Great Lakes RESTORATION

Great Lakes Restoration Initiative Report to Congress

April 2026

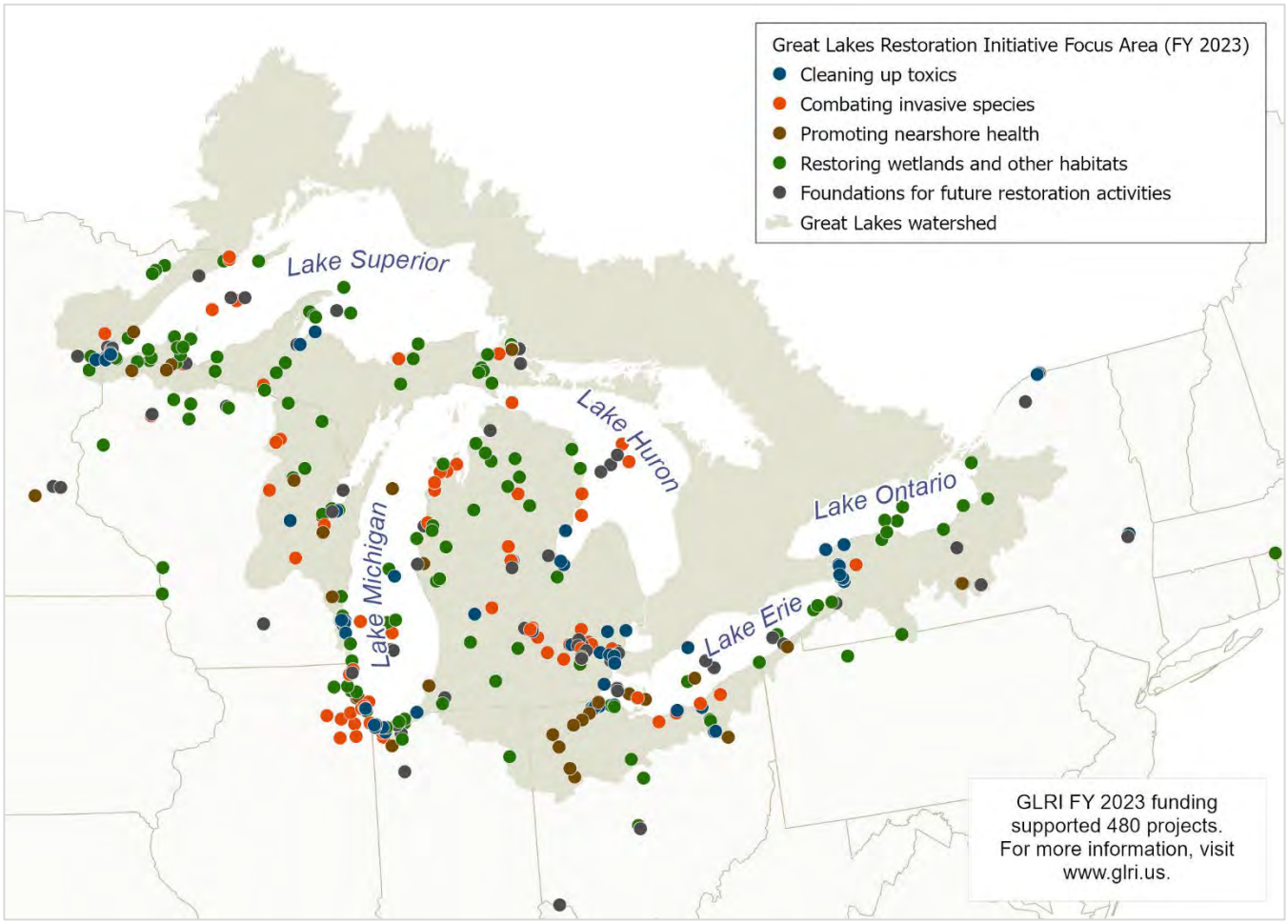
Fiscal Year 2023

Contents

About This Report

This report presents an overview of progress made under the Great Lakes Restoration Initiative (GLRI). It includes information through Fiscal Year 2023 on funding, project accomplishments, success stories, and actual results compared to planned targets under GLRI Action Plan III. Data on direct spending is taken from the U.S. Environmental Protection Agency financial system. Information on GLRI projects and activities is also available at https://glri.us.

The U.S. Environmental Protection Agency Administrator is required by Clean Water Act Section 118 (c)(7)(H)(iii) to provide this report to the House Committee on Transportation and Infrastructure and the Senate Committee on Environment and Public Works.



Section 1 – Executive Summary

The Great Lakes Restoration Initiative, or the GLRI, has greatly accelerated efforts to protect and restore the Great Lakes—the world's largest system of fresh surface water. Since its 2010 inception, the GLRI has continued to address the historically challenging environmental problems and imminent threats facing this indispensable ecosystem.

Under the U.S. Environmental Protection Agency's leadership, the GLRI has been a catalyst for unparalleled coordination among the federal agencies or departments that make up the GLRI Interagency Task Force and the GLRI Regional Working Group. Through Fiscal Year (FY) 2023, GLRI has funded over 8,000 projects focusing on the most important Great Lakes environmental issues, including cleaning up highly contaminated Areas of Concern (AOCs), protecting and restoring native habitat and species, and preventing and controlling invasive species.

Section 118 of the Clean Water Act (CWA) authorizes GLRI funding and directs efforts across five priority areas: (i) the remediation of toxic substances and areas of concern; (ii) the prevention and control of invasive species and the impacts of invasive species; (iii) the protection and restoration of nearshore health and the prevention and mitigation of nonpoint source pollution; (iv) habitat and wildlife protection and restoration, including wetlands restoration and preservation; and (v) accountability, monitoring, evaluation, communication, and partnership activities.

The five priority areas correspond directly with the Action Plan III Focus Areas described below. This report provides an overview of progress during FY 2023 for each Focus Area within Action Plan III.

GLRI Action Plan III Focus Areas

1) Toxic Substances and Areas of Concern

During FY 2023, GLRI federal agencies[1] and their partners made significant progress in remediating contaminated sediment and restoring habitat in AOCs. Seven Beneficial Use Impairments (BUIs) were removed, bringing the cumulative total of BUIs removed to 120, which surpasses the FY 2023 target set in GLRI Action Plan III (see Appendix A, Table A-1). Through the end of FY 2023, GLRI federal agencies and their partners also delisted or completed all management actions necessary to ultimately delist over half the original number of U.S. AOCs (i.e., 16 out of 31). The GLRI federal agencies and their partners also continued their work to protect human health from contaminants in Great Lakes fish and assess the impacts of chemicals of emerging concern (e.g. per- and polyfluoroalkyl substances (PFAS)) on fish and wildlife populations in the Great Lakes basin.

2) Preventing and Controlling Invasive Species

During FY 2023, GLRI federal agencies and their partners continued efforts to prevent the introduction of new invasive species and to control existing invasive species throughout the Great Lakes ecosystem. Ongoing work continued to prevent the migration of silver carp, bighead carp, and black carp into the Great Lakes. Since the GLRI began, federal agencies and their partners have taken actions to control invasive species on over 260,000 terrestrial and aquatic acres, including over 22,000 acres in FY 2023.

3) Nonpoint Source Pollution Impacts on Nearshore Health

During FY 2023, GLRI federal agencies and their partners implemented conservation activities to reduce nonpoint sources of pollution that threaten Great Lakes nearshore regions. These partners worked collaboratively to target nonpoint sources of excess phosphorus runoff that contribute to harmful algal blooms (HABs) around the Great Lakes in priority watersheds, such as the Lower Fox River, Saginaw River, and Maumee River. GLRI federal agencies estimate that GLRI-funded projects implemented since the program's inception have prevented more than 2.5 million pounds of phosphorus from leaving farms and entering the Great Lakes (including over 183,600 pounds of phosphorus in FY 2023). In addition, GLRI federal agencies and their partners worked collaboratively in urban and suburban areas in FY 2023 to prevent more than 48 million gallons of polluted stormwater from entering the Great Lakes.

4) Habitat and Species

During FY 2023, GLRI federal agencies and their partners protected, restored, and enhanced habitats and native species throughout the Great Lakes basin. Since GLRI began, these efforts have included protecting and restoring over 529,000 acres of coastal wetland, nearshore, and other habitats (including over 23,000 acres in FY 2023). These efforts have also benefited native fish, bird, and amphibian species and include the significantly protecting and promoting recovery of the Poweshiek skipperling and brook trout through completed management actions in FY 2023. Since the start of the GLRI, these actions have increased connectivity for aquatic organisms in more than 8,100 miles of streams and rivers (including over 990 miles in FY 2023).

5) Foundations for Future Restoration Actions

During FY 2023, GLRI federal agencies and their partners engaged over 90,000 youth through hands-on education and stewardship projects. GLRI federal agencies and their partners also conducted comprehensive monitoring to assess and collect data on Great Lakes ecosystem status and trends. These data guided plans for projects addressing coastal resiliency and both nuisance and harmful algae.

[1] Includes U.S. Department of Agriculture (Animal and Plant Health Inspection Service, Natural Resources Conservation Service, and U.S. Forest Service); U.S. Department of Commerce (National Oceanic and Atmospheric Administration); U.S. Department of Army (U.S. Army Corps of Engineers); U.S. Department of Health and Human Services (Agency for Toxic Substances and Disease Registry and Centers for Disease Control and Prevention); U.S. Department of State; U.S. Department of Homeland Security (U.S. Coast Guard); U.S. Department of the Interior (Bureau of Indian Affairs, U.S. Fish and Wildlife Service, National Park Service, and U.S. Geological Survey); U.S. Department of Transportation (Federal Highway Administration and Maritime Administration; and EPA (Great Lakes National Program Office).

Section 2 – Program Accomplishments

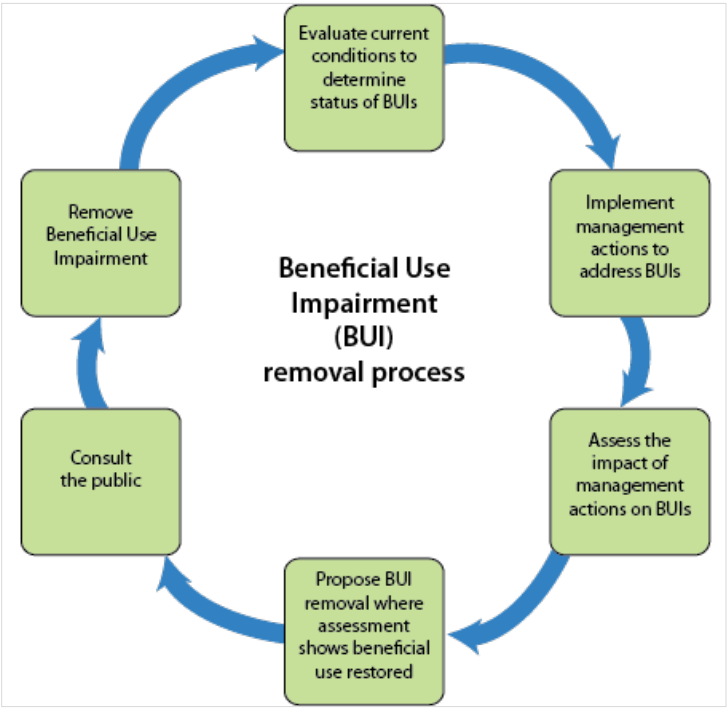
FOCUS AREA 1: Toxic Substances and Areas of Concern

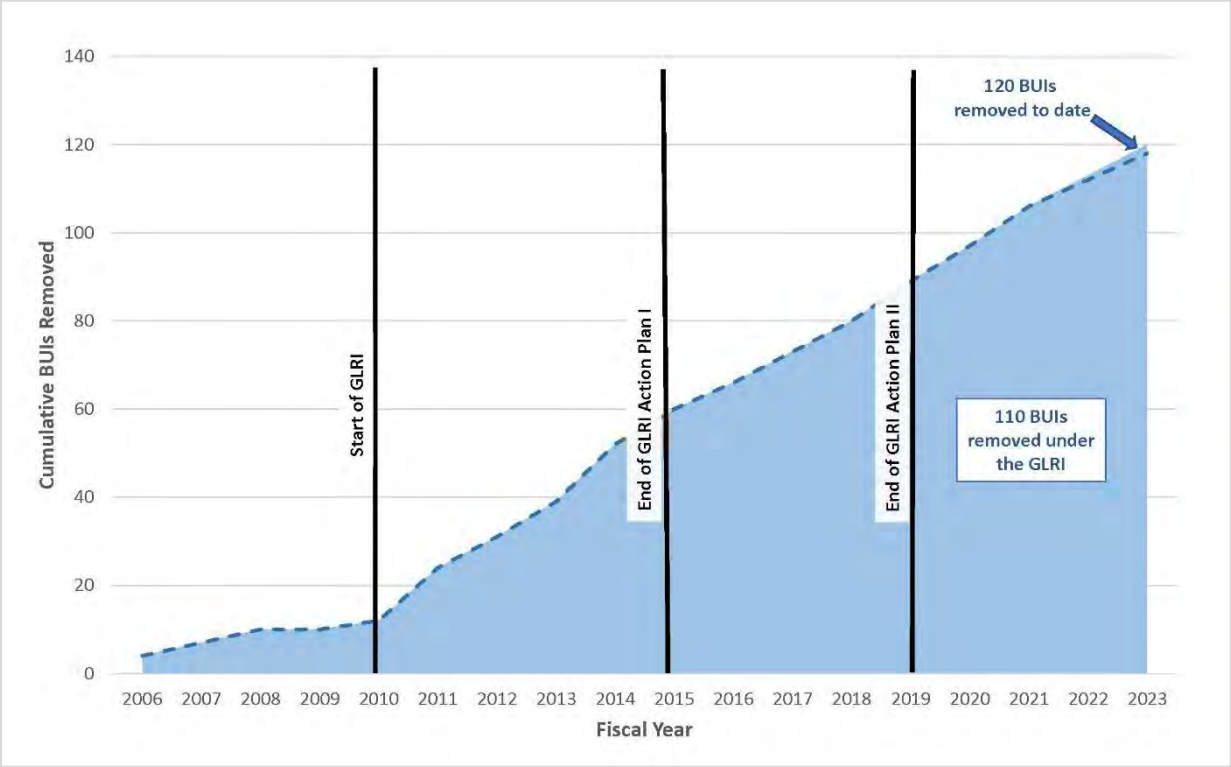
As defined in the Great Lakes Water Quality Agreement, AOCs are specific areas of the Great Lakes basin that are heavily contaminated with legacy pollutants and show signs of significant environmental degradation, such as habitat loss and contamination levels necessitating fish consumption advisories.

The type of environmental degradation in the AOCs is characterized by one of fourteen Beneficial Use Impairments (BUIs) listed in the GLWQA. The removal of these BUIs typically relies on monitoring of environmental conditions and meeting the local established criteria for restoration. Once all BUIs identified for an AOC are removed, the formal delisting process is initiated. This process involves state and local partners and opportunities for public review of the actions taken and resulting status of the AOC. After EPA and the Department of State concur that all impairments have been addressed the AOC can be formally delisted in accordance with Annex 1 of the GLWQA.

Through the end of FY 2023, the EPA and their GLRI federal and state partners delisted six AOCs, with 10 more AOCs that have completed all management actions necessary to ultimately delist.

In FY 2023, GLRI federal agencies and their partners removed seven BUIs, indicators of environmental harm, at six AOCs in four states, bringing the cumulative total of BUIs removed since FY 2010 to 120. Between FY 2010 and FY 2023, 110 BUIs have been removed, which is 11 times the total number of BUIs removed before the inception of the GLRI (see the graphic on the next page). Once all BUIs in an AOC are removed, the AOC can move forward with delisting. The circular graphic on the following page describes the BUI removal process.





The number of BUIs removed under the GLRI since 2006.

During FY 2023, GLRI federal agencies supported projects to help six Tribal and state organizations collect and share information regarding Great Lakes fish and wildlife consumption. GLRI federal agencies and their partners conducted outreach activities, targeting populations that consume high amounts of Great Lakes fish, and they provided the public with information on the benefits and risks of Great Lakes fish consumption. Partners continued to implement efforts to enhance communication of fish consumption advice to multiple Tribal and Asian (Hmong, Burmese, and Bhutanese) communities. Additionally, GLRI federal agencies and their partners conducted monitoring activities to assess contaminant levels in fish collected from the Great Lakes and inland waters of the basin that will be used by Tribes and states to establish safe fish consumption guidelines for mercury,

perfluorooctane sulfonic acid (PFOS), and other contaminants. Other projects enabled Tribes and states to collect and share fish tissue contaminant information that was used to update fish consumption guidelines.

GLRI federal agencies and their partners began implementing several projects assessing chemicals of mutual concern and other priority chemicals in the Great Lakes. Through these efforts, GLRI partners are working to fill critical information gaps on contaminants such as PFAS, mercury, and short-chain chlorinated paraffins. A topic of focus by GLRI partners included studies aimed at understanding how bioaccumulation of PFAS differs from that of other contaminants.

Focus Area 1 Success Stories

South Hennepin Marsh Barrier Shoal Islands Construction Project in Detroit, Michigan

South Hennepin Marsh is in the Trenton Channel of the Detroit River. This area had been an important coastal marsh with submergent habitat for native wildlife and fish species (including lake sturgeon, walleye, bass, northern pike, and others). The original shoals eroded over time, leaving the marsh exposed to stressors, such as boat traffic, wave action, and ice flows that degraded the habitat. Through a $5,975,000 GLRI-funded National Oceanic and Atmospheric Administration (NOAA) Office of Habitat Conservation partnership grant, the Friends of the Detroit River led the effort to rebuild the shoals and restore the marsh. The project was completed in 2023, with over 1,130 linear feet of shoals constructed to protect 25 acres of marsh habitat.

Image depicts barrier shoal islands constructed and planted with native vegetation as part of habitat restoration work in Hennepin Marsh. Image: NOAA

Lake George Middle/East Dredging and Lake George Middle Capping in East Chicago, Indiana

EPA, the U.S. Army Corps of Engineers (USACE), the East Chicago Waterway Management District, and Atlantic Richfield–British Petroleum completed the Lake George Middle and East Projects in 2023. The $15 million projects dredged and contained 60,000 cubic yards of contaminated sediment; and will restore fish populations and prevent polycyclic aromatic hydrocarbons, polychlorinated biphenyls, heavy metals, and other chemicals from entering the food chain. The projects added a sand cap over existing sediment, stabilized streambanks, installed geotextile fabric and sheet pile, and conducted ecosystem restoration. The cap will contain and minimize the resuspension of contaminated sediment. Habitat monitoring and maintenance will continue through 2025. These projects will contribute to the ultimate delisting of the Grand Calumet River AOC.

Planting native Buttonbush as part of the upland restoration work at Lake George Middle. Image: USACE

Cedar Point National Wildlife Refuge – John Gradel Marsh in Maumee AOC

The U.S. Fish and Wildlife Service (USFWS) received over $825,000 in GLRI funds to plan, design, and implement habitat restoration activities at the Cedar Point National Wildlife Refuge – John Gradel Marsh (formerly the Pool 2 Project). About 155 acres of coastal wetland habitat were restored and reconnected to Lake Erie's hydrology. This project, completed in 2023, also enhanced 55 acres of habitat around the City of Toledo Low Service Pumping Station. The partners added a fish passage structure and installed pump structures to restore water level management capabilities and divert water from farm fields into a wetland on adjacent private agricultural land. The project expanded fish access to coastal wetlands and improved local fish populations and water quality. Partners included the EPA, H2Ohio, Ohio EPA, and John Gradel & Sons Farms, Inc.

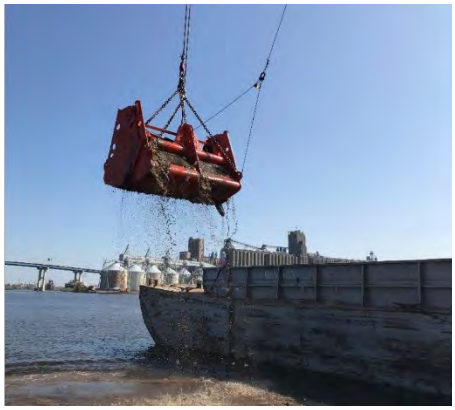
Pictured is the installed fish passage structure that provides access for fish from Lake Erie to the John Gradel Marsh for spawning and feeding. Image: Courtney Lopez, USFWS

Howard Marsh Restoration – Phase II in Maumee AOC

Aerial drone imagery of the Phase II restoration area at Howard Marsh. Image: Toledo Aerial Media

The 987-acre Howard Marsh Metropark is an agricultural property in Lucas County, OH owned by Metroparks of the Toledo Area (MTA). Ducks Unlimited, MTA, Ohio Division of Wildlife, NOAA, and other partners worked from 2013 to 2018 on the Phase I restoration of Howard Marsh. Phase II was supported with $4,250,000 in GLRI funds via a regional partnership between NOAA's Office of Habitat Conservation and Ducks Unlimited. Phase II focused on another ~235 acres of agricultural land, restoring another 200 acres of coastal wetlands and 15 acres of upland forest and native grass. In Phase II, partners disabled subsurface drain tiles, constructed 2.25 miles of earthen levee, and installed a primary water control and seasonal fish passage structure to connect the wetland with Lake Erie.

Howards Bay Dredging in Superior, Wisconsin



A bucket removing contaminated sediment from Howards Bay as part of mechanical dredging for sediment remediation. Image: USACE

In FY 2021, a voluntary public-private partnership was formed under the Great Lakes Legacy Act between the EPA; the USACE; Wisconsin Department of Natural Resources (DNR); the City of Superior, Wisconsin; and the Fraser Shipyard. Using about $13 million in GLRI funds, along with other nonfederal sponsor funding, partners dredged 80,000 cubic yards of contaminated sediment and debris from the Howards Bay portion of Duluth-Superior Harbor, including the adjacent Hewitt and Fraser Slips, within the St. Louis River AOC. This dredging effort was required to remove BUIs and to support the effort to delist the St. Louis River AOC. After the partners removed and disposed of the contaminated sediments, they placed a sand cover to control the remaining contaminants. The project also included dredging 34,000 cubic yards of material from the federal navigation channel. All dredging and residual sand cover placement was completed in December 2021; dock wall stabilization backfill was completed in November 2022. Vegetation establishment at the Wisconsin Point Landfill continued through 2022 and 2023, and the project was officially completed in December 2023.

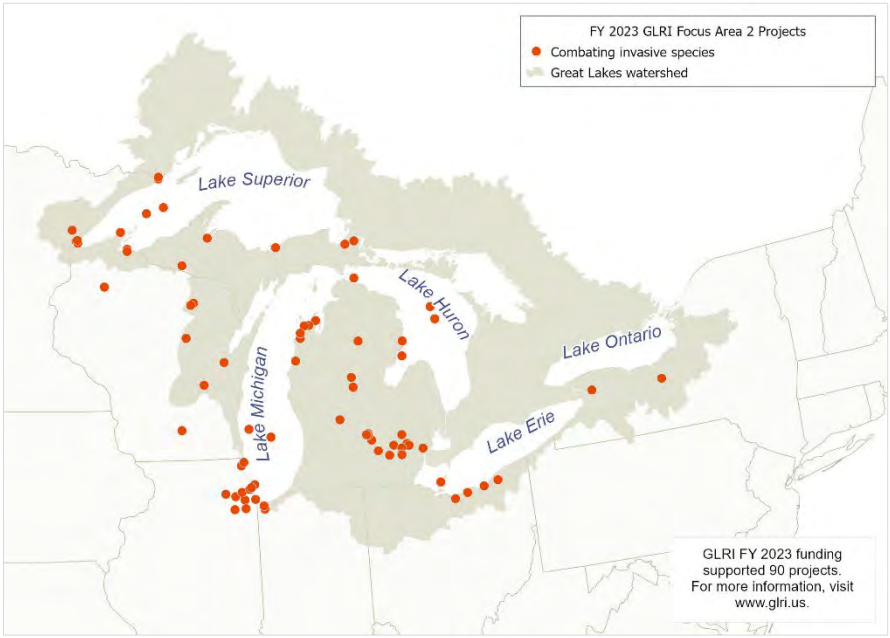
Spirit Lake Sediment Remediation

Aerial view of Spirit Lake project features, including new shallow sheltered bay, delta upland cap and the upland confined disposal facility. Image: EPA

Under the Great Lakes Legacy Act, the EPA and U.S. Steel worked with project partners to implement an $186 million project to remediate contaminated sediment from Spirit Lake. Spirit Lake is a large open area in the St. Louis River AOC near the former U.S. Steel plant in Duluth, Minnesota. The cleanup operations began in October 2020 and included dredging 460,000 cubic yards of contaminated sediment, placing 119 acres of sediment cap, and placing material into two on-site confined disposal facilities. Habitat restoration plantings took place through fall 2023 in upland and in-water portions of the site. This work will improve the aquatic ecosystem by creating new public waters, including a 42-acre shallow sheltered bay, restoring open-water aquatic habitat for fish spawning, and restoring wetlands. Additional recreational features were completed in fall 2023, including a pedestrian trail, interpretive signage, a publicly accessible waterfront with fishing, and canoe-kayak launches.

FOCUS AREA 2: Preventing and Controlling Invasive Species

During FY 2023, GLRI federal agencies and their partners continued efforts to prevent the introduction of new invasive species and control existing invasive species populations in the Great Lakes ecosystem. GLRI investments in Focus Area 2 in FY 2023 continued to prioritize the prevention of new introductions of non-native and invasive species into the Great Lakes. This proactive approach allows for greater efficiency and cost-savings.

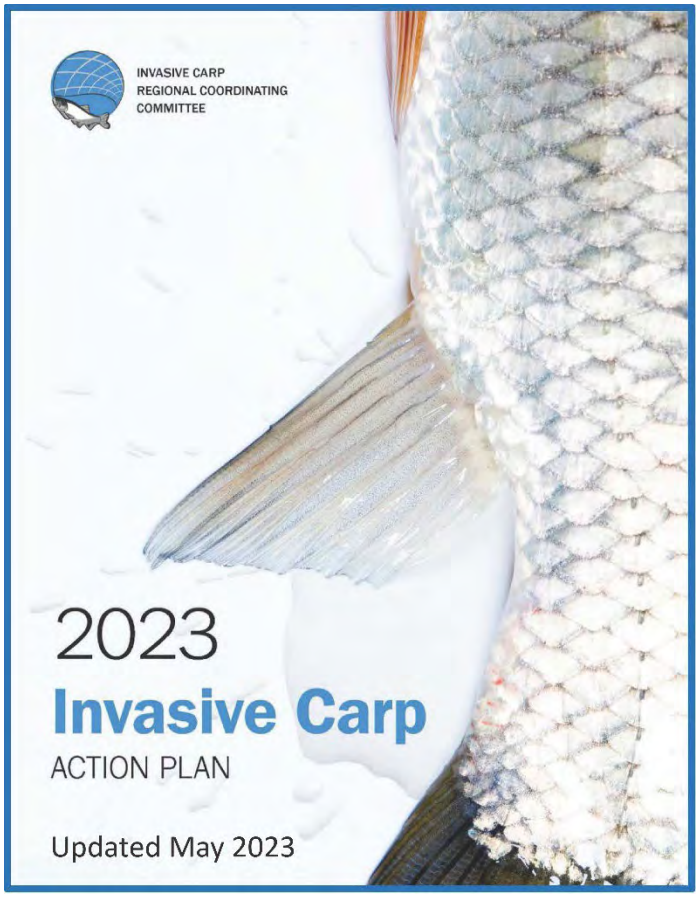


Key investments during FY 2023 included continuing critical prevention activities, such as maintaining a comprehensive invasive species tracking and reporting system - the Great Lakes Aquatic Nuisance Species Information System (GLANSIS); targeted monitoring of high-risk sites for introductions of new invasive species; completing risk assessments for invasive species not currently present, but which could become established if introduced; and developing and applying genomic tools to aid early detection of aquatic nuisance species.

A 2023 post-treatment assessment by the Saint Regis Mohawk Tribe at a site previously infested by an invasive species monoculture; currently, multiple native plant species have returned to the site. Image: Angello Johnson, Saint Regis Mohawk Tribe

During FY 2023, GLRI funded 44 early detection monitoring activities that enhance the ability of GLRI federal agencies and their partners to detect and respond to new invasive species introductions. GLRI federal agencies and their partners also completed training in response to new species detections and conducted 13 tabletop exercises, field responses, and/or drills—exceeding the GLRI Action Plan III target of eight rapid responses and exercises in FY 2023.

GLRI federal agencies and their partners have further reduced the risk of invasive species entering the Great Lakes watershed by funding 20 projects in FY 2023 that help block the pathways of introduction. These pathways include canals and waterways, recreational boating, commercial shipping, illegal trade of banned species, the release of aquarium species, and the release of live bait.



GLRI federal agencies and their partners also restored habitats degraded by aquatic, wetland, and terrestrial invasive species. GLRI federal agencies supported community efforts to control and reduce the spread of invasive species. These projects were implemented with local partners who are expected to continue maintenance and stewardship beyond the duration of the federally funded project's lifespan. In FY 2023, GLRI funded projects controlled aquatic and terrestrial invasive species on over 22,000 acres in national forests, parks, wildlife refuges and other important habitats for a cumulative total of more than 260,000 acres since the inception of GLRI.

In FY 2023, GLRI federal agencies and their partners maintained or increased support to seven species-specific "collaboratives," which help communicate the latest control technologies and management techniques to their members. Collaboratives that received continued funding focus on invasive carp, *Phragmites*, invasive mussels, invasive crayfish, monoecious hydrilla, European frog-bit, and forest health. These collaboratives are actively involved in invasive species prevention and control efforts under the GLRI.

During FY 2023, GLRI federal agencies and their partners developed and refined invasive species control technologies and management techniques while minimizing harm to noninvasive fish, wildlife and plant species. To evaluate their effectiveness in controlling invasive species, GLRI federal agencies and their partners field-tested four different technologies and methods.

Continuing in FY 2023, the GLRI supported the implementation of a Great Lakes Ballast Water Research and Development Plan to address the unique challenges faced by commercial ships operating solely within the Great Lakes. This comprehensive plan includes extensive collaboration with states, port authorities, non-governmental organizations, industry, academics and other stakeholders. It is accelerating shipboard and land-based testing of ballast water management systems to identify technologies and practices capable of reducing ship-mediated transfers of organisms within the Great Lakes. The research and technology development effort is being led by the Great Waters Research Collaborative operating out of the University of Wisconsin–Superior's Lake Superior Research Institute through an agreement with the U.S. Department of Transportation's Maritime Administration.

Protecting the Great Lakes from invasive carp

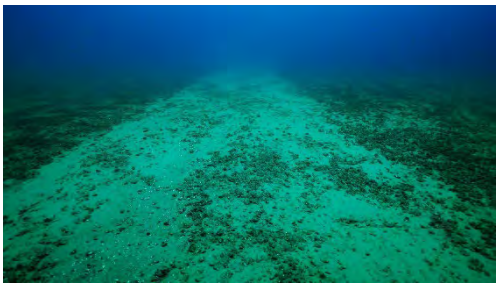
The GLRI provides support to the Invasive Carp Regional Coordinating Committee (IRCC).

More IRCC information is available at https://icrcc.fws.gov/.

Focus Area 2 Success Stories

New Tool for Invasive Mussel Control Tested in Lake Michigan

Invasive quagga mussels are a major stressor in the Great Lakes and other freshwater systems in North America. Scientists from NOAA Great Lakes Environmental Research Laboratory and the University of Wisconsin–Milwaukee collaborated in FY 2023 to explore methods to remove invasive quagga mussels from critical areas on the bottom of Lake Michigan. They designed and deployed a “mussel masher” device that was towed behind a research vessel, the R/V Neeskay, to treat a 2,500-square-meter area at a depth of 40 meters (130 feet). Initial measurements indicate the masher may have reduced mussel densities by as much as 80%. The scientists continue to monitor the site to determine the long-term effectiveness of this method and how the removal of invasive mussels may affect sediment chemistry and the abundance of other bottom-dwelling organisms.



A 3-meter-wide path cleared through an invasive quagga mussel bed by the "mussel masher". Image: Zach Melnick, Inspired Planet Productions

Collaborative Invasive Species Control by Great Lakes Tribal Nations in Wisconsin

Several Great Lakes Tribes made progress removing invasive plant species across critical habitats in FY 2023 through GLRI funding from the U.S. Department of Agriculture (USDA) Forest Service. The Wisconsin Tribal Conservation Advisory Council worked with the Oneida Nation to partner and conduct on-the-ground control and education to the 11 Tribal Nations in Wisconsin. Project staff and partners used innovative species control technologies such as drones, slope mowers, and an amphibious extreme terrain vehicle to remove invasive plants on terrestrial land and wetlands. To date, project partners have removed 41.3 acres of invasive plants and conducted training on plant management.

Staff use a remote-controlled slope mower to control phragmites. The vehicle safely mows vegetation on steep and uneven hillsides. Image: Michael Arce, Wisconsin Tribal Conservation Advisory Committee

Following Invasive Species Removal with Habitat Restoration in Michigan

In FY 2023, the Mason-Lake Conservation District completed a GLRI project surveying 115 acres for invasive species, treating 130 acres of invasives, and restoring 10 acres of habitat. The District treated 12 different invasive species, including Japanese knotweed, wild parsnip, garlic mustard, and round leaf bittersweet. The project was largely completed in public spaces, serving as showplaces for Great Lakes invasive species control and habitat restoration activities. In Cartier Park in Ludington, over 600 native plant plugs and 66 native trees were installed, including in a demonstration plot, and informational signs were installed to draw attention to the work completed.

Planting native tree species after removing invasive species jump-starts site restoration. Image: Mason-Lake Conservation District

Proactive Steps to Address the Spread of Invasive Red Swamp Crayfish in Michigan

In FY 2023, USFWS collaborated with the Michigan DNR to implement Michigan's Red Swamp Crayfish Response Plan, which focused on implementing and evaluating control measures to eradicate red swamp crayfish. GLRI funding was used for an intensive trapping strategy to remove the invasive crayfish and suppress populations. With help from partners across 28 sites, the effort resulted in the removal of 9,816 crayfish. These efforts added to the total numbers to date, resulting in approximately 170,000 red swamp crayfish removed from Michigan waters from 2017-2023. Red swamp crayfish are a worldwide invader with the potential to negatively impact native ecosystems by competing with native crayfish species, eroding shorelines due to burrowing behavior, and altering water quality. Intensive trapping continues to show signs of suppressing population growth. Overall, the percentage of *native* crayfish has been increasing at high-priority locations where response actions have been focused.

Invasive red swamp crayfish. Image: Michigan DNR

Tribe Restores Beetle-plagued Forest in Upstate New York

With funding from the GLRI through the USDA Forest Service, the Saint Regis Mohawk Tribe in upstate New York removed ash trees plagued by emerald ash borer (EAB) and replaced them with other trees to restore a forest. Restoring forests impacted by EAB can help to maintain water quality by reducing erosion and nutrient runoff and providing shaded riparian habitat. St. Regis Mohawk Tribe Land Resources staff planted trees as part of the ash canopy loss restoration project. EAB is one of the most destructive ash-tree-killing pests in North America. Native to Asia, the insect was first detected on this continent in southeastern Michigan over two decades ago. Since then, EABs have killed significant numbers of North American ash trees around the Great Lakes and northeastern parts of the U.S. The Tribe first detected EAB on its territory in Akwesasne in 2016. EAB galleries form under the bark of an ash tree. Once hatched, larvae eat through the tree's vascular tissues in a meandering pattern that ultimately affects the tree's ability to move nutrients and water from the roots to the crown, effectively killing the tree.

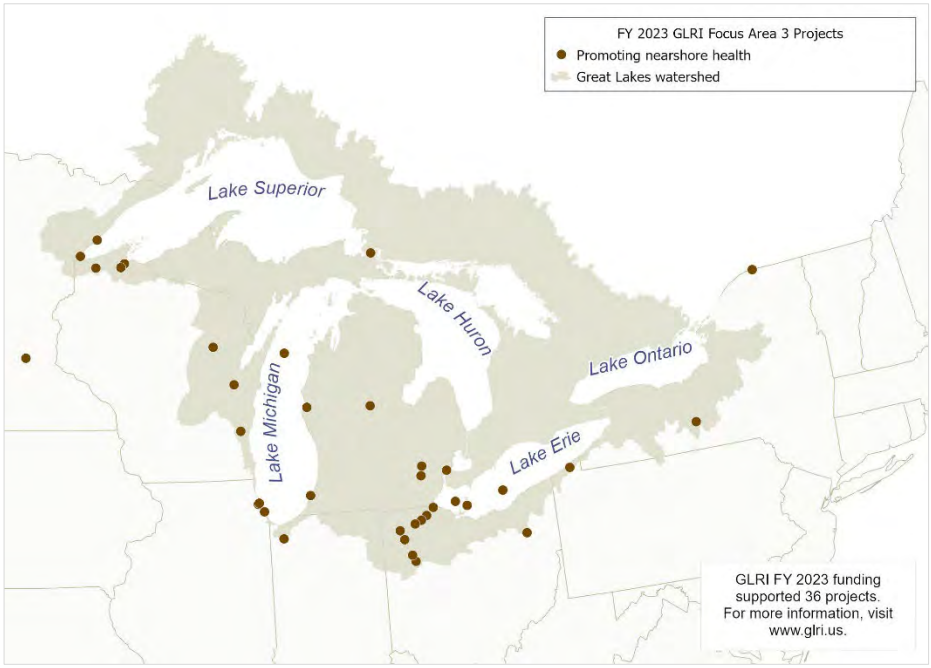
Emerald ash borer-affected tree. Image: Normand Genier, St. Regis Mohawk Tribe

New Trap on the Au Gres River Further Protects Lake Huron Fishery from Invasive Sea Lampreys

With GLRI funding, the USACE Detroit District and Great Lakes Fishery Commission (GLFC) installed a $1.67 million permanent sea lamprey trap on the East Branch Au Gres River in Iosco County, Michigan. The project represents a long-standing partnership between USACE and GLFC to control invasive sea lampreys and protect the $5 billion Great Lakes fishery. Sea lampreys, parasitic fish that suck blood from other fish (e.g., lake trout, Pacific salmon), invaded the Great Lakes through shipping canals and devastated local fisheries in the mid-1900s. Because sea lampreys are most vulnerable to capture as they move from lakes into tributaries to spawn, the control program relies on physical barriers to block their upstream migration during the spring, thereby reducing the population. Specially designed traps are built into or placed immediately downstream of sea lamprey barriers to remove the spawning sea lampreys from the system and support the control program's assessment efforts.

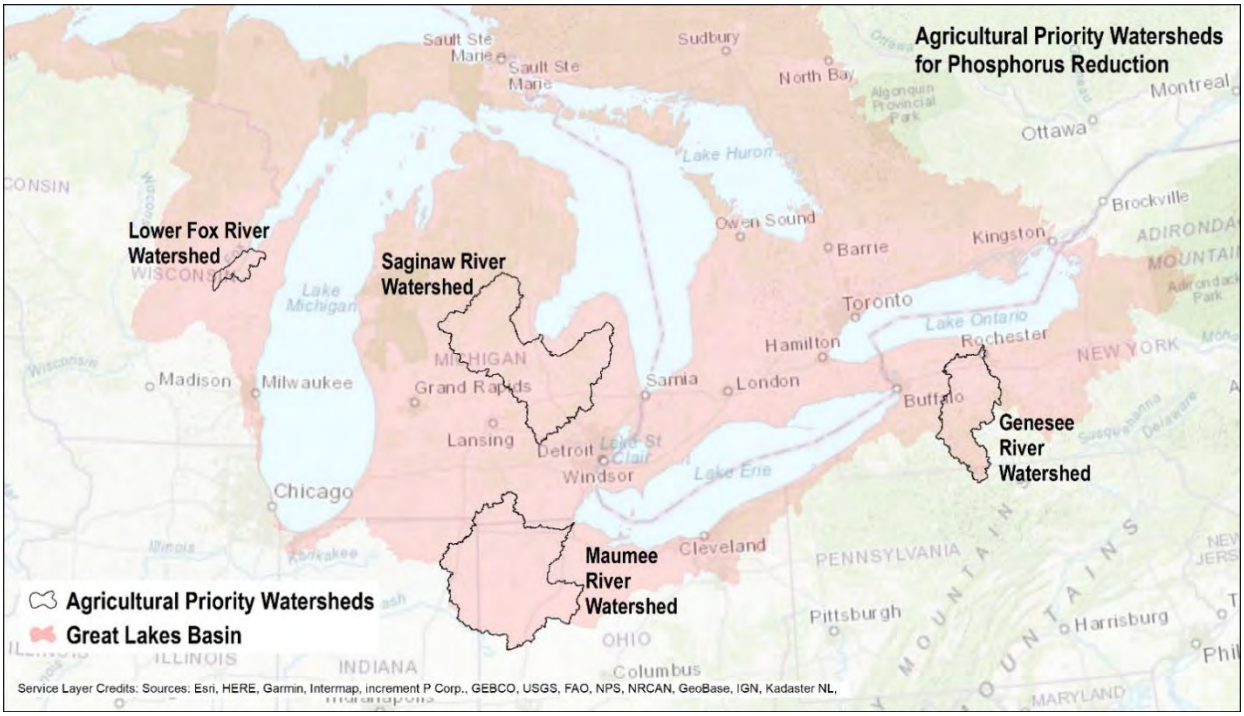
The permanent $1.67 million sea lamprey trap on the East Branch Au Gres River. Image: USACE

FOCUS AREA 3: Nonpoint Source Pollution Impacts on Nearshore Health



Polluted runoff, also known as nonpoint source pollution, threatens the Great Lakes ecosystem by contributing to HABs, nuisance algae, drinking water impairments, ecological dead zones, and beach closures that result in lost recreational opportunities. Runoff carries nutrients from fertilizer, sediment, bacteria, road salts, and other land-applied chemicals, such as herbicides and pesticides.

The pollutant carried by runoff that most significantly impacts the Great Lakes nearshore areas is phosphorus because it is the primary nutrient that drives algal growth. GLRI federal agencies and partners are working to reduce phosphorus loadings from agricultural watersheds in several ways. GLRI funding is used to supplement other prominent agricultural conservation programs, such as USDA's Natural Resources Conservation Service's (NRCS) Environmental Quality Incentives Program, which provides technical and financial assistance to agricultural producers to plan and install conservation practices. In addition, GLRI federal agencies partner with and provide grants to support nongovernment programs and projects at the state and local levels, such as demonstration farms. Phosphorus reduction efforts to help prevent excess algae growth in the Great Lakes are prioritized in the four GLRI agricultural priority watersheds - the Lower Fox River, Saginaw River, Maumee River, and Genesee River watersheds.



GLRI agencies estimate that over 183,600 pounds of phosphorus will be prevented from entering the Great Lakes as a result of projects in agricultural areas funded in FY 2023. These projects include a renewed focus on improving on-farm nutrient management through technical and financial assistance to farmers on over 147,700 acres. Many of the conservation practices being adopted also reduce other pollutants like nitrogen and sediment.

GLRI federal agencies and their partners also use GLRI funding to support watershed-based projects to address nonpoint source pollution in urban areas. Projects started in FY 2023 will capture over 48 million gallons of untreated urban runoff per year and protect approximately 28 miles of streams and shoreline. These projects reduce flooding, increase green space in urban areas, reduce bacterial contamination, and return vacant properties to productive use. The types of best management practices implemented include tree planting, bioretention ponds and bioswales.

These projects reflect over $10.6 million in investments to treat, slow, or capture untreated stormwater runoff, helping to improve water quality conditions in the following 18 areas:

- Benton Harbor, MI
- Griffin, IN
- Detroit, MI
- Erie, PA
- Grand Rapids, MI
- Lorain County, OH
- Cleveland, OH
- Flint, MI
- Buffalo, NY
- Fort Wayne, IN
- Marquette, MI
- Sterling, MI
- Two Rivers, WI
- Milwaukee, WI
- Sheboygan, WI
- Lake Nebagamon, WI
- Ozaukee County, WI
- Onondaga, NY

Transforming Milwaukee Schoolyards with Green Infrastructure

With GLRI support, Milwaukee Public Schools (MPS) and partners are transforming schoolyards with green infrastructure. These projects will improve the quality of the local receiving waters flowing into Lake Michigan, reducing the amount of stormwater entering the combined sewer system during heavy storms. MPS has redeveloped 21 schoolyards to date, and another 15 schools are in the design and/or construction process. Projects are tailored to the specific needs of the school's community and often involve replacing large areas of asphalt with bioswales, rain gardens, and trees. Projects also include adding outdoor classroom spaces, improved recreational facilities, and arts opportunities. The five schools most recently supported by GLRI funds are designed to capture an estimated 4.3 million gallons of stormwater runoff annually. Transforming schoolyards is part of a strategic and collaborative effort to go beyond removing pavement to maximize benefits for communities, the environment, and the local economy.

Before (above) and after (below) transformation at Nathaniel Hawthorne School. Images: Reflo Sustainable Water Solutions

GLRI federal agencies conduct over 30 nutrient monitoring and assessment activities annually to evaluate the effectiveness of nutrient and stormwater reduction practices. These include an edge-of-field monitoring network in the agricultural priority watersheds and urban stormwater monitoring in Gary, IN; Detroit, MI; Buffalo, NY; and Milwaukee, WI. In addition, GLRI leverages partnerships like the NRCS Conservation Effects Assessment Project (CEAP) to document the outcomes of conservation practices being implemented in the western Lake Erie basin.

Focus Area 3 Success Stories

Conventionally Farmed Cropland is No Longer a Source of Soil Erosion in Rochester, New York

Retired farmer Phil Race became concerned with the condition of the cropland he had rented to a farmer south of Rochester, NY. A few ephemeral gullies had formed, and the consequent soil erosion resulted in sediment leaving the property. Also, excessive tillage led to poor soil health. With help from the Natural Resources Conservation Service (NRCS), Phil and his partner, working together with their neighbor, converted a total of 50 acres of their conventionally farmed cropland to permanent pasture. Their primary goal was to heal the land, with a secondary goal of producing healthy meat. They implemented prescribed grazing management and soil erosion plans to prevent the loss of sediments and nutrients to the headwaters of the Keshequa Creek (part of a GLRI Agricultural Priority Watershed).

Before (left) and after (right) converting eroding cropland to permanent pasture (arrow shows the neighbor's pond is no longer brown). Image: NRCS

Healthy Soil Improves Profitability in Ozaukee County, Wisconsin

Just a few miles off the Lake Michigan shoreline, a father-and-son farming team, Roger and Brian Karrels, produce grain crops on 1,600 acres in northern Ozaukee County, WI. Prior to the project, their typical tillage would include a fall chisel plow without any green covers going into winter to protect the soil. But, with the assistance of NRCS, they have since switched to a no-till and cover cropping system; as a result, they are seeing improvements in the soil—and higher profits. These benefits motivated the Karrels to become a GLRI Demonstration Farm, and they now hold field days to showcase their success to local farmers. "If we can show that no-till, cover crops, and other soil health practices can work to be profitable on heavy clay soils, within 3 miles of Lake Michigan and all of its micro-climate effects, we can demonstrate that they can be implemented anywhere," said Mike Patin, NRCS.

Brian Karrels of Lake Breeze Farms, part of the Ozaukee Demo Farms Network. Image: NRCS

Battling Rural Runoff Using Nature's Infrastructure in Michigan

In 2018, the Conservation Resource Alliance (CRA) launched a five-year initiative to plant 100,000 native trees and to reduce runoff by 1.8 million gallons per year. Building on previous GLRI investments, the CRA partnered with the Grand Traverse Regional Land Conservancy to reforest recently restored riparian corridors where dams were removed. In just two years, partners planted over 26,000 native trees and shrubs that will reduce runoff by 480,000 gallons per year and reduce sediment loss by 100 tons per year. The project protects 4.7 miles of waterways and 144 acres of high-quality habitat draining to northern Lake Michigan and Lake Huron.

Volunteers planting trees along the Boardman River. Image: Grand Traverse Conservation District

Planting Trees Protects Waterbodies from Urban and Agricultural Runoff near Sault Ste. Marie, Michigan

The Chippewa Luce Mackinac Conservation District used GLRI funds to plant 7,200 native trees and 1,225 native shrubs to improve water quality on four sites in the Munuscong River watershed in the Pickford Township near Sault Ste. Marie, Michigan (10.8 acres total). The project is expected to intercept over 500,000 gallons of rainfall annually over 20 years. In addition, over 8,000 native plants were planted in rain gardens, which are expected to collect at least 160,000 gallons of rainfall annually.

Volunteer planting event at the Pickford Township Park. Image: Chippewa Luce Mackinac Conservation District

Reducing Runoff and Erosion in Agricultural Drainage Ditches in Michigan and Ohio

Trees and floodplains play a critical role in reducing stormwater runoff and filtering pollutants that would otherwise enter waterways. In FY 2023, the Muskegon Conservation District and Drainage Commissioner in Muskegon County, Michigan used GLRI funds to plant 220 large trees and 2,000 seedlings along 11 agricultural drains discharging into Lake Michigan. The trees will intercept an estimated 130,000 gallons of stormwater in the first year and an average of 780,000 gallons annually over the next 20 years. For more details, see the YouTube video (Michigan Tree Planting Project Targets Drainageways to Preserve a Watershed).

A Muskegon Conservation District natural resource project manager fills water bags that hydrate the trees alongside a drainage ditch. Image: USDA Forest Service.

In another example, eroding streambanks were restored by expanding the drainage channel and floodplain along a highly channelized agricultural ditch in the Maumee River watershed, where nonpoint source phosphorus runoff contributes to HABs in Lake Erie. This project in Lucas County, Ohio employed natural channel design features to restore 3.9 acres and 0.72 miles of riparian corridor and floodplain. These improvements will reduce nutrient loads to the watershed by 470 pounds per year. See Van Fleet Ditch: Drainage Project Information for more details.

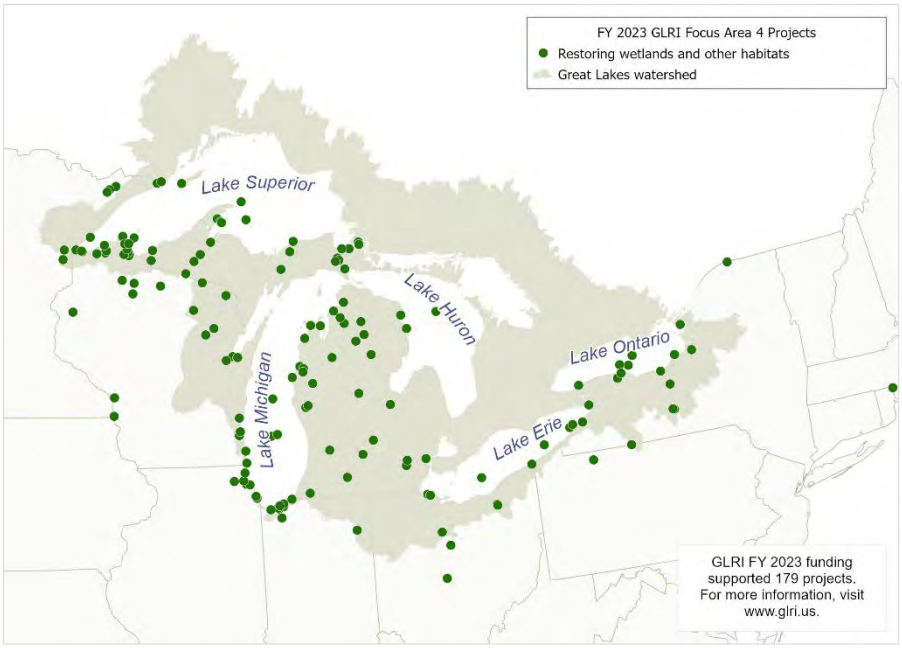
Rain Garden Training in the Saginaw Chippewa Indian Community

The Saginaw Chippewa Indian Tribe developed a Master Rain Gardener "Train the Trainer" program for their community with the support of a GLRI grant. The program aims to educate individuals who can then inform others about the benefits of rain gardens and how to build them. Members built two rain gardens as part of their training: the Nibiish Migwanns (Water Little Feather) rain garden located behind their community building and the Mishiikenh (Turtle-Medicine Wheel) rain garden, which was designed and planted by 4th-grade Tribal youth. The Saginaw Chippewa Indian Tribe has since completed trainings for another 24 students.

Mishiikenh (Turtle-Medicine Wheel) rain garden designed and planted by 4th grade Tribal youth. Image: Saginaw Chippewa Indian Tribe

FOCUS AREA 4: Habitat and Species

During FY 2023, GLRI federal agencies and their partners implemented projects to protect, restore and enhance Great Lakes habitats and native species. The project has led to the reopening of more than 8,000 miles of Great Lakes tributaries, which has increased aquatic connectivity for numerous fish species. Projects that addressed aquatic connectivity in FY 2023 supported continued restoration of native fish species, including brook trout and lake sturgeon.



Since GLRI began in 2010, the EPA has highlighted the importance of efforts to protect, restore, and enhance Great Lakes coastal wetlands. These wetlands provide residents of the Great Lakes with many environmental and economic benefits, including protecting property from high water levels and wave action, removing nutrients from rivers and the nearshore areas of the Great Lakes before they feed harmful and nuisance algae, and supporting fish nursery habitats necessary to support recreational and commercial fisheries. Nearly 85,000 acres of coastal wetlands have been protected, restored, and enhanced - aided by a GLRI-supported comprehensive annual monitoring effort of these habitats.

Woodlawn Beach, NY a wetland restoration project to improve water quality at the beach. Image: NY State Parks, Recreation, and Historic Preservation

Restoration and protection efforts continued to be assisted and informed by the Great Lakes Coastal Wetland Monitoring Program. This program continues to provide a comprehensive assessment of Great Lakes coastal wetland status and trends across the five Great Lakes.

States and their local partners continued to play critical roles in advancing important projects across the Great Lakes Basin that benefitted fish and wildlife and neighboring communities.

In Blasdell, New York, the New York State Office of Parks, Recreation, and Historic Preservation enhanced stream and wetland habitat for fish and wildlife populations in addition to improving water quality conditions for communities using the swimming beach at Woodlawn Beach State Park.

Piping plover along Lake Michigan. Image: USFWS

In Erie, Pennsylvania, the Pennsylvania Department of Conservation and Natural Resources and the Regional Science Consortium continued to transform Presque Isle State Park from its former degraded condition (due to invasive species infestation) to a high-quality barrier beach and coastal wetland supporting marsh breeding birds and Great Lakes Piping Plover.

In Pleasant Prairie, Wisconsin, the Wisconsin DNR and the Chiwaukee Prairie Preservation Fund enhanced native plant populations by protecting abandoned land parcels and actively managing and restoring existing state natural areas.

The City of Duluth, Minnesota, collaborated with the Minnesota DNR, St. Louis County, and the Minnesota Land Trust to place more than 400 acres of land along the St. Louis River in long-term protection with dual purposes of maintaining important habitat and providing greater recreational opportunities for residents.

Kenosha Dunes, WI. Image: T. Kevin O'Donnell

Tribal Nations continued to identify and implement projects exercising caregiver responsibilities of indinawemaaganag (our relatives) using funding made available through the GLRI Distinct Tribal Program. The Grand Traverse Band of Odawa Indians conducted on-the-ground conservation, restoration, and monitoring on High Island in Michigan. The High Island spit is designated as critical habitat for the endangered piping plover and provides a suitable habitat for threatened plants such as Pitcher's thistle. The project restored habitat for piping plovers and Pitcher's thistle by removing invasive plants that have degraded habitat quality. The Red Cliff Band of Lake Superior Chippewa Indians (Gaa-Miskwaabikaang) collaborated with the University of Wisconsin–Madison, the National Park Service (NPS), and the Great Lakes Indian Fish and Wildlife Commission to conduct research aimed at understanding the metapopulation dynamics of black bears in the Bayfield Peninsula.

Black bear cub and sow entering and exiting black bear hair corral as part of the "Mainland-island black bears: quantifying connectivity and viability of bear populations between Red Cliff and the Apostle Islands National Lakeshore" project. Image: Red Cliff Band of Lake Superior Chippewa.

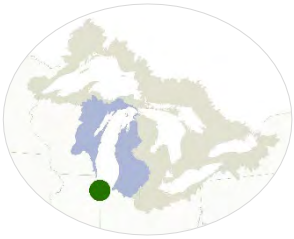
Focus Area 4 Success Stories

Collaborative Great Lakes Manoomin (Wild Rice) Project

In FY 2023, NOAA's Office for Coastal Management continued the Great Lakes Manoomin (Wild Rice) Project in partnership with Tribal communities and other partners with GLRI funds. This multiyear effort focuses on protecting, monitoring, and restoring wild rice and its habitat in the northern Great Lakes basins. The third and final project phase began in 2024 and supports wild rice monitoring, protection, restoration efforts, and knowledge sharing.

Northern wild rice, Zizania palustris, in bloom. Source: Michigan Sea Grant (2019).

Restoring Powderhorn Lake Provides Dual Benefits for Flood Reduction and Wildlife Habitat in Chicago, Illinois



In FY 2023, with the support of GLRI funds through NOAA's Office of Habitat Conservation partnership with the Great Lakes Commission, Powderhorn Lake, a 50-acre freshwater lake with an adjacent 55-acre shallow pool (owned by the Forest Preserves of Cook County in southern Chicago, Illinois) was re-connected with Wolf Lake, a 950-acre freshwater lake to the north (owned by the Illinois DNR). Restoration included adding a half-mile connection that runs aboveground via creeks and underground via pipes large enough to pass fish and turtles. The project also installed two water control structures that allows water management during high water levels. Powderhorn Lake's northern shallows once again function as a fish nursery, and the connection to Wolf Lake allows movement between lakes. Fish and wildlife will benefit from over 100 acres of diverse marsh habitat, and neighboring communities will see reduced flooding, better water quality, and more green space.

*Post-restoration aerial photo of restored connection to Wolf Lake, immediately d*ownstream of *Powderhorn Lake. Image: NOAA Fisheries*

Restoring Fish Passage for Native Brook Trout along Wisconsin's South Shore of Lake Superior

In FY 2023, NOAA's Office of Habitat Conservation and the Great Lakes Fisheries Commission completed a GLRI-funded project to remove a culvert and an abandoned railroad embankment impeding migratory fish passage in Nebagamon Creek, a tributary to the Boise Brule River and Lake Superior. The project restored natural hydrologic conditions for fish passage and sediment transport. The project addressed (1) a Lake Superior Committee priority to address hydrological modifications affecting brook trout production in Wisconsin's south shore tributaries of Lake Superior and (2) the GLRI Action Plan III goal to identify habitats that support important Great Lakes species and take actions to restore, protect, enhance, and/or provide connectivity for these habitats.

Aerial view: removing the culvert and embankment (September 2023). Image: NOAA Fisheries

Ecosystem Restoration in Sandusky Bay – Cedar Point, Sandusky, Ohio

In FY 2023, the USACE placed 140,000 cubic yards of dredged sediment into containment cells previously constructed as part of the coastal wetland project in Sandusky, Ohio. This was the second sediment placement at the site, and work was performed in a manner similar to FY 2022, when another 140,000 cubic yards of material were placed. Dredging was performed using a hydraulic cutterhead dredge, and sediment was pumped over 7,000 feet from the navigation channel to the coastal wetland facility. The dredged sediment will be allowed to consolidate and will be graded to the desired contours in the next phase of the coastal wetland construction project. Completing this project will result in the restoration of in-water coastal wetlands and enhanced wildlife, waterfowl, and fisheries habitat in Sandusky Bay. In addition, the completed project will contribute to improved nearshore water quality by reducing the nutrient and suspended sediment loads.

Sediment placement within a constructed wetland is the first step in creating new in-water wetland habitat in Sandusky Bay. Image: USACE

Protection of High-Quality Forest Habitat along Lake Superior Shoreline

Through a GLRI grant administered by the USDA Forest Service, a 226-acre parcel of land along Lake Superior's shore was conserved as the Keweenaw North Shore/Gratiot Community Forest. The parcel in Allouez Township in Keweenaw County, Michigan provides links to five other public access sites in the Gratiot River Recreation Area. The community forest includes coastal wetlands, old-growth forests, and portions of the Gratiot River that provide native trout habitat. Other species within the area include Canada lynx, grey wolf, northern long-eared bat, tricolored bat, rufa red knot, and monarch butterfly. The Great Lakes Conservation Corps will be conducting monitoring and restoration work to support the community forest.

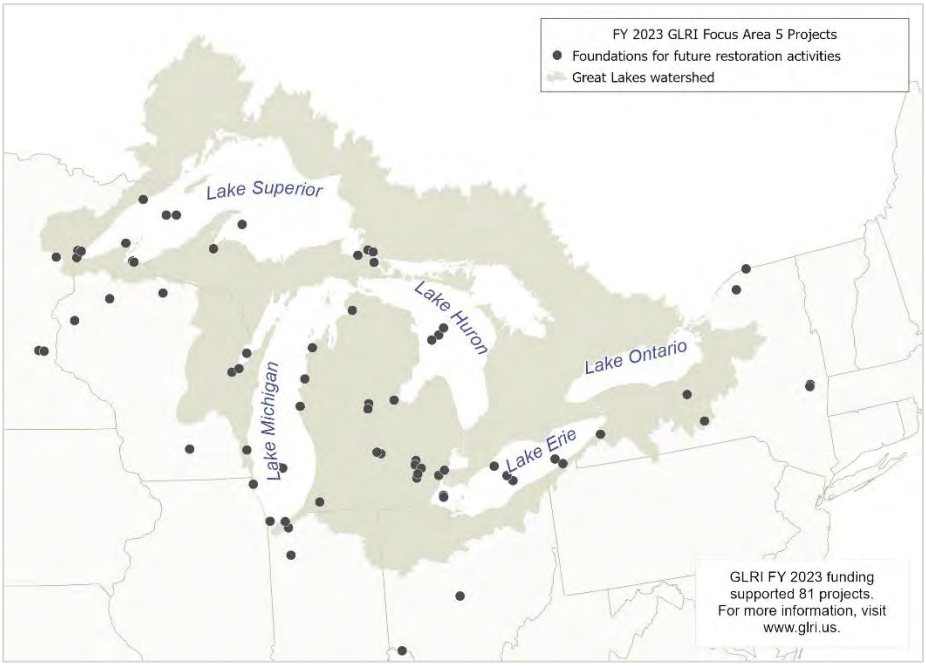
Classic cobble beach at the Gratiot River Community Forest. Image: Superior Watershed Partnership

Restoring Michigan's Maple River for Brook Trout

The Maple River's West Branch in Michigan consistently boasts one of the state's highest densities of brook trout. The Maple River's East Branch is also one of six streams in Michigan (and one of seven worldwide) with an extant population of federally endangered Hungerford's crawling water beetle. In FY 2023, more than $450,000 in GLRI funds supported work on three Maple River road crossings: Maple-Robinson Road, Mackinac-Petoskey Trail, and Douglas Lake Road. This important work completed efforts to free-span the entire Maple River, which started in 2004 with the Conservation Resource Alliance in partnership with USFWS and Michigan DNR. By removing dams and redesigning road crossings, the partners removed barriers for native trout populations. From 2011-2-23, GLRI-funded efforts have created 53 miles of free-flowing river for brook trout and other aquatic organisms. By increasing connectivity among trout populations and improving habitat quality and access throughout the system, the partners aim to improve the resiliency of the resident brook trout.

Maple River road crossing constructed using GLRI funding. Image: USFWS

FOCUS AREA 5: Foundations for Future Restoration Actions



As a foundation for future restoration, the GLRI continues to promote Great Lakes-based ecosystem education and stewardship. During FY 2023, GLRI federal agencies and their partners educated over 90,000 youth through NOAA's Great Lakes Bay Watershed Education and Training program, NPS interpretive programs, the Great Lakes Sea Grant's Center for Great Lakes Literacy, and state educational programs led by the Ohio DNR, the Michigan DNR, and the Michigan Department of Environment Great Lakes, and Energy. These programs provide hands-on experiences for youth, educational resources, and networking opportunities to promote Great Lakes literacy among an engaged community of educators, students, and citizens.

Sixth-grade students explore an ancient Lake Superior shoreline in Calumet Township Park in May 2022. Image: MiSTEM Network

The From Students to Stewards (FS2S) Initiative is a collaboration between the Michigan Department of Environment, Great Lakes, and Energy's Office of the Great Lakes and the Michigan Department of Labor and Economic Opportunity's MiSTEM Network. FS2S teaches students about the Great Lakes, Michigan watersheds, and the impact of people on water resources. The program engages students and prepares them for various careers in the STEM field with hands-on experiences that integrate water literacy principles into place-based, problem-based, and project-based (3P) STEM learning across all grade levels. This program also connects 3P learning to the Michigan Integrated Continuous Improvement Process, an important element of the collaborators' strategy to establish and sustain Great Lakes learning and freshwater stewardship throughout Michigan's K-12 schools.

Science is another key piece of the GLRI activities in this Focus Area. During FY 2023, GLRI federal agencies and their partners conducted comprehensive monitoring to assess the status and trends of the Great Lakes ecosystem. GLRI federal agencies and their partners monitored coastal wetlands, contaminants, nutrients, hypoxia, HABs, zooplankton, phytoplankton, benthic communities, and prey fish, among many other components of the Great Lakes ecosystem. Monitoring data are used to prioritize future GLRI-funding decisions by identifying the ecosystem's most significant ongoing and emerging problems.

The GLRI Action Plan III incorporates science-based adaptive management to guide restoration and protection actions by using the best available science and lessons learned from GLRI investments. In FY 2023, GLRI federal agencies continued implementing projects to address cross-focus area science priorities: HABs/nuisance algae and the need for coastal resilience. New in FY 2023 is a focus on understanding ecological processes during winter months, including diatom blooms in Lake Erie and the status of lower food webs in the lakes. These priorities were identified in coordination with Tribal, state, and Lakewide Action and Management Plan partners. These priorities, along with results of annual science and monitoring, are used to guide GLRI project planning.

In FY 2023, the U.S. Geological Survey (USGS) and NOAA, using previously-appropriated GLRI funds, continued their collaborative efforts to better understand and predict the toxicity of HABs in Lake Erie and Saginaw Bay. The now completed project helped to establish a baseline understanding of cyanotoxins, HAB microbial communities, and cyanotoxin producers and how they change under different environmental and nutrient conditions. The resulting data will be used to quantify and characterize HAB toxicity and support restoration of the Great Lakes by improving the understanding of the relation between the drivers of toxicity and the management options for controlling those drivers.

In FY 2023, GLRI federal agencies and their partners continued tracking the progress of GLRI-funded projects. GLRI federal agencies used an improved relational database, Environmental Accomplishments in the Great Lakes 2 (EAGL2), an accountability system, to track results from GLRI-funded projects against the GLRI Action Plan III Measures of Progress. To evaluate and improve the quality of reporting, EPA conducts annual systemwide audits of the accountability system in accordance with the EAGL2 implementation manual.

Focus Area 5 Success Stories

Educators Onboard for Shipboard Science on Lake Ontario

In FY 2023, fifteen educators from across the Great Lakes basin shared a unique adventure on Lake Ontario aboard the EPA's R/V *Lake Guardian*, working side by side with scientists to collect and process water samples and interpret the data. Hosted and facilitated by the Sea Grant's Center for Great Lakes Literacy with GLRI funds, this annual, week-long workshop aims to support educators' ability to teach their students about the Great Lakes and incorporate the shipboard science experience into their Great Lakes education programs and stewardship efforts. Collectively, workshop participants engage more than 1,600 youth annually.

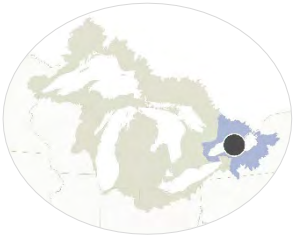
A Cornell University scientist and high school teachers wash excess sediment from a benthic sample for processing aboard the R/V Lake Guardian. Image: EPA

Place-based Learning about Nearshore Ecosystems in Great Lakes National Parks

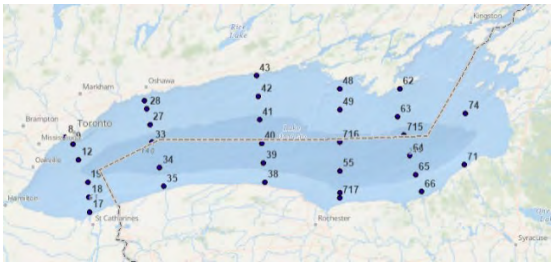
In FY 2023, GLRI funds supported place-based learning programs focused on nearshore ecosystem science and issues, reaching more than 30,000 youth through hands-on activities in the Great Lakes basin. Topics covered included lake ecology, water quality, HABs, plastic pollution, invasive species, and habitats in Great Lakes national parks. As a highlight, education programs at the Indiana Dunes National Park engaged youth and adults through visitor park experiences, including camps, guided hikes, nature-based park activities, and special programming. NPS also partnered with the Dunes Learning Center through programs such as "Watershed Ed," which helps students gain an increased awareness, understanding, and appreciation for the Lake Michigan watershed while working together to paddle a Voyageur canoe. Students also learn about biodiversity and natural resources through hands-on learning stations and stewardship activities.

High school students learn about Lake Michigan coastal habitats and water quality as they paddle a Voyageur canoe through the Indiana Dunes National Park. Image: NPS

2023 Lake Ontario Lower Food Web Assessment (LOLA)



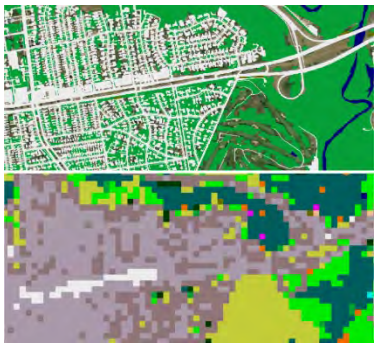
In FY 2023, EPA scientists and partners completed the Lake Ontario Lower Food Web Assessment (LOLA), which provides valuable information regarding the state of Lake Ontario's food web. The project was part of the 2023 Lake Ontario Cooperative Science and Monitoring Initiative field year. The Cooperative Science and Monitoring Initiative, an effort implemented under the Great Lakes Water Quality Agreement, coordinates science and monitoring activities in one of the five Great Lakes each year to generate data and information for environmental management agencies. Scientists working on LOLA collect and analyze water quality data and assess the base of the food web, including phytoplankton, zooplankton, and mysid populations. Resource managers ultimately use this information to assess how changes in the base of the food web can affect the rest of the ecosystem, which can inform decisions on fish stocking and other management actions.



Lake Ontario Lower Food Web Assessment (LOLA) station map for sampling in 2023.

New High-Resolution Land Cover Data Available for the Great Lakes Region

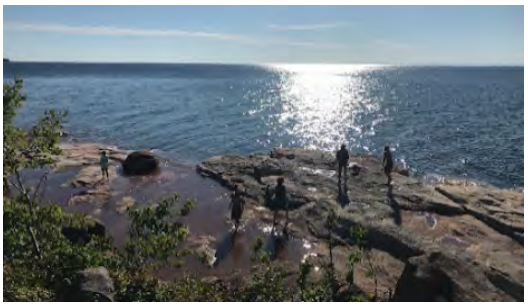
NOAA's Coastal Change Analysis Program (C-CAP) provides regional land cover data for the coastal U.S. The C-CAP program received GLRI funds to help enhance the resolution of land cover products in the Great Lakes region to a 1-meter resolution. Initial products include three feature layers—impervious surfaces, tree canopy, and water features. NOAA finalized these in 2023, officially released the data in January 2024, and they are now available on NOAA's Digital Coast. These new high-resolution land cover data sets support a range of applications, including flood inundation modeling, stormwater management, nature-based solutions, and urban forestry. In addition to the three feature layers, C-CAP will perform refinements and additional mapping, such as identifying wetland classes, in 2025 through 2027.



New high-resolution landcover data in places like Detroit, Michigan (top), will help resource managers make mored informed restoration and protection decisions, compared to the previous regional 30-meter land cover data (bottom)

NOAA's Great Lakes Bay Watershed Education and Training for Indigenous Communities 2023

NOAA's Great Lakes Bay Watershed Education and Training program, which funds place-based environmental stewardship education for K–12 students, held an inaugural grant competition for Indigenous Communities. Awarded projects provide youth with outdoor environmental education that incorporates Indigenous Knowledge. Four FY 2023 projects received a collective total of $367,694:



Students explore the Lake Superior lakeshore on a canoe trip supported by the Red Cliff Band of Lake Superior Chippewa and the Apostle Islands National Lakeshore Park—part of the Nibi gaa-gikinoo'amaage, Nibi gaa-bimaaji'iwemagak project. Image: Alex Breslav

- The Red Cliff Band of Lake Superior Chippewa and the University of Wisconsin-Madison's Earth Partnership Indigenous Arts and Sciences initiative: *Nibi gaa-gikinoo'amaage, Nibi gaa-bimaaji'iwemagak (Water Will Teach, Water Will Give Life) II*
- The Inter-Tribal Council of Michigan: *Creating Meaningful and Cultural Watershed Educational Experiences for the Students of the Ojibwe Charter School*
- The Saginaw Chippewa Indian Tribe: *Ninkchiwaawenindimin ("We honor each other")*
- Michigan Technological University, with support from the Keweenaw Bay Indian Community: *Braiding Knowledge Systems for Increased Earth Literacy: Inawendiwin: Connection, Observation, & Learning Together*

Monitoring and Assessing *Cladophora* in the Great Lakes

The USGS is assessing the status, trends, and drivers of *Cladophora* and associated benthic algae using sentinel sites, autonomous underwater vehicles (AUVs), and satellite remote sensing. These data will inform nuisance algal management decisions. In FY 2023, the team collected sentinel site data at transects in Lakes Michigan, Huron, Erie, and Ontario. Data collected in 2023 and prior years are being used to develop the *Cladophora* assessment for the *2025 State of the Great Lakes* report. This past year, the team increased its focus on the diversity of benthic algal communities in sentinel site collections, refined algorithms for benthic algae detection in AUV imagery, and began integrating algal observations from sentinel site, AUV transect, and satellite remote sensing scales.

A USGS diver samples from a dense community of benthic algae and stalked diatoms in Lake Huron in July 2023. Image: USGS

Section 3 – Regional Partner Engagement

The GLRI federal agencies collaborate and coordinate extensively with numerous entities each fiscal year to address the challenging ecosystem problems that affect the Great Lakes. This section provides a few examples of this engagement with Great Lakes Tribes and states.

Great Lakes Tribes

GLRI support for Tribal nations within the Great Lakes basin has created and enhanced valuable partnerships and resulted in the implementation of important restoration and protective actions, including controlling invasive species, reducing nutrient and phosphorous loadings into waterways, reopening tributaries to restore fish passage, protecting Lake Superior coastal wetlands, and restoring several culturally significant species such as lake sturgeon, moose, and wild rice.

In FY 2021, EPA and BIA, working with Great Lakes Tribes, finalized the GLRI Distinct Tribal Program Framework. This Framework describes how the GLRI federal agencies will work with Tribal governments in the spirit of self-determination, maximum flexibility, and consistent with Federal Indian trust responsibilities to support Tribal priorities that are consistent with GLRI goals and objectives. The EPA continues to work with Tribal governments and the Bureau of Indian Affairs (BIA) to implement this program.

Accompanying the GLRI's FY 2023 enacted appropriation (Public Law [PL] 117-328) was explanatory language (House Report 117-83) calling for EPA to maintain funding for Tribal-related activities at not less than $15 million. PL 117-328 also include explanatory language (Senate Report 115–276) that encourage EPA to "work with Tribal governments and the Bureau of Indian Affairs to develop a proposal for the creation of a distinct GLRI Tribal program through which GLRI funds would be provided to allow Tribes the flexibility to develop the programs that are of the highest priorities to their communities, and which fulfill the spirit of self-determination, meet treaty obligations, and carry out Federal trust responsibilities."

Since GLRI's inception in FY 2010, Tribes have received a total of over $158 million in GLRI funding, including over $22 million directed to Tribes in FY 2023. This funding has been key in building Tribal resource management capacity and contributing to protecting and restoring treaty-reserved resources and culturally significant habitats and species that support Tribal lifeways.

Great Lakes States

GLRI federal partners are committed to working with all eight states within the Great Lakes Basin. These states—Minnesota, Wisconsin, Illinois, Indiana, Michigan, Ohio, Pennsylvania, and New York—play a critical role in restoring and protecting the health of the Great Lakes to ensure the quality of their economies and the health of their citizens. The partnership between the Great Lakes states and the GLRI federal agencies continues to result in important work activities, including controlling invasive species, protecting fisheries, reducing nutrient and phosphorous loadings into waterways, capturing and treating urban runoff, and delisting AOCs. Since GLRI's inception in FY 2010, over $541 million of GLRI funds have been awarded to Great Lakes states through the end of FY 2023, including over $20 million from the FY 2023 appropriation.

Section 4 – Financial Reporting

Annual GLRI Appropriations

From FY 2010 to FY 2023, the EPA has been appropriated approximately $4.5 billion in GLRI funds. The agencies that receive GLRI funds use multiple funding mechanisms, including interagency agreements, fund transfers, competitive grants, and capacity-building grants to Tribes and states.

Table 1 and Chart 1 provide information on FY 2019–FY 2023 GLRI funding by focus area. Table 2 provides summary information for FY 2019–FY 2023 GLRI funding by individual agency.

Table 1. FY 2019–FY 2023 Annual GLRI Appropriations Focus Area Allocations as of September 30, 2023 (Dollars in Thousands)

Focus Area	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Toxic Substances and Areas of Concern	$107,400	$115,800	$121,400	$64,300	$103,490
Invasive Species	$57,000	$62,900	$65,700	$78,500	$62,205
Nonpoint Source Pollution Impacts on Nearshore Health	$51,200	$51,000	$53,000	$82,600	$71,296
Habitat and Species	$51,400	$54,500	$56,500	$81,400	$79,303
Foundations for Future Restoration Actions	$33,000	$35,800	$33,400	$41,200	$51,706
Totals:	$300,000	$320,000	$330,000	$348,000	$368,000

Chart 1. FY 2019–FY 2023 Annual GLRI Appropriations Focus Area Allocations as of September 30, 2023 (Dollars in Thousands)

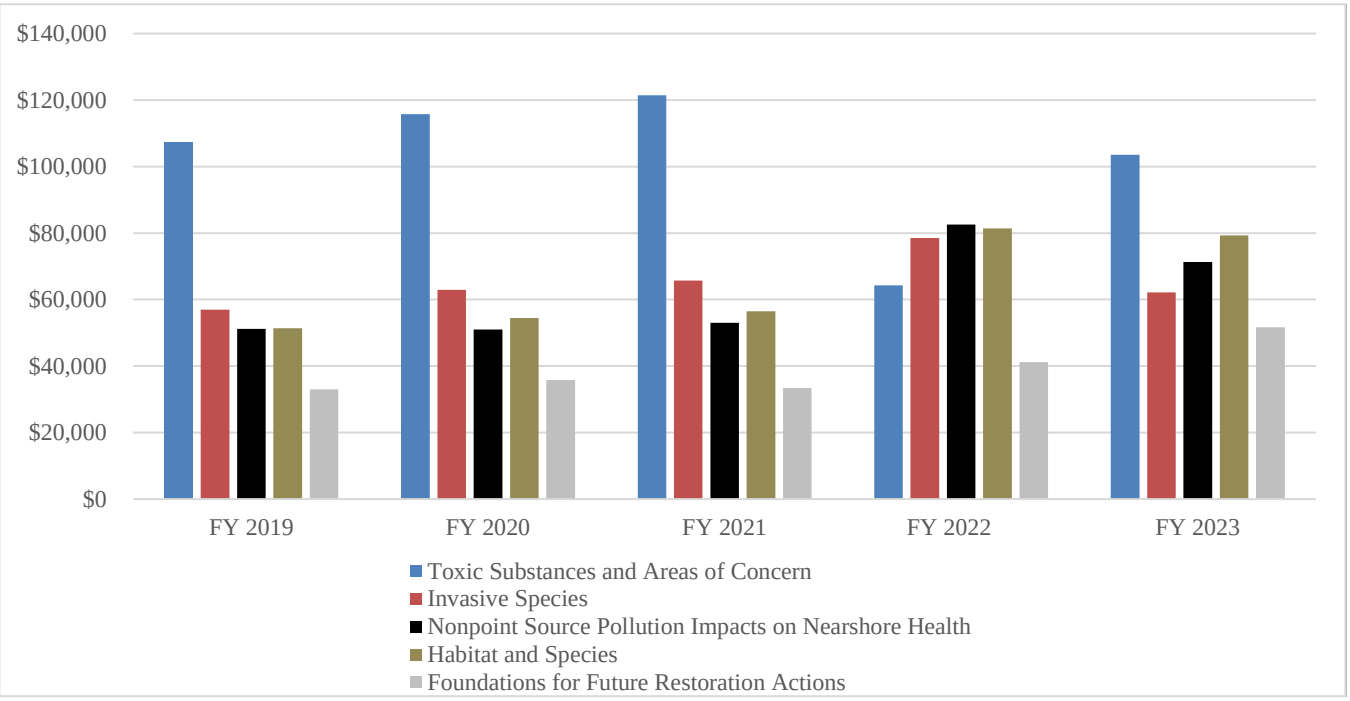


Table 2. FY 2019–FY 2023 Annual GLRI Obligations by Agency as of September 30, 2023 (Dollars in Thousands)

Agency	Obligations[a]				
	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
DHS-USCG	$1,660	$1,250	$1,300	$1,200	$1,300
DOC-NOAA	$29,405	$28,163	$16,621	$30,361	$22,789
DOD-USACE	$37,335	$30,558	$42,595	$29,067	$13,015
DOI-BIA	$9,842	$15,840	$15,765	$19,724	$21,245
DOI-NPS	$3,822	$3,794	$4,968	$7,816	$7,615
DOI-USFWS	$47,272	$53,523	$59,288	$88,082	$79,327
DOI-USGS	$21,603	$19,780	$19,790	$24,980	$22,875
DOT-MARAD	$797	$5,500	$8,000	$6,500	$0
HHS-ATSDR	$0	$0	$0	$0	$0
USDA-APHIS	$1,308	$1,362	$1,459	$1,832	$2,138
USDA-NRCS	$20,697	$22,239	$24,374	$31,824	$33,091
USDA-USFS	$11,646	$9,921	$12,464	$12,958	$14,148
IA totals:	**$185,387**	**$191,931**	**$206,623**	**$232,343**	**$217,542**
EPA, GLFC, and miscellaneous IAs[b]	**$113,607**	**$126,910**	**$121,473**	**94,813**	**$99,733**
Total obligated	**$298,994**	**$318,840**	**$328,096**	**$347,156**	**$317,275**
Returned[c] or remaining[d]	**$1,006**	**$1,160**	**$1,904**	**$844**	**$50,725**
GLRI grand totals:	**$300,000**	**$320,000**	**$330,000**	**$348,000**	**$368,000**

Notes:

DHS = U.S. Department of Homeland Security; USCG = U.S. Coast Guard; DOC = U.S. Department of Commerce; NOAA = National Oceanic and Atmospheric Administration; DOD = U.S. Department of Defense; USACE = U.S. Army Corps of Engineers; DOI = U.S. Department of the Interior; BIA = Bureau of Indian Affairs; NPS = National Park Service; USFWS = U.S. Fish and Wildlife Service; USGS = U.S. Geological Survey; DOT = Department of Transportation; MARAD = Maritime Administration; HHS = U.S. Department of Health and Human Services; ATSDR = Agency for Toxic Substances and Disease Registry; USDA = U.S. Department of Agriculture; APHIS = Animal and Plant Health Inspection Service; NRCS = Natural Resources Conservation Service; USFS = U.S. Forest Service; GLFC = Great Lakes Fishery Commission; IA = interagency agreement

[a] Obligations are the dollar amount of orders placed; interagency agreements, contracts or grants awarded; and similar transactions by EPA. The amount also reflects deobligations, which generally result from events such as completing a project under budget, contract termination, changes in project scope or focus, or other unforeseeable circumstances.

[b] Components include: (i) grants totaling approximately $65.0 million (including funding for the Great Lakes Fishery Commission, an organization identified in the President's budget); (ii) Great Lakes National Program Office support costs (payroll, travel, general expenses, and working capital) totaling approximately $16.3 million; and (iii) contracts and miscellaneous interagency agreements (other than those above) totaling approximately $18.4 million.

[c] Returned funds (FY 2019–FY 2023) are determined by subtracting obligations as of September 30, 2023, from appropriated funds. Returned funds generally result from deobligating funds as a result of completing a project under budget, contract termination, changes in project scope or focus, or other unforeseeable circumstances. The amount in this line can also include reserves that have been established to provide for contingencies or to effect savings under the Antideficiency Act.

[d] Remaining funds (FY 2023) have been carried over by EPA to fund priority projects, including competitively selected projects and state projects.

GLRI Appropriations as Part of the Infrastructure Investment and Jobs Act

From FY 2022 through FY 2026, the EPA has received $200 million each year in additional GLRI funds. The GLRI federal agencies that receive GLRI funds use multiple funding mechanisms, including interagency agreements, fund transfers, competitive grants, and capacity-building grants to Tribes and states.

Tables 3 and 4 provide summary information on FY 2022–FY 2023 GLRI IIJA funding by AOC and by project.

Table 3. GLRI FY 2022 IIJA Reporting by Project as of September 30, 2023 (Dollars in Thousands)

AOC[a]	Project Name[b]	Total Spending[c]
	Boston Mills Habitat Restoration Construction	$7,200
	E. 185th Spillway/Euclid Creek Habitat Restoration Design	$400
	GLLA Cuyahoga River Old Channel Remedial Design	$1,570
	GLLA Gorge Dam Post Final Remedial Design Support	$216
Cuyahoga River	**Total**	**$9,386**
	Elizabeth Park Site Characterization	$908
	Environment, Great Lakes, and Energy Sediment Sampling Sites Site Characterization	$1,121
	Gibraltar Canals Site Characterization	$1,362
	GLLA Upper Trenton Channel Remedial Design Finalization	$10
	GLLA Wilson Park Remedial Action	$15,635
	Harbortown Site Characterization	$1,464
	Riverbend Site Characterization	$1,482
	Rouge Ecorse Shoreline Site Characterization	$1,225
Detroit River	**Total**	**$15,081**
	GLLA East Branch Grand Calumet Phase Two Remedial Design	$800
Grand Calumet River	**Total**	**$800**
	Collins Park Stream Restoration Design	$332
	GLLA Swan Creek Feasibility Study	$358
	GLLA Swan Creek Site Characterization	$242
	University of Toledo Medical Center Swan Creek Habitat Restoration Design	$203
	University of Toledo Medical Center Swan Creek Habitat Restoration Implementation	$346
Maumee River	**Total**	**$1,481**
	Dredged Material Management Facility	40,000
	GLLA Milwaukee Pre-Design Investigation	$1,784
	Milwaukee Toxic Substance Control Act	$1,200
	South Shore Beach Remedial Action	$8,000
Milwaukee Estuary	**Total**	**$50,984**
	Cherry Farms Shore Habitat Restoration	$261
	R.C. Wilson Park Habitat Restoration	$12,500
Niagara River	**Total**	**$12,761**
	River Raisin Technical Support and Design	$234
River Raisin	**Total**	**$234**
	GLLA Lower Rouge River Old Channel Remedial Action Oversight	$1,073
	GLLA Rouge River Mainstem Feasibility Study	$182
Rouge River	**Total**	**$1,255**
	GLLA Crawford Creek Focus Feasibility Study	$434
	GLLA Munger Landing Remedial Action	$23,117
	GLLA Scanlon Reservoir Remedial Action	$5,541
	GLLA Spirit Lake Remediation Action	$52,348
	GLLA Thomson Reservoir Remedial Design Review	$108
	GLLA Torch Lake Focus Feasibility Study	$4
St. Louis River	**Total**	**$81,552**

AOC[a]	Project Name[b]	Total Spending[c]
	Grand Total	**$181,660**
	NOAA, USACE, and U.S. EPA Programmatic	**$7,046**
	Amount Available	**$11,294**
	Budget Authority	**$200,000**

Notes:
GLLA = Great Lakes Legacy Act; NOAA = National Oceanic and Atmospheric Administration; USACE = U.S. Army Corps of Engineers.
[a] The Great Lakes Water Quality Agreement (Annex 1 of the 2012 Protocol) defines AOCs as "geographic areas designated by the Parties where significant impairment of beneficial uses has occurred as a result of human activities at the local level." An AOC is a location that has experienced environmental degradation.
[b] The name of each project describes the phase of the project, the site where the work is taking place, and the type of work being done.
[c] The dollar amount committed, obligated, and expended; interagency agreements, contracts, or grants awarded; and similar transactions by EPA. The amount also reflects deobligations, which generally result from events such as completing a project under budget, contract termination, changes in project scope or focus, or other unforeseeable circumstances.
[d] GLNPO programmatic costs include payroll, travel, general expenses, and working capital.
[e] Resources currently available for spending or allocation within a specific budgetary period. This portion represents the portion of the Total Authority that has not be committed, expended, or obligated.
[f] The amount of money available to a federal agency for a specific purpose. The authority to commit to spending federal funds is provided to agencies by law. The budget authority is provided to agencies through the annual appropriations process.

Table 4. GLRI FY 2023 IIJA Reporting by Project as of September 30, 2023 (Dollars in Thousands)

AOC [a]	Project Name[b]	Total Spending[c]
Non-AOCs	Benton Harbor Ox Creek Green Infrastructure Projects	$1,059
	Buffalo Reef Coal Dock Jetty Design	$700
	Total	$1,759
	Grand Total	**$1,759**
	NOAA, USACE, and U.S. EPA Programmatic[d]	**$8,780**
	Amount Available[e]	**$189,461**
	Budget Authority[f]	**$200,000**

Notes:
USACE = U.S. Army Corps of Engineers
[a] The Great Lakes Water Quality Agreement (Annex 1 of the 2012 Protocol) defines AOCs as "geographic areas designated by the Parties where significant impairment of beneficial uses has occurred as a result of human activities at the local level." An AOC is a location that has experienced environmental degradation.
[b] The name of each project describes the phase of the project, the site where the work is taking place, and the type of work being done.
[c] The dollar amount committed, obligated, and expended; interagency agreements, contracts, or grants awarded; and similar transactions by EPA. The amount also reflects deobligations, which generally result from events such as completing a project under budget, contract termination, changes in project scope or focus, or other unforeseeable circumstances.
[d] GLNPO programmatic costs include payroll, travel, general expenses, and working capital.
[e] Resources currently available for spending or allocation within a specific budgetary period. This portion represents the portion of the Total Authority that has not be committed, expended, or obligated.
[f] The amount of money available to a federal agency for a specific purpose. The authority to commit to spending federal funds is provided to agencies by law. The budget authority is provided to agencies through the annual appropriations process.

Appendix A – GLRI Action Plan III: Measures of Progress

Table A-1 provides an overview of the results achieved for each of the 23 Measures of Progress in the GLRI Action Plan III. Targets for Measures of Progress were established under assumptions contained in Action Plan III. Fourteen measures have annual targets; the rest track progress toward long-term goals that will take more than five years to reach. Detailed information is provided in the following pages (Table A-2).

Table A-1. Overview of the Results Achieved for the 23 Measures of Progress in the GLRI Action Plan III

Focus Area	Measure[1]	Baseline/ Universe[2]	FY 2020 Result/Target[3]	FY 2021 Result/Target[4]	FY 2022 Result/Target[5]	FY 2023 Result/Target[6]
Toxic Substances	1.1.1. AOC management actions*	B: 12/ U: 31	*14/16*	*15/18*	*16/19*	*16/20*
	1.1.2. BUIs*	B: 80/ U: 225	97/93	106/101	113/109	120/118
	1.1.3. AOC management action lists*	B: 18/ U: 31	22/22	24/24	*24/26*	*24/28*
	1.2.1. Organizations sharing consumption information with vulnerable populations	NA	9	7	13	6
	1.3.1. Chemical monitoring and assessment activities	NA	15	12	11	11
Preventing and Controlling Invasive Species	2.1.1. Rapid responses or exercises	B: 8	20/8	57/8	47/8	13/8
	2.1.2. Projects managing pathways	B: 16.25 avg.	38	28	58	20
	2.1.3. Early detection activities	B: 12.25 avg.	14	32	45	44
	2.2.1. Aquatic/terrestrial acreage controlled*	B: 153,569	201,963/ 165,000	215,515/ 171,000	238,080/ 177,000	260,550/ 183,000
	2.3.1. Technologies and methods field tested	B: 10 avg.	13	6	4	4
	2.3.2. Collaboratives developed/enhanced*	B: 10	17	19	20	20
Nonpoint Source Pollution Impacts on Nearshore Health	3.1.1. Phosphorus reduction throughout Great Lakes watersheds* (pounds)	B: 1,113,603	1,784,790/ 1,600,000	2,066,521/ 1,900,000	2,334,783/ 2,200,000	2,518,432/ 2,500,000
	3.1.2. Nutrient management assistance in priority Great Lakes watersheds* (acres)	B: 1,614,511 U: 10,711,434	*1,762,484/ 2,200,000*	*1,831,158/ 2,370,000*	*1,940,785/ 2,515,000*	*2,088,515/ 2,685,000*
	3.2.1. Stormwater captured or treated* (millions of gallons)	B: 252	372.4/350	413.6/400	511.3/450	560.2/500
	3.2.2. Shoreline restored or protected* (miles)	B: 26	34.3/33	43.6/40	61.1/47	89.7/54
	3.3.1. Nutrient monitoring and assessment activities	B: 30	31/30	31/30	33/30	35/30
	3.3.2. Nutrient/stormwater practices or tools	B: 10	14/10	12/10	15/10	12/10
Habitats and Species	4.1.1. Habitat restored, protected, or enhanced* (acres)	B: 370,488 U: 1,550,000	463,058/ 394,000	479,293/ 406,000	506,113/ 418,000	529,564/ 430,000
	4.1.2. Aquatic connectivity* (miles)	B: 5,289	6,052/ 5,700	6,727/ 5,900	7,175/ 6,100	8,170/ 6,300
	4.2.1. Species benefited*	B: 0	1/1	2/2	4/4	6/6
Foundations for Future Restoration	5.1.1. Youth impacted through education/ stewardship*	B: 377,000	578,559	627,106	685,007	775,841
	5.2.1. Annual monitoring	NA	Yes	Yes	Yes	Yes
	5.2.2. Identify and address science priorities	NA	Yes	Yes	Yes	Yes

Notes:

Shaded cells display results achieved/targets. Unmet targets are italicized in red-shaded cells. Green-shaded cells indicate targets are met. Cells without denominators show results for measures that do not have targets.

Avg. = average; B = Baseline; U = Universe; NA = not applicable

[1] Cumulative measures are indicated with an *.

[2] Baselines for cumulative measures identify results through FY 2018 except for measures 1.1.1 and 1.1.2 (through FY 2009). Baselines for noncumulative measures identify regularly expected annual results. The baseline and universe for measure 3.1.2 have been updated from Action Plan III to use an FY 2018 baseline and correctly account for eligible acreage. The "universe" is not available if not provided.

[3] The FY 2020 column identifies targets and results through September 30, 2020, for the GLRI Action Plan III measures.

[4] The FY 2021 column includes targets and results through September 30, 2021, for the GLRI Action Plan III measures.

[5] The FY 2022 column includes targets and results through September 30, 2022, for the GLRI Action Plan III measures.
[6] The FY 2023 column includes targets and results through September 30, 2023, for the GLRI Action Plan III measures.

Table A-2. GLRI Action Plan III Measures of Progress – Detailed Information

Measure	Target/Baseline/ Universe[2]	Result[3]	Explanation/Additional Information
1.1.1. Areas of Concern where all management actions necessary for delisting have been implemented (Cumulative)[1]	FY 2023: 20 FY 2022: 19 FY 2021: 18 FY 2020: 16 Baseline: 12 Universe: 31	FY 2023: 16 FY 2022: 16 FY 2021: 15 FY 2020: 14	No AOCs implemented all management actions necessary for ultimate delisting in 2023.
1.1.2. Beneficial Use Impairments removed in Areas of Concern. (Cumulative)[1]	FY 2023: 118 FY 2022: 109 FY 2021: 101 FY 2020: 93 Baseline: 80 Universe: 225	FY 2023: 120 FY 2022: 113 FY 2021: 106 FY 2020: 97	*Degradation of Fish and Wildlife Populations*: St. Louis River, MN/WI – 01/2023; Muskegon Lake, MI – 05/2023 *Loss of Fish and Wildlife Habitat*: Muskegon Lake, MI – 05/2023; Buffalo River, NY – 07/2023 *Degradation of Aesthetics*: Maumee, OH – 07/2023 *Fish Tumors and Other Deformities*: Cuyahoga River, OH – 08/2023 *Degradation of Benthos:* Buffalo River, NY – 09/2023
1.1.3. Areas of Concern with a complete and approved list of all management actions necessary for delisting. (Cumulative)	FY 2023: 28 FY 2022: 26 FY 2021: 24 FY 2020: 22 Baseline: 18 Universe: 31	FY 2023: 24 FY 2022: 24 FY 2021: 24 FY 2020: 22	No additional AOCs had all management action lists completed and approved in FY 2023.
1.2.1. State and Tribal organizations that collect and share information with vulnerable populations regarding the consumption of Great Lakes fish, wildlife, and harvested plant resources.	No targets Baseline: NA Universe: NA	FY 2023: 6 FY 2022: 13 FY 2021: 7 FY 2020: 9	The GLRI funded several Great Lakes states to help develop and enhance fish consumption advisory material, including the development of new fish consumption advice to multiple Tribal and Asian (Hmong, Burmese, and Bhutanese) communities. The GLRI also funded contaminant monitoring, including monitoring of PFAS in waterfowl in Wisconsin to determine if consumption advisories are warranted.
1.3.1. Discrete chemical monitoring and assessment activities conducted.	No targets Baseline: NA Universe: NA	FY 2023: 11 FY 2022: 11 FY 2021: 12 FY 2020: 15	The GLRI supported several monitoring and assessment projects focusing on priority chemicals, including CMCs. These projects assessed PFAS in the Great Lakes food web; evaluated factors impacting mercury release and methylation from restored peatlands in the St. Louis River watershed, and assessed CMCs in Lake Huron and Lake Superior fish-eating birds and their fish prey.
2.1.1. Rapid responses or exercises conducted.	FY 2023: 8 FY 2022: 8 FY 2021: 8 FY 2020: 8 Baseline: 8 Universe: NA	FY 2023: 13 FY 2022: 47 FY 2021: 57 FY 2020: 20	The eight Great Lakes states have committed to conducting annual training exercises but prioritize activities to respond to detections of new invasive species. Efforts include tabletop exercises, drills, and field responses.
2.1.2. Projects that manage pathways through which invasive species can be introduced to the Great Lakes ecosystem.	No targets Baseline 16.25 avg. Universe: NA	FY 2023: 20 FY 2022: 58 FY 2021: 28 FY 2020: 38	GLRI funded 20 projects intended to block invasive species' introduction pathways in places such as canals, waterways, recreational boats, commercial shipping, aquarium trade, and live bait sales.

Measure	Target/Baseline/ Universe[2]	Result[3]	Explanation/Additional Information
2.1.3. Early detection and surveillance activities conducted.	No targets Baseline: 12.25 avg. Universe: NA	FY 2023: 44 FY 2022: 45 FY 2021: 32 FY 2020: 14	Early detection activities were conducted in FY 2023, including conventional monitoring techniques (nets, traps, electroshocking) and eDNA and genomic approaches.
2.2.1. Aquatic/terrestrial acreage controlled. (Cumulative)	FY 2023: 183,000 FY 2022: 177,000 FY 2021: 171,000 FY 2020: 165,000 Baseline: 153,569 Universe: NA	FY 2023: 260,550 FY 2022: 238,080 FY 2021: 215,515 FY 2020: 201,963	Collaborations among federal agencies, Tribes, state agencies, and the public continue to protect high-value ecological and recreational sites from the establishment of invasive species while promoting the re-establishment of native species. Invasive species were controlled on more than 22,000 acres of terrestrial and aquatic environments.
2.3.1. Technologies and methods field tested.	No targets Baseline: 10 avg. Universe: NA	FY 2023: 4 FY 2022: 4 FY 2021: 6 FY 2020: 13	Technologies included ballast water treatment systems, species-specific toxicants, and behavioral fish barriers. In 2023, new methods for removing invasive quagga mussels from critical habitats were tested in Lake Michigan.
2.3.2. Collaboratives developed/ enhanced. (Cumulative)	No targets Baseline: 10 Universe: NA	FY 2023: 20 FY 2022: 20 FY 2021: 19 FY 2020: 17	Tribal participation in the Midwest Invasive Species Network continues. Tribes in Wisconsin restored over 40 acres of habitats degraded by invasive plants. Tribal partners in New York performed projects to mitigate the effects of the emerald ash borer.
3.1.1. Estimated pounds of phosphorus reductions from conservation practice implementation throughout Great Lakes watersheds. (Cumulative)	FY 2023: 2,500,000 FY 2022: 2,200,000 FY 2021: 1,900,000 FY 2020: 1,600,000 Baseline: 1,113,603 Universe: NA	FY 2023: 2,518,432 FY 2022: 2,334,783 FY 2021: 2,066,521 FY 2020: 1,784,790	Contributing agencies: BIA, USFWS, NRCS, and EPA. Results can vary each year due to the nature of voluntary conservation assistance programs. The targets for 3.1.1 were developed based on assumptions about the types of conservation practices that would be adopted by private landowners and their effectiveness. In some years, the practices adopted resulted in an exceedance of performance goals for phosphorus reduction.
3.1.2. Acres receiving technical or financial assistance on nutrient management in priority watersheds. (Cumulative)	FY 2023: 2,685,000 FY 2022: 2,515,000 FY 2021: 2,370,000 FY 2020: 2,200,000 Baseline: 1,614,511 Universe: 10,711,434	FY 2023: 2,088,515 FY 2022: 1,940,785 FY 2021: 1,831,158 FY 2020: 1,762,484	Contributing agencies: NRCS and EPA. This measure focuses on improving the long-term adoption of nutrient management. Ambitious targets were set based on phosphorus reduction needs in the priority watersheds. Agencies expect to institute program adjustments that will improve the results for this measure.
3.2.1. Estimated gallons (in millions) of untreated stormwater runoff captured or treated. (Cumulative)	FY 2023: 500 FY 2022: 450 FY 2021: 400 FY 2020: 350 Baseline: 252 Universe: NA	FY 2023: 560.2 FY 2022: 511.3 FY 2021: 413.6 FY 2020: 372.4	Contributing agencies: USFS, USFWS, NRCS, and EPA. Results for on-the-ground construction projects are reported at the time of award. Actual results may vary as projects are implemented.
3.2.2. Miles of Great Lakes shoreline and riparian corridors restored or protected. (Cumulative)	FY 2023: 54 FY 2022: 47 FY 2021: 40 FY 2020: 33 Baseline: 26 Universe: NA	FY 2023: 89.7 FY 2022: 61.1 FY 2021: 43.6 FY 2020: 34.3	Contributing agencies: APHIS, USFWS, USACE, NRCS, and EPA. Results for on-the-ground construction projects are reported once implemented.

Measure	Target/Baseline/ Universe[2]	Result[3]	Explanation/Additional Information
3.3.1. Nutrient monitoring and assessment activities conducted.	FY 2023: 30 FY 2022: 30 FY 2021: 30 FY 2020: 30 Baseline: 30 Universe: NA	FY 2023: 35 FY 2022: 33 FY 2021: 31 FY 2020: 31	Contributing agencies: USGS and NOAA. This measure tracks ongoing monitoring and assessment activities. Actual results may vary each year as new projects are added.
3.3.2. Nutrient or stormwater runoff reduction practices or tools developed or evaluated.	FY 2023: 10 FY 2022: 10 FY 2021: 10 FY 2020: 10 Baseline: 10 Universe: NA	FY 2023: 12 FY 2022: 15 FY 2021: 12 FY 2020: 14	Contributing agencies: USGS, NOAA, EPA, and USACE. This measure tracks multiyear projects that evaluate or develop new tools or management practices. Actual results may vary each year as new projects are added.
4.1.1. Acres of coastal wetland, nearshore, and other habitats restored, protected, or enhanced. (Cumulative)	FY 2023: 430,000 FY 2022: 418,000 FY 2021: 406,000 FY 2020: 394,000 Baseline: 370,488 Universe: 1,550,000	FY 2023: 529,564 FY 2022: 506,113 FY 2021: 479,293 FY 2020: 463,058	Many collaborations and projects to restore coastal wetlands are completed or underway. For example, coastal wetlands in Presque Isle State Park have been restored following degradation due to invasive species, and new wetlands have been constructed in Sandusky Bay, OH. The Great Lakes Coastal Wetland Monitoring Program continued to aid and inform restoration and protection efforts.
4.1.2. Miles of connectivity established for aquatic species. (Cumulative)	FY 2023: 6,300 FY 2022: 6,100 FY 2021: 5,900 FY 2020: 5,700 Baseline: 5,289 Universe: NA	FY 2023: 8,170 FY 2022: 7,175 FY 2021: 6,727 FY 2020: 6,052	By the end of FY 2023, GLRI federal agencies and their partners had implemented projects that reopened more than 8,170 miles of Great Lakes tributaries, increasing aquatic connectivity for numerous fish species.
4.2.1. Species benefited where actions have been completed to significantly protect or promote recovery of populations. (Cumulative)	FY 2023: 6 FY 2022: 4 FY 2021: 2 FY 2020: 1 Baseline: 0 Universe: NA	FY 2023: 6 FY 2022: 4 FY 2021: 2 FY 2020: 1	Poweshiek skipperling and brook trout in FY 2023. Projects that addressed aquatic connectivity in FY 2023 also supported the continued restoration of native fish species, including lake sturgeon. Other projects to protect piping plover and Pitcher's thistle habitat are also ongoing.
5.1.1. Youth impacted through education and stewardship projects. (Cumulative)	No targets Baseline: 377,000 Universe: NA	FY 2023: 775,841 FY 2022: 685,007 FY 2021: 627,106 FY 2020: 578,559	GLRI federal agencies and partners have implemented many activities to promote Great Lakes-based environmental education and stewardship that focus on engaging educators and youth using place-based experiential learning.
5.2.1. Annual Great Lakes monitoring conducted and used to prioritize GLRI funding decisions.	No targets Baseline: NA Universe: NA	FY 2023: Yes FY 2022: Yes FY 2021: Yes FY 2020: Yes	GLRI federal agencies and partners conducted comprehensive monitoring to assess the status and trends of the Great Lakes ecosystem. Monitoring of coastal wetlands, contaminants, nutrients, hypoxia, HABs, zooplankton, phytoplankton, benthic communities, and prey fish, among many other components, was conducted throughout the Great Lakes basin. The monitoring data and information from previous years were used to identify the most significant Great Lakes problems and prioritize funding decisions to address those problems.

Measure	Target/Baseline/ Universe[2]	Result[3]	Explanation/Additional Information
5.2.2. Identify and address science priorities to support implementation of GLRI and the Great Lakes Water Quality Agreement.	No targets Baseline: NA Universe: NA	FY 2023: Yes FY 2022: Yes FY 2021: Yes FY 2020: Yes	GLRI federal agencies and partners conducted several projects addressing the established science priorities under this focus area. Such projects included studying on *Cladophora* nuisance algae, monitoring HABs in Lake Erie and determining drivers of HAB toxicity, mapping wetlands, and assessing the status of nutrients and lower food web organisms during the winter.

Notes:
NA = not applicable
[1] Results from this Action Plan measure are achieved through GLRI funding as well as other non-GLRI federal and/or state funding.
[2] Baselines for cumulative measures identify results through FY 2018 except for Measures 1.1.1 and 1.1.2 (through FY 2009, the year prior to the GLRI) and Measure 3.1.1 (through FY 2017). Baselines for non-cumulative measures identify regularly expected annual results. The baseline and universe for measure 3.1.2 have been corrected from Action Plan III to exclude acreage outside Great Lakes priority watersheds. The "universe" is not available if not provided.
[3] Results are included for FY 2020–FY 2022.