



2021
ANNUAL
REPORT

LAKE MICHIGAN

LAKELIKE ACTION AND MANAGEMENT PLAN

Huron-Manistee National Forests - Lake Michigan Recreational Area. Credit: K. Malloy

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What is the Lake Michigan LAMP?

Under the [2012 Great Lakes Water Quality Agreement \(GLWQA\)](#), the Governments of Canada and the United States have committed to restore and maintain the physical, biological, and chemical integrity of the waters of the Great Lakes.

The Lake Michigan Lakewide Action and Management Plan (LAMP) is an ecosystem-based strategy for protecting and restoring Lake Michigan's water quality. The LAMP is coordinated by the Lake Michigan Partnership, which is led by the U.S. Environmental Protection Agency (EPA) with participation from federal, state, tribal and local governments or agencies, and with input from nongovernmental stakeholders and the public. The next LAMP will be issued in 2022 and in the coming years, the Lake Michigan Partnership will be working to assess the state of the lake, measure progress towards LAMP goals and objectives, and promote management actions to address identified problems.

This 2021 Annual Report highlights accomplishments and progress in achieving LAMP goals and objectives.

OVERVIEW

Lake Michigan is the world's fifth largest lake and is surrounded by the world's largest collection of freshwater sand dunes, along with many wetlands, prairies, forests, and savannas. These essential habitats support a diverse array of plant and animal species, serve as a key North American migratory bird flyway, and provide critical benefits to local communities. Lake Michigan is a source of high-quality drinking water, and beaches and nearshore areas continue to provide opportunities for swimming and recreational use. However, protective and restorative actions are necessary to address continued and emerging stressors that affect both water quality and the lake's food web.

Over the past year, the Lake Michigan Partnership agencies have cooperated to restore the lake's water quality and ecosystems through targeted actions and programs. These actions include drafting a new LAMP and developing science and monitoring priorities that guided the 2020-2021 Cooperative Science and Monitoring Initiative (CSMI) intensive field year investigations for Lake Michigan. In the following sections of this Annual Report, the Lake Partnership provides updates on activities to reduce chemical contamination, manage nutrients and algae, prevent and control invasive species, and restore and protect the habitats and species of Lake Michigan.

REDUCING CHEMICAL CONTAMINATION

Lake Michigan continues to be a good source of high-quality drinking water. Although concentrations of toxic chemicals in fish and wildlife have decreased significantly since the 1970s, concentrations of some chemicals such as polychlorinated biphenyls (PCBs) and mercury can accumulate in fish tissues and drive fish consumption advisories. Efforts to reduce inputs of chemicals to Lake Michigan are continuing through sediment clean ups at Lake Michigan Areas of Concern (AOCs).

Manistique River Area of Concern Updates

In September 2021, the *Restrictions on Dredging Activities* Beneficial Use Impairment (BUI) was removed from the Manistique River AOC. Sediment in the lower Manistique River was contaminated with PCBs from the de-inking of carbonless copy paper at a manufacturing facility adjacent to the river. Since the early 1990s, several projects have been implemented in the lower river and harbor to remove tens of thousands of cubic yards of contaminated sediment, sawdust, and related organic materials. The final cleanup project was completed in 2019 with funding from the federal Great Lakes Restoration Initiative (GLRI). The project included removal of PCBs and the placement of a clean sand cover mixed with granular activated carbon to chemically bind any residual contaminants and provide a physical barrier to reduce the potential for any future biological uptake. Findings from the most recent analyses indicate that sediments in the federally maintained navigation channel consist of over 94% clean sand, and there are no special handling or disposal measures required for those materials. With this BUI removal, only one impairment remains for the Manistique River AOC: *Restrictions on Fish and Wildlife Consumption*. It is expected that PCB concentrations in fish tissue will continue to decline over time now that there are no longer any known sources of PCBs in the area. It is anticipated that fish samples will be collected and analyzed in 2023 to determine whether contaminant concentrations have sufficiently declined to levels comparable to non-AOC reference sites.

Grand Calumet River AOC: Lake George Branch Sediment Project Underway

The Lake George Branch of the Indiana Harbor Ship Canal in Northwest Indiana will soon be significantly cleaner, thanks to a joint project underway by partners including the EPA, the East Chicago Waterway

Management District, Atlantic Richfield Company, BP Products North America Inc., and the U.S. Army Corps of Engineers. When completed, this remediation and restoration effort will minimize exposure of aquatic life to historical sediment contamination and will ultimately contribute to delisting of the Grand Calumet River AOC.

In December 2020, 23,804 cubic yards of sediments contaminated with petroleum products, heavy metals, and other pollutants were removed from portions of the Lake George Branch. This first phase of dredging was accompanied by the removal of approximately 60,000 linear feet of abandoned pipelines at two adjacent former refinery sites. The second phase of dredging, currently planned to take place in 2024, is expected to remove an additional 50,000 cubic yards of contaminated sediment from the waterway. This dredging will be accompanied by installation of a sheet pile wall designed to prevent recontamination of the waterway.

This dredging effort will be complemented by placement of an engineered barrier along approximately 2,100 feet of the Lake George Branch, just to the west of the dredged segment. This isolation cap will be accompanied by bank controls to prevent recontamination, as well as aquatic habitat restoration within the canal and along the banks. The design for this portion of the project was completed in 2021, with construction scheduled to be completed in 2023.

Additional efforts are being planned to address contaminated sediment in the westernmost portion of the Lake George Branch. Once complete, these projects will help protect both human health and the environment along approximately 1.4 miles of the Indiana Harbor Ship Canal.

MANAGING NUTRIENTS, ALGAE, & BACTERIAL CONTAMINATION

Management of nutrients and algae in Lake Michigan continues to be a challenge because there are contrasting trends in the nearshore vs. the offshore waters. Phosphorus concentrations are very low in the offshore waters, limiting productivity, but they remain high enough in some nearshore areas and in Green Bay to cause nuisance algae growth. Issues related to nutrients, algae, and bacterial

contamination are being addressed through nutrient management programs, research to better understand how nutrients move through the ecosystem, and new approaches to keep the public informed about local conditions.

Approval of the Nonpoint Source Pollution (NPS) Coastal Management Program

The Indiana Lake Michigan Coastal Management Program (LMCP) formed the Northwest Indiana Septic System Work Group in 2013 to support voluntary inspections of Onsite Sewage Disposal Systems (OSDS), which can contribute significantly to nonpoint source pollution if not properly managed. The workgroup, made up of federal, state, and local OSDS stakeholders, works to identify and address potentially failing OSDS within the coastal watersheds and conducts outreach and education programs for proper system maintenance. The workgroup launched a Good Neighbor Program to encourage homeowners within identified areas of potentially failing OSDS to properly maintain and inspect their systems. The State of Indiana has set a goal to inspect 67% of the operating OSDS within these counties over the next 15 years, which will be tracked through partnerships with Porter and Lake Counties and the Indiana Onsite Wastewater Professionals Association (IOWPA).

Indiana has also developed several training programs that promote routine inspections of existing OSDS. The LMCP, the Indiana Department of Environmental Management (IDEM), the Greater Northwest Indiana Association of Realtors (GNIAR) and the IOWPA work together to provide annual training for realtors and certified IOWPA inspectors in Northwest Indiana on the importance of OSDS inspections, especially during property transfers for the realtor audience.

In addition to the in-person trainings geared toward professional audiences, LMCP and IDEM are partnering with Purdue University Extension, Illinois-Indiana Sea Grant, the Indiana Department of Health, GNIAR, and IOWPA to develop online septic system education modules to facilitate virtual learning. The online modules will be adaptable for several different audiences including homeowners, realtors, IOWPA members, and local communities. The State plans to hold virtual training events several times a year within the coastal nonpoint program management area and host the education material online so that interested individuals will be able to access it at any time.

Nutrient Processing Study in the Fox River

Cyanobacteria blooms in Green Bay, driven by runoff of excess nutrients from agricultural and urban areas in the Fox River Watershed, are a frequent problem during the summer. Some cyanobacteria species can produce toxins that are harmful to humans, pets, and other animals. Managers in the Fox River Watershed have implemented point source and non-point source control programs to reduce nutrient runoff from agricultural and urban areas and improve water quality.

Water quality also can be improved through natural processes occurring in the water and streambed sediments in the river system. With support from the GLRI, researchers from the U.S. Geological Survey (USGS) measured the nutrient retention and removal potential in streambed sediment of the Fox River Watershed, as well as the water column nutrient processing at the Fox River mouth from 2016-2018. The [results of this study](#) show that microbial activity in the streambed sediments can remove nitrogen from the water, especially in areas with more vegetation along the sides of the river. The streambed sediments also store phosphorus and convert it to a form that algae cannot use as easily; therefore, the phosphorus is less likely to fuel cyanobacteria blooms even if it is later released back into the water. Protecting and restoring riparian vegetation and stream habitats could help reduce nutrient pollution entering Green Bay.



Biologist collects streambed sediment sample from the Upper Fox River, as part of a study to measure sediment nutrient processes that can improve downstream water quality. Source: Sean Baily, USGS

Indiana's New Lake Michigan Beach Monitoring and Notification System

In 2021, the IDEM with support from the GLRI, developed IDEM BeachAlert, a modern and mobile-friendly beach monitoring and notification system. Such a system, which meets requirements set by the [Beaches Environmental Assessment and Coastal Health \(BEACH\) Act](#), is critical to collecting and disseminating information on beach closings and advisories to members of the public, researchers, and others.



Beach Status and Water Quality Alert Signs at Indiana Dunes State Park in Chesterton, IN. Source: IDEM.

BeachAlert, like IDEM's legacy BeachGuard system, is a free service that allows users to check if their favorite beaches are under an advisory or closure, view *E. coli* water sample results, and find out information about the organization responsible for monitoring the beach. It also adds multiple new features, including: a mobile-friendly interface, an interactive map, information on local beach amenities, water safety alerts (e.g., closures due to rip currents or other dangerous conditions), social media integration, and improved data export capabilities. In 2022, IDEM will be expanding the capabilities of the system even further, adding the ability for users to receive text and email alerts of advisories and closures at user-selected beaches. The data collected by the BeachAlert program also factors prominently in evaluating the status of the [Beach Closings Beneficial Use Impairment \(BUI\)](#) within the Grand Calumet River AOC.

Interested parties should visit <https://portal.idem.IN.gov/beachalert> for the IDEM BeachAlert experience.

PREVENTING AND CONTROLLING INVASIVE SPECIES

Approximately 140 non-indigenous species have become established in Lake Michigan, causing direct and indirect impacts to the ecology and water quality of the basin. Once established, invasive fish, plants, and other organisms are very difficult to eradicate. Efforts to detect and control invasive species are ongoing.

Wisconsin Lake Monitoring & Protection Network

In 2021, the Wisconsin Department of Natural Resources (WDNR) implemented a new grant program called the Lake Monitoring & Protection Network (LMPN) to prevent the spread of aquatic invasive species (AIS) and protect the health of the state's waters. The program provides funding to all 72 counties in Wisconsin for lake monitoring and AIS prevention activities. Eligible network cooperators include counties, federal agencies, tribal governing bodies, and cooperative agents designated by a county. Of the program's \$1 million funding, \$400,000 went to communities in the Lake Michigan basin.

The purpose of the Network is to provide comprehensive and uniform coverage of AIS programming outlined in WDNR's AIS management plan. This plan focuses on expanding the reach of programs like Clean Boats Clean Waters, Water Action Volunteers, AIS Snapshot Day, and the Citizen Lake Monitoring Network. In large part due to the LMPNs efforts monitoring and outreach efforts, Wisconsin completed over 47,000 watercraft inspections within the Lake Michigan basin in 2021.



Watercraft inspector and conservation officer working together to inspect a boat for aquatic invasive species. Source: WDNR

RESTORING AND PROTECTING HABITAT AND SPECIES

The Lake Michigan basin includes many important habitats including coastal wetlands, in-lake spawning reefs, and coastal and open water migratory bird stopover areas. Infrastructure that changes how water moves across the landscape and through the watershed, such as dams and impermeable pavement, degrades habitats and can negatively affect native species populations, biodiversity, and ecosystem resilience to other stressors. Continued efforts to inventory, protect, and restore critical habitats and native species are important to ensure long-term health ecosystem health. Numerous projects are underway to improve aquatic habitat connectivity and quality, as well as understand how Lake Michigan habitats may respond to climate change.

Restoration Efforts on Northern Michigan Reefs

The U.S. Fish and Wildlife Service (USFWS), USGS, the states of Michigan and Wisconsin, The Nature Conservancy, several tribal nations, and other partners are collaborating on a series of new multi-year efforts to protect and restore important fisheries reefs in northern Lake Michigan, including Green Bay. These reefs are critical spawning areas for Lake Trout, Whitefish, Cisco, Smallmouth Bass, Walleye, and native prey fishes. The Lake Michigan Committee, composed of fisheries managers from each of the four states and the Chippewa-Ottawa Resource Authority, has identified reef restoration as one of its top environmental priorities. In Michigan waters, a new GLRI-funded project will conduct extensive habitat mapping to characterize the current condition of the reefs. The project will collect data on the spatial extent, physical characteristics, and general condition of the reefs, including sedimentation and coverage by invasive species, as well as on the native biota and behaviors of species using the reefs (e.g., spawning incidence, egg and larval survival). The project will provide prioritized recommendations for future reef habitat management activities. To view the State of Michigan's story map on reefs, visit <https://gis-egle.hub.arcgis.com/>.

Fish Habitat Restoration in Little Cedar Creek

Little Cedar Creek is a high-quality cold-water tributary to the Muskegon River in Michigan. This project will restore 3.5 miles of fish passage, 500 feet of in-stream fish habitat, and reconnect 12 acres of wetland habitat and essential spawning and nursery habitat for lake-run and resident fish species, such as native Brook

Trout, Sculpin, and Brown Trout. With GLRI funding, the National Oceanic and Atmospheric Administration (NOAA) supported the planning phase of this project. In 2022, WMSRDC and partners will use GLRI funding to replace two perched, plugged, undersized culverts with adequately sized, clear span culverts and bridges, and create in-stream fish habitat enhancements to improve fish habitat and facilitate passage near the new structures.



Baseline fish sampling prior to replacing perched culverts in Little Cedar Creek at Sweeter Road to restore fish passage for native Brook Trout. Source: NOAA

Powderhorn Lake Habitat Restoration & Connectivity Project

This three-year project made possible through a collaborative effort by NOAA, Great Lakes Commission, Illinois Department of Natural Resources, Audubon Great Lakes, and the Forest Preserves of Cook Count (FPCC), will restore 192 acres of wetlands by reconnecting the northern marsh of Powderhorn Lake to Wolf Lake in Illinois. The GLRI-funded restoration effort will re-establish historic habitat that is essential to native fish, birds, and other wildlife while also reducing flooding in nearby neighborhoods. It will also enhance recreational activities on publicly accessible land close to a major population center. When complete, this project will improve critical nursery habitat and spawning grounds for native fish species by re-establishing a hydrological connection between coastal wetland habitat, the Calumet River and, ultimately, Lake Michigan.

In 2021, the project design was finalized, which required engaging the adjacent residential communities, coordinating with the railroad that

runs along the perimeter of the site, and securing all necessary permits. The pre-restoration fish and water quality monitoring was completed, and construction commenced in October 2021. Additional information can be found at the [FPC project website](#).

Willow Creek Fish Passage - Sheboygan River and Harbor

Engineering and design began in spring 2021 for a fish passage project in Willow Creek, a cold-water tributary to the Sheboygan River in Wisconsin. Two culverts will be removed in 2022, allowing passage of aquatic organisms, including Brook Trout, which naturally reproduce in the stream. The project is located within Willow Creek Preserve, a 143-acre nature preserve owned by Glacial Lakes Conservancy (GLC). Acquisition of the preserve, the fish passage project, and other restoration work on the property are funded by the Sheboygan River and Harbor Natural Resources Damages Assessment and Restoration settlement. The Natural Resource Trustees for the river (WDNR, NOAA, and USFWS) are supporting GLC with technical support as they finalize plans, draft a request for proposals, select a contractor to implement the project, and coordinate monitoring of project outcomes. Removal of the culverts will allow fish to reach more spawning habitat and improve in-stream habitat.



Undersized culvert on Willow Creek to be removed in conjunction with stream bed restoration to improve fish passage of Lake Michigan trout and salmon. Source: WI DNR

Indiana Lake Michigan Coastal Region Wetlands Functional Assessment

The Indiana Lake Michigan Coastal Region Wetland Functional Assessment was completed in partnership

with Ducks Unlimited in June 2021. The project updated wetland mapping for the National Wetland Inventory (NWI) and provided information for functional assessment of NWI features such as flood water storage and habitat. Data have been submitted to the USFWS for inclusion in the NWI map. Data are stored within the Indiana Department of Natural Resources GIS database and will support creation of the Indiana Coastal Atlas. The results from this project will provide local decision makers with more detailed information about the locations of coastal wetlands and the ecosystem services they provide; this information is important to effectively manage and protect this critical habitat.

Conservation Blueprint for Green Bay Region

The Green Bay Conservation Partners (GBCP) have developed a landscape conservation “Blueprint” for the Fox River, Wolf River, and Green Bay region. The Blueprint is a shared vision of the collaborative conservation community and summarizes shared goals, needs, and mandates. This effort, led by the USFWS, provides partners and stakeholders with a tool to leverage funding, plan, and implement projects to ensure the sustainability of the Green Bay ecosystem services for current and future generations.

The Blueprint is “top down” in its approach to meet state and federal mandates using a shared plan, but also “bottom up” in that it requires consensus of regional partners in how best to align local, state, and federal priorities and policy. Using this planning model, the GBCP Blueprint Working Group identified shared goals and priorities and developed implementation opportunity maps to restore and protect natural resources in five core areas (Thriving Habitats, Healthy Waters, Sustainable Lands, Connection to Nature, and Climate Change). These deliverables were included in the comprehensive [Conservation Blueprint for the Fox, Wolf and Green Bay Region](#) finalized in early 2021.

Pilot Shoreline Erosion Protection Project at Illinois Beach State Park

Illinois Beach State Park (IBSP) is one of the last remaining natural shorelines in the state, and it is eroding at an unprecedented rate, due primarily to higher water levels and increased storm activity associated with climate change. This 3,000-acre park, managed by the Illinois Department of Natural



USACE building offshore, submerged ridge at Illinois Beach State Park. Source: Healthy Port Futures

Resources (IL DNR), supports important wetland, dune, and savanna habitats. These critical habitats are home to many important endemic and/or endangered plant and animal species, including four federal and 60 state listed species.

Solutions to erosion issues are costly and often focus on shoreline or offshore armoring, which changes the natural dynamics of a coastal system. In an effort to identify and implement strategies to more effectively manage shoreline erosion, the [IL DNR Coastal Management Program \(CMP\)](#) partnered with Healthy Port Futures, a landscape architect team, to implement a pilot project for innovative shoreline management at IBSP. GLRI funding provided to CMP, USACE Chicago District, and NOAA Office for Coastal Management was used for pre-construction monitoring, material acquisition, and construction.

This study was designed to test the effectiveness of a lower-cost, lower impact, and more rapid response intervention in slowing down the erosion rate of targeted coastal shoreline without obstructing the natural transport of sand along the shoreline or impacting the experience of the coast. The nature-based design consists of a low, broad field of ridges that incrementally reduce wave energy and ideally prevents severe erosion and slows, but not stops, critical coastal processes. This pilot project provides the opportunity to offer an alternative model for shoreline protection at other sites around the Great Lakes.

Project construction was completed October 2021. A five-year monitoring plan is a vital part of the pilot project

and will measure the effect of the intervention on the topo-bathymetry, vegetation, wave conditions, and biological communities. From the initial science and monitoring that informed the design planning, through construction, to post-construction monitoring, this project partnership is a model for multi-agency, multi-sector project development in coastal management. Learn more about this project and the partners here: <http://healthyportfutures.com/project/illinois-beach-state-park/>.

Lake Michigan’s Deep Waters Are Warming as a Result of Shorter Winters

[NOAA’s Lake Michigan Temperature Trends study](#) is based on three decades of high-frequency subsurface water temperature data from Lake Michigan. This unique data set reveals that deep water temperatures are increasing in the winter and provides precise measurements of the timing of fall overturn, the point of minimum temperature, and the duration of the winter cooling period. Data show that a shortened winter season results in higher subsurface temperatures and earlier onset of summer stratification. Shifts in the thermal regime of Lake Michigan can lead to permanent changes in the lake’s seasonal mixing patterns, potentially leading



Lake Michigan sunset from the NOAA R/V Laurentian. The 30-year, deep-water temperature dataset overlaying this photo (the “heartbeat of Lake Michigan”) reveals a hidden story about how the lake’s deep waters are responding to climate change. Source: NOAA.

to profound impacts on the ecosystem. For example, changes to mixing could affect primary productivity rates and disrupt the function of the food web, resulting in negative impacts on fisheries and recreation.

OUTREACH AND ENGAGEMENT

You can keep up to date on GLWQA engagement opportunities in the [Engagement](#) section of Binational.net. Information on many of our partner organizations' upcoming outreach and engagement opportunities can also be found at the Great Lakes Commission's "[Great Lakes Calendar](#)".

The Lake Michigan Partnership will also participate in the 2022 [Great Lakes Public Forum](#). The Forum is held every three years to engage the public on the state of the Great Lakes, as well as present progress achieved under the GLWQA over the past three years and priorities to guide the science and actions for the next three years (2023-2025).

Indiana Lake Michigan Webinar Series

Between October 2020 and February 2021, the IDEM and partner organizations hosted a series of nine informational webinars to coincide with the development of the Lake Michigan LAMP. In the spirit of the LAMP, the goals of the series were to facilitate communication across the entire 10 county portion of Indiana's Lake Michigan basin and provide information about tools and programs available to assist with implementation of watershed protection and restoration efforts. To accomplish these goals, each 60- to 90-minute webinar was designed with a diverse audience in mind, including Municipal Separate Storm Sewer System (MS4) coordinators, watershed groups, and members of the public.

Specifically, the webinars introduced watersheds and categories of pollution, presented information about IDEM programs to assess and improve water quality, and hosted discussions on the roles of numerous organizations in maintaining and improving water quality in Indiana, including the USDA Natural Resources Conservation Service, Urban Waters Federal Partnership, Soil and Water Conservation Districts, Lake Michigan Coastal Program, MS4s, watershed groups, and the state river basin commissions.

The webinar recordings and presentation slides have been posted to the IDEM website. To view them, interested parties should visit <https://www.in.gov/idem/lakemichigan/resources/lake-michigan-basin-webinar-series/>.

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