required permits include a bottomlands permit under Part 325 (Great Lakes Submerged Lands) of the Natural Resources and Environmental Protection Act (NREPA), Public Act 451 of 1994, for placement of net pens in the Great Lakes, mooring buoys, bottom anchors and other materials. The U.S. Army Corps of Engineers requires the same permit and would conduct its own review. Both agencies would have to approve any net pen aquaculture to be sited in the Great Lakes. In order to operate and discharge, a National Pollutant Discharge Elimination System permit would be required from the Michigan Department of Environmental Quality under the federal Clean Water Act and Part 31 (Water Resources Protection) of NREPA. Finally, a fish stocking permit would be required from the Michigan Department of Natural Resources under Part 487 (Sport Fishing) of NREPA. A fish stocking permit in treaty-ceded areas of the Great Lakes would require agreement of the tribal nations to that activity.

Aquaculture in Michigan faces growth constraints including feed costs (no local producer of feed), insufficient in-state processing capacity, financing, and experienced labor. These limitations exist, as noted by others, for both commercial net pen aquaculture as well as land-based aquaculture enterprises. From the economics study, the hypothetical best-case results suggest that locating two one million pound commercial net pen aquaculture trout facilities in Michigan could lead to up to 17 direct jobs, an additional 27 jobs from indirect activities (e.g. fish processing) and generate an annual personal income of \$2.5 million. This volume of production would likely contribute \$10.3 million in total output, provided fish processing is done in Michigan. Critics of this modeled outcome suggest the amounts used to generate these results may be an overestimate given the variability of commercial prices for trout in the market.

The overall economic impact of recreational fishing in the Great Lakes for Michigan is estimated at about \$1 billion per year. Other noted uses include boating and swimming. As a matter of perception, the public input process noted that the tourism industry could be negatively affected because of the belief that the water was degraded or not clean for recreational purposes. The economic reports were inconclusive as to the effect that these risks may have, so the economic information provided general guidance to the agencies rather than a definitive economic cost-benefit outcome.



Nine of the 12 federally-recognized Native American tribes participated in a consultation meeting. The input the state received from the tribes, both verbally and written, expressed serious concern regarding commercial net pen aquaculture in the Great Lakes because the activity may negatively affect the fishery and water quality. The tribes also pointed out that they should be included in any process for pursuit of this activity.

Nearly 1,700 written comments were received by the QOL agencies. More than 1,600 were in opposition, with 11 letters in support. Of those in opposition, 90 percent were an electronically submitted form letter through the Food and Water Watch organization. An additional 117 individual comments were received articulating ardent opposition to commercial aquaculture net pens from individuals from Michigan, Illinois, and Indiana, tribal nation governments, nongovernmental environmental groups (Michigan United Conservation Clubs, National Wildlife Federation, Michigan Trout Unlimited, etc.), and one Great Lakes State Department of Natural Resources (Indiana). One letter was neutral.

Those in opposition point to risks to water quality, the fishery (genetics, disease, escapes), tourism, and many of the other issues identified by the Science Panel. Some that were opposed to commercial net pen aquaculture were supportive of recirculating aquaculture and in some cases also supported flow through aquaculture. Those in support stated the provision of jobs, economic benefits to local economies, and provision of a desired product.

New funding would be required to provide the oversight and protection for the Great Lakes that the public expects. The following estimates are provided as an example program based on experience in addressing Great Lakes bottomland development (windpower), monitoring (Michigan Department of Natural Resources Fisheries Division Great Lakes Assessment Program), and staffing for program assistance, management, and coordination among the QOL agencies and with industry. Startup costs for this program would be approximately \$3.33 million with ongoing costs of approximately \$2.4 million annually to create a Great Lakes commercial net-pen aquaculture program that would serve the aquaculture industry while providing the people of Michigan with a scientifically-based program to regulate and for the protection of the Great Lakes.

After reviewing all of this information, the Michigan QOL agencies did not recommend pursuing of commercial net pen aquaculture in the Great Lakes at this time. While not recommending the pursuit of commercial net pen aquaculture in the public waters of the Great Lakes, the state can and will continue to work within existing authorities to assist the industry in development of well-designed flow through ponds and recirculating aquaculture facilities.

Targets Set to Reduce Lake Erie Algae

Nutrient load targets set to reduce size of harmful blooms and protect water quality

By: Mary Anne Evans, Research Ecologist, U.S. Geological Survey

In February 2016, the Great Lakes Executive Committee, which oversees the implementation of the Great Lakes Water Quality Agreement (GLWQA) between the U.S. and Canada, approved phosphorus loading targets for Lake Erie to reduce the size of harmful algal blooms (HABs), reduce the presence of the low oxygen zone in the central basin, and protect nearshore water quality. The targets are set with respect to the nutrient loads calculated for 2008. To reduce the impacts of HABs on Lake Erie a target was set of a 40 percent reduction in total and soluble reactive phosphorus loads in the spring from two Canadian rivers and several Michigan and Ohio rivers, especially the Maumee River (<https://binational.net/2016/02/22/finaltargets-ciblesfinalesdep/>). States and the province of Ontario are already developing Domestic Action Plans to accomplish the reductions and scientists are developing research and monitoring plans to assess progress.

Algae are a critical part of a lake's ecology. Like plants, algae convert sunlight into food. Because Lake Erie supports such robust algal growth, it has the largest fishery of any of the Great Lakes. It supports 37 percent of all recreational Great Lakes anglers and a larger commercial fishery than all of the other Great Lakes combined (Michigan Sea Grant). It is considered by many to be the "walleye capital of the world."

Algal growth is only considered harmful when it goes beyond supporting aquatic life and begins to cause problems. For instance, algae is considered harmful when it produces toxins; when it produces compounds that, though not toxic, smell or taste bad; or when it produces so much biomass that it clogs beaches, harbors harmful bacteria, or uses up oxygen needed by fish and other aquatic life.



Two main types of HABs occur in the Great Lakes and are caused by two different kinds of algae. The GLWQA calls for addressing both types of HABs. The first type is caused by species that grow on the lake bottom or attached to rocks, such as the green algae *Cladophora*. Most of these algae are not toxic, but their bulk can clog shallow waters or water intake lines. When they rot near the end of the summer, the decomposition process can cause low oxygen conditions harmful to fish and other aquatic organisms. In addition, when these algae finally slough off and wash ashore, the decaying “muck” can harbor harmful bacteria, including human and animal pathogens, and cause stinky and unsightly Great Lakes beaches and harbors. This type of HAB occurs in Saginaw Bay and along the eastern shore of Lake Michigan, as well as in other parts of the Great Lakes.

The second type of HAB common to the Great Lakes is caused by algae and cyanobacteria, or blue-green algae, which float in the water column. Technically a photosynthetic bacterium, cyanobacteria can produce compounds that are toxic to humans, pets, livestock, and other animals. In the Great Lakes region, these toxins have caused swimming beaches to close and pet deaths. In August 2014, a cyanobacteria bloom that produced toxins caused disruption of municipal drinking water supplies to cities along Western Lake Erie, including Toledo, Ohio. These HABs are most prominent in the western basin of Lake Erie but also occur in Saginaw Bay, Green Bay (Wisconsin), and many small bays and lakes adjacent to the Great Lakes.

The nutrient targets established under the GLWQA were based on a scientific consensus that the amount and concentration of phosphorus entering western Lake Erie are dominant factors controlling the size and intensity of HABs. Scientists used multiple mathematical models to determine bloom potential and tested them against data from recent HABs to confirm their predictive strength. Tests show that spring phosphorus loads and concentrations from major tributaries are important drivers for bloom intensity. However, factors other than phosphorus, such as water temperature and storm patterns, can also influence HABs.

Because these additional factors are outside the control of environmental managers, the management focus is on the reduction of phosphorus inputs. Scientists have also noted the influence of nutrients other than phosphorus on HABs.

For instance, nitrogen concentrations may control both HABs development and the amount of toxin produced. Although current models can predict HABs size, they cannot predict the amount of toxin produced. Controls on toxin production are an active research topic among regional scientists. Because excess nutrients and resulting HABs impact many locations throughout the Great Lakes basin, the process of establishing nutrient targets will be repeated in the other four Great Lakes in coming years.

Additional Progress in Lake Erie:

The Governors for the Western Lake Erie Basin States of Michigan and Ohio and the Premier of the Province of Ontario formed the Western Lake Erie Basin Collaborative Agreement in June, 2015 with goals to reduce phosphorous inputs to the basin by 40 percent. This goal was reaffirmed as a priority action by Governor Snyder in the release of the Michigan Water Strategy.

Annex 4 of the Great Lakes Water Quality Agreement between the U.S. and Canada identifies objectives and joint actions to address nutrient inputs to the Great Lakes.

The U.S. Environmental Protection Agency has provided grants to continue efforts to invest in and expand municipal green infrastructure initiatives in Great Lakes shoreline cities.

The city of Detroit has invested in green infrastructure in the form of rain gardens, permeable pavement, and constructed wetlands at William G. Milliken State Park to increase storm water infiltration and decrease combined sewer overflow events.

The University of Michigan’s Water Center at the Graham Sustainability Institute has conducted studies on the Detroit River to better understand and address challenges through science.

The Michigan Department of Environmental Quality recognized Michigan’s portion of the Western Lake Erie basin as “impaired,” in November 2016, highlighting the importance of collaborative action to address the issue.

Studying Enbridge Energy Oil Pipelines at the Straits of Mackinac

Michigan analyzes pipeline risks and alternatives to protect the Great Lakes

By: Robert Reichel, Assistant Attorney General, Michigan Department of Attorney General

In recent years, few, if any, issues potentially affecting the Great Lakes have drawn more focused public and governmental attention in Michigan than the two 63-year-old oil pipelines operated by Enbridge Energy at the Straits of Mackinac. The twin pipelines transport up to 540,000 barrels of crude oil and natural gas liquids each day. They are literally in the Great Lakes, in a uniquely sensitive environment, where strong and shifting currents at the confluence of Lakes Huron and Michigan could widely distribute pollution in the event of a pipeline failure or release. While there are differing perspectives on the likelihood and potential magnitude of such a release, it is widely recognized that if a release were to occur, the ecological and economic consequences would be very significant.

How did the straits pipelines get there?

The straits pipelines are part of network of oil pipelines called the Lakehead System, now operated by Enbridge in the Great Lakes region. More specifically, they are a segment of Line 5, which extends 645 miles from Superior, Wisconsin, across Michigan's Upper Peninsula, and across the Mackinac Straits (where it separates into two 20-inch diameter pipelines), then through the Lower Peninsula to Marysville, Michigan, where it crosses the St. Clair River into Sarnia, Ontario. It was originally constructed in 1953 to allow uninterrupted pipeline transport of crude oil produced in Alberta, Canada to refinery facilities located in Sarnia, replacing a fleet of tankers that previously carried the oil from a terminal in Superior, through the Great Lakes, to Sarnia. Today, Line 5 is connected through other pipelines to refineries in Detroit, Michigan and Toledo, Ohio. In addition to crude oil, it carries natural gas liquids, some of which are delivered to a terminal in the Upper Peninsula where it is used to supply propane. Line 5 also now transports crude oil produced in the Lower Peninsula.

Who oversees the straits pipelines?

Under current law, the federal government has primary responsibility for regulating the safety of interstate oil pipelines, including Line 5. It does so through laws and regulations administered by the Department of Transportation and Pipeline and Hazardous Materials Safety Administration.

The U.S. Environmental Protection Agency and U.S. Coast Guard also play a role in review and implementation of spill response plans. The State of Michigan has some legal authority regarding the straits pipelines, based in part upon conditions of state approvals that were required when they were built. Enbridge's predecessor applied for and obtained approval from the Michigan Public Service Commission to build and operate Line 5, based on certain design specifications. And, because the straits pipelines were constructed on state-owned Great Lakes bottomlands, their construction and continued operation are conditioned upon the terms of the "Straits of Mackinac Pipe Line Easement" granted by the state to Enbridge's predecessor in 1953. The Easement is a legally binding agreement. Among other things, it requires Enbridge to "at all times...exercise the due care of a reasonably prudent person for the safety and welfare persons and all public and private property..." It also contains various design specifications, including a requirement the pipelines must be supported at least every 75 feet to ensure stability as it crosses the lake bottom.

What is the state doing to address concerns about the straits pipelines?

Since 2014, the State of Michigan, through the Attorney General, the Departments of Environmental Quality and Natural Resources, and the Michigan Agency for Energy, has engaged in an open dialogue with Enbridge about the straits Pipelines and Enbridge's continuing obligations under the 1953 Easement. And in 2014, the State convened the Michigan Petroleum Pipeline Task Force, comprised of representatives of eight state agencies, including the Office of the Great Lakes. The goal of the Task Force was to gather information and identify and recommend actions within state government to protect public health, safety and welfare and the environment from risks presented by petroleum transportation pipelines, including the straits pipelines.

The Task Force issued its final report in July, 2015. It is available at www.michigan.gov/documents/deq/M_Petroleum_Pipeline_Report_2015-10_reducedsize_494297_7.pdf and contains more detailed information about the straits pipelines and pipeline regulation. The report made four recommendations specific to the straits pipelines. Each of the recommendations has been or is being implemented.

1. Prevent the transportation of heavy crude oil through the straits pipelines. Spills of heavy crude oil into open water, such as the Straits of Mackinac, cannot be effectively cleaned up. Because transporting that product through the straits pipeline would cause an unreasonable risk of harm, the state sought, and in 2015 obtained, a legal agreement in which Enbridge agreed not to do so. It is available at www.michigan.gov/documents/deq/Final_Agreement_Line_5_Heavy_Crude_Transport_FINAL_090315_All_Signature..._499287_7.pdf
2. Require an Independent Risk Analysis of the potential liability from a worst-case scenario spill from the straits pipelines. The Task Force recommended that Enbridge be required to pay for, but not control, an independent analysis by qualified experts of the consequences of a worst-case scenario spill because that information is needed to determine the amount of financial assurance Enbridge is required to maintain under the Easement and to help guide decisions about the future of the pipelines.
3. Require an Independent Analysis of Alternatives to the existing straits pipelines. The Task Force recommended that Enbridge be required to pay for, but not control, an independent analysis by qualified experts of the existing pipelines in comparison to an array of alternatives to them. The analysis would include considerations of risks, feasibility, benefits, and costs in order to guide decisions about the future of the pipelines. The state, with advice from the Pipeline Safety Advisory Board (established by Governor Snyder based on a separate Task Force recommendation) developed scopes of work and requests for proposals for both the Independent Risk Analysis and Alternatives Analysis, evaluated proposals, selected the successful bidders, and is now overseeing the studies which are to be completed by the fall of 2017.

Enbridge has agreed to fund the studies through an escrow account controlled by the state. Additional detail about this subject is available at the Board website: www.michigan.gov/energy/0,4580,7-230-73789_74071---,00.html. As each of the studies proceeds and draft reports are prepared, the state will provide the public with information and opportunity to provide input.

4. Obtain additional information from Enbridge regarding the straits pipelines. The Task Force recommended that the state use its authority under the Easement to fill in gaps in information provided by Enbridge. In 2016, the state requested further information in relation to the condition and operation of the pipelines, and in a form that could be more readily used and evaluated. Enbridge complied with the request and information provided is available at: www.michigan.gov/ag/0,4534,7-164-18157_76405---,00.html

In addition to implementing the specific Task Force recommendations as outlined above, the state is continuing to monitor Enbridge's compliance with the Easement, considering information provided by interested parties, and engaging with stakeholders on this subject of great public importance, all with the goal of protecting the public trust resources of the Great Lakes.

The Great Lakes Maritime Transport System

Advancing technology and growing international trade creates regional opportunity

By: Jim Goodheart, Senior Policy Advisor, Michigan Department of Environmental Quality
Rachel Cromell, Outreach Coordinator, Michigan Office of the Great Lakes

Michigan has a significant history as a hub of regional maritime trade, principally due to its advantageous location within the heart of the Great Lakes. Its interconnected network of lakes, straits, and rivers served as the first rapid transit system. Although we now have vast trucking, airline, and online systems to swiftly transfer goods and information, there remains an essential need for maritime transit to move large volumes of goods and raw materials in a low cost, energy-efficient manner.

The maritime transportation sector is experiencing rapid global growth shaped by expanding international trade and increased efficiency in information systems. Mounting consumer expectations drive a market that enthusiastically adopted the introduction of Amazon Prime's two-day shipping service. Direct transport from portside warehouses by aerial drones looms in the future as transit and shipping technologies advance.

The Great Lakes region's maritime sector, which already contributes more than \$30 billion (U.S.) to the U.S. and Canadian economies, accounts for more than 220,000 jobs and is a foundation of the regional economy.

“The maritime system connects regional markets with one another, and with the world. By leveraging maritime transport on the Great Lakes and St. Lawrence River, we can boost the region’s \$5 trillion economy and create jobs throughout the region,”

said Michigan Governor Rick Snyder, Great Lakes and St. Lawrence Governors and Premiers Conference Chair.

The Great Lakes region's maritime transport system has tremendous growth potential, but the system is aging and requires structural updates and policy reform to remain competitive.

To address maritime issues and modernize the system, the Conference of Great Lakes and St. Lawrence Governors and Premiers launched the “Great Lakes-St. Lawrence Maritime Initiative” in 2013 to improve the efficiency and competitiveness of the regional maritime transportation system, grow the regional economy, increase the internal movement of goods across the region, expand the movement of goods to and from foreign markets, and create jobs. Binational collaboration to manage the maritime transportation system (MTS) as a single, integrated network is necessary to increase efficiency, improve communications, and integrate strategies to prevent the spread of aquatic invasive species.

The Maritime Initiative produced a Regional Maritime Strategy, released in 2016. The Maritime Strategy was developed under the leadership of the Great Lakes and St. Lawrence Governors and Premiers in partnership with an advisory committee that included carriers, shippers, federal agencies, non-governmental organizations and other stakeholders. The finalized Strategy reflects a consensus on steps to improve the region's MTS. Primary objectives are to double maritime trade, shrink the environmental impact of the transportation network, and support the region's industrial core.

Key steps in achieving Regional Maritime Strategy goals include:

- The construction of a second “Poe-size lock” is needed to allow for traffic from today's larger ships (1000 feet in length), provide downtime to maintain the locks, and address the security of the maritime economy. Some studies estimate that if the current Poe lock were to become non-functional for any reason, the costs of closure would be an economic loss to Michigan of \$160 million within 30 days.
- Preparing to adapt to cyclical fluctuations of Great Lakes water levels. Currently, the Great Lakes region is experiencing a trend where navigation and dockage are improved with rising water levels. However, just a few short years ago, the trend was exactly the opposite. The Michigan legislature addressed this by establishing an “emergency dredging fund” and appropriated about \$20 million to deepen impacted harbors along the Great Lakes coastline.

- The establishment of a sustainable “sediment budget” to reliably maintain Michigan’s Great Lakes ports and harbors would greatly reduce risk to the maritime economy.
- Dredging the system’s critical chokepoint, the St. Mary’s River, to its authorized depth of 27 feet, and conducting a longer-term, system-wide analysis of bottlenecks to ensure dredging dollars are used effectively.
- Developing recommendations for a treaty or other binding agreement between the U.S. and Canada to cooperatively manage the regional maritime system, and harmonize regulations across levels of government.
- Expediting the movement of goods and travelers across the U.S.-Canada border by cooperatively streamlining the customs clearance processes for cruise passengers and maritime cargo.

In addition to Maritime Strategy recommendations, there is a growing interest by shipping companies in renovating old waterfront brownfield sites along Michigan’s shores and rivers. This presents an opportunity to revitalize abandoned sites, create blue economy jobs, and begin to reduce or reverse the impacts of legacy contamination.

The Michigan Office of the Great Lakes, Michigan Department of Transportation, and the Michigan Economic Development Corporation have respective roles in Michigan’s maritime system from a policy and environmental perspective and a planning and economic development perspective.

A thriving maritime system is important to a healthy blue economy. The region’s system must become more efficient and effective to attract traffic and remain globally competitive. The future of maritime transportation will play a key role as a part of Michigan’s economic resurgence.



Great Lakes Natural History, Resources, and Culture



Michigan's Birding Trails

Birding trails offer ecological and economic value to the Great Lakes region

By: Keith Kintigh, Forest Conservation Specialist, Michigan Dept. of Natural Resources
Sherry MacKinnon, Wildlife Ecologist, Michigan Department of Natural Resources

Word is getting out that the Great Lakes States are ideal for birding. Millions of migratory birds pass through the region during their spring and fall migrations. Of the Great Lakes states, Michigan is uniquely positioned as a birding destination. From Harsens Island to Isle Royale, Michigan contains diverse wetlands, fields, and forests which provide habitat for over 200 species of breeding birds and at least 100 migrating species passing through. As a transition zone between major biomes, Michigan sees species of the great plains grasslands like the Grasshopper Sparrow, Bobolink, and Northern Harrier; species of the central hardwood forest like Cerulean Warbler and Scarlet Tanager; and species of the boreal forest like Canada Warbler, Blackburnian Warbler, and Spruce Grouse.

The geography of the Great Lakes themselves act as a bird migration funnel. Migrating birds, reluctant to fly long distances over water, concentrate along the coasts and often converge at short-distance water crossings like the Straits of Mackinac, Whitefish Point, and Magee Marsh in Ohio. These stopover sites along the Great Lakes provide birds with places to rest and sources of food in the form of hatching insects. This gives them the energy to continue their journeys and successfully establish breeding territories.

Opportunities for birding recreation in Michigan have never been better. Because of their use of coastal lands, there are thousands of great locations to see both resident and migratory bird species throughout Michigan. To capitalize on this, several birding trails have been established across the state in the last few years. Birding trails are driving routes which contain identified birding spots in a region, often on local conservancy lands or other public lands. The Superior Birding Trail in the Eastern Upper Peninsula was the first such trail in the state. It was followed by the Saginaw Bay Birding Trail, the Sleeping Bear Birding Trail, the Beaver Island Birding Trail, and the Sunrise Coast Trail in the northeast Lower Peninsula. This past spring, the Northern Lake Huron Birding Trail was dedicated at the Aldo Leopold Festival in Les Cheneaux. The Sunset Coast Birding Trail, located in the northwest Lower Peninsula, will be dedicated in Spring of 2017.

The development of birding trails and opportunities for growth in recreation represent the work of many dedicated individuals and organizations including the Michigan Audubon Society, Saginaw Basin Land Conservancy, Little Traverse Conservancy, Saving Birds Thru Habitat, and the Mackinac Straits Raptor Watch. Support through planning and grants has been provided by the Michigan Department of Natural Resources and the Coastal Management Program in the Michigan Office of the Great Lakes.

To celebrate birding and raise awareness of birding issues, there are birding festivals nearly every weekend across the state from May through October. Festival goers can learn about bird ecology, new birding techniques, and participate in guided birding tours. Festivals include the Mackinaw Raptor Festival in Mackinac City, Warblers on the Water on Beaver Island, Tawas Birding Festival in Tawas City, and the Annual Sandhill Crane and Art Festival in Bellevue.

There are many reasons why this work is important. Birding trails make it easier for people to connect with wild animals and wild places. Birds are great ambassadors for conservation; they are visible, interesting, and ephemeral. They use a broad array of wild and not-so-wild lands and, through migration, highlight the importance of international cooperation and coordination. Because of the way they help connect people to nature, birding trails encourage people to care about wild places that mean something to them whether they're conservancy lands, state and federal forest lands, or local community parks.

The best birding occurs at stop-over sites, water crossings, and nesting or wintering areas; often-sensitive lands that appreciation can help protect and conserve. Birding trails and birding festivals bring people in to communities and help local economies during the "shoulder seasons-" either side of peak tourist visits. The economic impact of the \$40.9 billion industry (U.S. Fish & Wildlife Service, 2011) is significant. Recreational birding contributes to the ecological and economic future of Michigan communities, and birding trails are a way to position the state as a leader in both.

Manoomin

The story of wild rice in Michigan

By: Barbara Barton, Water Quality Specialist, Michigan Department of Transportation
Roger LaBine, Water Resources Technician, Lac Vieux Desert Band of Lake Superior Chippewa

Wild rice (*Zizania spp.*), called Manoomin in the Anishinaabek language, is an important plant to both the indigenous people of the Great Lakes and our ecological landscape. Manoomin is an annual aquatic grass which grows in the shallow waters of lakes, bayous, rivers, and coastal marshes. To the Anishinaabek it is considered sacred and, as it has been for generations, an integral part of daily diet and life.



Prior to the logging era, Manoomin was found in great abundance along the coastlines of Lakes Huron, Erie, St. Clair, and Michigan, and beds were also found growing inland in lakes, rivers, and streams. Over time, logging, dredging, draining, hydraulic changes, carp, and poor water quality wiped out nearly all the coastal beds as well as many inland stands.

Timber logging dams were built on Michigan rivers in the late 1800s, followed by concrete dams during the 1930s. The dams raised lake levels, wiping out many wild rice beds and contributing to the loss of harvesting opportunities for the Anishinaabek. As non-Tribal hunters noticed a decline in duck populations at the turn of the 20th century, they began seeding Manoomin to increase duck habitat. This effort was picked up by state and federal agencies and the planting continued into the 1940s. However, there was little success and it was determined that efforts were better spent on other aquatic plants utilized by waterfowl.

The decline of Manoomin continued through the rest of the 20th century due to dredging, draining, and other impacts. It is still a challenge for Manoomin to thrive on populated lakes and rivers due to the desire of many shoreline residents to have waters free of "weed species." Add to that the abundance of carp and other non-native species which negatively impact rice, and we have a considerable challenge in conserving and restoring Manoomin.

The Tribes have been working hard to reawaken traditional teachings and harvesting practices in their communities by holding traditional rice camps and conducting restoration projects on

Tribal lands. At these events, participants learn the traditional teachings and natural history of Manoomin, and how to harvest and process this important grain. On the non-Tribal side, there has been an important effort over the past decade to promote the cultural and ecological understanding of Manoomin through presentations at conferences, stories in the news media, and most importantly, through the traditional rice camp demonstrations, where participants gain hands-on experience working with the rice and meeting Manoomin where it lives. They learn how important Manoomin is in providing habitat, its value in cleaning the water, and equally important, the cultural and spiritual significance to the Anishinaabek.

Wild rice restoration projects are underway across the Upper and Lower Peninsulas by most of the Tribes, other governmental agencies, and non-profit organizations. Restoration goals are to increase opportunities for harvesting and to provide wildlife habitat. This important work also returns traditions to the Tribes that were interrupted or lost due to historical events. What is still missing, however, is protection for our remaining wild rice beds.

Today's largest remaining wild rice bed and a jewel of Michigan is Tawas Lake, a 1600-acre lake located in eastern Iosco County near Lake Huron. Abundance varies by year, but approximately 700 acres of the shallow lake's surface is covered with Manoomin, including a stand of the state threatened species *Zizania aquatica*.

The Manoomin at Tawas Lake is now facing threats similar to those of the past. Many lakeside property owners deem it a nuisance, and have been cutting the bed and are proposing chemical treatment to remove rice from in front of their properties. Tribal people and wild rice advocates recognize its value both culturally and as an important part of the wetland ecosystem. This situation illustrates the differing relationships between Manoomin, Tribal, and many non-Tribal people, yet it provides an excellent opportunity for learning and working together to protect a rare example of the history of this land and its people.

While many residents still do not know that wild rice grows in Michigan, there is hope that through education and restoration, we can honor and appreciate this beautiful plant and the wild rice traditions of the Anishinaabek, and preserve an important part of our collective history for the next generations who will call this place home.

Progress in the St. Marys River AOC

Continued work including major Little Rapids Restoration Project moves international Area of Concern closer to restored status

By: Mike Ripley, Chippewa Ottawa Resource Authority
Dr. Greg Zimmerman, Professor of Biology, Lake Superior State University

The Area of Concern (AOC) Remedial Action Plan (RAP) process involves a unique, binational partnership of federal, state, provincial, tribal and local stakeholders. In the St. Marys River, the Binational Public Advisory Council (BPAC) has been working to restore the river since 1988.



The Great Lakes have three major connecting passages where one Great Lake flows into another. These are Niagara Falls, the St. Clair-Detroit Corridor, and the St. Marys River. The St. Marys River is the connecting channel where water from Lake Superior flows into Lake Huron, forming the border between Canada and the United States. The twin cities of Sault Ste. Marie, Michigan and Ontario, located on the St. Marys River, have fascinating histories as an important Native American gathering place, a center of French and British fur trading, and as a 20th Century industrial hub for manufacturing steel, paper, leather and more. This intense human use led to pollution from industry and sewage from growing cities. The pressure, combined with habitat loss from destruction of the famous St. Marys rapids for navigation and hydroelectric development, prompted the listing of the St. Marys River as an international Great Lakes AOC in 1985. Today, progress is being made to restore the river's ecosystem.

Any visitor to the "Soo" will easily notice the presence of the second largest steel manufacturing plant in Canada, currently operated by Essar Steel. Steel from iron mines on Lake Superior has been manufactured in the Soo for over 100 years. In the past, there were very few environmental regulations in place. Until the 1980s, waste water and byproducts from the steel-making process like benzene, cyanide and heavy metals were simply dumped into the river. Likewise, a neighboring paper plant and a leather tannery on the U.S. side of the border (now closed), dumped their waste into the river leading to pollution that collected on the river bottom.

The cleanup of the St. Marys River through the Remedial Action Plan process is measured through removal of beneficial use impairments (BUIs). The original impairments for the St. Marys River, as defined in the RAP are below:

- Degradation of aesthetics (*removed on U.S. side*)
- Bird or animal deformities or reproductive problems (*removed on U.S. side*)
- Eutrophication or undesirable algae (*in review for U.S. removal*)
- Beach closings (*removed on U.S. side*)
- Fish tumors or other deformities (*on track for U.S. removal*)
- Restrictions on fish and wildlife consumption (*monitoring for U.S. removal*)
- Restrictions on dredging activities
- Degradation of benthos
- Degradation of fish and wildlife populations
- Loss of fish and wildlife habitat

Thanks in no small part to the efforts of the Binational Public Advisory Council, substantial progress has been made on restoring the river and removing the BUIs.

The first two BUIs on the list (Bird and Animal Deformities and Degradation of Aesthetics) have been removed from the U.S. portion of the river, while two more (Eutrophication or undesirable algae and Beach Closings) are presently in review for removal. The Fish Tumors BUI is also on track for removal. Restrictions on Fish and Wildlife Consumption (i.e., what fish eating advisories are in place beyond those typical of Great Lakes waters) will take some additional study and monitoring. Restrictions on Dredging and Degradation of Benthos are related to the contaminated sediments situation.

On the U.S. side, two major projects addressed these issues. The leather tannery site and a long-gone coal gasification plant site were remediated using funding, in part, from the Great Lakes Legacy Act managed by the U.S. Environmental Protection Agency. These projects were completed within the last several years. Environment and Climate Change Canada has characterized sediment contamination at Bellevue Marine Park, where the contaminants are mainly concentrated, and are now quantifying sediment transport to provide information for the remediation process.

The Degradation of Fish and Wildlife Populations and loss of fish and wildlife habitat BUIs are primarily related to loss of rapids habitat in the river. While most of the river outside the urban areas of the twin Soos remains in good condition, nearly all the urban rapids habitat was destroyed for navigation and, in the case of the "big rapids," for hydropower.

This year, a major project to restore habitat at the "little rapids" site has been completed. The Little Rapids Restoration Project replaced an existing causeway that had only two, undersized culverts with an open span, restoring flow.



The Little Rapids Project was funded through the Great Lakes Restoration Initiative. The collaborative project was managed by the Great Lakes Commission and represented a partnership between several agencies and organizations including Chippewa County Road Commission (the property owner), U.S. Environmental Protection Agency, National Oceanic and Atmospheric Administration, Lake Superior State University, Eastern Upper Peninsula Regional Planning and Development Commission, Michigan Department of Natural Resources and Michigan Department of Environmental Quality. The Soo Area Sportsmen group was also an important supporter of the project.

The Little Rapids Restoration Project will provide improved habitat and recreational opportunities to the area.

With the completion of the Little Rapids Project, the major investments in restoration projects on the U.S. side of the St. Marys AOC will be mostly complete. The BPAC looks forward to continued work on the U.S. and Canadian sides to remove BUIs and eventually delist the St. Marys River as an AOC. The St. Marys River is a true asset to the Great Lakes community, and a restored river will help make it an even more valued part of this great place.

Above: Construction begins at the Little Rapids site.

Left: Photo taken soon after construction of bridge that restored flow to the Little Rapids in the St. Marys River AOC.



Mud Snails Move to Michigan

New Zealand mud snails hitchhike to Michigan, pose threats to native ecology

By: Sarah LeSage, Aquatic Invasive Species Program Coordinator, Michigan Department of Environmental Quality

New aquatic invaders mean new challenges for Michigan citizens including anglers, boaters, business owners, and natural resource managers. New Zealand mud snails are now known to be established in three high-quality rivers: the Pere Marquette, AuSable, and Boardman. The long-term impacts this snail will have on Michigan streams and rivers is unclear; however, it's important to understand this harmful species and take action to limit its spread to new waters.



New Zealand mud snails are tiny (about 1/8th of an inch long) and can live in a wide variety of habitats including reservoirs, estuaries, rivers, and lakes. Similar to other invasive species, New Zealand mud snails reproduce in massive quantities and are extremely resilient. While they are able to reproduce sexually, it is not necessary; one snail is all that is needed to start a new population. Where established, New Zealand mud snails can dominate aquatic communities and outcompete other invertebrates that are a vital food source for many fish species. They hold little nutritional value for native fishes and can pass through the gut alive and intact.

New Zealand mud snails are native to New Zealand and were discovered in rivers in the western U.S. in the 1980s and the Great Lakes in the 1990s. Genetic analysis shows two separate clones of snails, and scientists hypothesize there have been two or more separate introductions to these distinct geographic regions. The snails discovered in the Pere Marquette River in 2015 are the clone found in the western rivers, indicating transportation across the U.S. rather than spread from the Great Lakes to inland waters.

The movement of New Zealand mud snails has been linked to recreational uses such as boating and angling. New Zealand mud snails can hitchhike to new locations on gear like waders due to their small size and ability to survive for long periods of time out of water.

Unfortunately, control options for New Zealand mud snails are limited and once they are established in Michigan's streams and rivers, there is no way to eradicate them without causing unacceptable harm to native plants and animals. Research is underway to learn more about the impacts these new invaders may have on aquatic communities and how we can best limit transport by anglers and boaters.

This introduction highlights the importance of taking steps to inspect and disinfect gear to protect Michigan's waters and world-class fisheries. Partnerships between the Michigan Department of Natural Resources and Environmental Quality, universities, and angling groups are critical to promote prevention of New Zealand mud snails and other aquatic invasive species. Clean, drain, and dry all gear and equipment before moving between lakes, rivers, and streams. Report new sightings of aquatic invasive species to the Midwest Invasive Species Network at www.misin.msu.edu.

Required Actions – It's the Law in Michigan!

- Remove aquatic plants from boats, boating equipment, and boat trailers before launching or placing in the water (*NREPA Part 413 Sec. 41325*).
- Drain live wells, bilges and all water from boats before leaving the access site (*MDNR Fisheries Order 245*).
- Dispose of unused bait in the trash. Do not release bait into the water (*MDNR Fisheries Order 245*).
- Don't transfer fish to water bodies other than where they were caught (*MDNR Fisheries Order 245*).

The Great Lakes Region: An Inspiration

Experiencing Michigan's natural beauty inspires artistic expression and stewardship

By: Rachel Cromell, Outreach Coordinator, Michigan Office of the Great Lakes

The Great Lakes region is home to landscapes of wind-whipped dunes, old-growth forests, rolling meadows, craggy rock outcrops, and a crowning set of sparkling freshwater seas. Elk and deer roam grassy fields, while plovers flit above rocky beaches and rare orchids bloom under the canopies of verdant marshes. This diversity sets the Great Lakes region apart as an ecological gem.

Michigan's natural beauty creates inspiration for artists of many types, expressing their creativity through canvas and ink, photography, music, poetry, and other media. Art inspired by the natural world communicates emotions that we can now interpret with science, quantified in a 2015 paper from Stanford University which concluded that contact with areas filled with natural beauty can reduce stress and raise quality of life. More recently, a study from Michigan State University contributed to this growing area of research with its study on the positive psychological effects of blue spaces, which abound in the Great Lakes region.

A connection to nature matters, not just from a therapeutic perspective, but because when we value something, we protect it. Experiencing the outdoors makes us feel connected to our environment. This connection results in increased stewardship and care, allowing us to enjoy its benefits and pass them on to the next generation. In a world increasingly overtaken by videophilia, an attachment to sedentary, indoors-oriented electronic media and technology, it is important to recognize the benefit of getting people into nature (and bringing that connection into our lives through the arts) for measurable impacts on public health and the health of the environment.

This 2016 report features a small sampling of photos and artistic works inspired by water and Michigan's water resources. These depictions capture some of the artist's thoughts and emotions, communicating the unique ways people of Michigan connect with the environment. Many thanks to Grand Valley State University for being a rich source of many of the featured pieces.



Science

Technology and Innovation



Tracking Progress with Blue Accounting

How are our investments protecting and restoring the Great Lakes?

By: Steve Cole, Chief Information Officer, Great Lakes Commission
Beth Wanamaker, Communications Manager, Great Lakes Commission

The Great Lakes are a unique collection of diverse ecosystems under intense pressure from human use. They are the largest source of surface freshwater in the world, and the system is invaluable as the source of drinking water for more than 48 million people in the U.S. and Canada. The lakes directly generate more than 1.5 million jobs and \$60 billion in wages annually. They're home for more than 3,500 plant and animal species, some of which are found nowhere else on Earth. Finally, the lakes provide the backbone for a \$4.5 trillion regional economy that would be one of the largest in the world if it stood alone as a country.

More than 100 different entities - including eight states and two provinces - invest billions of dollars in restoring and maintaining this vital system, but we don't have a way to measure the effectiveness of these efforts across ecological, economic, social and cultural outcomes. Our decision-makers and the public need a way to share information and measure progress so that they can better allocate limited resources and understand the value of their investments.

At their 2013 summit, the Great Lakes Governors and the Premier of Ontario passed a resolution calling for a comprehensive approach to monitoring Great Lakes water resources. This resolution led to the creation of Blue Accounting (<http://BlueAccounting.org>), a new initiative and online platform that will provide a sophisticated suite of information services never before available in one place.

Blue Accounting is a long-term initiative of strategic importance to the Great Lakes basin and its residents. The Great Lakes Commission (GLC) and The Nature Conservancy have entered into a partnership to lead the effort and are receiving broad support from across the basin, including a cornerstone \$4 million grant from the C.S. Mott Foundation.

This data-driven program is designed to help leaders and decision-makers across the region manage the world's largest freshwater ecosystem in a more collaborative, effective and holistic manner.

For the first time, they will share access to the most comprehensive data related to protecting ecosystems, safeguarding human health, and bolstering the economy.

The Blue Accounting approach brings together groups of stakeholders and experts around issues and desired outcomes for the Great Lakes. These groups will establish measures of progress towards shared goals and select sources of data to inform each metric. A Blue Accounting information management system will be developed to collect, maintain and deliver information about these metrics. It will provide Great Lakes leaders with the necessary context to support interpretation of our progress and facilitate informed decisions on each issue. This system will combine the GLC's well-established Great Lakes Information Network and The Nature Conservancy's innovative Great Lakes Inform into one regional resource.

The Blue Accounting team is developing pilot projects in four areas. Each of these projects is valuable in its own right and, together, they will improve the program's practices and approaches to future development. The pilots aim to develop appropriate metrics and measure progress toward:

1. Reducing phosphorus entering the western Lake Erie basin by 40 percent by 2025;
2. Securing safe and sustainable water in the Great Lakes;
3. Reconnecting waterways by removing barriers like dams and road crossings that block fish and disrupt ecosystems; and,
4. Effectively managing and prevent the spread of destructive aquatic invasive species.

Blue Accounting is a critical step toward making sure that the money and time we spend protecting and restoring the largest freshwater system on Earth are utilized in the most efficient and effective way. Over the next five years, we envision Blue Accounting will become an established strategic asset for the region that will grow and adapt to the changing needs of the region over time.



MDC Launches Water Design Prize

Statewide competition stimulates innovation in water-centric industrial design

By: Jeff DeBoer, Chairman, Michigan Design Council

Since January of this year, significant progress has been made toward fulfilling the Michigan Design Council (MDC) mission to: 1) promote the organic development of industrial design talent among Michigan youth and adults, 2) establish Michigan as the prime destination for individuals in industrial design and related design professions to help Michigan-based businesses prosper, and 3) encourage businesses to locate to Michigan by virtue of its robust industrial design talent base.

To date, several milestones have been achieved, including successfully transitioning the MDC from a Michigan Economic Development Corporation-funded “start-up” to 501(c)3 status. Media platforms have been designed and launched, displaying a visually rich statement of Michigan’s deep and long history in industrial design. The website showcases companies around the state that have embraced industrial design as a critical business strategy.

The keystone initiative launched for 2016 was the Michigan Design Prize. This competition is open to all Michigan residents and is unique in the country. Each year, participants will tackle a singular design challenge linked to Michigan and larger societal issues. The MDC selected water as a perfect example of a topic that is an essential part of Michigan heritage and has great importance to society as a whole.

The Michigan Design Prize has been established as an annual competition celebrating exceptional Michigan industrial design talent.

The 2016 challenge was: design a physical product solution that allows people to safely enjoy the benefits of Michigan’s diverse water resources. This year’s focus on using industrial design talent to solve water challenges encouraged participants to use their design skills to create solutions to problems in focus areas including water quality, boating safety, recreation, efficiency, industrial use, and strategies to address global water shortages.

Given that 2016 was the inaugural year for the Michigan Design Prize, community outreach was critical to create awareness about the competition. Council members spoke to a wide spectrum of organizations around the state about the benefits of participation. Council members also worked one-on-one with youth to explain what industrial design is, conducted workshops and promoted Michigan’s design legacy and job opportunities in the industrial design profession.

This year’s Design Prize was successful in attracting youth, adults, and educators to the challenge. In fact, several school districts and instructors used the Design Prize curriculum guide to bring project-based learning and design thinking principles (STEAM)¹ into their classrooms.

Entries in the 2016 Michigan Design Prize were judged by MDC members, based on four key criteria:

- **Creativity:** Level of originality of the discovery, approaches, and solution
- **Significance:** Level of meaningfulness and relevance to the topic
- **Quality:** Level of design thinking and visualization
- **Value:** Level of potential impact on industry, economy, society, and individuals in Michigan and around the world.

Finalists and grand prize winners were selected in three categories; K – 5th grade, 6th – 12th grade, and collegiate/professional.

The primary award for finalists and grand prize winners was pairing each of them, regardless of age or experience, with professionals to accelerate their design skills and design thinking abilities. Companies like Sundberg-Ferrar, Newell Rubbermaid, Herman Miller, Whirlpool, Stryker and FCA all provided a design team member to work one-on-one with the finalists.

An example of a contest entry from a finalist is the “Light Jacket” concept from a 7th grader at Surline Middle School. The student envisioned a garment designed to illuminate on contact with water. She was paired with a professional designer from Sundberg-Ferrar, an industrial design and innovation firm, to create a product concept, investigate youth fashion trends, and learn about the technology required to provide a creative alternative to traditional lifesaving gear. The student created the “Light Jacket” to encourage use rates among youth, improve water rescue efforts, and thereby reduce drownings.

Encouraging the exploration of fresh ideas and innovation from today's students can create a path for tomorrow's designers to make products that improve thoughtfulness in relation to our water resources.

The creative output from the contest, including high-quality renderings from the mentoring sessions, was captured on large banners that were displayed at the 2016 Michigan Design Prize celebration held at the Eli and Edythe Broad Museum of Art in East Lansing. Finalists, families, educators, and representatives from the Michigan Economic Development Corporation and Office of the Great Lakes were in attendance at this inaugural event. The ceremony kicked off with a compelling message, delivered via video, from Governor Rick Snyder. Governor Snyder spoke to the important role industrial design plays in driving Michigan's economy. Participants were then recognized by MDC with certificates and medallions created especially for the event by General Motors design staff.

The success of this event is evidence of the positive impact the MDC and its Michigan Design Prize competition are having on Michigan's youth and professional designers by creating awareness of Michigan's unparalleled design capability and accelerating young design talent toward fulfilling careers in industrial design and related fields.

The MDC is already gearing up for the 2017 Michigan Design Prize. It anticipates far greater awareness and participation in next year's competition, and is excited to announce the Michigan Economic Development Corporation as its key sponsor for 2017.

For more information about the Michigan Design Council, please contact:

Jeff DeBoer, Chairman, Michigan Design Council
info@michigandesigncouncil.org
michigandesigncouncil.org

Footnote:

1. STEAM: An education philosophy emphasizing Science, Technology, Engineering, the Arts, and Mathematics.



Microplastics: An Emerging Contaminant

Studies find increasing evidence of impacts from microplastic pollution

By: Austin K. Baldwin, U.S. Geological Survey

There has been growing concern in recent years surrounding plastics, and especially microplastics, in the Great Lakes and their tributaries. Microplastics, defined as plastic particles less than 5 mm in diameter, come from many different sources, some of which likely remain unidentified. One source of microplastics, microbeads in personal care products, was banned by the U.S. federal government in 2015 (going into effect in 2017). However, numerous other, potentially more important sources of microplastics remain. These sources include urban runoff (Styrofoam, plastic bags, bottles, wrappers, cigarette butts, and tire particles), fishing gear and discarded debris from boats, plastic shavings and dust from factory floors, wastewater treatment facility effluent (synthetic fibers from clothing and textiles, fragments of larger debris), combined sewer overflows, and atmospherically-deposited synthetic fibers.

A primary concern surrounding microplastics is their potential to impact aquatic organisms. Microplastics continue to break down into smaller and smaller particles over time, making them ingestible by all levels of the food web, from plankton to mussels, fish, and birds. While some organisms are capable of egesting at least some shapes and sizes of microplastics, studies have reported bioaccumulation in other organisms. Synthetic fibers, the most common microplastic type, are thought to present the greatest threat, as they have been shown to lodge in the gut and bioaccumulate. Studies on wild mussels have found an average of over 100 synthetic fibers per organism.



Microplastics enter the Great Lakes from many sources. Some result from the breakdown of larger pieces. Others enter through washing effluent, atmospheric deposition, and storm water runoff.

The effects of microplastic ingestion by aquatic organisms are poorly understood. Plastics contain a variety of toxic or endocrine-disrupting chemicals such as flame retardants, antimicrobials, and bisphenol-A. Additionally, plastics act as sponges for chemical contaminants in the surrounding water, including polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), organochlorine pesticides, and metals.

There is concern that these contaminants may be transferred from microplastics to fish and other organisms upon ingestion. Recent laboratory studies have reported ingestion-related effects including uptake of microplastic particles into the circulatory system and the cells, impaired reproduction and hatching success, decreased growth rates, clogging of feeding appendages, ulceration, inhibited response to olfactory threat cues, and increased predator-induced mortality rates.

“Microplastics have been shown to effectively and uniquely transport pathogens from wastewater treatment facilities to downstream locations, presenting a potential human health issue.”

The majority of microplastics field studies have focused on the marine environment, but among freshwater systems the Great Lakes Basin has been an area of considerable attention. Microplastics enter the Great Lakes through their tributaries at concentrations of up to 32 particles per cubic meter according to a recent study of 29 tributaries. Synthetic fibers constitute the majority of microplastics entering from tributaries (71 percent), followed by fragments of broken-down litter and other debris (17 percent). Microplastic pieces of foam, film (from plastic bags and wrappers), pellets, and microbeads make up the remainder.



Scientific sampling for microplastics in Lake Michigan near Milwaukee, Wisconsin.

Upon reaching the Great Lakes, microplastics may either float or sink, depending on their density, degree of biofouling, and other factors. Floating microplastics have been reported at concentrations of thousands to hundreds of thousands of particles per square kilometer. One recent study estimated one billion microplastic particles floating on the surface of Lake Michigan. These “floaters” are dominantly fragments. Other microplastics appear to sink upon reaching the lakes, including the synthetic fibers that constitute the majority of tributary samples.

Studies are few, but there is increasing evidence that lakebed sediments are becoming vast depositories of synthetic fibers and other microplastics, with concentrations in the hundreds to thousands of particles per kilogram (dry weight) of sediment. This accumulation in lakebed sediments may have important effects on bottom-feeding organisms as well as organisms higher in the food chain.

“There is increasing evidence that lakebed sediments are becoming vast depositories of synthetic fibers and other microplastics”

We are only beginning to understand the sources, fate, ecological, and human health effects of microplastics in the Great Lakes and its tributaries. The increase in plastic production, stability of plastics in the environment, and long residence time in the Great Lakes ensure that these contaminants will continue to accumulate in Great Lakes water, sediment, and biota well into the future. The ban on the use of microbeads in personal care products was an important first step in reducing the flow of microplastics into the lakes, but many sources remain. Taking proactive approaches to issues including package design, product life cycles, continued research, and pollution prevention are the next steps needed to ensure healthy Great Lakes.

Great Lakes Research Centers

University water centers and institutes pioneer innovative Great Lakes research

By: Katerina Crowley, Michigan State University Glassen Scholar, Michigan Office of the Great Lakes

Michigan is a powerhouse of water research. Many federal and state agencies are contributing to the body of Great Lakes and water related research and knowledge including the U.S. Geological Survey, National Oceanic Atmospheric Administration and the Great Lakes Science Center, Great Lakes Fishery Commission, and the Cooperative Institute for Limnology and Ecosystems Research, among others. In addition to these federal and state partners, we have five university water centers and seven water institutes tackling some of the most complex issues facing the Great Lakes Region.

Millions of dollars are flowing into these water centers and institutes. The University Research Corridor (Michigan State University, University of Michigan, and Wayne State University) received almost \$300 million for water-related research between 2009 and 2013.¹ Other research institutes are also receiving significant amounts of money: Lake Superior State University recently received nearly \$12 million to create a Center for Freshwater Research and Education, and Michigan Technological University recently opened a \$25 million Great Lakes Research Center with marine facilities, a state of the art laboratory, and a supercomputer.² The University of Michigan launched a \$9 million Water Center that was partly funded by the Erb Foundation to improve Great Lakes restoration.

Michigan's water centers and institutes are addressing water issues with innovative, data-driven approaches. Below are several examples of the cutting edge research underway:

University of Michigan Water Center: *Putting Hydrodynamics Research to Work for Fish*

The Great Lakes Restoration Initiative has funded efforts to bring sturgeon back to the Detroit and St. Clair Rivers by constructing reef spawning beds, which are essentially beds of loose rock on the bottom of the river. Researchers from the Water Center have been working together with engineers to construct these spawning beds in a way that prevents loose silt and sand from accumulating. By reducing sediment build-up, the researchers ensure that the spawning beds will remain useful to the sturgeon and require less maintenance in the future.

Michigan Technological University Great Lakes Research Center: *The Cladophora Resurgence in Lake Ontario: characterization and implications for management*

Scientists at the Great Lakes Research Center have linked the recent growth of *Cladophora* in Lake Ontario to the exponential spread of zebra mussels, an aquatic invasive species. They concluded that although invasive mussels are the largest factor for the increased algal blooms, the only effective way to reduce future growth is to control phosphorous runoff around the lake. The resulting paper was praised by its publisher, the Canadian Journal of Fisheries and Aquatic Sciences, as work of "particularly high caliber and importance."

Michigan State University Institute of Water Research: *Launching the Michigan Sensitive Areas Identification System*

The Institute of Water Research, in collaboration with United States Department of Agriculture Natural Resource Conservation Service, Michigan Office, has launched the Michigan Sensitive Areas Identification System. This tool, available online at <http://sais.iwr.msu.edu>, identifies and maps areas on farm fields that are sensitive to soil erosion and nutrient leaching. Producers can view their property, print a report with a summary of the results, and contact the Natural Resource Conservation Service to learn how to mitigate these threats to water quality.

Central Michigan University Institute for Great Lakes Research: *Real-time Data Collection on the Beaver Island Ferry*

The Beaver Island Boat Company's Emerald Island ferry now does double-duty, moving people to and from the island and carrying Institute for Great Lakes Research equipment to monitor real-time Lake Michigan conditions. The boat was fitted with equipment to measure water chemistry and temperature that could be accessed remotely from the Institute's research station on Beaver Island. Initial data from this one-of-a-kind partnership reveals warming trends in the Great Lakes, including Michigan. Real-time monitoring will allow researchers to better assess how temperature and chemistry changes within a day, and on a day-to-day basis.

Saginaw Valley State University Saginaw Bay Environmental Science Institute: *Using Drones for Water Quality Monitoring*

Researchers at the Saginaw Bay Environmental Science Institute are tackling the issue of water quality monitoring in a unique way: with drones. The Institute's unmanned drones are able to travel to remote, hard-to-reach places to collect water samples. They are even able to bore through ice for winter samples, providing a faster, more efficient, and safer option than sending researchers to venture onto the frozen Great Lakes.

Grand Valley State University Annis Water Resources Institute: *Integrated Watershed Commission*

A new project at the Annis Water Resources Institute assessed opportunities for managing watersheds in a more coordinated manner. Management would take place along natural boundaries rather than at government boundaries such as cities or townships and involve a broad range of stakeholders: drain commissioners, watershed councils, state and federal natural resource agencies, and others. These Integrated Watershed Commissions embody the collaborative governance approach that was called for in Michigan's Water Strategy. Managing our water resources in a collaborative way allows us to address emerging, multi-faceted problems that don't respond to traditional methods.

Michigan Water Institutes and Research Centers

- **Central Michigan University**
Institute for Great Lakes Research
- **Grand Valley State University**
Annis Water Resources Institute
- **Lake Superior State University**
Center for Freshwater Research and Education
- **Lawrence Technological University**
Great Lakes Storm water Management Institute
- **Macomb C. College/Wayne State University**
HEART Freshwater Center
- **Michigan State University**
Center for Water Sciences
Institute of Water Research
- **Michigan Technological University**
Great Lakes Research Center
- **Northwestern Michigan College**
Great Lakes Water Studies Institute
- **Saginaw Valley State University**
Saginaw Bay Environmental Science Institute
- **University of Michigan**
Erb Institute
Graham Sustainability Institute Water Center

Footnotes:

1. Rosaen, Alex L. Anderson Economic Group LLC. 2014. Innovating for the Blue Economy: Water Research at the University Research Corridor.
2. Austin, John. Michigan Economic Center. 2015. Water, Michigan, and the Growing Blue Economy. <http://issuu.com/primacivitasfoundation/docs/blue-economy-white-paper/1?e=4816200/5479433>

About Katerina Crowley

Katerina Crowley is an undergraduate student at Michigan State University pursuing a degree in Fisheries and Wildlife. She started working for the Office of the Great Lakes in January 2016 as a student assistant and continued her work in the summer as a Glassen Scholar. The Hal and Jean Glassen Scholars Program offers students exposure to policymaking in Michigan and real-world experience while working for an organization that focuses on complex natural resource issues in Michigan. She has provided invaluable assistance on projects including the Michigan Water Strategy and analysis of regional cross-border trade organizations. Prior to her assistantship at OGL, she worked for Michigan Trout Unlimited and Tip of the Mitt Watershed Council. Katerina hopes to obtain an M.S. in natural resources before pursuing a career in citizen science coordination and watershed management.



Water Monitoring in Southeast Michigan

Research conducted to coordinate reactivation of Huron-Erie Corridor water monitoring system

By: Michael Beaulac, Senior Project Administrator, Michigan Office of the Great Lakes

Background

The 80-mile Lake Huron to Lake Erie international corridor supplies drinking water to 4.5 million people who live on both sides of the U.S.-Canada border. The corridor includes the St. Clair River which empties Lake Huron into Lake St. Clair, and exits via the Detroit River which drains to Lake Erie. It is a major global shipping route and its shores see heavy manufacturing along downriver Detroit and a concentrated network of petrochemical plants just south of Sarnia, Ontario. Nine pipelines cross under both rivers, some used for petroleum-based products. Past corridor spills from a number of sources, include vinyl chloride, methyl ethyl ketone, and other volatile organics have been well-documented. Additionally, nutrient loadings initiated by rainfall events from CSOs and SSOs¹ are frequently recorded running into Lake St. Clair. The corridor's fast flow rates limit response time to address spill-related contamination events for downstream users like community water supply treatment facilities, and pose a real threat to people who depend on this source of water.

A quick-response water monitoring system is seen as essential.

To counter these threats, the Huron-to-Erie Real-time Drinking Water Protection Network was created in the mid-2000s with funds from the Department of Homeland Security, U.S. Environmental Protection Agency, and State of Michigan. The \$3 million cost went toward the purchase of monitoring equipment installed in 13² drinking water treatment plants (WTP). This water quality monitoring network provided early detection of drinking water contamination from chemical spills and other threats to public health. An online database of chemical monitoring results, equipment training and the first few years of annual equipment calibration and maintenance was also included.



Drinking Water Monitoring Equipment - SW Detroit

In the event of a confirmed contamination in the corridor, WTP operators, county health officials and state agencies were to engage in a course of action including shutting down water intakes in the spill's path. The volumes of real-time data would also be available for public users involved in research, spill investigation, river modeling, water treatment, or ambient water quality monitoring.

Water Treatment Plant Monitoring Network Assessments and Lessons Learned

The Michigan Department of Environmental Quality (MDEQ) expected the community WTP's to identify funding sources to support equipment maintenance and calibration, database management, and staffing once the initial grants expired. This was met with limited success due to a variety of reasons. Consequently, today's monitoring network consists of only six or so of the original 14 participating members.

Accordingly, interviews with WTP operators and municipal officials were conducted this summer and fall by a team of researchers from the MDEQ's Office of the Great Lakes, Wayne State University's Healthy Urban Waters Program, and the Southeast Michigan Council of Governments (SEMCOG)³ to determine lessons-learned and interest in reengagement. Among the team's findings:

Challenges

Several pressures challenged the successful implementation of the original corridor monitoring network.

The 2007-2009 global recession forced communities to aggressively prioritize line items in their annual budgets. Staff training and equipment maintenance, especially because the network was not a legal requirement, was hard to justify during budget-cutting. Additionally, some of the equipment was high maintenance and suffered recurring malfunctions, resulting in questionable data output.

Aging equipment and sporadic maintenance/calibration sometimes created false positives, sending erroneous email/text message alerts to WTP operators. This made it difficult for operators to distinguish real events from false alarms.

Some of the equipment sensors measured parameters that are already required under the Safe Drinking Water Act, creating unnecessary duplication.

Governing bodies in some communities and even some participating WTPs lost interest and/or did not see the value of the network due to their location in the corridor. As WTPs dropped out of the network, a domino effect was created and

community interest in continued network participation waned.

The public component of the database (Real-time Water Quality Information Management System) was not regularly updated and is most likely not used.

No formal response plan to events exists as part of the river monitoring network. This portion of the monitoring is left to the individual utilities (i.e., via use of email and phone).

Opportunities

Lessons learned from the original monitoring network open the door to improved management and coordination in future efforts. Observations and suggestions from reserachers and WTP operators include:

All monitoring parameters should be reviewed relative to the equipment used to detect them and duplication should be discontinued. Past and future data “erraticism” should be investigated to distinguish measurement error from environmental variability.

Attention to data, sensor performance, WTP data comparisons and data trending all should be routinely reviewed by a contractor or staff trained in data interpretation.

Monitoring equipment data output should be viewable from a console versus a website login process, streamlining the process.

The public-facing database and website should be redesigned with a more user-friendly interface. The web application could serve as a major outreach component to the network and could be a hub for regional water quality data.

Any budget should include “depreciation of assets over useful life” to ensure equipment replacement costs. Equipment life expectancy and/or warranties should be verified.

More specific recommendations on monitoring equipment and a budget that includes annual maintenance costs is in progress. A funding mechanism to pay for a re-engaged network of WTPs, either from external state and federal or internal community sources will be a challenge, but the need for cohesive, collaborative monitoring system remains. Each step toward a revitalized monitoring network moves the region closer to better protection of its drinking water resources.

Footnotes:

1. CSOs and SSOs: Combined sewer overflows and sanitary sewer overflows
2. Monroe, the 14th member, was added in 2012
3. Organization Information:
 - Michigan Office of the Great Lakes, www.michigan.gov/deqogl
 - Wayne State University’s Healthy Urban Waters Initiative <https://uweg.wayne.edu/healthy-urban-waters>
 - Southeast Michigan Council of Governments (SEMCOG), www.semco.org



Figure 1: Water Treatment Plant Monitoring Locations

Pursuing Innovation at Henry Ford

Looking to technologies of the past fuels ideas to solve contemporary challenges

By: Christian Overland, Executive Vice President, The Henry Ford

There are qualities in the American character that are defined by ingenuity, resourcefulness and innovation. We are problem solvers. We create, grow, design, make, and serve for our citizenry as well as the world. In the 21st century, Americans and the entire world are faced with many opportunities as our technology advances, and we are faced with challenges as well. Our population will have the opportunity to live longer in this century, and our challenge is that the world also has a growing population. The world is rapidly approaching nine billion people who need to be fed. The United Nations Food and Agriculture Organization estimates that the demand for food will rise 70 percent between now and 2050. Our world has to find the means of feeding 219,000 new mouths every day. By 2030 it is estimated that the world's farmers will need 45 percent more water than today although our aquifers are not producing enough to keep up with the demand. Additionally, great rivers such as the Colorado and Rio Grande do not reach the sea for part of the year because of the demand of our agricultural system. It is a system that has been part of a process of continual innovation since the 19th century. Yet we can see that it has been stretched to the point where society is beginning to experience serious problems brought on by the failure of said system, problems that will become critical in the future without innovation and new ideas.

The Henry Ford's agriculture collections are among the best in the world. They thoroughly document the problem-solving processes of how we developed our agriculture systems as they exist today. To better understand our agriculture and environmental systems of the future, our museum staff has decided to go beyond merely collecting agriculture implements. We are investing in documenting environmental systems such as water technologies and water stewarding processes within the categories of Agriculture and The Environment, Design and Making, Society and Social Transformation, and Power and Energy. We intend to seize the opportunity to inspire designers, engineers and students to solve 21st century issues such as clean sustainable water systems by presenting water technologies and sustainable environmental processes in the context of history where people can find answers by making connections between the past and present.

Our collections include the 1750 Newcomen steam engine, the oldest surviving steam engine in the world. This engine represents the very origins of the industrial revolution, which began with the removal of water from mines in England. Water turbines and water wheels used to power mills in the 19th century along with archives documenting their design, construction and use are part of our collections, as well. Greenfield Village's historic farms combined with our artifacts of irrigation



Water technology will help future farmers innovate to use water efficiently and feed the world.

systems, water filters, and water purifiers present a record of the use and stewardship of water for agriculture, communities, and personal use.

Currently, The Henry Ford is documenting innovators of today such as Eric Ryan and Adam Lowery, Michigan natives who grew up near the Detroit River. Ryan and Lowery founded Method Home safe cleaning products. Along with creating cleaning products that are safe for people and the planet, they have developed an innovative, sustainable company. Lowery's story of creating a sustainable packaging system utilizing the world's first plastic bottles made from plastic waste collected from the ocean has been featured on The Henry Ford's Innovation Nation television show. Examples of this ingenious packaging are also part of The Henry Ford's Collections.

The Henry Ford also has a partnership with Industrial Society of America. The winners of the Industrial Design Excellence Awards (IDEA) become part of the permanent collections of The Henry Ford and are on exhibition each year. This year's IDEA Gold Winner is the Swater sensor faucet designed by the Runner Group. The simple yet dedicated design of the Swater sensor faucet makes the manufacturing process of forging, machining and assembly less complicated, resulting in less labor and material cost. Perhaps another reason for The Henry Ford to include the Swater in its collections is that it addresses resource and water stewardship as it is made of lead-free copper and recyclable materials. Moreover, the faucet creates water saving awareness in public spaces with the well-thought design of a handle that returns to its original position automatically after use.

Our purpose of collecting and presenting water technologies and their processes is to inspire the next generation of innovators and entrepreneurs our country and region will depend on.



Experiencing The Great Lakes

Macomb's Blue Economy Initiative

County sees sustainable future in implementing economic, environmental plan

By: Gerard Santoro, AICP, Program Manager, Macomb County Dept. of Planning & Economic Development

Macomb County has historically been a national leader in water-related businesses and is known for its nearly 32 miles of Lake St. Clair coastline and the Clinton River with its many tributaries. Our blue waters provide a unique opportunity to expand Macomb's economy and increase quality of life.

Throughout history, our waterfront and river have been greatly utilized, dating back to our indigenous people, early fur traders and French missionaries. After heavy timbering and the Industrial Revolution in southeast Michigan, Macomb County saw dramatic development of its waterfront. A majority of the land was used for private development, marinas, and waterfront amusement and was consequently hardened, impacting ecosystems. With the exception of a few public parks like Lake St. Clair Metropark, a majority of waterfront property was closed off for most residents and visitors.



About 10 years ago, the Macomb County Department of Planning & Economic Development began to look at coastline and riverine areas as a means to a sustainable future by further developing a sense of place. This is how the Blue Economy was developed as a major program to make our waters healthier and more accessible.

Under the direction of Macomb County Executive Mark A. Hackel, the Macomb County Department of Planning & Economic Development worked to enhance our Blue Economy with strategic planning. Few places on earth have the abundance of usable freshwater and water-related features that Macomb County has. With over 70 active marinas, a world-class recreational boating and fishing industry, and numerous public and private access points providing many ways to enjoy the water, Macomb County realized the time was ripe to harness and leverage these opportunities by focusing on the Blue Economy with a strategic development plan.

The Blue Economy Initiative is designed around three key areas that focus on realizing Macomb County's fullest potential to be healthy and sustainable. They are as follows:

- 1. Economic Development:** Develop and foster the types of economic development that are reliant on these water assets and create a key targeted industry sector that recognizes both our current business activities and assistance in creating more opportunities that utilize adaptive and recreational water uses and water technology. This is also a key part of our strategy to diversify our local economy in a post-industrial climate in the Great Lakes region.
- 2. Environmental Stewardship:** By supporting the many recent improvements in our local natural environment, the Blue Economy is working to restore and implement even greater environmental programs that will assist in the continued improvement and recovery of these assets. Clean water is key to this region's future success.
- 3. Quality of Life:** Macomb County looks to fully embrace its attractive and appealing local municipalities by helping them enhance quality-of-life aspects for residents, employers and visitors by educating and branding our offerings. As we continue to utilize and develop our Blue Economy infrastructure, there are already several key stakeholders at work.

To learn more about the Blue Economy Initiative in Macomb County or to find out how to get involved visit ped.macombgov.org/PED-LandAndWater-About.

Seize the Day on Michigan Water Trails

State-designated water trails offer communities recreational, economic opportunity

By: Ronda Wuycheck, Coastal Management Program Chief, Michigan Office of the Great Lakes
Marc Miller, Deputy of Regional Initiatives, Michigan Department of Natural Resources

Across the state, the Michigan Department of Natural Resources and partners like the Michigan Office of the Great Lakes' Coastal Management Program are working to encourage the growth of paddle sports and tourism to new users by developing state-designated water trails. Providing clear and useful information to the public through the development of water trail standards can encourage positive outdoors experiences and provide a level of comfort and expectation when people try out a new area or outdoor recreation sport. Through locally-led applications and efforts, a state designation can help provide information about the water trail segment, its amenities, and offer complementary excursions that make an outing enjoyable and repeatable.

Some of the information the Michigan Department of Natural Resources is seeking to answer for the public are answers to questions like:

How difficult is the water trail to paddle? What skills do I need to paddle the water trail? Can I take my children, my scout troop, or a group of friends? What are the safety considerations that I need to know? Where can I stop for amenities such as bathroom breaks, water, and snacks? Does the water trail provide conservation, heritage, and recreation opportunities?

Regional engagement, coordination, and broad-based community partnerships are needed to develop, market, and maintain a water trail. The state designation process encourages private-public partnerships and public engagement, fostering the additional resource development.

Looking specifically at the coast of our great state, the Office of the Great Lakes Coastal Management unit is proud to report many accomplishments in building strategic local partnerships resulting in a state-wide interactive website¹ allowing paddlers to research a water trail experience with an easy click. The program has made investments in excess of one million dollars over the past four years supporting the development of Great Lakes Coastal Water Trail Network, and recently, working with its local partner LIAA, hosted the Michigan Water Trail Summit that brought together paddlers, local organizers, communities, and state representatives around this common platform.



The power of partnership can leverage resources, bring together ideas, and harness enthusiasm to result in projects that benefit local communities. An example is a partnership between the Office of the Great Lakes and the city of South Haven to enhance the ability for all paddlers to access the Black River and Harbor through the installation of a specialized floating easy-access launch. The launch is located at the Black River Park and provides the only free, universal public access point in the Black River Harbor. This access point connects the Kal-Haven Trail, used by hikers and bikers, to the Lake Michigan Water Trail and Bangor-South Haven Heritage Water Trail.

Trail corridors such as these benefit coastal communities by increasing recreational opportunities, promoting environmental awareness and enhancing local tourism opportunities. The Black River Launch project was made possible through the Coastal Management Program with funds made available, in part, by the National Oceanic and Atmospheric Administration.

Michigan is blessed with seemingly endless miles of inland rivers and streams and the longest freshwater coastline in the world. Myriad opportunities for use and enjoyment are waiting for you. Jump in your canoe, kayak, or paddleboard and seize the day by experiencing a Michigan water trail.

Footnote:

1. www.michiganwatertrails.org

Making Michigan's Waterways Accessible

Accessibility to water resources provides physical and emotional healing

By: Jessica Stark, Cert. Therapeutic Recreation Therapist, Lighthouse Neurological Rehabilitation Center



As I sit and think about our great state of Michigan's waterways, I can't help but think about access to this wonderful resource for all individuals, especially those with disabilities. As a Recreational Therapist, my goal is to see more waterways around our state become accessible, and more programs available to allow everyone a chance to enjoy them. Here is a highlight of some of the ways our lakes and rivers have become more accessible and available programs to assist those in need. This is in no way a comprehensive list, but presents an opportunity to encourage thoughtfulness about accessibility to water resources in local communities.

Next time you are sitting at the beach or getting onto a boat, think about what some of the barriers might be to doing these activities for those who use a wheelchair or walker. One might be getting across the sand safely or without fear of becoming stuck. Another may be getting into or out of a watercraft. Many times, people in these situations are forced to stay at home or on shore while friends and family enjoy the water wonderland that defines Michigan.

This is why the Lighthouse Neurological Rehabilitation Center has supported development of adaptive kayaking clinics. The goal is to provide opportunities for people of all abilities to enjoy our wonderful water resources. As Michiganders, this is what we do with our summers; we play in the water. At our clinics, we are able to provide physical assistance to those in need and adapt the sport to increase active participation.

Ways to do this include modifying holds on the paddles, using tandem kayaks to compensate for decreased strength or cognitive deficits, providing means to transfer into and out of the kayaks, or providing emotional support to achieve the participants' goals. It has been amazing to see people achieve goals they didn't know were possible and to be there to share in their excitement.

We had the pleasure of assisting a lady who hadn't been able to kayak in over five years after an automobile accident left her paralyzed. Watching her kayak again brought tears to everyone's eyes; we were so happy for her.

Another woman who was in a similar situation came in from kayaking and shouted "this is freedom!"

The Lighthouse Neurological Rehabilitation Center has developed a partnership with Interlochen State Park, which has been a gracious host to our events and was able to secure funding to make their waterway more accessible. Interlochen State Park now features a docking system across the beach which allows people with assistive devices the ability to access the shoreline and make transfers into kayaks or other self-propelled watercraft safer and possible.

The park is also able to provide a beach wheelchair for any visitor who may need a device that can travel across the sand and float in the water.

The Michigan Office of the Great Lakes chose to release part of the State Water Strategy at an adaptive paddling clinic that was part of the Lighthouse Rehabilitation Center - Interlochen State Park partnership, highlighting recommendations to increase statewide public access for those of all abilities.

Examples of other places the Department of Natural Resources have made State Park beaches more accessible include accessible walkways at the following parks: Harrisville, Sleepy Hollow, Tawas Point, Holland, Grand Haven, Ludington, Wells, and Keith J. Charters Traverse City State Park. Beach wheelchairs can be found at the following parks: Holland, Sleepy Hollow, Ludington, Grand Haven, and Keith J. Charters Traverse City State Park.

Many local parks are also taking steps to make their facilities more accessible. An example is Clinch Park in Traverse City, which has recently added an adaptive kayak launch and beach mat.

Many beaches around the state have are becoming more accessible for all because of local efforts and partnerships; however, there is still work to be done. The Lighthouse's adaptive kayak clinics are only one example of the programs available across the state.

If you are reading this and are unaware of opportunities or resources available in your community, there is a wealth of information available through a variety of partnerships and community initiatives. Seeking ways to raise funds and awareness to make beaches more accessible and partnering to develop programs to assist those in need makes a real difference. Together, we can help make Michigan's waterways enjoyable for all.

- Jessica Stark



Above: Photos from a summer adaptive paddling clinic at Duck Lake, Interlochen through a partnership between the Michigan Department of Natural Resources and the Lighthouse Neurological Rehabilitation Center.

Opposite: Beach wheelchairs, boardwalks, universal access launches, and assistive devices can help those with disabilities safely and confidently enjoy Michigan's beaches, lakes, and rivers.

Image Credits

Gulls of Leland

Mathias Alten, Oil on Canvas, 1936 30.5in x 30.25in **Cover**
Gift of George H. and Barbara Gordon. 1998.589.1
Courtesy of the Grand Valley State University Art Gallery

Kayaker

Michael Beaulac, Michigan Office of the Great Lakes **2**

Sailboats on Reed's Lake

Mathias Alten, Oil on Canvas, circa 1930. 12in x 16in **4**
Gift of the Stuart and Barbara Padnos Foundation. 2013.68.1
Courtesy of the Grand Valley State University Art Gallery

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Gift of the Lixenberg family in memory of Saskia Lixenberg.
2007.257.1
Courtesy of the Grand Valley State University Art Gallery

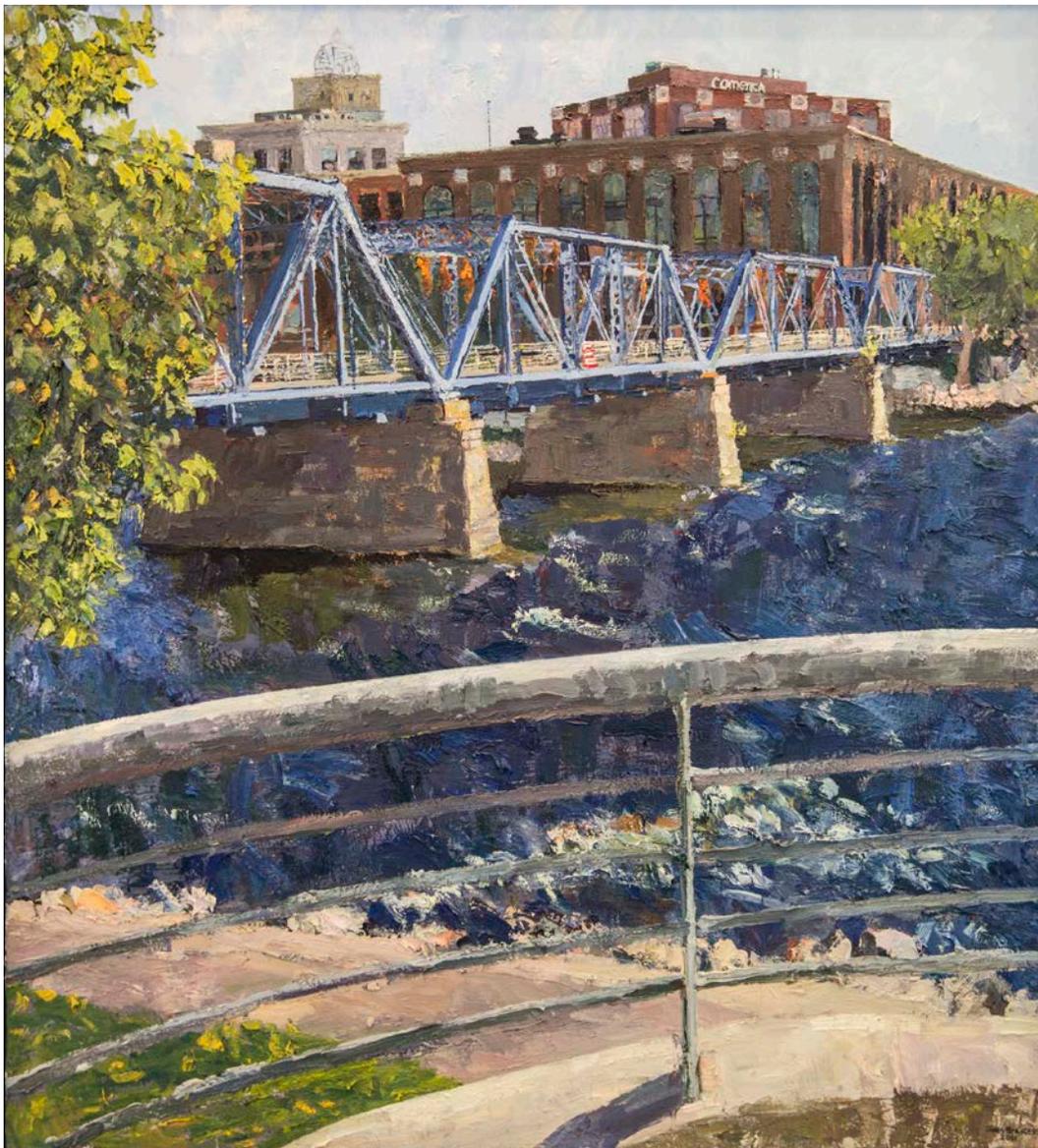
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Rick Snyder, Governor

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MICHIGAN OFFICE OF THE GREAT LAKES