



NUTRIENTS ANNEX

PROGRESS REPORT OF THE PARTIES

OVERVIEW

In some areas of the Great Lakes, excess phosphorus loadings threaten water quality and ecosystem health by contributing to harmful and nuisance algal blooms that can cause drinking water impairments, exacerbate low oxygen conditions, and drive beach closures that result in a loss of recreational opportunities. Recognizing the magnitude of the threat to Lake Erie in particular (Figure 7), the 2012 Agreement requires Canada and the United States to: 1) by 2016, revise, and if necessary, establish new phosphorus loading targets for Lake Erie, allocated by country; 2) by 2018, have in place Domestic Action Plans to achieve the Lake Erie targets.

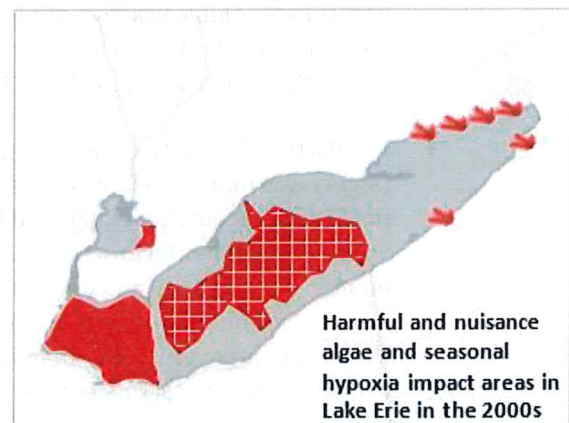
On February 22, 2016, following a robust binational science-based process and an extensive public consultation, the United States and Canada adopted new phosphorus reduction targets for the western and central basins of Lake Erie. The Parties and multiple partner agencies are now working to develop Domestic Action Plans to meet the 2018 deadline.

Figure 7 – Excess Phosphorus Loadings Threaten Great Lakes Water Quality and Ecosystem Health.

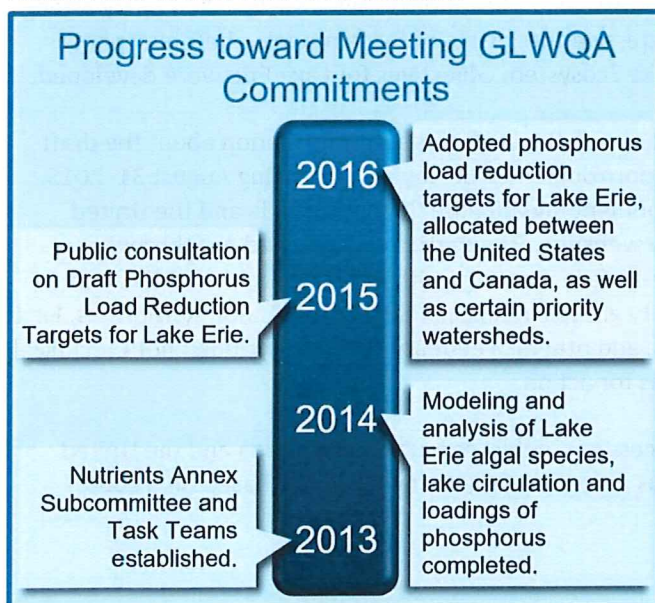


State of the Great Lakes, 2016 Draft Assessment of the Nutrients in Lakes Sub-indicator

- Good
- Fair
- Poor
- ⇨ Improving Trend
- ⇨ No Change in Trend
- ⇨ Deteriorating Trend



- Harmful and nuisance algae:
- Cyanobacteria
 - Cladophora
- Seasonal hypoxia: ■ Low oxygen conditions exacerbated by excess nutrients



This Annex's implementation is supported by the Nutrients Annex Subcommittee, co-led by the United States Environmental Protection Agency and Environment and Climate Change Canada. Organizations on the Subcommittee include: **United States Environmental Protection Agency**, Great Lakes and St. Lawrence Cities Initiative, Indiana Department of Environmental Management, Michigan Department of Agriculture & Rural Development, Michigan Department of Environmental Quality, New York Department of Environmental Conservation, Ohio Department of Agriculture, Ohio Department of Natural Resources, Ohio Environmental Protection Agency, Pennsylvania Department of Environmental Protection, United States Department of Agriculture, United States Geological Survey, United States National Oceanic and Atmospheric Administration, **Environment and Climate Change Canada**, Agriculture and Agri-Food Canada, Conservation Ontario, Ontario Ministry of Agriculture Food and Rural Affairs, Ontario Ministry of Environment and Climate Change, and the Ontario Ministry of Natural Resources and Forestry.

Binational Actions Taken

The Nutrients Annex of the 2012 GLWQA established commitments for both countries to take action to manage phosphorus concentrations and loadings, and other nutrients if warranted, in the waters of the Great Lakes. The following is a summary of the binational actions taken to date for each of the Annex's five key commitments.

By 2016, develop binational substance objectives for phosphorus concentrations, loading targets, and loading allocations for Lake Erie.

- The Parties led an extensive binational effort to increase understanding of the Lake Erie algae problem in relation to the three main basins of the Lake – the western basin, the central basin and the eastern basin. Information on algal patterns and species, lake circulation, and sources and loadings of phosphorus were studied. Modeling experts from Canada and the United States used nine different computer simulation models to correlate changes in phosphorus levels with levels of algal growth. Emerging science on the bioavailability of different forms of phosphorus, particularly soluble reactive phosphorus (dissolved phosphorus that is easily taken up by algae), was considered. By comparing and contrasting the results of these models, draft phosphorus load reduction targets to achieve the Lake Ecosystem Objectives for Lake Erie were developed.
- The Parties then led extensive consultations on the draft targets. Information about the draft targets was made available online, for approximately a 60 day period ending August 31, 2015, through www.binational.net, and Environment and Climate Change Canada and the United States Environmental Protection Agency websites. The Parties also reached out through a number of binational and domestic face-to-face meetings with interested stakeholders and partners including agricultural commodity groups, municipalities, Conservation Authorities, First Nations, non-government organizations, and others. Feedback received included both technical comments on the targets as well as ideas for action.
- Following this robust science-based process and public consultation, Canada and the United States adopted the following phosphorus reduction targets for Lake Erie (based on a 2008 baseline year):

- **To minimize the extent of hypoxic zones in the waters of the central basin of Lake Erie:** a 40% reduction in total phosphorus entering the western and central basins of Lake Erie—from the United States and from Canada—to achieve an annual load of 6,000 metric tons to the central basin. This amounts to a reduction from the United States and Canada of 3,316 metric tons and 212 metric tons, respectively.
 - **To maintain algal species consistent with healthy aquatic ecosystems in the nearshore waters of the western and central basins of Lake Erie:** a 40% reduction in spring total and soluble reactive phosphorus loads from the following watersheds where algae is a localized problem: in Canada, Thames River and Leamington tributaries; and in the United States, Maumee River, River Raisin, Portage River, Toussaint Creek, Sandusky River and Huron River (Ohio).
 - **To maintain cyanobacteria biomass at levels that do not produce concentrations of toxins that pose a threat to human or ecosystem health in the waters of the western basin of Lake Erie:** a 40% reduction in spring total and soluble reactive phosphorus loads from the Maumee River in the United States.
- While the above targets for the western and central basins of Lake Erie are expected to reduce nuisance benthic algae growth (e.g., *Cladophora*) in the eastern basin, further science and analysis is underway to determine if further reductions will be necessary to address the issue in the eastern basin as well.

By 2018, develop binational phosphorus reduction strategies and domestic action plans for Lake Erie.

- The United States and Canada are working with multiple partner agencies, tribes, First Nations, Métis, and stakeholders to develop a binational phosphorous reduction strategy and Domestic Action Plans. These plans will identify the actions required to meet the agreed-to load reduction targets. Stakeholders are being engaged during the development process, and the draft plans will be available for further consultation in 2017.

Assessing, developing, and implementing programs to reduce phosphorus loadings from urban, rural, industrial and agricultural sources.

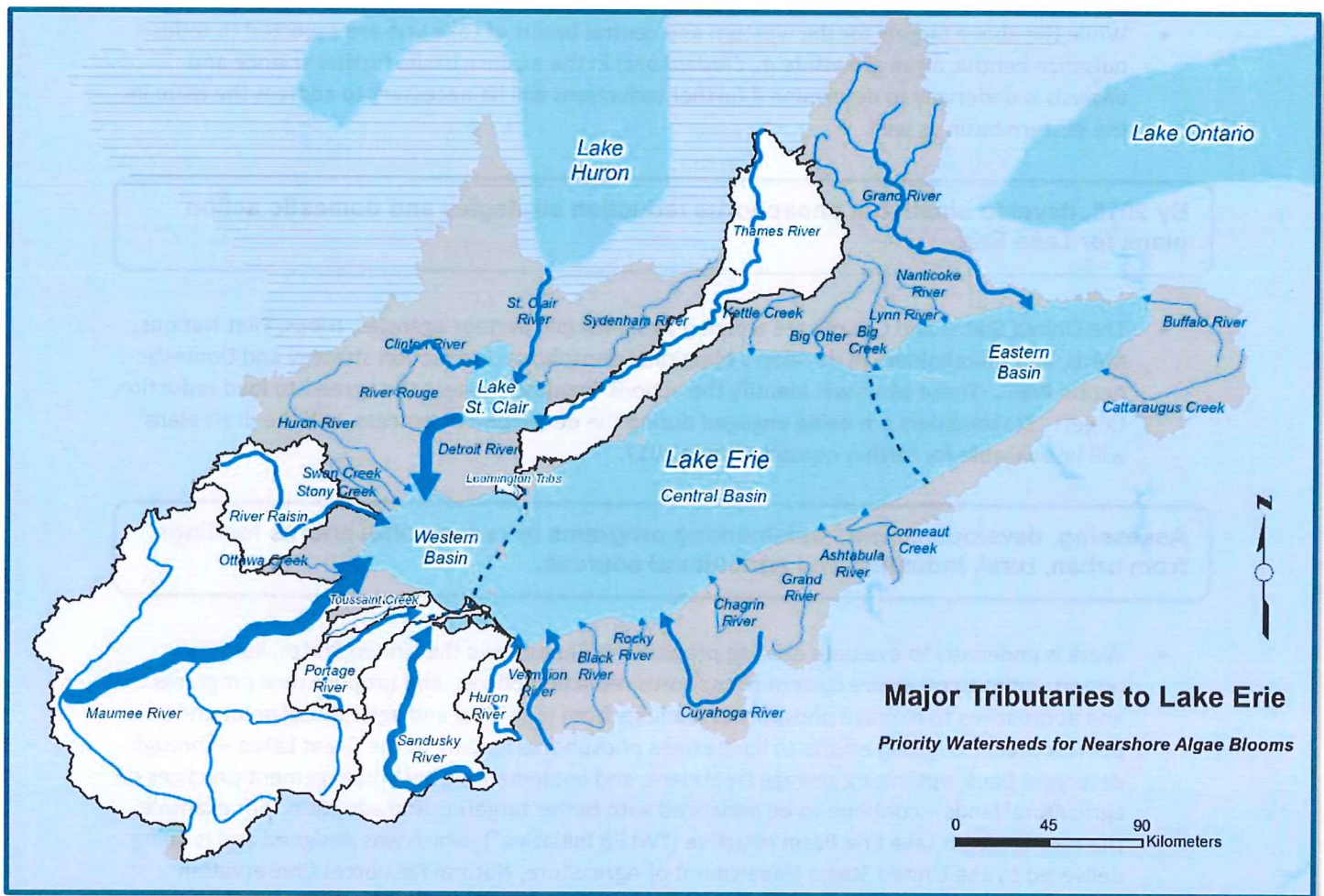
- Work is underway to evaluate existing programs in Canada and the United States, identify opportunities to maximize current phosphorus reduction efforts, and propose new programs and approaches to manage phosphorus loadings from municipal and agricultural point and non-point sources. Ongoing efforts to limit excess phosphorus loading to the Great Lakes – through detergent bans, optimizing sewage treatment, and implementing best management practices on agricultural lands – continue to be enhanced with better targeting and adoption. For example, the new Western Lake Erie Basin Initiative (“WLEB Initiative”), which was designed and is being delivered by the United States Department of Agriculture, Natural Resources Conservation Service, is based on a comprehensive assessment of conservation effects and remaining treatment needs on croplands in the western basin of Lake Erie watershed. The WLEB Initiative is designed to complement existing programs on agricultural lands in the region such as the Great Lakes Restoration Initiative, Regional Conservation Partnership Program, and general

Farm Bill efforts. Similarly, the Governments of Ontario and Canada recently launched the Great Lakes Agricultural Stewardship Initiative to provide targeted support for farmers in the Lake Erie and Lake St. Clair watersheds. For information on actions being taken in the United States and Canada to reduce phosphorus, see the “Domestic Actions Taken” section.

Identifying priority watersheds that contribute significantly to local algae development.

- The United States and Canada identified eight priority watersheds (as seen in Figure 8) – two in Canada and six in the United States – where phosphorus control is required in order to address algal blooms occurring in the nearshore waters of Lake Erie.

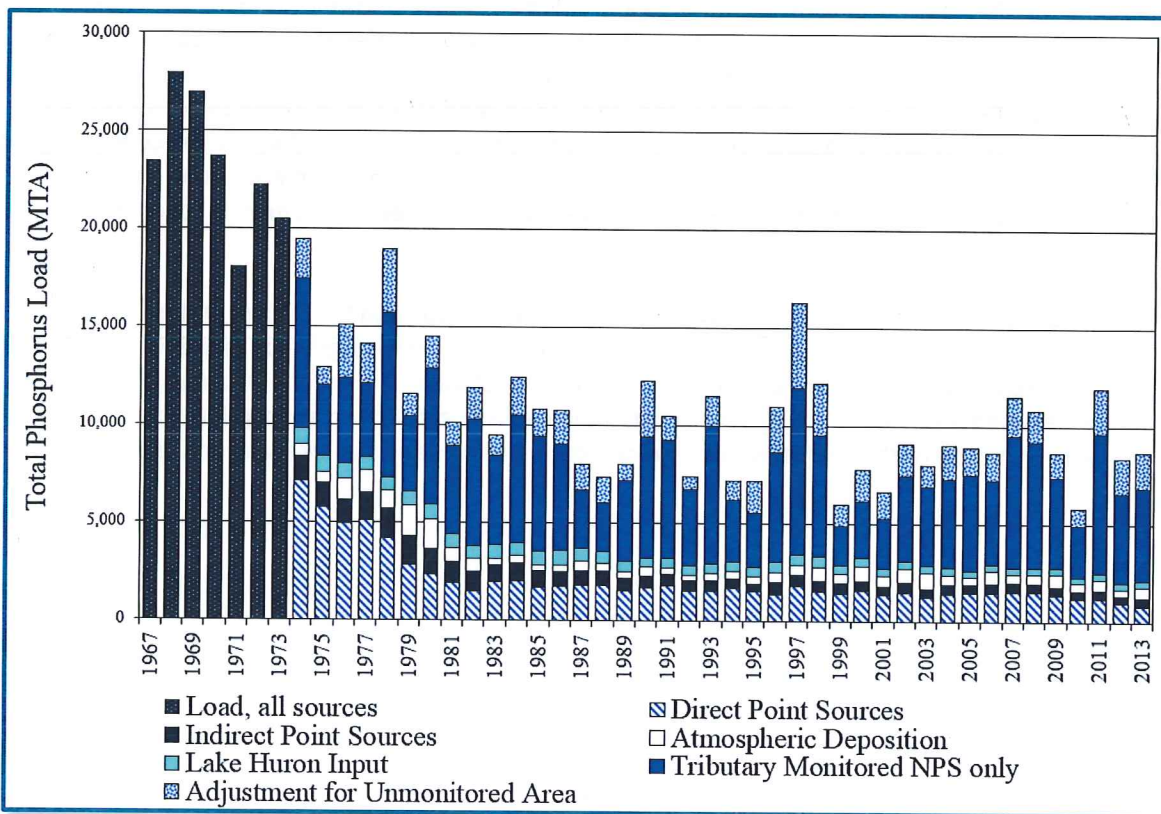
Figure 8 – Major Tributaries to Lake Erie and the Priority Watersheds for Nearshore Blooms. Tributary Size Indicates Magnitude of Phosphorus Loading to the Lake in 2008.



Undertake and share research, monitoring and modeling necessary to establish, report on and assess the management of phosphorus and other nutrients and improve the understanding of relevant issues associated with nutrients and excessive algal blooms.

- Canada and the United States engaged many scientific experts in the development of the new phosphorus loading targets for Lake Erie, and are currently developing an approach to monitor and track progress towards the new targets. The following priorities for research, monitoring and modeling have been identified:
 - Monitoring of total phosphorus and soluble reactive phosphorus loads and harmful algal blooms and hypoxia extent and duration to evaluate effectiveness of load reduction efforts and the lake's response over time;
 - Research on factors that contribute to toxin production by harmful algal blooms; and
 - Better understanding of internal lake phosphorus loads, including factors controlling the growth of the nuisance algae *Cladophora* and improvement of ecosystem models to assist in understanding the relationship between external and internal phosphorus loads and the occurrence of algal blooms.
- Figure 9 shows historical phosphorus loadings data. Canada and the United States tracked phosphorus loads and sources on a whole-lake basis. The new targets for Lake Erie are refined to specific locations, forms of phosphorus, and time of year. Going forward, tracking and assessments related to these new targets will need refinement and appropriate data collection will be critical to the evaluation of implementation efforts and the lake's response over time.

Figure 9 – Total Phosphorus Loads to Lake Erie by Source Type, 1967 - 2013.



Source: Maccoux M.J., Dove A., Backus S.M., Dolan D.M. (In press). Total and soluble reactive phosphorus loadings to Lake Erie. Journal of Great Lakes Research [\[http://www.sciencedirect.com/science/article/pii/S0380133016301460\]](http://www.sciencedirect.com/science/article/pii/S0380133016301460).

Domestic Actions Taken

While not a comprehensive list, the following summary is intended to convey the scope and variety of nutrient management efforts by federal, state and provincial departments and agencies since the 2012 GLWQA was signed in 2013.



- In the United States, hundreds of millions of dollars are being allocated for a wide array of projects that will reduce the loading of nutrients to the Great Lakes. The United States Environmental Protection Agency (EPA) is the coordinating agency for the Great Lakes Restoration Initiative (GLRI) – the largest investment in the Great Lakes in two decades – which is implemented by an Interagency Task Force of 11 federal departments or agencies. Federal agencies and their state partners are leveraging GLRI, the Farm Bill, and many other funding resources to enhance existing programs and develop new programs aimed at reducing nutrient loads into the Great Lakes. Some examples of this are highlighted below, with a focus on Lake Erie.

More than 680 projects and \$60 million of GLRI funds were invested in the Lake Erie basin from 2010 through 2015 to reduce nutrient pollution and to support related science and monitoring work.

- Major progress is being made to: 1) accelerate nutrient reductions on the ground, 2) enhance monitoring and research efforts to better understand the effectiveness of actions taken to reduce nutrient loadings, and 3) minimize health impacts associated with harmful algal blooms. Furthermore, many recently adopted strategies, policies and legislative actions in the Great Lakes Region will have lasting impact on protecting human health and the environment from excess nutrients.

Nutrient reductions “on the ground”

- During fiscal year 2015 alone, the GLRI funded nutrient and sediment reduction projects on over 100,000 acres in targeted agricultural watersheds in the Great Lakes basin. These projects are projected to prevent over 160,000 pounds (72.5 metric tons) of phosphorus from entering the Great Lakes annually. Federal agencies and their partners also funded urban runoff projects that are anticipated to capture an average annual volume of more than 37 million gallons of untreated urban runoff per year. These projects reduce flooding, increase green space in urban areas, and return vacant properties to productive use.
- In 2015, United States Department of Agriculture (USDA) awarded \$17.5 million to a Regional Conservation Partnership Program (RCPP) in the western Lake Erie watershed. The targeted approach focuses efforts on the 855,000 acres that have been identified as the most critical areas to treat within the larger 7-million-acre watershed. The RCPP project: 1) expands access to public and private technical assistance, 2) supports new and ongoing innovative conservation practices, and 3) provides expertise for modeling and evaluating outcomes to farmers in critical sub-watersheds. The five-year multi-state project includes more than 40 collaborating public and private sector organizations with representation from Ohio, Michigan and Indiana, state and local governments, as well as non-profit entities, universities and private sector businesses, committing an additional \$28 million to the project.

- In 2016, the USDA Natural Resources Conservation Service (NRCS) launched a new funding initiative and strategy based on the findings of their special study evaluating the impacts of voluntary conservation in the western basin of Lake Erie and conservation treatment needs. The WLEB Initiative will help landowners reduce phosphorus runoff from farms by more than 640,000 pounds (290 metric tons) each year – 175,000 pounds of which is in the form of soluble phosphorus – by effectively doubling the acres under conservation in the western basin of Lake Erie watershed over the course of the three-year investment.
- GLRI funding of more than \$1.7 million was provided by NRCS in 2015 to reduce phosphorus runoff and sediment pollution in priority watersheds in the Great Lakes basin through the Great Lakes Sediment and Nutrient Reduction Program. This federal/state partnership coordinated by the Great Lakes Commission was formerly known as the Great Lakes Basin Program for Soil Erosion and Sediment Control, but became the Great Lakes Sediment and Nutrient Reduction Program in 2015 to recognize the program’s increased emphasis on phosphorus reduction.
- The GLRI is also accelerating the implementation of conservation practices on Demonstration Farms in the Fox River watershed in Wisconsin and elsewhere in the region. The farms are open for annual tours where other farmers in the watershed can view the installed practices, hear farmers’ opinions on the value that conservation farming practices can add to their farming operations, and ask questions. In 2016, Ohio NRCS and the Ohio Farm Bureau Federation entered into a 5-year agreement to create the Blanchard River Demonstration Farms Network. Three farms committed a total of 700 acres to be enrolled in the Network and will implement standard and innovative conservation systems to reduce the quantity of sediment and phosphorus entering the western basin of Lake Erie watershed. Data collected by the USDA Agricultural Research Service from edge-of-field water quality monitoring stations will be used to evaluate the effectiveness of these conservation systems. “Farmer field days” will be held for peer-to-peer education and technology transfer over the life of the project.
- The Ohio Environmental Protection Agency is leading implementation of the Maumee River Sediment and Nutrient Reduction Initiative – a new \$3.7 million 5-year GLRI initiative comprised of a diverse coalition of 10 public and private entities using innovative agricultural sediment reduction practices and aggressive implementation.
- The Ohio Clean Lakes Initiative appropriated more than \$3.55 million for the installation of best management practices (BMPs) to reduce nutrient runoff in the western basin of Lake Erie watershed. State and local partners worked with more than 350 farmers to implement BMPs on more than 40,000 acres.
- Since 2010, the Ohio Environmental Protection Agency has awarded more than \$292 million in low-interest and interest-free loans from the Water Pollution Control Loan Fund for 138 projects in the western basin of Lake Erie watershed. These projects help local communities develop and implement long-term control plans to reduce overflows of nutrient-rich sewage into streams and lakes following heavy storms and snow melt.
- The Michigan Department of Environmental Quality has been working with the Detroit Water and Sewerage Department to proactively take measures to reduce loadings of Total Phosphorus from the Detroit plant, through lower permitted effluent limits and strategies to minimize untreated discharges from combined sewer systems. Optimization of the plant in 2013 has

reduced the average annual loading of Total Phosphorus to Lake Erie by approximately 65 Metric Tons.

- Indiana is working with landowners to help improve the water quality of streams and inland rivers, and ultimately Lake Erie, by partnering on several projects which will result in significant measurable load reductions in nutrients and sediment. A summary of the progress being made in Indiana's portion of the western basin of Lake Erie can be found at the Indiana State Department of Agriculture website (<http://www.in.gov/isda/3261.htm>).
- Pennsylvania is working with Lake Erie MS4 (municipal separate storm sewer system) municipalities to plan for future stormwater infrastructure needs, and with grape farmers to improve environmental and economic sustainability of their agricultural operations through the Pennsylvania Vested in Environmental Sustainability Program.
- The New York State Department of Environmental Conservation (DEC) is forming the Lake Erie Watershed Protection Alliance, comprised of three counties and numerous municipalities within the Lake Erie watershed that will work cooperatively to monitor Lake Erie tributaries and work locally to further reduce sources of nutrients and pathogens. The DEC is also partnering with the State's Department of Agriculture and Markets and the Genesee River Watershed Coalition of Conservation Districts to implement a strategy to promote and track the effectiveness of nutrient reduction best management practices among farms in the Genesee River watershed (part of the Lake Ontario Watershed), a GLRI Priority Watershed for Nutrient Reduction.

Enhanced monitoring and forecasting tools

- GLRI-funded research led by the National Oceanic and Atmospheric Administration's Great Lakes Environmental Research Laboratory, in collaboration with partners from the University of Michigan's Cooperative Institute for Limnology and Ecosystems Research, is investigating the impact of land use changes on algal bloom development in the western basin of Lake Erie and in Lake Huron's Saginaw Bay. The Great Lakes Environmental Research Laboratory combines remote sensing, monitoring, and modeling to produce weekly forecasts of *Microcystin* bloom concentration and transport in Lake Erie, which are distributed to regional stakeholders. National Oceanic and Atmospheric Administration researchers, with their partners at Heidelberg University, have also initiated early season projections of the seasonal harmful algal bloom severity in western Lake Erie.
- During fiscal year 2015, GLRI partners established a network of four real-time continuous observing buoys to track detailed water quality conditions to support modeling, forecasting, and public warnings of harmful algal bloom conditions throughout western Lake Erie. The observing buoys are capable of tracking water quality and bloom conditions and measuring soluble phosphorus concentrations at hourly intervals. During the 2015 bloom season, these buoys collected over 7,000 in-lake nutrient and water quality measurements, providing unprecedented spatial and temporal details of internal lake dynamics and bloom development. In addition to providing real-time tracking of harmful algal bloom conditions for water intake managers and recreational users, the observing data will be used to improve ongoing forecasting efforts covering a range of spatial and temporal scales including seasonal harmful algal bloom forecasts, five-day forecasts, and vertical distribution forecasts.

- After the “do not drink” advisory issued in Toledo, Ohio in August 2014, Ohio passed legislation in July 2015 to address harmful algal blooms and algal toxins at public water supplies. New rules were then finalized in 2016 that established a drinking water action level for microcystins, outlined monitoring requirements for microcystins and cyanobacteria screening, and established public notification, reporting, treatment technique and laboratory certification requirements. The state agencies in Ohio also worked together to revise the State’s Harmful Algal Bloom Response Strategy for Recreational Waters where harmful algal blooms exist or are suspected. Ohio is one of the first states to establish formal rules for issuing advisories when algal toxins are present at or above threshold levels.
- In coordination with the Pennsylvania Lake Erie Harmful Algae Bloom Task Force, the Pennsylvania Department of Environmental Protection began a strategic partnership with the Regional Science Consortium at Presque Isle to complete comprehensive monitoring of Pennsylvania Lake Erie beaches and public areas for the presence of harmful algal bloom conditions throughout the 2016 season.
- United States Geological Survey scientists collect water-flow and water-quality data from 24 tributaries to the Great Lakes to measure natural and human-caused sources of nutrients and sediment to the lakes. The Great Lakes National Monitoring Network continues to be enhanced through the use of automated samplers and water quality multi-sensor probes, to provide better baseline information on nutrient loads and demonstrate the ability to reduce monitoring costs through the use of real-time sensors.
- The National Oceanic and Atmospheric Administration National Weather Service is leveraging GLRI funding to develop and implement runoff risk reduction tools aimed at enhancing short-term (*i.e.*, the next 10 days) nutrient application management. Incorporated into their daily routines, this tool will alert applicators of future unsuitable conditions caused by rainfall or snowmelt that could result in undesired transport of recently applied manure and fertilizer from their fields into nearby water bodies.
- Federal agencies and partners are also working to expand edge of field (EOF) monitoring and research, which measures the amount of nutrients and sediment in water runoff from agricultural fields to compare the improvements under different conservation systems. This research is critical to evaluating the effectiveness of agricultural best management practices. The United States Geological Survey is leading a GLRI-funded effort with NRCS and other partners to conduct EOF monitoring on 22 farm sites in the Maumee River, Fox River, Saginaw River and Genesee River watersheds. These watersheds were selected because of the high density of agricultural land use and their ecosystem impairments.
- Also in partnership with NRCS, the United States Department of Agriculture’s Agricultural Research Services (ARS), has an extensive network of 42 EOF study sites in Ohio. The number, quality and spatial extent of this ARS managed effort is unprecedented and science from this work, particularly in conjunction with watershed assessment under NRCS’s Conservation Assessment Effects Program, has already been key to assessing nutrient losses and informing conservation strategies in the WLEB.

New Nutrient Management Strategies, Policies and Legislative Actions

- In June 2015 Governor Rick Snyder of Michigan, Premier Kathleen Wynne of Ontario and Lieutenant Governor Mary Taylor of Ohio signed the Western Basin of Lake Erie Collaborative Agreement which establishes a collaborative initiative that will use adaptive management to achieve a recommended 40% total load reduction in the amount of total phosphorus and soluble reactive phosphorus entering the western basin of Lake Erie by the year 2025 with an aspirational interim goal of a 20% reduction by 2020. Each state and province committed to developing, with stakeholder involvement, a plan outlining their proposed actions and time lines toward achieving the phosphorus reduction goal. Michigan and Ohio released draft implementation plans in response to this commitment in 2015 and 2016, respectively.
- In May 2014, Ohio Governor John R. Kasich signed into law Senate Bill 150. The bill requires fertilizer applicators to undergo education and certification by the Ohio Department of Agriculture (ODA); encourages producers to adopt nutrient management plans; and allows ODA to better track the sales and distribution of fertilizer. In April 2015, the Governor signed Senate Bill 1, legislation to protect Lake Erie and Ohio's water quality. Highlights include: restrictions on fertilizer and manure application on frozen, snow-covered or saturated ground in the western basin of Lake Erie watershed; prohibition of open lake disposal of dredge material by 2020; and additional phosphorus monitoring at wastewater treatment facilities.
- Minnesota's landmark buffer law will establish new perennial vegetation buffers along rivers, streams, lakes, public ditches and some wetlands. Buffers protect water resources by helping filter out phosphorus, nitrogen and sediment. Governor Mark Dayton championed the buffer initiative legislation in the 2015 and 2016 sessions. Studies by the Minnesota Pollution Control Agency show that buffers are critical to protecting and restoring water quality and aquatic habitat.
- In January 2010, New York's Phosphorous Runoff Act went into effect, designed to reduce water pollution caused by excess phosphorus running off lawns into New York waters by restricting sales of all non-agricultural fertilizer to concentrations less than 0.67% phosphate, with certain exceptions. Since 2014-2015, the State Attorney General has reached settlements on violations of the law by major retailers at 12 stores in the Lake Erie/Niagara River watershed.
- In June 2014, Congress reauthorized the Harmful Algal Bloom and Hypoxia Research and Control Act (HABHRCA) by passing the Harmful Algal Bloom and Hypoxia Research and Control Amendments Act of 2014 (HABHRCA 2014, P.L. 113-124). The reauthorization of HABHRCA acknowledged concerns related to harmful algal blooms (HABs) and hypoxia, extended the scope of the legislation to include freshwater HABs and hypoxia, and recognized the need for further coordinated action across the federal sector to address these issues. Additionally, the legislation called for federal agencies to provide integrated assessments on the causes and consequences of and approaches to reducing HABs and hypoxia nationally, with particular emphasis on the Great Lakes. Finally, the reauthorization included a specific focus on the needs of stakeholders, requiring that federal agencies engage with stakeholders around the country.
- On August 7th, 2015, the President signed H.R. 212 (Drinking Water Protection Act) which directs EPA to develop and submit a strategic plan for assessing and managing risks associated with algal toxins in drinking water provided by public water systems. The resulting [Algal Toxin Risk Assessment and Management Strategic Plan for Drinking Water](#), released in November

2015, includes steps and timelines to assess: algal toxins and their human health effects, health advisories, factors likely to cause HABs, treatment options, analytical methods, frequency of monitoring, treatment options, and source water protection practices.

- Currently there are no U.S. federal water quality criteria, or regulations for cyanobacteria or cyanotoxins in drinking water under the Safe Drinking Water Act (SDWA) or in ambient waters under the Clean Water Act (CWA). However, under the SDWA, EPA may publish Health Advisories for contaminants that are not subject to any national primary drinking water regulation. EPA developed Health Advisories for the cyanobacterial toxins microcystins and cylindrospermopsin in 2015, and is currently developing Ambient Water Quality Criteria for cyanotoxins for the protection of recreational activities in freshwater systems.
- The Ohio Environmental Protection Agency is developing Nutrient Water Quality Standards targeting phosphorus and nitrogen in response to U.S. EPA's national nutrient criteria recommendations and the Clean Water Act. In 2013, the Ohio Environmental Protection Agency asked for public comments from various stakeholder groups. A nutrient technical advisory group will advise Ohio Environmental Protection Agency as it moves forward with the next steps in developing nutrient standards.
- As part of Indiana's Nutrient Reduction Strategy, in 2013, the Indiana Conservation Partnership began using a common Load Reduction model to track and report the impact of installed conservation practices on water quality. Nutrient and sediment load reductions are estimated from a variety of state and federally funded programs. Indiana is the only state in the country to adopt a common model among so many partners to estimate conservation impact on a statewide scale.
- Following an extensive engagement process, the Michigan Department of Environmental Quality's Office of the Great Lakes recently finalized a new Water Strategy built around a 30-year vision for ensuring that Michigan's water resources support healthy ecosystems, residents, communities and economies. A key recommendation in the strategy is to achieve a 40% reduction to phosphorus in the western basin of Lake Erie watershed.



- Canada and Ontario are taking action under the Canada-Ontario Agreement on Great Lakes Water Quality and Ecosystem Health, 2014, to reduce phosphorus loads to Lake Erie through urban, agricultural, rural and industrial or commercial point and non-point source initiatives including ongoing infrastructure and agricultural stewardship programs. To further improve the effectiveness of current and future phosphorus reduction actions in Lake Erie, Canada and Ontario, along with their partners and stakeholders, are working to review and where necessary implement changes to the existing program, policy and legislative phosphorus management frameworks.
- Canada's Great Lakes Nutrient Initiative (2012-2016) enhanced Environment and Climate Canada funding to support the critical science and policy development needed to support the establishment of new phosphorus reduction targets for Lake Erie. Initiative activities included:
 - Enhanced water quality monitoring at key locations in the Lake Erie basin – including the Thames River, the Sydenham River, the Detroit River and the Grand River – in order to

- measure phosphorus concentrations and loads from the Canadian portion of the Lake Erie basin;
 - New modeling and research to enhance understanding of the factors contributing to the reoccurrence of large scale outbreaks of toxic and nuisance algae in Lake Erie;
 - An assessment of current Canadian best practices and policy options for reducing loadings of phosphorus to Lake Erie in order to achieve targets;
 - An assessment of socio-economic costs of algal blooms in Lake Erie;
 - The development of inventories of phosphorus management programs;
 - Cost-benefit modeling of phosphorus management in the Grand River basin; and
 - An assessment of future trends and demographics in urban and agriculture landscapes in the Lake Erie basin.
- Canada's 2016 Federal Budget announced \$3.1 million in 2016 to 2017, to Environment and Climate Change Canada, to continue to improve nearshore water and ecosystem health, by reducing phosphorus and the resulting algae in Lake Erie. With these resources, and building on the work accomplished under the Great Lakes Nutrient Initiative, the focus will shift from setting phosphorus targets to achieving them, including developing a domestic action plan in collaboration with Ontario and other partners, and monitoring and reporting on progress.
- Canada's 2016 Federal Budget also announced a five-year, \$5.0 billion investment in water, wastewater and green infrastructure projects across Canada. This includes the \$2 billion Clean Water and Wastewater Fund (CWWF), of which \$569,642,062 has been allocated for water and wastewater projects in the Province of Ontario. The CWWF, and existing programs such as the New Building Canada Fund – Provincial-Territorial Infrastructure Component (NBCF-PTIC), will address phosphorus loads from municipal wastewater, as well as other priorities. Provinces and territories, in consultation with municipalities, are responsible for identifying projects to be funded through the CWWF and the NBCF-PTIC, including projects for reducing phosphorus loads in the Great Lakes.
- Canada continues to invest in research that improves our understanding of phosphorus uptake and movement, and develops best management practices and technologies to improve crop nutrient use efficiency and reduce phosphorus losses from agricultural production to the Great Lakes. Over the last three years, projects funded by Agriculture and Agri-Food Canada have investigated the nature of losses of phosphorus through subsurface tile drains, improved field and regional indicators of risk of phosphorus loss to water, developed tests to indicate availability of phosphorus from different manures and soils to crops and losses by water, and characterized the Canadian basin of Lake Erie by agricultural production systems (*i.e.*, cropping, livestock, horticulture). Research on Lake Erie is also a priority under the science sector strategy for *Agro-ecosystem Productivity and Health*, which is one of the sector strategies guiding future Agriculture and Agri-Food Canada investment in research.
- Canada has also launched discussions with provinces, towards renewing Canada's federal-provincial agricultural policy framework, called Growing Forward. Discussions on priorities for a renewed Growing Forward agreement will take into consideration agricultural contributions to phosphorus loadings.
- As part of the Growing Forward agreement, the governments of Ontario and Canada launched the Great Lakes Agricultural Stewardship Initiative (<http://www.ontariosoilcrop.org/oscia->

[programs/glasi/](#)), to provide \$4 million annually, over 2015 to 2018, in targeted support for farmers in the Lake Erie and Lake St. Clair watersheds, and in Lake Huron’s southeast shores watershed. Producers and their advisors will identify ways producers can improve soil health, reduce run-off, modify equipment to address risks related to manure application, create soil erosion control structures, grow cover crops, manage crop residue, and build buffer and shelter strips. As part of this initiative:

- Sub-watersheds requiring focus and attention have been selected where a systems approach to best management practices will be demonstrated, verified, measured and modeled to determine their reduction of non-point phosphorous loading.
 - Education and outreach projects are underway to promote greater understanding of Great Lakes water quality and to promote the uptake of actions to improve it.
 - The Farmland Health Checkup, a proactive whole farm environmental evaluation was created. The Farmland Health Checkup identifies site specific actions to manage phosphorus and soil health by teaming farmers with trained agronomic and water quality experts. Cost-share funding is available for implementing identified actions that reduce phosphorus loss and improve soil health.
- Agriculture and Agri-Food Canada and the Ontario Ministry of Agriculture, Food and Rural Affairs funded the Water Resource Adaptation and Management Initiative (WRAMI) and the Water Adaption Management and Quality Initiative (WAMQI) for \$3 Million. The WRAMI initiative in 2013 (17 projects) and the expanded WAMQI in 2014 (28 projects) included projects to help Ontario farmers better manage nutrients and minimize off-site impacts of nutrients on surface and ground water quality. Demonstration of technologies such as closed system water recycling, precision manure application, low erosion and cover crop planting were all part of this initiative.
 - Ontario’s Great Lakes Protection Act, 2015, which received Royal Assent on November 3, 2015, reflects the goals and principles of Ontario’s Great Lakes Strategy and enshrines it in law, setting out detailed requirements for strategy contents, reporting and periodic review (<https://www.ontario.ca/page/protecting-great-lakes>). The Act is designed to help address the significant environmental challenges facing the Great Lakes and St. Lawrence River basin, including the changing climate. One of the initial priorities identified under the Act for immediate action is reducing harmful algal blooms by committing to establishing at least one target within two years to support the reduction of algal blooms; and the Act will enable geographically-focused initiatives as a tool for developing and implementing policies to address priority issues, including reducing excessive algae, in a specific location.
 - Ontario government researchers are adding to the understanding of harmful algal blooms and nuisance algae by monitoring nearshore water quality at 17 drinking water intake sites in the Great Lakes, including five locations in Lake Erie. The Government of Ontario also monitors 70 sites in nearshore areas of the Great Lakes to track long-term trends in Great Lakes water quality. These long-term data sets, together with special studies in the lakes and their tributaries, advance our understanding of nearshore responses to climate change and other stressors, including changes in nutrient loading.
 - In 2013, the Government of Ontario launched the Multi-Watershed Nutrient Study. The seven-year study will examine the management of agricultural land and the extent of nutrient runoff in

11 agricultural watersheds in the basins of Lakes Erie, Ontario and Huron. This will be an ongoing study to determine the role agriculture can play in resolving a very complex issue. Comparative data from previous studies will be used to track changing climate conditions, to develop a “then-and-now” analysis and to model future scenarios.

- The Ministry of Environment and Climate Change, together with the Ministry of Agriculture, Food and Rural Affairs, ensure the requirements of the Nutrient Management Act and regulations are met by farmers through approval of nutrient management plans and strategies that detail the source, rate, time and placement of nutrients for crop growth. Ontario continues to provide training, examination and certification of professional nutrient management planners which work with farmers to apply environmentally responsible nutrient use. Resources detailing better management practices and regulatory requirements have been updated to be more interactive and easier to use.
- In 2016, the Government of Ontario increased targeted engagement with the agricultural community to encourage organizations and industry to take the lead in addressing the phosphorus issue. A working group, composed of farmers, conservation authorities, agri-business and farm organizations, was convened to discuss and analyze key priorities to identify and implement additional actions to improve water quality. Topics included timing of application of nutrients and expanded use of cover crops. Workgroup members have initiated pilot projects to support further uptake of actions by farmers such as: in-field demonstrations; education workshops; best management practices toolkits; performance standards coaches for nutrient management; and research to support continuous improvement.
- The Government of Ontario worked with the Ontario Greenhouse Alliance on an overall strategy to reduce phosphorous discharges into the Leamington tributaries – a priority watershed under the 2012 GLWQA due to the presence of nearshore algae blooms. In January 2015, as part of this strategy the Government of Ontario instituted new regulations, under the Nutrient Management Act, to provide an effective option whereby nutrients that can no longer be used in the greenhouse, may be applied to field crops. In the spring of 2016, growers were offered additional information and cost-share support to help them achieve compliance approval for surface water discharges by March 31, 2017.
- 4Rs Nutrient Stewardship is an internationally recognized approach based on core scientific principles of applying the right source of plant nutrition, at the right rate, at the right time, and in the right place to improve nutrient use efficiency to reduce any potential nutrient loss into the environment. As a result of the partnership of the Ontario Ministry of Agriculture, Food and Rural Affairs, Fertilizer Canada, and the Ontario Agri Business Association, Ontario is piloting 4R initiatives ahead of broader implementation across the Lake Erie basin and has successfully:
 - Implemented 20 4R Demonstration Farms;
 - Reached more than 115 Ontario growers through 4R Nutrient Stewardship Workshops;
 - Enrolled 21 agri-retailers in the Ontario Agri Business Association’s voluntary 4R Designated Acres pilot program; and
 - Launched the Ontario Certified Crop Advisor 4R Nutrient Management Specialty Certification; 65 of Ontario’s Certified Crop Advisors are registered to write the certification exam in August 2016.

- Between 2013 and 2016, Ontario Ministry of Agriculture, Food and Rural Affairs' research programs, University of Guelph Partnership and New Directions, provided approximately \$3.4 million in direct project operating funding to 25 research projects that targeted improvement of agri-food sector's water quality and nutrient management efficiency in the Great Lakes watershed. Another \$1 million since 2013 in 21 applied field projects verified and demonstrated best management practices to support the reduction of phosphorus to Lake Erie. The objectives of these research projects include development and evaluation of wastewater treatment technologies/best management practices, improvement of nitrogen use efficiency in crops, understanding phosphorus dynamics and non-point sources in the field, groundwater quality and soil health. The major research collaborators/partners include primary producers, food processors, Ontario universities and colleges, conservation authorities and non-governmental organizations.