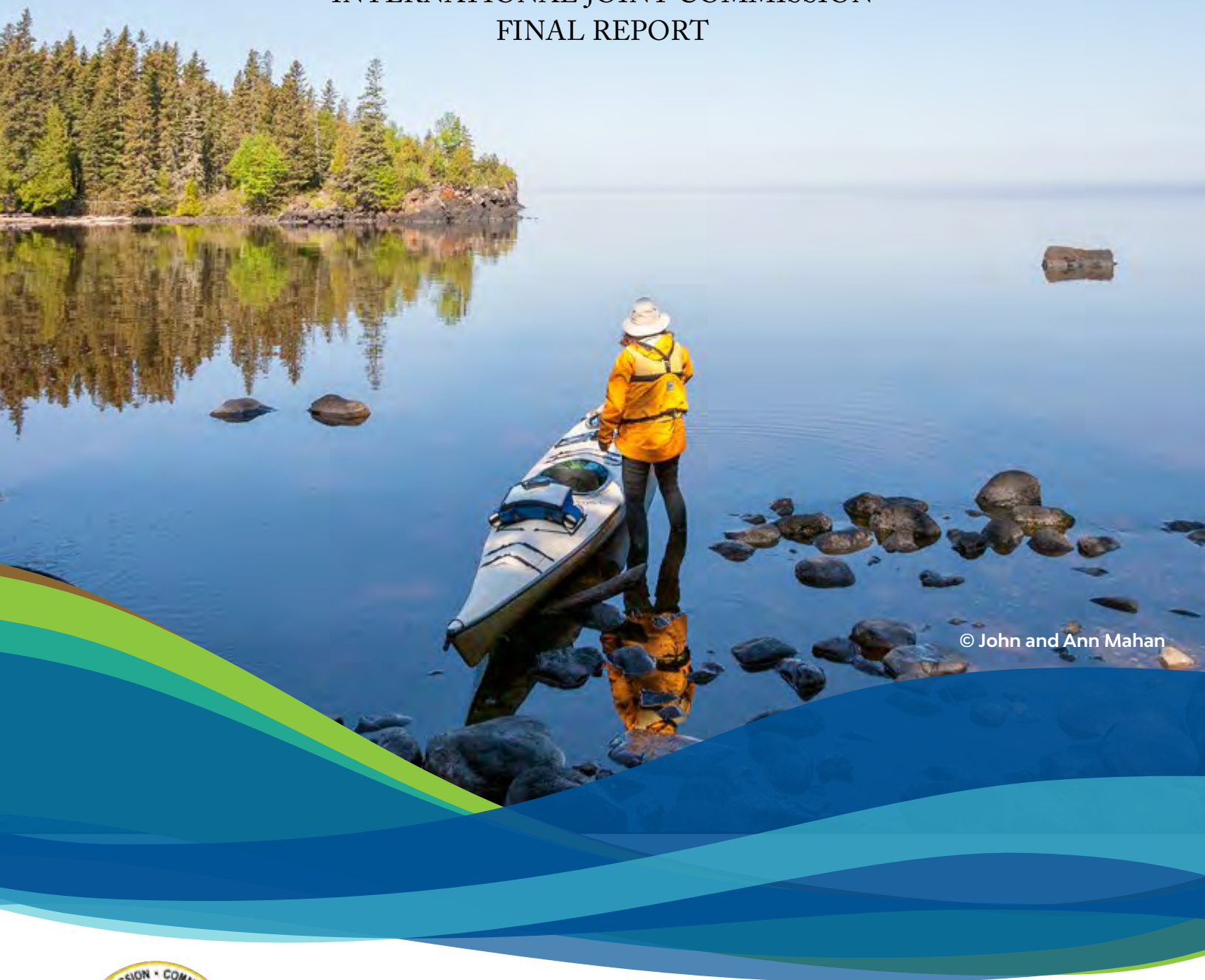


~ FIRST TRIENNIAL ASSESSMENT OF PROGRESS ON~

# GREAT LAKES WATER QUALITY

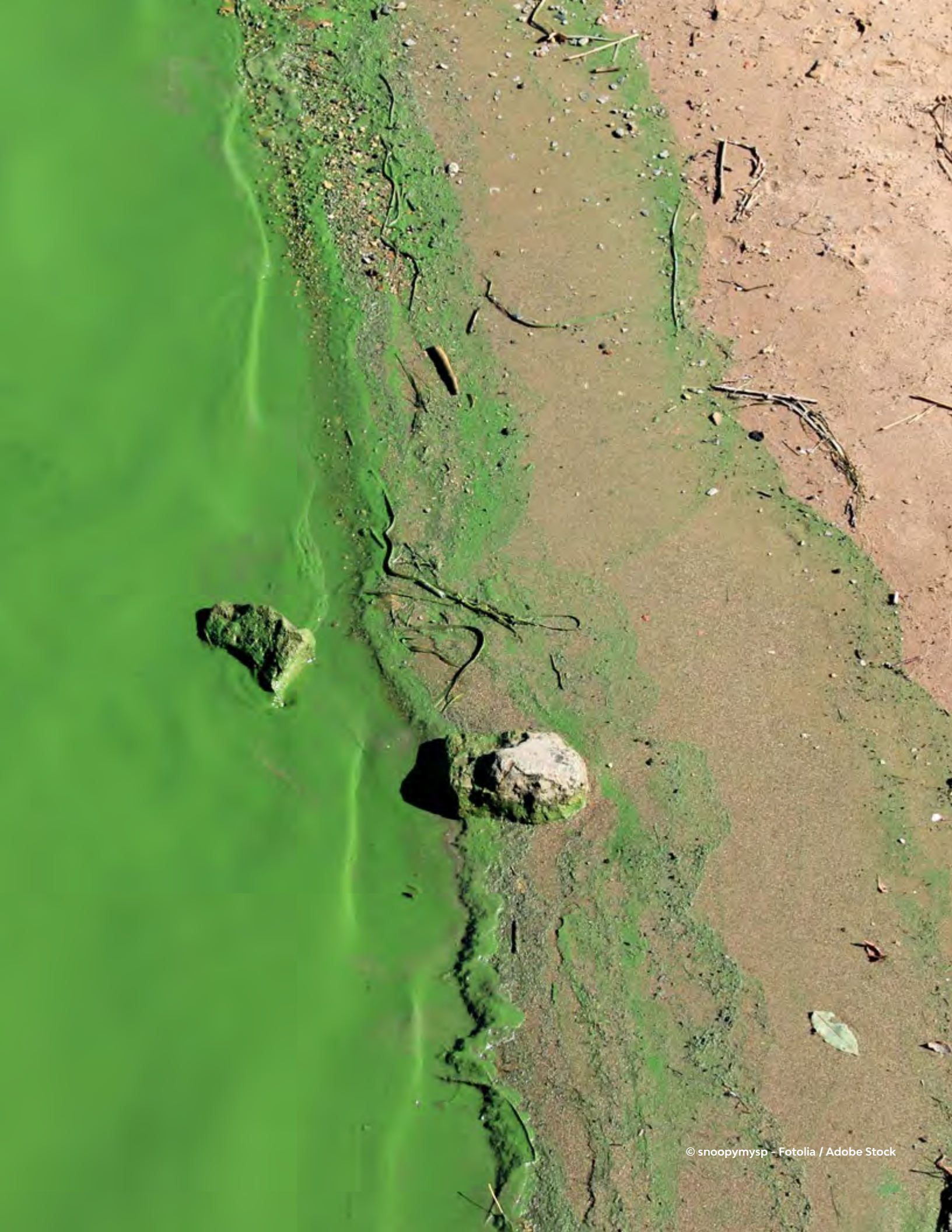
INTERNATIONAL JOINT COMMISSION  
FINAL REPORT




Prepared by  
The International Joint Commission Pursuant  
to Article 7 (1) (k) of the 2012 Great Lakes Water  
Quality Agreement

NOVEMBER 28, 2017









*“Environmental  
pollution is an incurable  
disease. It can only  
be prevented.”*

– Barry Commoner

Barry Commoner (1917-2012) was an American biologist, college professor and politician, and among the founders of the modern environmental movement.

## COMMISSIONERS

*Lana Pollack*

*Gordon Walker*

*Rich Moy*

*Benoît Bouchard*

*Richard Morgan*

November 28, 2017

Please go to <http://ijc.org/files/tinymce/uploaded/GLWQA/TAP.pdf> to download the full Triennial Assessment of Progress report, to [http://ijc.org/files/tinymce/uploaded/GLWQA/TAP\\_TA.pdf](http://ijc.org/files/tinymce/uploaded/GLWQA/TAP_TA.pdf) to download the Technical Appendix, and to [http://ijc.org/files/tinymce/uploaded/GLWQA/TAP\\_PCA.pdf](http://ijc.org/files/tinymce/uploaded/GLWQA/TAP_PCA.pdf) to download the Summary of Public Comment Appendix.









# MESSAGE FROM THE INTERNATIONAL JOINT COMMISSION

Governments exist to serve the people. With this in mind, the International Joint Commission presents its first triennial assessment of progress on Great Lakes water quality pursuant to Article 7.1 (k) of the 2012 Great Lakes Water Quality Agreement (GLWQA).

This report provides advice and recommendations to assist the federal governments to better meet the general and specific objectives of the GLWQA. The advice and recommendations found in this report may also be applicable to other levels of government, academia, nongovernmental organizations, private industry and the public.

This report is grounded in science and rooted in the values and views of the many individuals who comprise the Great Lakes community. After releasing a draft of this report in January 2017, the Commission sought the community's reactions through thirteen public meetings, roundtables and listening sessions, through our online democracy platform, Participate IJC, and our newsletters, social media and website, and via email and letters.

The dialogue was robust. The public raised more than 65 issues and provided insight and advice. While the Commission did not research or incorporate in its recommendations all the public's concerns, it found much value in the insights of those who contributed during the open comment period.

For the last 45 years, since the initial signing of the Agreement, the governments of both great nations have recognized their responsibilities, as trustees of the lakes on behalf of their citizens, to protect, defend and restore the multiple values of these freshwater jewels. This report is a direct outgrowth of their commitment to be accountable to the public for the fulfillment of these responsibilities. The Agreement has evolved since 1972 to reflect a changing scientific understanding of the lakes, a growing binational relationship, and emerging challenges such as climate change.

Why is the Commission charged with preparing this report? Since the 1978 revision of the water quality agreement, the International Joint Commission has served as an independent assessor of the progress made by the two governments in achieving the Agreement's objectives.

The Commission wishes to acknowledge other governments deeply concerned with the health of the Great Lakes. Amongst these governments are Tribal, First Nations and Métis governments. These governments and their peoples need to be engaged as rights holders with recognition and appreciation of their governance, identity, cultures, interests, knowledge and traditional practices.

Commissioners appreciate the essential support of its staff in preparing this report and want to note with respect and gratitude the valuable contributions made by the Great Lakes Water Quality Board, the Great Lakes Science Advisory Board

and the Health Professionals Advisory Board of the IJC, as well as the public and indigenous peoples. The Commission strongly encourages a continuing dialogue and engagement with all groups to sustain the restoration, maintenance and protection of the lakes for future generations. Commissioners hope that this report will be an important part of this dialogue.

The governments of Canada and the United States and Great Lakes civil society as a whole are living with the costly consequences of past failures to anticipate environmental problems. In making this assessment of progress, the Commission viewed matters through the prism of prevention, how lessons learned from the past are used to avoid current and future problems. Actions by the governments to implement the GLWQA were reviewed not just with respect to what existing water quality issues were addressed but also with respect to actions taken to prevent new degradation of water quality from occurring. The Commission urges both countries to adhere to the prevention principle they wisely incorporated in the 2012 revision to the GLWQA. A number of recommendations provided in this report offer specific examples of how this can be implemented.

Despite different perspectives and opinions, there is a value shared among the peoples of the lakes: that all the riches of the Great Lakes matter, and that we must do our best to preserve them for all time. We hope this report will contribute to that cause.



Gordon Walker  
Canadian Section Chair

Lana Pollack  
United States Section Chair

Benoît Bouchard  
Canadian Commissioner

Rich Moy  
United States Commissioner

Richard Morgan  
Canadian Commissioner











## EXECUTIVE SUMMARY

The International Joint Commission (IJC or Commission) is charged by the 2012 revision of the Great Lakes Water Quality Agreement (referred to throughout this report as GLWQA or Agreement) to submit a triennial assessment of progress regarding Great Lakes water quality to the United States and Canadian governments (the Parties to the GLWQA). Pursuant to Agreement Article 7.1 (k) the Assessment of Progress Report is to include:

- i. a review of the Progress Report of the Parties;
- ii. a summary of public input on the Progress Report of the Parties;
- iii. an assessment of the extent to which government programs and measures are achieving the General and Specific Objectives of this Agreement;
- iv. consideration of the most recent State of the Lakes Report; and
- v. other advice and recommendations, as appropriate.

This report fulfills these requirements.



This is the IJC's first triennial report under the 2012 GLWQA. In submitting it to the Parties, the Commission believes it will also be useful to other orders of government, and all people who care about the well-being of the lakes.

The IJC finds much to commend in the Parties' work under the GLWQA. In this first triennial cycle of implementation, the Parties successfully met deadlines to develop priorities for science and action, propose a nearshore framework, and set phosphorus load reduction targets for Lake Erie. The 2012 GLWQA also galvanized new energies and activity over a larger span of issues than was covered by previous versions of the Agreement.

Progress toward meeting the GLWQA's general objectives includes accelerated restoration of contaminated Areas of Concern, the development of binational habitat conservation strategies, the absence of newly introduced aquatic invasive species, and comprehensive reporting on groundwater science. But more work needs to be done.

Significant challenges include the increase in harmful algal blooms in Lake Erie, the slow pace in addressing chemicals of mutual concern, and the spread of previously introduced invasive species. Governments also need to pay additional attention to infrastructure investments that are essential to eliminate the discharge of untreated or insufficiently treated waste into the Great Lakes and reduce risks to human health.

The IJC firmly believes that achieving the GLWQA's purpose and objectives will happen only if all sectors of the Great Lakes community are involved. Article 7 of Agreement requires the Commission to consult on a regular basis with the public, increase awareness of the lakes' inherent value, and prepare a summary of public input on the Progress Report of the Parties. The IJC conducted extensive public engagement activities to meet these requirements and to solicit views from the public on a draft of this report released in January 2017. The Commission received input at thirteen public meetings, roundtables and listening sessions, through the online democracy platform, Participate IJC, and its newsletters, social media and website, and via email and letters. All comments were carefully considered in the production of this triennial assessment of progress report.

Article 2 of the GLWQA sets forth a set of 16 principles and approaches the Parties agree to use in Agreement implementation. The IJC views three as especially important: prevention, foremost, followed by accountability and engagement. The Commission identified progress on each of these three principles and approaches, but



adds that improvements are needed to fully realize their potential.

Based on its assessment of progress and the input received from the public, the Commission presents this summary of key findings and recommendations from the report.

## IMPLEMENTING THE GLWQA

The IJC finds that the 2012 GLWQA galvanized new energies, activity and binational cooperation. **The Parties are to be commended for authoring the new GLWQA, giving it momentum and harmonizing implementation activities.**

In just three years, the Parties have made remarkable progress formalizing mechanisms by which the new GLWQA can be implemented and meeting deadlines for initial Agreement commitments.

The Commission salutes the Parties for these achievements. **To support further progress, the Commission recommends that governments' financial investment in restoration and prevention continue at current or higher levels.**

## PROTECTING HUMAN HEALTH

**The IJC finds that governments have not demonstrated sufficient progress toward achieving the human health objectives in their implementation of the GLWQA.**

The human health objectives are those related to the drinkability, swimmability and fishability of the Great Lakes. The Parties could improve their approach to and success in addressing human health objectives by enhancing focus on objective achievement, increasing coordination among jurisdictions and improving accountability.



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The Commission identified specific gaps in achieving human health objectives, including the protection and reporting of source water quality in the United States and the need for better communication of fish consumption advisories to vulnerable populations across the basin. Most importantly, the IJC finds that the continued discharge of inadequately treated and untreated sewage into the Great Lakes is unacceptable. **The IJC recommends that the Parties establish an accelerated and fixed period of time by which zero discharge of inadequately treated or untreated sewage into the Great Lakes will be effectively achieved and dedicate sufficient resources to accomplish the task.** The Parties also need to provide support to communities to proactively and systematically improve their capacity to respond to extreme storm events, especially as related to combined sewer overflows, planning, zoning and adaptation.



## REDUCING POLLUTANTS

**The IJC finds that progress on chemicals of mutual concern has been insufficient relative to the threat that toxic pollutants pose to the health of humans, wildlife and aquatic organisms in the Great Lakes basin.** The Commission recommends that the Parties accelerate work on strategies for elimination or continual reduction of chemicals of mutual concern with clear timelines set and met for strategy development and implementation. **These strategies should have at their core the principle of zero discharge. The IJC also recommends that the Parties adopt and extend policies and programs based on the principles of Extended Producer Responsibility on a broad range of products, including flame retardants, to prevent introduction of toxic and non-toxic contaminants into the Great Lakes.**

## CONTROLLING NUTRIENTS

**The IJC finds that the water quality of western and central Lake Erie remains unacceptable.** The Commission acknowledges the progress that has been made by the Parties, including setting phosphorus load reduction targets for the western and central basins. In particular, the IJC commends the participative approach used by the Parties for the development of these targets. However, the poor condition of Lake Erie warrants swifter action designed to achieve the targets.





The IJC recommends that the Parties further act on advice from the IJC's 2014 report on Lake Erie, most notably with respect to the need for enforceable standards governing the application of agricultural fertilizer and animal waste, along with better linkage between agricultural subsidies and farm operator use of conservation practices that are demonstrably effective at curbing phosphorus runoff. The IJC also recommends periodic testing and enforceable standards for septic systems, better stormwater management systems in urban areas and the accelerated use of green infrastructure. **Most importantly, the domestic action plans to achieve phosphorus load reduction targets must**

**include details on timelines, who is responsible for actions, expected deliverables, outcomes, and quantifiable performance metrics in order to assure accountability.** Finally, as recommended in the 2014 IJC report, the State of Ohio should, under the United States Clean Water Act, list its waters of the western basin of Lake Erie as impaired because of nutrient pollution. This would trigger the development of a tri-state phosphorus total maximum daily load (TMDL) involving Ohio, Michigan and Indiana, with US Environmental Protection Agency oversight. The State of Michigan has now listed its Lake Erie waters as impaired.



## COMBATING INVASIVE SPECIES

Preventing the introduction of new invasive species, both aquatic and terrestrial, receives strengthened consideration in the 2012 GLWQA. **The IJC finds that there has been significant progress in preventing the introduction of aquatic invasive species to the Great Lakes.** However, continued vigilance is required to prevent new introductions. The Commission recommends the Parties require ballast water exchange

and flushing in addition to discharge treatment for seagoing vessels. The IJC also recommends that the Parties continue to devote significant resources to prevent Asian carp from invading the Great Lakes. **The Commission finds that work is required to control the spread of species that have already been introduced, in particular invasive *Phragmites*.** To address the spread of previously introduced invasive species, the Commission recommends that the Parties reach agreements on permitting the use of safe and effective control measures across all jurisdictions.



## CLEANING UP AREAS OF CONCERN

The IJC finds that the first triennial cycle of the 2012 GLWQA has been a time of great progress for Areas of Concern (AOCs) with many beneficial use impairments removed in the United States and Canada and three US AOCs delisted. The IJC recommends that the Parties continue to advance implementation of remedial actions in all remaining AOCs by maintaining, or accelerating, investments and action, and setting a 15-year goal for completing remedial actions at all AOCs. The IJC also recommends enhancing public engagement through the remedial action program by creating meaningful opportunities for binational dialogue between AOC stakeholders, and supporting public advisory councils as they transition to life after delisting in their AOC.

## RESPONDING TO CLIMATE CHANGE

A changing climate has been influencing the Great Lakes for some time. Further climatic change is built into the future, thanks to inexorably rising carbon dioxide concentrations in the atmosphere. The addition of a Climate Change Impacts Annex to the 2012 GLWQA represents a positive step towards addressing these issues in the basin. **However, the IJC finds that there is no Great Lakes**

**basinwide perspective, approach or strategy for addressing climate change. The Commission recommends that the Parties demonstrate global leadership by jointly developing, in cooperation with other government jurisdictions, including indigenous governments, and nongovernmental organizations in the Great Lakes, a binational approach to climate change adaptation and resilience in the Great Lakes.** The IJC also recommends that the Parties invest in a binational vulnerability assessment, defining the risks posed by climate change and providing technical support for measures to adapt to climate change, to engage stakeholders and all orders of government, and to identify priorities for responsive actions in the Great Lakes region, in particular recognizing the impacts of climate change on water infrastructure.





## STRENGTHENING ENGAGEMENT

In the GLWQA, the Parties commit to “incorporating Public opinion and advice, as appropriate, and providing information and opportunities for the Public to participate in activities that contribute to the achievement of the objectives of this Agreement.”

**The IJC finds that the Parties have not fully incorporated robust public engagement into their activities.** For example, the Parties are not showing sufficient urgency in confirming their approach to public engagement and related activities for Annex 2 (Lakewide Action and Management Plans or LAMPs). Additionally, LAMP partnerships took more than three years to begin establishing their outreach and engagement work groups – after the existing committees were disbanded. Without robust

engagement, connections do not always exist between GLWQA processes and many affected communities. The Commission recommends that the Parties accelerate and deepen their approach to public engagement in LAMPs, including inbasin opportunities for participation and the use of social media and online engagement mechanisms.

**The IJC also finds that the Commission and the Parties should reach beyond the limits and audiences typically recognized and should factor in consideration of environmental justice as a key objective.** The Commission recommends that the Parties include more opportunities for public engagement with diverse communities and engage Tribal, First Nations and Métis governments in GLWQA implementation, incorporating greater contributions from these groups in the triennial Progress Report of the Parties.



## ENHANCING ACCOUNTABILITY

The IJC finds that the Parties have substantially improved accountability under the GLWQA by implementing a three-year reporting cycle, producing the Progress Report of the Parties, and improving the selection of indicators in the State of the Great Lakes Report. However, accountability mechanisms can be further improved in subsequent cycles. Release of the Progress Report of the Parties and State of the Great Lakes report should be timed to support discussion at the Great Lakes Public Forum. **Clear, time-bound targets for action are needed as are long-term aspirations for improvements in the**

**status and trends of Great Lakes indicators against which progress can be more definitively assessed. The Commission supports a comprehensive binational Great Lakes monitoring program to provide the essential information and understanding needed to forecast change, prevent or mitigate impacts, and restore and preserve the Great Lakes ecosystem.**

The IJC sincerely appreciates the time, thoughts and experiences of each person who contributed to the consultation process undertaken for this report. The IJC hopes that this assessment stimulates a continued vigorous dialogue about progress and that it supports ideas and action to further strengthen Great Lakes protection and restoration.



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S. Nordrum (The Leech Lake Band of Ojibwe Youth Ricing)





# GREAT LAKES INDIGENOUS NATIONS THANKSGIVING ADDRESS

*The Great Lakes have been a site of human activity since time immemorial. We humbly ask permission from all our relatives, our elders, our families, our children, the winged ones, the four legged, the swimmers and all the plant and animal nations, to work on their behalf for the protection of the waters. We are stewards of the Great Lakes to which we are deeply connected knowing that our health as a people is intricately tied to the health of the lakes. Our first medicine is water, because life would not be possible without the blessings of the waters. The Great Lakes do not separate us. They connect us together in our humanity.*

*We gather in peace and honor our duty to work for the protection of the Great Lakes. We bring our minds together as one, and we give greetings and thanks to each other as relations. We acknowledge the spirit and support of our clans as we work to protect the lakes. We give thanks for when we are able to come together to speak for the waters. And we ask in a humble and a good way for everyone to have the strength and courage to carry forward the actions detailed in this report. Now our minds are one. We remember to give thanks and offer respect for all those who have gone on before us and those yet to come. And on behalf of our children, we say, with love, thank you to the waters of the Great Lakes.*

**Kelsey Leonard, Shinnecock Indian Nation**





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## 1. INTRODUCTION

The International Joint Commission (IJC or Commission) is a binational organization created by Canada and the United States in the *Boundary Waters Treaty of 1909* (the Treaty). Under the Treaty, the two countries cooperate to prevent and resolve disputes relating to the use and quality of many lakes and rivers along their shared border. The Great Lakes Water Quality Agreement (GLWQA or Agreement) assigns the IJC an independent advisory role in assessing progress, engaging the public and providing scientific and policy advice to help the two countries restore and maintain the chemical, physical and biological integrity of the waters of the Great Lakes.

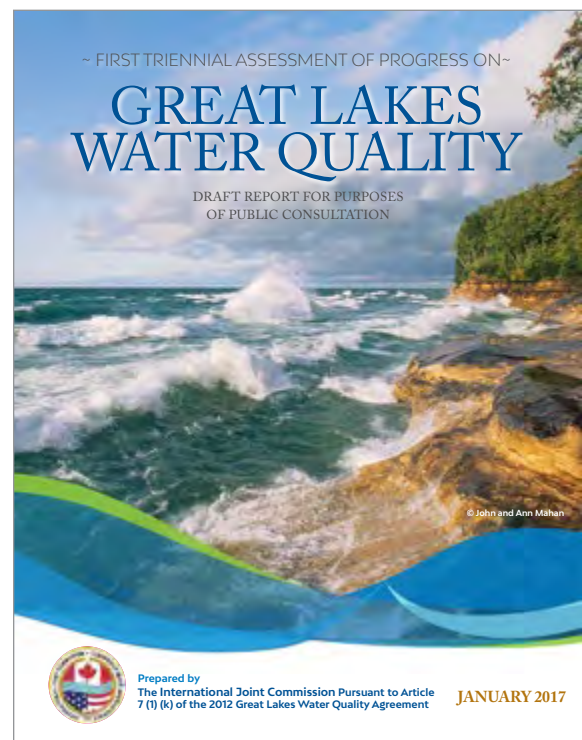
This report is the IJC's first triennial assessment of progress under the authority of the 2012 Protocol to the GLWQA. Article 7.1 (k) of the Agreement specifies that the IJC's triennial "Assessment of Progress Report" is to include:

- (i) a review of the Progress Report of the Parties (PROP)
- (ii) a summary of public input on the PROP
- (iii) an assessment of the extent to which programs and other measures are achieving the General and Specific Objectives of the GLWQA
- (iv) consideration of the most recent State of the Lakes (SOGL) Report, and
- (v) other advice and recommendations, as appropriate.

This triennial report replaces the IJC's previous biennial reporting cycle on Great Lakes Water Quality. The IJC issued the last biennial report, the 16<sup>th</sup>, in 2013. Anticipating the 2012 GLWQA, the [16th Biennial Report](#) assessed progress under the Agreement from 1987 to 2012 and marked the return to undertaking a more comprehensive assessment. This last biennial report used seven indicators of chemical integrity, five indicators of biological integrity, two of physical integrity, and two performance indicators to assess progress over the 25-year period ending in 2012.

In this report, the IJC presents a review of the PROP (Chapter two), a summary of public input (Chapter three) and considers the most recent SOGL report

(Chapter four). The Commission also assesses the extent to which programs and measures are achieving GLWQA objectives based on its own review and information in the PROP and SOGL reports (Chapter five), and provides advice on critical issues (Chapter six). The assessments presented in these chapters are supported by a substantive [Technical appendix](#) that provides supporting information and more detailed analysis. The report concludes with findings and recommendations (Chapter seven). At the end of the report, a list of acronyms and a glossary are provided.



Cover of the draft report of the first Triennial Assessment of Progress on Great Lakes Water Quality by the International Joint Commission, January 2017.



## REPORTS REQUIRED BY THE GREAT LAKES WATER QUALITY AGREEMENT

### Progress Report of the Parties (PROP)

This report documents actions relating to the Agreement, taken domestically and binationally, by the US and Canadian governments. PROP is to be issued before each triennial Great Lakes Public Forum.

### State of the Great Lakes Report (SOGL)

Also issued triennially, this report provides data on progress towards achieving the overall purpose of the Agreement to restore and maintain the physical, chemical and biological integrity of the Great Lakes Basin Ecosystem through reporting on ecosystem conditions and trends. It is a report on ecosystem conditions, rather than actions and programs of the governments, which are covered in PROP.

### Triennial Assessment of Progress Report (TAP)

The Agreement requires the IJC to prepare and submit to the governments a report that reviews PROP, summarizes public input on PROP, assesses the extent to which programs and other measures are achieving the General and Specific Objectives of the Agreement, considers the most recent SOGL and provides other advice and recommendations, as appropriate.

The recommendations in this report are based on the Commission's best judgment and are informed by input from the IJC's Great Lakes advisory boards. This report was written considering the vast array of input received from the public, including public comments on the PROP and on the [January 2017 draft of this report](#). A record of the public input received is provided in the [Summary of Public Comment](#) appendix that supplements this report.

In this Triennial Assessment of Progress (TAP) report, assessment of programs and measures in chapter five is organized by the nine general objectives set out in the GLWQA. This is in contrast to the organization of the PROP, which documents government actions relating to the Agreement for each of its annexes. Organizing this assessment by objectives is consistent with the charge to the IJC under the GLWQA and how the Parties presented their most recent SOGL report.

One of the laudable features of the GLWQA is its inclusion of 16 guiding principles and approaches, ranging from accountability to zero discharge. The IJC has rendered its assessment with these principles and approaches in mind. In particular, the Commission supports the approach of prevention, which the GLWQA defines as “anticipating and preventing pollution and other threats to the quality of the Waters of the Great Lakes to reduce overall risks to the environment and human health.” An emphasis on prevention would have forestalled some of the most serious harms the Great Lakes ecosystem has suffered, such as the introduction of the zebra mussel, which was known to be a threat years before its arrival. The IJC is optimistic that adherence to the GLWQA’s guiding principles and approaches will foster healthier and more resilient Great Lakes.

The IJC hopes that this assessment stimulates a continued vigorous dialogue about progress and that it supports ideas and action to further strengthen Great Lakes protection and restoration.











## 2.

# A REVIEW OF THE PROGRESS REPORT OF THE PARTIES

The GLWQA requires that the IJC's triennial assessment of progress include a review of the [Progress Report of the Parties](#) (PROP), produced by the governments of Canada and the United States as Parties to the GLWQA. This chapter assesses the quality of the PROP in meeting reporting requirements and demonstrating implementation of the principles and approaches established in [Article 2.4 of the GLWQA](#) that are relevant to reporting. The full list of reporting requirements and applicable principles and approaches is found in the [Technical Appendix](#), along with a more detailed review of the PROP.



Cover of Progress Report of the Parties released September 28, 2016 by the governments of Canada and the United States.



The production of the PROP is a new commitment by the Parties under the 2012 GLWQA. It and the IJC review of the report are key government accountability features. The IJC commends the Parties for adding these accountability mechanisms in the Agreement and for their implementation.

A key reporting requirement for the PROP is set out in Article 5.2 (e) of the GLWQA, where it states that the PROP is to document actions taken domestically and binationally in support of the Agreement. The PROP accomplishes this with a clear and readable catalogue of actions related to the articles and annexes, and also addresses each of the specific reporting requirements identified in the annexes.

Under the GLWQA, the Parties commit to publicly reporting in the PROP, SOGL and lakewide action and management plans (LAMPs) on progress in achieving the Agreement's objectives. The PROP does not significantly discuss progress relative to the GLWQA's general objectives, and the Parties

have not yet established specific objectives for lake ecosystems or substances, except for phosphorus in Lake Erie. Progress relative to GLWQA's general objectives is the focus of the SOGL 2017 reports that describe changes in indicator levels relative to each objective. However, although the PROP was published on September 28, 2016, the SOGL Highlights report was not published until June 2017. The SOGL technical report was not published until September 2017, almost a year after the PROP. The PROP and SOGL reports relate very closely to each other and coordinated release of these reports in the future would better enable a review of the actions presented in the PROP in comparison to the indicator levels associated with each of the objectives. Having access to the most current SOGL is essential to fully review the progress of governments in GLWQA implementation.

GLWQA principles and approaches relevant to the review of reporting in the PROP are accountability, adaptive management, coordination, and public engagement.

## ACCOUNTABILITY

The first principle is accountability, defined in the GLWQA as establishing clear objectives; regularly reporting on progress to the public; and evaluating, in a transparent manner, the effectiveness of work undertaken to achieve the Agreement's objectives. The general objectives are important for continuing and ongoing work on the Great Lakes; however, they give limited insight into the particular implementation goals and management actions for an individual three-year work cycle.



Other possible targets against which the progress of the governments could be measured include commitments made in the 2012 GLWQA and the priorities for science and action that the governments are required to develop under Article 5.2 (Consultation, Management and Review). The PROP reports on commitments, which is most effective where commitments are specific and time-bound. In cases where commitments are more general, assessment of the appropriateness of the extent, depth and timing of the task undertaken is more problematic for the public and the IJC to evaluate.

## YOUR VOICE

"We would like to applaud the effort to have regular Progress Reports of the Parties as well as State of the Great Lakes reports preceding these triennial reviews. As these reports are revised and updated, it will be important to clarify the intent of each report, the organization of each document and the manner by which the public should comment and engage on the content."

Healing Our Waters-Great Lakes Coalition,  
comment via email, April 14, 2017

Priorities for science and action that are set by the Parties at the beginning of each triennial cycle offer additional targets against which to measure progress. The PROP would have benefitted from addressing [priorities set for 2014-2016](#) as directly and

clearly as the time-bound commitments in the GLWQA. On the implementation of the chemicals of mutual concern (CMC) annex, for example, the PROP fails to mention that progress falls well short of the annex's 2014-2016 priorities for action, which included the development of binational strategies for the first set of CMCs by summer 2015. Draft strategies for only two CMCs have been developed as of the publication of this report in autumn 2017. However, to effectively fulfill the role of setting targets for a work cycle and improve accountability, the priorities for science and action must be well defined and show how actions are being prioritized within and between objectives and annexes. Unfortunately, the Parties' [2017-2019 priorities for science and action](#) do not incorporate a sufficient number of specific targets for proposed activities, including no specific targets for implementation of the CMC annex.

If the PROP is to be sustained as an accountability mechanism under the GLWQA, reporting on near-term targets in the priorities for science and action will become increasingly important. The number of GLWQA commitments with specific deadlines declines sharply after this first work cycle. Apart from one further time-bound requirement regarding the development of phosphorus reduction strategies and domestic action plans for Lake Erie, only general and cyclical commitments remain. These include triennial reporting and priority setting processes and the requirement to produce a LAMP for each Great Lake every five years.



The SOGL report can also be used as a mechanism for setting targets for accountability. These targets would be longer-term aspirations for changes in the trends or status of indicators. The importance of these types of targets is that they would relate to the actual status of the lake as opposed to the implementation of management actions, and would be longer term since it takes time for management actions to be evidenced in the status of the lakes.

The IJC recommendations in this report provide further targets against which the progress of the Parties in implementing the GLWQA can be assessed. The Parties should report progress relative to these recommendations in future rounds of PROP reporting.

## ADAPTIVE MANAGEMENT

In the GLWQA, adaptive management is defined as implementing a systematic process by which the Parties assess effectiveness of actions, and adjust future actions to achieve the Agreement objectives as outcomes and ecosystem processes are better understood. The PROP paints a very positive picture of GLWQA implementation. Although that picture is often justified, transparency would be served and the report would be more accurate if it included discussion of where past or current programs have fallen short of expectations. This discussion would give the governments the opportunity to show how they are implementing an adaptive management approach to achieve the objectives of the GLWQA over time.



## COORDINATION

Coordination is defined in the GLWQA as developing and implementing coordinated planning processes and best management practices by the Parties, as well as among state and provincial governments, tribal governments, First Nations, Métis and municipal governments, watershed management agencies, and local public agencies. The PROP demonstrates that the Parties are implementing the principle of coordination with federal, state and provincial bodies. There is broad engagement by departments and agencies – listed in the report – that are contributing to the various annex committees. However, coordination beyond these bodies is less clear. Some annex committees, notably Annexes 2 (Lakewide Management) and 6 (Aquatic Invasive Species), have broad and varied composition. Others, for example, Annexes 3 (Chemicals of Mutual Concern), 8 (Groundwater), and 10 (Science), have predominantly, if not exclusively, government membership.



The Annex 6 subcommittee is most notable with respect to coordination in that it has a reasonably broad membership, including Tribal and First Nations organizations, a municipal organization and two nongovernmental organizations in addition to federal, state and provincial governments. It also works in close cooperation with the Great Lakes Panel on Aquatic Nuisance Species that has its own broad, binational membership. The Parties could demonstrate wider coordination and engagement if, as per Annex 3, details of the extended subcommittee were provided in the PROP report or on the binational.net website. The Parties could also show stronger evidence of coordination in the PROP through greater inclusion of binational and domestic actions conducted by a larger range of organizations.

Looking specifically at coordination with indigenous governments, the PROP does not paint a satisfactory picture. Only five different indigenous governments or organizations are listed by name as members of annex committees and only four annex subcommittees have representation from these groups. The lists of binational and domestic actions only include three projects that mention indigenous involvement.

## PUBLIC ENGAGEMENT

Public engagement is defined in the GLWQA as incorporating public opinion and advice, as appropriate, and providing information and opportunities for the public to participate in activities that contribute to the achievement of Agreement objectives. In future rounds of reporting, the Parties should improve the PROP in content and delivery in

order to serve as an effective tool for public engagement. The PROP could include relatable case studies and more pictures and graphics to make it more compelling for readers. For the purpose of public engagement, the Parties should release the PROP publicly at least one month prior to the Great Lakes Public Forum, the triennial event that provides a key opportunity for the Parties to discuss and receive public comments on the state of the lakes and binational priorities, and for the IJC to receive input on the PROP. The Parties should also promote the PROP extensively throughout the basin using a variety of traditional and social media and use the

report at the Forum as the centerpiece for the presentations on annex implementation. Release of the SOGL report prior to the Forum, in coordination with the PROP, would further advance and improve public engagement and understanding of the status of Great Lakes water quality.

The lack of promotion of the PROP to the public by the Parties was clearly evident by the lack of awareness of the report at the public engagement sessions held by the IJC, and the scant mention of the PROP by the public during the Commission's call for public input.



IJC (Detroit meeting)



## CONCLUSION

The PROP is a clear, readable catalogue of actions. Overall, the PROP in itself represents a large step forward in accountability under the GLWQA. However, coordinated release of the SOGL report with the PROP is essential in order to conduct a proper assessment of governments' progress. Accountability would be further improved over time with the addition of clear, specific, time-bound commitments for implementation goals and management actions. The report would also benefit from a more critical evaluation of the effectiveness of programs and measures by the Parties themselves, a greater demonstration of coordination outside of federal, state and provincial agencies, particularly with indigenous governments, and greater focus on and communication of the PROP as a public engagement tool.

## RECOMMENDATIONS

To further improve reporting, the IJC recommends that:

- The Parties set clear, time-bound targets for action and also longer-term aspirations for improvements in the status and trends of Great Lakes indicators as measured by science-based indicators.
- In future reporting cycles, the Parties coordinate the timing of the Progress Report of the Parties and the State of the Great Lakes report and release the reports sufficiently before the Great Lakes Public Forum to ensure informed discussion at the Forum.
- The next Progress Report of the Parties, expected in 2019, and those following include reporting on how the recommendations in this triennial assessment of progress are being addressed.







### 3.

## SUMMARY OF PUBLIC INPUT ON PROGRESS

The IJC believes strongly that public engagement is the foundation of effective public policy and that achieving the Great Lakes Water Quality Agreement's (GLWQA or Agreement) purpose and goals will only happen if all sectors of the Great Lakes community are involved. Because of this belief, and the fact that Article 7 of the GLWQA requires the Commission to consult on a regular basis with the public, increase awareness of the lakes' inherent value, and prepare a summary of comments on the Progress Report of the Parties (PROP), the IJC conducted several public engagement activities as part of its triennial assessment of progress under the GLWQA. Input was received at thirteen public meetings, roundtables and listening sessions, through the IJC's online democracy platform, Participate IJC, and its newsletters, social media and website, and via email and mailed letters.

## Public engagement responsibilities assigned to the International Joint Commission in Article 7

The Parties agree that, pursuant to Article IX of the Boundary Waters Treaty, the Commission shall have the following responsibilities:

1. (g) consulting on a regular basis with the Public about issues related to the quality of the Waters of the Great Lakes, and about options for restoring and protecting these waters, while providing the Public with the opportunity to raise concerns, and tender advice and recommendations to the Commission and the Parties;  
(h) engaging with the Public to increase awareness of the inherent value of the Waters of the Great Lakes, of the issues related to the quality of these waters, and the benefit of taking individual and collective action to restore and protect these waters;  
(k) providing to the Parties, in consultation with the Boards established under Article 8, a triennial “Assessment of Progress Report” that includes:
  - (ii) a summary of Public input on the Progress Report of the Parties;”

Four meetings were held in fall 2016 – the public comment session at the Parties’ Great Lakes Public Forum in Toronto, two public meetings in Toronto, Ontario and Milwaukee, Wisconsin and a scientific roundtable in Milwaukee – to obtain input on the PROP report as well as participants’ perceptions of progress to restore and protect the lakes. Nine additional sessions were held in March 2017 in six communities around the basin to hear what people felt about Agreement progress as well as the IJC’s draft assessment report. In total, more than 1,000 people participated in these sessions.

Each meeting was unique in its design to provide a variety of opportunities for participants to comment on the PROP and the IJC’s draft report, to learn about local and regional innovative programs addressing Great Lakes issues, and to provide their

thoughts about the status of Great Lakes water quality. Their comments reflect the specific perspectives and priorities of each community, reinforcing the adage that we may think globally but we are most likely to act locally about the issues that most affect our individual lives. At the same time, some also discussed issues that impact the entire watershed and illustrate the need for an ecosystem approach to Great Lakes management.

Videos of these sessions were uploaded to [Participate IJC](#), an online democracy tool that provides detailed information and opportunities for input and dialogue on various IJC initiatives, including activities under the GLWQA. This tool allows people to record their comments on the website and also to view other people’s comments and presentations made at the public meetings.





The IJC actively promoted and reported on these events through its newsletters and traditional and social media. It invited comments on progress to restore and protect the lakes via email and letters from October 5, 2016 to April 15, 2017, which were received from individuals, nongovernmental

organizations from all sectors of society, and from municipalities and other governments in addition to the oral comments given at the public meetings. All oral and written comments, letters, articles and other correspondence have been considered carefully in preparing this final report.

Each person's input throughout this GLWQA assessment process as well as summaries of each public meeting, which illustrate the unique issues and perspectives relevant to those communities, are included in the [Summary of Public Comment Appendix](#) to this TAP report. The IJC sincerely appreciates the time, thoughts and experiences each person contributed to this consultation process, and their dedication to the health of the Great Lakes.



## THEMES AND ISSUES RAISED DURING THE PUBLIC CONSULTATION PROCESS



### Public Meetings

Before the Commission traveled around the basin to hear from the public, it coordinated with local experts, governments and organizations to organize meetings that focused on issues most relevant to their community and region. Most meetings were designed so participants could divide into small groups to develop recommendations on key issues. In larger meetings the sessions focused on brief presentations and providing ample time to hear everyone's views. While complete summaries of each meeting's discussions and recommendations are available in the [Summary of Public Comment Appendix](#), highlights of the themes and key issues at each public session have highlighted here.

- In **Toronto**, the evening public meeting focused on waterfront regeneration, the area's remedial action plan, wastewater treatment and particularly combined sewer overflows, toxic substances, and fish habitat. During the IJC's public comment session at the Great Lakes Public Forum, statements reflected a variety of topics, including climate change, indigenous rights, reductions in nutrient loads into Lake Erie, nuclear waste, storage and transport, radionuclides, protecting natural heritage, wetlands preservation, and public engagement in Great Lakes issues.



## YOUR VOICE

"It's the most important thing to the people of the Great Lakes when they come to you expressing their concerns when they can't drink the water or they can't eat the fish or go swimming. We have to do a better job of reflecting that and letting them know that they are heard and ... engaging them to go ahead and act individually."

Mark Mattson, Lake Ontario Waterkeeper, IJC  
public comment session at the Great Lakes  
Public Forum, Toronto, Ontario, October 5, 2016

- **Milwaukee's** public meeting addressed green infrastructure, the Milwaukee Metropolitan Sewerage District's 2035 vision and goals, the Watercentric Cities Initiative to develop regional management plans that focus on the water resource, citizen-based water monitoring, nutrient reduction and aquatic invasive species in Lake Michigan, and consideration of the latest Waters of Wisconsin report.



- At an afternoon listening session with members of First Nations and Tribes in **Sault Ste. Marie, Ontario** and at an evening public meeting, topics raised were wastewater infrastructure, the St. Marys River fisheries habitat project as part of that area's remedial action plan, the Lake Superior Water Trail, the history and role of First Nations and Tribes in Great Lakes management and protection, toxic contamination, aquatic invasive species and climate change. Also emphasized were threats to the safety and health of the ecosystem from the Enbridge Line 5 pipeline and from the proposed Deep Geological Repository for low and intermediate level radioactive waste near Lake Huron in Kincardine, Ontario.
- In **Detroit, Michigan**, afternoon roundtable and evening session participants focused on the swimmability, drinkability, and fishability of regional Great Lakes beaches and waterways, water infrastructure needs and equitable funding. Participants discussed public access to the water, public engagement including how best to coordinate and

communicate data and notify people about beach closures, and stormwater and agricultural runoff management strategies. Issues related to industrial pollution, energy production and transport, radionuclides and nuclear power, and binational coordination for the Detroit River Area of Concern were also raised.

- At the afternoon public session in **Sarnia, Ontario**, attendees discussed the successes and challenges in restoring the St. Clair River Area of Concern, chemicals of mutual concern in air and water and their effects on human health, dredging, controls on agriculture to reduce nutrients, controls for invasive species such as the plant *Phragmites*, the role of indigenous communities in Great Lakes protection, and nuclear waste.



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## YOUR VOICE

"I am a mother who brought her daughter with me tonight. This has been a tremendous education for both of us. My parents were farmers, when I was young we saw frogs and bees everywhere. We don't see either anymore. Our children will remember what we do. Please be active and consider this a personal mission to protect our earth."

Elizabeth Uhlik, Public Meeting on the Great Lakes, Toledo, Ohio, March 23, 2017

- **Toledo, Ohio's** public meeting focused almost exclusively on how to control nutrients entering Lake Erie that create harmful algal blooms. Specific topics related to this issue included the effects of using animal waste as fertilizer and other nonpoint sources of nutrient pollution, impacts on drinking water and beach closures, progress to restore the Maumee River Area of Concern, and habitat and wetlands restoration. Other issues raised were climate change, aquatic invasive species, and radionuclides and nuclear waste.
- Two public sessions were held in **Buffalo, New York**, where community leaders, scientists and other local residents talked about the accomplishments, challenges and further actions needed to restore and protect the Buffalo-Niagara region of the Great Lakes, including



the Buffalo River Area of Concern, wetlands restoration and protection, and recreation as an essential element in economic development strategies. Other themes at the two meetings included a holistic approach to water quality, community education and engagement, and developing plans to deal with combined sewer overflows and with radionuclides from nuclear waste facilities.

- At the **St. Catharines, Ontario** meeting, presentations summarized progress to improve the water quality of the Grand River and Lake Ontario, reduce nutrient runoffs by practicing sustainable and precision agriculture, and restore the Niagara Area of Concern. Participants also raised issues such as the lack of beach or water access and beach closures, microplastics, combined sewer overflows, nuclear waste transport, and the terrestrial invasive species, *Phragmites*.

## Written Correspondence

Individuals, nongovernmental organizations, industry associations and municipal governments provided a wealth of additional input in written correspondence via email, letter and on the online democracy website, Participate IJC. As with comments made at the public meetings, the letters and emails reflect a deep appreciation for Great Lakes waters as a precious resource, their concern for the lakes' health and future, and a collective commitment to contribute to their restoration and protection.

Six topics were raised more than others in letters from individuals. Concerns for nuclear energy production, waste storage and transport were prevalent, as well as for toxic contamination, safe drinking water, the effects of nutrients from agricultural runoff and other sources to the lakes, threats and impacts from aquatic invasive species – particularly Asian carp – and from climate change. Other issues raised frequently were harmful algal blooms, possible cuts to US funding for Great Lakes restoration, combined sewer overflows, and progress to restore Areas of Concern.



The wide variety of nongovernmental organizations that represent Great Lakes residents and businesses – with combined membership of more than a million people – also focused their comments primarily on the same six issues raised by individuals. For toxic contamination, organizations cited the Agreement’s requirement for governments to identify and control chemicals of mutual concern. They also recommended actions needed to advance Lakewide Action and

Management Plans and restoration efforts in Areas of Concern. Several groups identified concentrated animal feeding operations, or CAFOs, as a key source of nutrients to the lakes. The organizations focused their comments on these and other issues in terms of successful and additional actions needed by governments to implement accountable, enforceable programs and actions that accomplish the goals and objectives of the GLWQA.

## TOPICS OF PUBLIC CONCERN

Seventy topics were raised by the public. A complete list is available in the [Summary of Public Comment Appendix](#). The top 25 topics by frequency of mention throughout the TAP public engagement process are included here.

### Top 25 Topics of Public Concern

1. Safe drinking water (drinkable)
2. Recreation and tourism (swimmable, fishable)
3. Nuclear plants/nuclear waste
4. Proposed Lake Huron nuclear waste repository
5. Toxic contamination and other pollutants
6. Proposed US funding cuts to Great Lakes programs
7. Radionuclides as a chemical of mutual concern
8. Nutrients, agricultural runoff and best management practices
9. First Nation/Tribe/Métis involvement
10. Infrastructure and wastewater treatment plants
11. Draft TAP report content and findings
12. Citizen activism, public participation and education
13. Areas of Concern
14. Enbridge Line 5 pipeline
15. Climate change
16. Mandatory regulations for concentrated animal feeding operations
17. Aquatic invasive species
18. Harmful algal blooms
19. Asian carp
20. Safe beaches/closures
21. Combined sewer overflows
22. Environmental justice
23. Ballast water controls
24. Lack of government action/mismanagement
25. Nestlé/bottled water withdrawals



Input received on these and other topics are organized in the rest of this chapter by the themes that emerged throughout the consultation process and as they relate to the [Agreement's general objectives](#). Not all issues raised by the public fall under the ambit of the GLWQA, but in virtually all cases they do impact the health of the Great Lakes or the people who live in the basin. The views expressed in the following sections of this

chapter are those of participants in the IJC's consultation process and not necessarily the Commission, but were taken into account as this report and its recommendations were finalized. Given the importance and value of this input, all comments are included in the [Summary of Public Comment Appendix](#), where specific attribution to the issues summarized below is provided.

## Objectives 1, 2, and 3: Drinkable, Swimmable, Fishable

Great Lakes residents connect to the lakes according to where they live and how they can or cannot use and enjoy them. Their desires for safe drinking water, safe beaches for recreation and tourism, and fish safe to eat were prominent themes throughout all meetings as well as in individual letters and emails.

### Safe Drinking Water

Throughout the Great Lakes region, the public overwhelmingly felt that clean, safe drinking water should be the highest priority. The emergencies in [Toledo](#) in 2014 and in [Flint](#), Michigan starting in 2015, gave them clear evidence of this reality. Infrastructure improvements in wastewater treatment and especially combined sewer overflows are crucial, particularly in urban areas. Consistent regulations and regional plans for sewage discharge are needed across the states and provinces to deal effectively with this basinwide issue.

Some people and organizations want geographic breakdowns of drinking water quality rather than generalized data across

entire lake basins that make this indicator appear rosier than what they feel is actually occurring. Several Great Lakes organizations and an Ontario municipality noted that source water quality is reported on in Canada while in the United States only the quality of drinking water after treatment is reported. The United States lacks a national database for the quality of source water used as a public drinking water supply. These and other commenters felt such measures should be identical in both countries to ensure parity in drinking water quality and to effectively assess progress to meet the Agreement's objective that "the waters of the Great Lakes be a source of safe, high quality drinking water."



## YOUR VOICE

"I urge you to protect the Great Lakes as a source of safe, fresh drinking water for present and future generations by mandating source water protection plans. Ensuring public health will help not only the local residents who depend directly on the lakes for drinking water but will ensure a thriving outdoor recreation industry."

Petition via email from 56 New York residents,  
April 4-9, 2017

Several individuals and representatives of municipal governments and nongovernmental organizations said that public education is essential to engage communities in local and regional drinking water and recreation issues. Residents need to learn how water is treated, where to access information about the quality of their drinking water, how to recognize sewage overflows and contact authorities. Residents also need to know how to participate in decisions about infrastructure improvements and support development of green infrastructure, which was proposed as often more cost effective than traditional water treatment options.

By visiting several Great Lakes communities, the IJC also learned about innovative municipal efforts to protect and restore water quality. In Milwaukee and Toronto, for example, respective [Watercentric](#) and [One Water](#) approaches are helping communities to develop water

use and conservation plans that encourage resource stewardship by governments and residents, address distribution and equity issues, provide funding incentives and options for aging infrastructure, and create new technologies to encourage green infrastructure and environmental sustainability. In other communities, major investments in stormwater collection and green infrastructure are reducing untreated runoff and increasing resilience against more extreme rainfall events.

People in urban communities such as Detroit and Milwaukee raised concerns about access to clean drinking water due to issues of affordability, treatment and distribution. Residents in Sault Ste. Marie, Sarnia, and Detroit also expressed the view that corporations are allowed to extract water for further distribution at a cheaper rate than residents pay for treated water.

### Safe Water for Recreation and for Fish and Wildlife Consumption

Opportunities to swim, fish and enjoy other water-based recreation are key concerns throughout the basin, and many commenters do not feel that governments adequately focus restoration efforts to reflect these important benefits of the lakes. However, some people remarked that many beaches are now open where swimming would not have been considered safe 20 years ago due to the quality of the water. Sewer bypass and overflow discharges continue to impact water quality and recreation opportunities in large urban centers as well as small shoreline communities. Many people want infrastructure improvements and consistent,



basinwide sewage discharge regulations that ultimately will eliminate sewage discharges and increase green infrastructure to capture stormwater and protect recreational water uses. In the interim, several people in Toronto and Milwaukee said effective advance communication is essential to warn residents of combined sewer overflows and that they should know how to report sewage discharges to authorities.

## YOUR VOICE

"I've fished and boated in Lake Erie for more than 70 years. We must push harder to help the sewer authority eliminate combined sewer overflows and reduce pollution runoff. These efforts must be funded."

Richard Smith, Public Meeting on the Great Lakes, Buffalo, New York, March 28, 2017

Many people at the public meetings in Toledo, St. Catharines, Detroit and Buffalo said that consistent basinwide rules for beach

advisories and closings and fish advisories are also needed, which should be used to track trends in specific locations where swimming or fishing is not allowed regularly. One [joint project](#) mentioned by government researchers between US EPA, the US Geological Survey's Great Lakes Observing System and Wisconsin Sea Grant holds promise to predict real-time water quality conditions and increase the accuracy of beach closure notifications. People living around Lake Erie and Lake Ontario, particularly Toronto, believe that both types of advisories must be communicated more broadly in affected communities using a wide variety of traditional and social media methods.

Participants in the Detroit roundtable session discussed the linkages between human health, quality of life and Great Lakes water quality. Several felt that social science indicators should be created that measure how and when people can and cannot use Great Lakes waters for recreation, and that reflect quality of life for Great Lakes communities. These might include rates and locations of combined sewer overflows, frequency and location of



harmful algal blooms, beach availability and fish advisories, just as biological indicators are used to measure ecosystem health. In addition, several people at this and other meetings and through letters from nongovernmental organizations noted that an Agreement annex dedicated to human health, or a human health committee to specifically address the objectives of drinkable, swimmable and fishable waters, is needed to develop and track specific programs and progress.

Finally, people from communities throughout the Great Lakes region recommended that increased public access to natural shorelines be a planning goal in all waterfront

communities. This will help communities to recognize the growing role and economic value of tourism, as well as the role that safe and easy access plays in fostering stewardship for the lakes. They said that people need to directly experience the Great Lakes to appreciate their intrinsic value, through boating, fishing and swimming in open waters, and picnicking, hiking and bicycling along their shores. Initiatives such as the Great Lakes Waterfront Trail and the Lake Superior Water Trail were enthusiastically discussed in Toronto and Sault Ste. Marie, respectively, as gateways to learn about the lakes and develop emotional connections to the watershed.

## **Objective 4: Water Free from Pollutants**

### **Legacy, New and Emerging Toxic Contaminants**

“Please do everything you can to make and keep the Great Lakes free of chemicals and toxic pollution.” This emailed statement from Karin Sletten-Farjo was echoed strongly throughout the basin for legacy, new and emerging contaminants. While some people recognized the significant steps that have been taken over the past 30 years to control and eliminate direct inputs of persistent toxic substances by governments and industry, particularly in Areas of Concern, many people and nongovernmental organizations doubt that current monitoring, control and prevention actions are adequate to preserve public health and the environment – let alone uphold the GLWQA’s principle of the virtual elimination of persistent toxic substances.

For example, some commenters said that data is not reported accurately or on a timely basis and is not widely available to the public to understand actual levels of toxic substances released into the lakes from point and nonpoint sources, such as the atmosphere, mining and hydrofracking activities, current and legacy industrial sites, urban stormwater runoff and groundwater. Public awareness of emerging contaminants such as pharmaceuticals in wastewater, flame retardants and microplastics – including microbeads found in personal care products, decaying plastics, and fibers from clothing – has grown because of recent studies and new detection technology. Many meeting participants called for increased research to identify sources and impacts as well as controls and prevention strategies for these emerging

contaminants, which they believe may cause adverse effects in fish, wildlife and humans even at extremely low levels.

## YOUR VOICE

"Our recommendation is that annual reporting of pollution releases and transfers to the Great Lakes basin should be created so that there is annual reporting that provides us with an accurate base of data that we can all work with."

Jacqueline Wilson, Canadian Environmental Law Association, IJC public comment session at the Great Lakes Public Forum, Toronto, Ontario, October 5, 2016

## Pollutants from Energy Production, Waste, Transportation and Storage

At every meeting and in a significant number of written comments, pollution threats from energy production, waste, transportation, and storage were identified as top public concerns. Many people expressed their belief that existing onsite nuclear waste storage and proposed nuclear waste storage facilities threaten the health and safety of Great Lakes waters, particularly the contaminated West Valley nuclear waste site 30 miles south of Buffalo and the proposed Deep Geological Repository near Lake Huron in Kincardine, Ontario. People also questioned whether adequate safeguards are in place for 38 operating nuclear power plants across the basin and for transporting nuclear waste through the watershed.

The safety of oil and natural gas pipelines was raised repeatedly at many of the meetings, particularly the Enbridge Line 5 pipeline that crosses the Straits of Mackinac in Michigan as well as others crossing the St. Marys and St. Clair rivers. People who raised the issue felt it would be impossible to contain spills from these pipes as well as from ships, trucks and other forms of transport, which could cause long-term, severe ecosystem degradation. The need for environmental and other risk-benefit analyses of proposed transport of petroleum-based fuels that cross wetlands and other sensitive habitats was also considered by some to be essential before new pipelines are approved. Hydraulic fracturing, petroleum coke (or petcoke) storage piles and thermal pollution were raised as additional reasons to review the safety of nuclear and other energy-producing activities.



## Chemicals of Mutual Concern

Reflecting its standing as the seventh most-identified issue, a significant number of commenters recommended at meetings and in letters that radionuclides should be designated a chemical of mutual concern (CMC) under Annex 3 in the GLWQA. They want comprehensive research about and monitoring of human health impacts of radionuclides already present in the Great Lakes ecosystem, followed by action to prevent further introduction. Industry officials disputed this need in their emails and letters, citing rigorous existing regulations, standards and licensing in both countries that require strict compliance to ensure safe nuclear production.

Frustration was also expressed by some people that the Parties' process to identify CMCs has taken too long, that binational strategies to reduce, eliminate and prevent releases have not been developed for the eight chemicals identified thus far, and that transparency and education are needed on the threats and impacts caused by CMCs.

### YOUR VOICE

"Please keep the Great Lakes Great! And FREE from chemical pollution. I can't believe I even have to write to ask this... but it is the world we live in."

Chrysta Bell, email, February 9, 2017

## Objectives 5 and 7: Wetlands and Habitat, and Invasive Species

People said the importance of wetlands and their preservation cannot be understated because they provide vital ecological habitat and improve water quality by slowing the runoff of nutrients and filtering pollutants. For example, a nongovernmental organization in northwestern Ohio is creating small-scale wetlands adjacent to agricultural land as a way to slow the transport of nutrients into receiving waters and thus improve water quality. Another organization suggested that this could be duplicated in other tributaries throughout the Great Lakes region, which collectively contribute 48 percent of annual inflow into the lakes. Another suggestion was for governments to commit to adopting minimal thresholds to protect natural

habitats on a watershed basis. This might include a goal to restore and protect 40 percent of historic wetlands of a watershed, or committing to buffer strips with natural vegetation along both sides of streams within a watershed.



AV Zejnati (*Phragmites*)



The IJC heard from many people from all sectors of the region who universally believe aquatic invasive species have significantly impacted the Great Lakes ecosystem. Once aquatic invasive species are in the lakes they are virtually impossible to remove, so people also believe that governments must do everything possible to prevent new species from entering. Consistent and compatible ballast water requirements between the United States and Canada were listed as a necessary step to protect from future threats. Recommendations from nongovernmental organizations include passing more stringent ballast water and shipping regulations such as mandatory ballast water treatment equipment on all ships entering the Great Lakes from foreign ports, strict fines for non-compliance, and excluding foreign ships from the Great Lakes beyond the Port of Montreal.

## YOUR VOICE

"The Great Lakes fisheries are in danger from invasive species brought from ballast water and other threats such as the Asian carp advancing into the Great Lakes. We saw a similar problem with the alewives back in the 1960s. Let us learn from the past and prevent Asian carp from invading the lakes!"

Joseph P. Gallagher, Sault Ste. Marie, Michigan, letter via email, April 11, 2017

Because Asian carp continue to pose an unacceptable risk to the lakes and native fisheries, many people throughout the region demanded that the Chicago Ship & Sanitary Canal be closed and/or a wide range of control measures used to prevent its entry. Given the devastating potential impact, several individuals and groups also called for collaboration between governments, indigenous nations, nongovernmental organizations, scientists and industry to create additional solutions that ensure Asian carp does not enter the lakes.

Terrestrial invasive species such as *Phragmites* were cited as additional threats, which can destroy habitat for native plants and devastate coastal ecosystems. People in the Lake Huron and Erie region, and in the Canadian portions of these lakes in particular, want increased research to identify sources and locations of infestations, improved mechanical and chemical controls, and expanded public awareness campaigns to share how invasive plants are spread and can be controlled.



J. Weber (Asian carp)

## Objective 6: Nutrients

Participants in all of the public meetings and many who provided written or emailed comments felt that the harmful algal blooms caused by inputs of excessive nutrients into Lake Erie, as well as in Green Bay and the Lower Fox River in Lake Michigan and Saginaw Bay in Lake Huron, significantly impact lake health and create dangerous cyanobacteria toxins – a cause of recreation-based illnesses. Agricultural producer and fertilizer organizations commented that substantial increases in voluntary nutrient reduction and stewardship programs administered by national, state and local organizations and the agricultural community around Lake Erie deserve recognition for reductions achieved thus far. This includes the 4R program – using the right nutrient source at the right rate, at the right time, and in the right place – and its associated education, training and certification initiatives.

### YOUR VOICE

"I have been a son of a property owner and property owner on Middle Bass island since 1963. The smells of the recent annual algae blooms in the lake brought me back to the late '60s and early '70s prior to Governor Rhodes hammering Proctor and Gamble to eliminate phosphate from Lake Erie. There are reams of data on phosphate in the lake but much less information on where it comes from."

Matt Richardson, Middle Bass Island, Ohio, via email April 7, 2017

### YOUR VOICE

"Specifically in agriculture, nongovernmental voluntary efforts for nutrient stewardship to address water quality have increased significantly in the last five years, and they should be recognized for their contribution to addressing Lake Erie water quality. Efforts by industry in partnership with crop and conservation organizations are growing and leading to successful implementation of practices on the farm... Mandatory regulations risk undermining innovation, reduce the incentive to go beyond minimum requirements and are time consuming and difficult to update and modify."

Agribusiness Council of Indiana, Fertilizer Canada, International Plant Nutrition Institute, Michigan Agribusiness Association, Ohio Agribusiness Association, The Fertilizer Institute, letter via email, April 13, 2017

Other organizations and individuals, particularly from the Lake Erie basin, said that intense harmful algal blooms every summer prove that voluntary actions alone will not reach the goal of 40 percent reduction in phosphorus loadings entering the western and central basins of the lake as set by the Parties. Many called for the western basin of Lake Erie to be listed as impaired under the US Clean Water Act's criteria for recreational uses to ensure that mandatory regulations are implemented, including domestic action plans in the

United States with enforceable programs and timelines. Several people at the Toledo meeting felt that nutrient loadings will diminish considerably if widespread use of animal waste as fertilizer on fields by concentrated animal feeding operations, or CAFOs, is regulated along with crop farmers' use of granule or liquid fertilizer. Also mentioned was the need for mandatory education, training and support for best practices for farmers to reduce nutrient loadings.

In addition, some people in Wisconsin and Michigan asked for increased support for monitoring, outreach and regulations enforcement on phosphorus loadings in Green Bay and the Lower Fox River and in Saginaw Bay, and in other areas where

dissolved phosphorus loadings contribute to the growth of the green algae *Cladophora*. Other suggestions to control nutrient sources included creating a drain code for all Great Lakes basin land, developing regional water plans that include collaboration between urban and rural communities, and using a results-based regulatory and enforcement approach to address all point and nonpoint sources of phosphorus and nitrogen. Another recommendation made by a research and policy organization was that monitoring needs to target multiple watershed scales and the many loading sources in order to accurately detect trends in nutrient concentrations.

## OTHER TOPICS OF CONCERN

Participants and presenters at every public meeting highlighted success stories in restoring **Areas of Concern**, from eliminating sources of toxic pollution to rebuilding habitat and restoring recreational uses. At the same time, municipal leaders and others voiced concerns about potential reductions in federal financial support in key areas such as infrastructure improvements and large-scale remediation projects that will impact momentum and continued progress, particularly in areas of recovery and post-delisted Areas of Concern. Equally important is monitoring to ensure that impairments are prevented from returning or that new development is allowed that may endanger restored areas, such as at the Menominee River shared by Michigan and Wisconsin. Participants in the Sault Ste. Marie and

Buffalo meetings expressed frustration with the dissolution of the Lake Superior **Lakewide Action and Management Plan's** citizen forums and the absence of outreach and education subcommittees.

Many people throughout the region recognize that **climate change** is already affecting the Great Lakes ecosystem, from increases in water temperatures and extreme weather events to alteration of biological communities and habitats. Several suggested that the region needs to appreciate the priceless resources the lakes provide and take collective action now to protect them – from the direct effects of climate change in the region to potential large-scale water diversions as a result of climate change impacts in other regions of the continent.





### **First Nations, Tribes and Métis**

representatives stated that the time has long past for their active inclusion in Great Lakes management. During the IJC's public comment session at the Parties' Great Lakes Public Forum in Toronto, in listening sessions and public meetings in Sault Ste. Marie and Sarnia, and at a meeting with the Métis Nation of Ontario in Toronto, they reinforced the indigenous philosophy of water as a sacred, living entity rather than an asset to be used, the intrinsic and economic price they have and are paying for others' perspectives and actions, and the need to include their people in effective actions to restore and protect the lakes. Some contributors also expressed appreciation to the IJC for including representatives of indigenous peoples on its Great Lakes advisory boards.

### **YOUR VOICE**

"It is time for the IJC to recognize the jurisdiction inherent and treaty rights of First Nations in all governance matters affecting the homeland of many First Nations across the Great Lakes...In making this request, we acknowledge the steps that the IJC has already taken, in particular the appointment of Dr. Henry Lickers ... to the Science Advisory Board and Mr. Dean Jacobs to the Water Quality Board. We acknowledge these steps. They are in the right direction."

Grand Chief Abram Benedict, Chiefs of Ontario,  
IJC public comment session at the Great Lakes  
Public Forum, October 5, 2016

People throughout the Great Lakes basin also desire greater involvement in the wide range of issues that impact the lakes, human health and their quality of life, and called for governments to commit to **meaningful outreach and engagement** among and

within a wide range of communities. Equally important is continued funding of research, remediation and protection actions to ensure that progress continues to restore and protect the Great Lakes.

## PROGRESS REPORT OF THE PARTIES (PROP)

Although many of the topics raised by the public in their comments are related to the PROP, limited input was received specifically about the report during the IJC's public comment sessions, at the Great Lakes Public Forum or in subsequent correspondence. In the small number of comments received on the report, the most common response was the need to translate data into wording the public can understand, and explaining the many acronyms that are not familiar to the broader community. Second, commenters felt that publicity about the report and the Forum was virtually nonexistent to the general public, which reflects poorly on the Parties' commitment to meaningful communications and outreach. They suggest the Forum was a lost opportunity for the Parties to share their progress toward meeting the GLWQA's objectives, and the importance of the evolving science and monitoring programs that assess the state of the lakes. Given the wealth of information provided in the PROP on Agreement progress and the value of science and monitoring programs, people said the report provides ample argument that financial and program support is essential to continue progress in these programs.

Specific public reactions to the PROP included:

- One nongovernmental Great Lakes organization applauded the Parties' efforts to produce Progress Reports of the Parties as well as State of the Great Lakes reports preceding the IJC's triennial reviews. It suggests that the intent of each report and how the public should best provide comment is important to clarify.
- Several people and groups in the Lake Erie basin feel that the lake's domestic action plans lack detail. The plans must include programs, policies and protections that successfully meet nutrient reduction targets. Without these, the plans will fail to achieve the 40 percent reduction goal, just as voluntary attempts to control nutrient pollution have failed elsewhere.
- The PROP states that expanding edge-of-field monitoring is underway in the United States, but results are not provided. Edge-of-field monitoring is used to assess the quantity and quality of agricultural runoff and evaluate conservation practices that aim to reduce sediment and nutrient loss.

It also can help to identify agricultural sources of excess nutrients that threaten the health of the Great Lakes. These results will be valuable when combined with existing watershed-level monitoring efforts and data.

- Social science and human health indicators should be created and incorporated into future progress reports to provide ongoing data on location-specific access to clean, affordable drinking water and safe beaches, disease outbreaks due to cyanobacteria exposure, consistent and well publicized fish consumption advisories, and the progress

and costs of infrastructure improvements to obtain zero discharge of raw sewage into the lakes. These data will illustrate which communities are succeeding and which are not in providing drinkable, swimmable and fishable water to their residents.

- The 2016 Progress Report of the Parties generalizes information across entire lake basins, which does not provide the level of details the public needs.
- Annex committees should be expanded to include experts in social science, public health and economics.



R. Bejankiwar



## CONCLUSION

As the IJC talked with and heard from people throughout the Great Lakes region, the level of interest in, commitment to and sense of personal responsibility for the health of the lakes – now and for future generations – was abundantly clear. They want to be informed about efforts to restore and protect the lakes, and they want opportunities to participate in that work. Whether they addressed harmful algal blooms, toxic contamination or limits to recreational use, residents want the Parties to take aggressive and sustained actions to meet commitments made in the GLWQA. This includes stronger enforcement of existing rules and programs addressing nutrient and toxic pollution, greater investment in infrastructure to prevent combined sewer overflows, continued progress to restore Areas of Concern, and a focus on the GLWQA's principles of accountability, and preventing future inputs of pollution and other threats to the health of the Great Lakes and to people who live in the watershed.







## 4. CONSIDERATION OF STATE OF THE GREAT LAKES REPORT

### OVERVIEW

The GLWQA requires the IJC's triennial assessment of progress to include "consideration of the most recent State of the Lakes Report." This report considers State of the Great Lakes (SOGL) 2017 in two main respects. First, this chapter provides a short review of indicator information the Parties have used in preparing their SOGL reports and suggests potential future enhancements. Second, Chapter five considers indicator status and trend information as part of the IJC's assessment of the extent to which programs and other measures are achieving Agreement objectives.

The GLWQA requires the Parties to establish and maintain comprehensive, science-based ecosystem indicators to assess the state of the Great Lakes, to anticipate emerging threats and to measure progress in relation to achievement of the Agreement's general and specific objectives. These indicators shall be periodically reviewed and updated as necessary. The GLWQA also dictates that the Parties shall issue a SOGL report to the IJC and the public every three years, which describes basinwide environmental trends and lake-specific conditions using these ecosystem indicators.



The first SOGL report developed and issued under the 2012 GLWQA was released as a [highlights \(summary\) report in June 2017](#). The full [technical report was released in September 2017](#). As the technical report was released shortly before the finalization of this report, the IJC had limited time to extensively consider its contents in this assessment. In the future, the Parties should coordinate the release of the SOGL highlights and technical reports with the Progress Report of the Parties (PROP) to yield a more informative and complete package for the public, and enable the IJC to consider all government reporting in its assessment of progress and provision of advice to governments.

As the SOGL Highlights report was released after the IJC's collection of public input on progress under the GLWQA, no public comments were received on the SOGL report. Public comments on indicator information reported by the parties at the Great Lakes Public Forum in October 2016 are addressed in chapter three, Summary of Public Input and chapter five, Assessment of Progress Toward General Objectives.



## BACKGROUND

It is important to effectively communicate the status and trends of the Great Lakes to the public in terms that can be readily understood. This will improve public awareness of the inherent value of the Great Lakes and the benefit of taking actions to protect and restore these waters. Assessing and reporting on the condition of a large-scale regional ecosystem such as the Great Lakes basin and communicating the findings to the public can be demanding.

Indicators are needed to describe the condition of the environment in the same manner as indicators are used to describe human health (for example, blood pressure) and economic conditions (for example, Dow Jones Index). Ecological information adds another level of complexity to communication with the public because, by its very nature, ecology reflects the interaction of a multitude of organisms with each other and their environment. The [Technical appendix](#) to this report describes some of the challenges of communicating scientific information and offers examples used by other environmental assessment programs to overcome them.

### Indicators

The Parties developed State of the Great Lakes reporting to assess the status of the Great Lakes. On page two of the SOGL report, the Parties describe how they used indicators and sub-indicators in their assessment, as follows: “The governments of Canada and the United States, together with their many partners in protecting the Great Lakes, have agreed on a set of nine indicators of ecosystem health. These indicators are in turn supported by 44 sub-indicators, measuring such things as concentrations of contaminants in water and fish tissue, changes in the quality and abundance of wetland habitat, and the introduction and spread of invasive species.”

[https://binational.net/wp-content/uploads/2017/06/SOGL\\_17-EN.pdf](https://binational.net/wp-content/uploads/2017/06/SOGL_17-EN.pdf)

The SOGL reports set out the status of each sub-indicator and summary indicator as poor, fair, good or undetermined. Trends in sub-indicator and indicator levels are described as deteriorating, unchanging, improving or undetermined. In this TAP report, these government assessments of indicator and sub-indicator status and trends are shown relative to each general objective in Chapter five.

It is also a challenge to summarize succinctly the status and trends of the several metrics or sub-indicators that are included in an indicator. The SOGL 2017 report builds on the history of State of the Lakes Ecosystem Conference (SOLEC) reporting, which uses indicators that governments began in 1994. The IJC has offered considerable advice to governments on their use of indicators and associated reporting. In its [16<sup>th</sup> Biennial Report on Great Lakes Water Quality](#) issued in 2013, the IJC recommended that

the Parties' SOGL reporting use a smaller set of indicators connected to the GLWQA objectives, and that the indicators have plain language descriptions and be presented in a report card format readily understood by the public. In 2014, the IJC followed with recommendations to the Parties on specific ecosystem sub-indicators for SOGL reporting. Also in 2014, the IJC forwarded advice to the governments on Great Lakes indicators related to human health.

## CONSIDERING STATE OF THE LAKES 2017



The SOGL Highlights report issued in June 2017 is a clear and concise report that sets out indicator status and trend information for each GLWQA general objective in an engaging way. The SOGL Technical report provided detailed information on each sub-indicator. The Parties improved the SOGL 2017 reporting from past SOLEC reporting

by adopting the IJC recommendation to reorganize the report into nine indicators (with various metrics or sub-indicators) that are linked to the GLWQA's general objectives. The Parties also graded the status of indicators and sub-indicators related to each objective, and included new sub-indicators.

In future triennial cycles, the SOGL Highlights report could include links to more information (for example, the SOGL Technical report, the PROP, and other websites), videos and interactive maps. Interpreting the key scientific findings via stories that connect indicators to each other and to observable phenomena would help people understand that behind every indicator are many other factors to consider. For example, telling stories about how forest and land cover, rainfall, water temperature, dreissenid mussels, nutrients in lakes, and harmful algal blooms (HABs) are all inter-related would help the public understand the importance of these specific sub-indicators.



The [SOGL 2011 Technical Report](#) effectively used storytelling. Going further and connecting these indicator stories to management actions discussed in the PROP would provide more context to understand status and trends. Interactive maps, such as applying the approach used by NOAA's Interactive Radar Map Tool to connect weather patterns to beach conditions, would enable interested readers to explore specific areas within the basin in more detail.

Current averaging of many indicator results across the basin or even within individual lakes obscures the high and low impacts in specific areas. Links to lake or basin reports, maps or videos could provide clear messages about areas that are especially pristine or degraded. The use of video, which has become more common in public messaging and used by other large-scale assessments, would improve the accessibility and delivery of information. For instance, the Chesapeake Bay Program tracks progress using indicators (for example, blue crab abundance) that present layers of progressively more detailed information, including videos.

The next two sections describe two ways in which SOGL reporting could be improved.

## 1. SOGL Technical Report - Indicator gaps

The IJC has identified improvements and recommended refinements to Great Lakes indicators. The IJC believes the sub-indicators that the Parties used in the SOGL 2017 report do an outstanding job reflecting the status and trends associated with the nine general objectives of the

GLWQA. However, a report produced by the Research Coordinating Committee of the IJC's [Science Advisory Board in 2016](#) showed that further improvements could be made to several ecosystem and human health sub-indicators.

## 2. Indicator Reporting

The Parties should collate data on indicators in a centralized and publicly accessible location. This will encourage standardization of data collection and assessment methods, which is needed to increase consistency in assessing long-term trends and detecting changes in lake health status. There is reasonable data coverage for a status assessment for the majority of sub-indicators in the SOGL report. Insufficient data are available for detecting trends for the coastal wetlands extent and composition sub-indicator and the harmful algal bloom (HAB) sub-indicator.

Several sub-indicators that are critically important to assess GLWQA progress are not included in the suite of indicators used in SOGL 2017 reporting. These include: the biological hazards and chemical integrity of source water (as opposed to treated drinking water); illness risk at beaches and the source of risks at beaches; tributary loadings and nearshore concentrations of total phosphorus and dissolved reactive phosphorus; recruitment and abundance of nearshore predators (bass and northern pike); and invasion rates and impacts of invasive plankton, round goby, Eurasian ruffe, and Asian carp. The Parties should include these additional sub-indicators in the next SOGL Technical report.

It is critically important for the Canadian and United States governments to fund and maintain a comprehensive and well-designed binational water quality monitoring program within the Great Lakes. Data from such a monitoring program are essential for forecasting change, preventing and mitigating impacts, and restoring and preserving the Great Lakes. Data are also needed to understand the linkages between storm events, agricultural and urban runoff,

combined sewer overflows, and harmful algal blooms in order to develop effective prevention and mitigation strategies.

Information could also be used to identify emerging water quality issues and to show changes in trends on key ecological and human health parameters. These data would also help governments and the IJC to respond to questions about whether the lakes are getting cleaner.

## IJC GREAT LAKES VITAL SIGNS

Considering the need to communicate key aspects of Great Lakes status and trends more clearly and concisely, the Science Priority Committee of the IJC's Science Advisory Board (SAB-SPC) developed another process to use scientific data that tells meaningful and compelling stories to the public about the Great Lakes ecosystem.

In 2016, the SAB-SPC issued a report on indicators that followed a rigorous process to select eight ecosystem measures deemed most communicable to the public. The SAB-SPC recommended that this process be repeated on a regular basis, perhaps every six to nine years as lake conditions, public interest and data availability change over time. The SAB-SPC also recommended that the exercise be expanded to include human health measures.

Based on the SAB-SPC report, the IJC identified Great Lakes Vital Signs, a refined set of eight measures that can be used to present rich yet concise information on the status and trends in Great Lakes health to the public. The IJC generally concurred with six of the eight measures recommended by SAB-SPC, but felt harmful algal blooms are better as a measure than nuisance algae because of public health impacts and data availability. The IJC also selected dissolved reactive phosphorus in addition to total phosphorus, because the dissolved form is more readily available for algal uptake and more influential



in promoting harmful algal blooms. The eight measures that the IJC would like to use for future vital signs reporting include:

- persistent bioaccumulative toxics in whole fish
- mercury and atrazine concentrations in water
- lake trout / lake whitefish abundance (walleye for Lake Erie)
- HABs in western Lake Erie, Saginaw Bay, and Green Bay using remote sensing images and the western Lake Erie Severity Index (presented at the Great Lakes Public Forum)
- total phosphorus and dissolved reactive phosphorus tributary loadings for the three sub-basins mentioned above and concentrations in the offshore in all the lakes
- sea lamprey abundance
- maximum ice cover
- long-term water level variability.

These vital signs are well suited for public communication. Reporting to the public on whether the lakes are getting better or worse would be enhanced by including data on these eight vital signs in the next TAP report. However, not all of the vital signs are included as sub-indicators in SOGL reporting. These vital signs should be included by the Parties in the next SOGL.

## CONCLUSION

Large-scale reporting on the Great Lakes is needed along with non-technical communication to help the public understand the condition of the lakes and motivate

or support actions to protect and restore them. The SOGL 2017 Highlights report provides clear and concise information on the status and trends of Great Lakes indicators relative to the general objectives of the GLWQA. The Parties have improved their reporting in SOGL 2017 by linking indicators to objectives and using a report card format for each objective. Looking ahead to future SOGL triennial reports, potential enhancements include coordinated release with the PROP and cross-references or links between the two reports, along with links to interactive maps and videos. Providing more storytelling in the Highlights report would help the public understand how the system functions and the interrelationships between sub-indicators. Another improvement to SOGL reporting could be achieved by adding the sub-indicators suggested by the IJC and ensuring the IJC vital signs are included as sub-indicators in SOGL reporting. Comprehensive binational monitoring needs to be strengthened to further improve indicator data and reporting.

## RECOMMENDATION

To further improve reporting, the IJC recommends that:

- The Parties strengthen support for a comprehensive binational Great Lakes monitoring program to provide the essential information and understanding needed to quantify and interpret indicators, forecast change, prevent or mitigate impacts and restore and preserve the Great Lakes ecosystem.









## 5. ASSESSMENT OF PROGRESS TOWARD GENERAL OBJECTIVES

The GLWQA requires the IJC's Triennial Assessment of Progress (TAP) report to include "an assessment of the extent to which programs and other measures are achieving the general and specific objectives of the Agreement." This chapter assesses selected programs and measures in the context of their contribution to achieving the GLWQA's general objectives and considering the State of the Great Lakes (SOGL) report. Additional assessment of and background detail regarding programs and measures related to the GLWQA's general objectives are presented in the accompanying [Technical appendix](#) report.

# 1. DRINKING WATER

## General Objective 1:

*The Waters of the Great Lakes should be a source of safe, high-quality drinking water.*

## SOGL Indicator

**Drinking Water** for the overall Great Lakes Basin:  
status good, trend unchanging

Sub-indicator across the basin:

- *Treated Drinking Water*: status good, trend unchanging.



Summary of the status and trend of the State of the Great Lakes  
Drinking Water sub-indicator for the Great Lakes (Source: SOGL, 2017)

Sub-Indicator	Lake Superior	Lake Michigan	Lake Huron	Lake Erie	Lake Ontario
Treated Drinking Water	No lake was assessed separately Great Lakes Basin assessment is <b>Good and Unchanging</b>				
Status:	GOOD	FAIR	POOR	UNDETERMINED	

## Overview

Treatment technologies and care on the part of drinking water system operators help to deliver clean, safe water an overwhelming majority of the time. However, the rare occasions when drinking water is compromised – such as the microcystin contaminations that happened in Toledo and Pelee Island in 2014 – can have tragic consequences for the health and livelihood of those impacted. Preventing further compromises of Great Lakes drinking water systems requires continued vigilance, foresight and investment and needs to be of utmost importance in GLWQA implementation. Furthermore, access to

clean water is of particular importance to indigenous peoples, not just for the protection of human health, but also for the important role water plays in their cultural practices and teachings.

The absence of a SOGL indicator for source water quality is a significant gap in ensuring the safety of drinking water and in the assessment of progress for this objective. Protecting source water for drinking water supplies, rather than simply treating water *after* it is withdrawn, is consistent with the prevention approach in the GLWQA and an important part of source-to-tap



protection. Additionally, the Progress Report of the Parties (PROP) does not have a human health-oriented summary of the quality of the waters of the Great Lakes or a summary of the annex activities to address the GLWQA's human health objectives. The lack of reporting on this and the other two human health objectives make it challenging to assess progress towards their attainment.

## Background

The Great Lakes and their connecting river systems are a source of drinking water to more than 40 million Canadians and Americans. However, these waters are susceptible to contamination from a variety of sources. As a result, the protection of these source waters is an important first step in the provision of safe drinking water. Protecting drinking water requires a comprehensive, “multi-barrier” approach, including source water protection, appropriate treatment, and infrastructure maintenance and monitoring throughout the delivery and distribution system.

Residents of the Great Lakes basin have experienced a number of serious drinking water contamination incidents, including: the *E. coli* O157:H7 contamination of a source water supply in Walkerton, Ontario (2000); the 2014 “do not drink” advisories for Toledo, Ohio and Pelee Island, Ontario in response to unsafe levels of microcystin in the treated water; and the 2015 crisis in Flint, Michigan, in which elevated levels of lead leached from distribution pipes as a result of failure to apply adequate anti-corrosion control.

Although only the water supplies that impacted Toledo and Pelee Island were drawn from the waters of the Great Lakes, these incidents serve as a reminder of the vulnerability and importance of safe drinking water. In addition, they may offer lessons that can lead to future improvements in the protection and delivery of safe drinking water. For example, the 2000 Walkerton incident resulted in the establishment of the *Ontario Safe Drinking Water Act* and the *Ontario Clean Water Act*, which together form the regulatory framework for a comprehensive management approach to drinking water.

While it is a positive step that lessons have been learned through these tragic events, a proactive approach that embodies the prevention principle called for by the GLWQA is required.

## Prevention

The GLWQA defines prevention as anticipating and preventing pollution and other threats to the quality of the waters of the Great Lakes to reduce overall risks to the environment and human health.

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*“Treatment without prevention  
is simply unsustainable.”*

– Bill Gates

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## Assessment

The Parties’ 2017 SOGL Highlights report illustrates that the Great Lakes are a high quality source of drinking water as currently reported separately for Canada and the United States.

According to the 2017 SOGL report, 60 percent of the population in Ontario receives its drinking water from the Great Lakes. Treated drinking water samples met the Ontario Drinking Water Quality Standards 99.8 to 99.9 percent of the time from 2007 through 2014. This represents samples taken from municipal systems and does not include private or First Nations systems. Water for these municipal systems is taken from the Great Lakes, inland lakes, rivers and groundwater. The samples included microbial, chemical and radiological parameters. Treated drinking water samples met radiological standards 100 percent of the time, chemical standards at least 99.67 percent of the time and microbial standards at least 99.85 percent of the time.

In the United States, SOGL reporting shows that from 2012-2014, 95 to 97 percent of the population living in the Great Lakes basin (approximately 27 million people) were served by water treatment systems meeting all health-

based water quality standards. During this same period, 6 percent of the water treatment systems incurred health-based system violations. It is not clear from the data reported whether this also includes Tribal communities.

Under Annex 1 (Areas of Concern or AOCs), progress has been made to remove restrictions on drinking water consumption, or taste and odour problems. Of the 43 AOCs designated by the Parties, ten have had a beneficial use impairment (BUI) associated with restrictions on drinking water consumption. To date, the Parties have removed this BUI at seven AOCs, with two of the remaining AOCs expected to remove the BUI within the next two to three years.

### Beneficial use impairments in Areas of Concern

AOCs are geographic areas designated by the Parties where significant impairment of beneficial uses has occurred because of human activities at the local level. BUIs are changes in the chemical, physical or biological integrity of the Great Lakes system sufficient to cause restrictions on uses.

Overall, people living in the Great Lakes basin can safely drink municipally treated drinking water, unless an advisory is in place.

However, not all populations in the basin get their drinking water from municipal systems and even for the samples reported, there is not 100 percent compliance with drinking water standards. **When it comes to safe drinking water, nothing less than 100 percent is acceptable.**

### Source water

The SOGL Technical report includes data on the quality of source water samples taken in Ontario only, the status of which is “good.” This is not reported in the SOGL Highlights report, which characterizes the quality of drinking water only after treatment. However, the GLWQA general objective identifies source water – that is, water quality prior to treatment. Greater focus on source water quality in SOGL reporting would provide a more direct

connection between indicator data and the first objective of the Agreement that the lakes should be a source of safe, high-quality drinking water. The lack of reporting on source water quality creates a gap in assessing progress toward meeting objective 1 under the GLWQA.

In 2014, based on a Health Professionals Advisory Board report, the IJC recommended the Parties adopt a set of human health indicators to assess progress under the GLWQA. The two indicators for source water, chemical integrity and biological hazard index, provide a cross-section of compounds potentially hazardous to human health for monitoring at source water intakes of drinking water treatment plants. The report underscored the importance of having the Great Lakes as a source of clean drinking water.





### Measuring source water quality

The quality of the waters of the Great Lakes is measured in many ways at many locations. The measurement of source water for drinking is considered to consist of measuring parameters relevant to drinking water where drinking water is being extracted, before it is treated. For example, the Ontario source water data reports on the percentage of drinking water systems where source water, monitored before treatment at over one hundred drinking water systems in the province, met Ontario Drinking Water Quality Standards.

A key component in the delivery of safe drinking water is the development and implementation of source water protection plans (SWPPs). The requirement for the development and implementation of SWPPs varies between Ontario, where it is mandated, and the US states, where it is voluntary. The Ontario Clean Water Act requires the development of watershed-based SWPPs as a first step in a multi-barrier approach to protecting existing and future sources of drinking water.

The US Safe Drinking Water Act includes provisions intended to protect the nation's drinking water at all sources to reduce water treatment costs and risks to public health. The act required that, by 2003, each state develop a Source Water Assessment Program to assess the susceptibility of public drinking water supplies to contamination. The act also requires states to develop a source water protection program but relies on voluntary state and local efforts. The assessments are intended to provide information to local stakeholders to prioritize actions in protecting the drinking water supply and encourage partnerships among local, state and regional agencies to manage and prevent contamination. Mandating the development of SWPPs, like the approach in Ontario, would offer an extra measure of protection.

### Communities and drinking water

Both Parties have collaborated with provincial, state, municipal, First Nations and Tribal governments in supporting essential infrastructure for drinking water treatment systems. However, the federal share of funding has changed over time. After signing the 1972 GLWQA, the Parties shouldered the preponderance of costs for wastewater and drinking water treatment. Over the ensuing decades, the US federal contribution has waned, putting significant upward pressure on US customer billing rates and fostering a steep increase in household service shutoffs due to payment delinquency.

At the IJC public meeting in Detroit, the Commission heard from many people concerned about their loss of access to safe drinking water due to cost. Although some may question whether these concerns fall within the scope of the GLWQA, the Commission believes that it is important that these voices are heard by the governments. The comments received on this topic, and presented in full in the Summary of Public Comment appendix, should be forwarded to appropriate agencies and decision makers. The Commission encourages the governments to take steps to assure that clean drinking water is available to all without regard to ability to pay. More than 300 municipalities take water from the Great Lakes; if it is prohibitively expensive to afford treated drinking water, the result is contrary to the intent of [general objective 1 of the GLWQA](#).

## YOUR VOICE

"We are right here in the middle of the city, and we don't have reliable water, and it's also priced too high. We have some of the highest priced water, and we are surrounded by water. Places that don't have water near them pay less than we do."

Stephen Boyle, IJC Public Meeting on the Great Lakes, Detroit, Michigan, March 21, 2017

## Tribes and First Nations

### Tribes

Tribal public water systems in the United States have more health-based violations of the US Safe Drinking Water Act (SDWA) than the US national average. They also have more SDWA violations overall, including those related to monitoring and reporting. In 2010, over five percent of tribal homes in the United States did not have access to safe drinking water. Many tribes are decades behind non-tribal communities in developing systems for compliance with environmental programs because of their initial exclusion from major environmental statutes established in the 1970s, such as the SDWA. Along with other major environmental laws originally established at that time, the SDWA did not include provisions for implementation on tribal lands for another 20 years.

### First Nations

Drinking water advisories are used to alert communities when drinking water is not safe for consumptive use. In Canada, [Human Rights Watch](#) reports that these advisories, including boil water advisories, occur disproportionately in First Nations communities across the country as compared to the general population. As of July 2017, Ontario had 92 drinking water advisories on First Nations reserves. Several of these are on reserves located in the Great Lakes basin, beginning as early as 2003. Several factors contribute to the water crisis experienced by First Nations, including lack of binding regulations on water quality for First Nations

reserves; continuous under-funding for water system costs (capital, operations and maintenance); worsening conditions of source water; and lack of capacity and support for water operators.

In Canada, provincial and territorial regulations for safe drinking water do not extend to First Nations reserves. Only

the federal government has the authority to pass binding regulations applicable to First Nations reserves. There are currently no drinking water regulations on reserves, though the federal government does provide protocols and standards for design, construction, operation, maintenance and monitoring of drinking water systems in First Nations communities.

### Drinking Water Advisories

Drinking water advisories in Canada include boil water, do not drink, and do not consume advisories. Boil water advisories are issued when drinking water has been, or is suspected to be, compromised by disease-causing organisms. "Do not consume" and "do not use" advisories are used when a chemical contaminant is present, or suspected to be present, in a drinking water supply. Similar categories are used in the different US states, though instead of advisories they could be labelled as drinking water "notices," "alerts," or "orders." The vast majority of advisories issued in Canada are boil water advisories. The causes of boil water advisories are most often due to a failure in the drinking water treatment process, equipment or distribution system. A similar breakdown of advisories and their causes could not be found for the United States.

*This material is taken from an ECCC report, "Canadian Environmental Sustainability Indicators Drinking Water Advisories in Canada." [https://www.ec.gc.ca/indicateurs-indicators/2C75C17A-BD2D-499A-9C8D-4B38E275727B/DrinkingWaterAdvisories\\_EN.pdf](https://www.ec.gc.ca/indicateurs-indicators/2C75C17A-BD2D-499A-9C8D-4B38E275727B/DrinkingWaterAdvisories_EN.pdf)*

*And the US Center for Disease Control's Drinking Water Advisory Communication Toolbox. <https://www.cdc.gov/healthywater/pdf/emergency/drinking-water-advisory-communication-toolbox.pdf>*



## YOUR VOICE

"My First Nation is 20 miles downstream from Michigan's upper peninsula mines. We receive all of their effluent so we've been on boiling water restrictions for years...We are the guardians for the lakes and yet we pay the price for others' actions, including poor management of the lands."

Chief Joe Buckell, Michipicoten First Nation, Public Meeting on the Great Lakes, Sault Ste. Marie, Ontario, March 2, 2017

### Improvements in indicator reporting

The drinking water indicator presented in the Parties' SOGL Highlights report uses municipally treated drinking water quality only. While it is useful for the public to know it is safe to drink treated water, it does not properly assess progress towards the GLWQA's objective 1 that the waters of the Great Lakes "should be a source of safe, high-quality drinking water."

The Ontario Drinking Water Surveillance Program collects untreated (source water) and treated drinking water samples from drinking water facilities and analyzes for a suite of organic and inorganic contaminants, both regulated and non-regulated. There is currently no national US database for source water used as a public drinking water supply. A federal repository for source water data could be established (or current repositories augmented, such as the electronic Storage

and Retrieval/Water Quality Exchange data systems), to enhance indicator reporting under SOGL. Additionally, collecting such data over long periods would allow for assessment of trends and changes in source water quality, and would inform source water assessments and protection planning.



### Gaps in Annex Implementation

The GLWQA highlights the important connection between the quality of Great Lakes waters with human health, particularly the need to restore nearshore waters since they are a major source of drinking water. However, a human health-oriented summary of the quality of Great Lakes waters doesn't exist in the PROP, nor does it report on activities to address human health issues or the drinking water general objective.

To increase the prominence in the GLWQA of the connection of human health to the quality of Great Lakes waters, a committee could be organized around human use of Great Lakes waters, including source waters used for drinking water. The committee could report on human health activities under the GLWQA, including domestic and binational actions specifically aimed at making progress toward achieving objective 1. The committee could also enhance the public's understanding of the Parties' efforts to address human health as affected by the waters of the Great Lakes, and examine emerging water quality issues that could affect human health. Such a committee could become a link among the various annexes that affect the source waters used for drinking (e.g. climate change, chemicals of mutual concern), increasing the importance of, and giving greater consideration to, drinking water impacts. Finally, it could provide an additional mechanism to engage the First Nations, Tribal and Métis communities, populations which may often rely on untreated sources of water for drinking, and incorporate traditional knowledge in protecting the waters of the Great Lakes.

## Conclusion

Federal, state, provincial and local governments have provided safe drinking water almost all of the time nearly everywhere in the basin. However, unsafe drinking water incidents have occurred in major cities and some First Nations and Tribes have had longstanding boil water advisories. The Commission considers 100 percent clean water as the only acceptable situation.

Protecting source water for drinking water supplies – where it is not already mandated – would help to reduce costs of treating water after it is withdrawn and benefit those drinking water supplies drawn directly from the lakes. This is also consistent with the prevention approach in the GLWQA. SOGL reporting should cover source waters in both countries, and increased binational collaboration on all human health issues would help to improve reporting and progress.

## Recommendations

To improve progress toward the objective that the waters of the Great Lakes should be a source of safe, high-quality drinking water, the IJC recommends that:

- The Parties monitor and report on source water quality for drinking water, and the United States match the Ontario requirement for source water protection plans to protect drinking water supplies.
- The Parties address infrastructure needs to eliminate all longstanding boil water advisories and persistent drinking water violations for communities everywhere in the Great Lakes basin.

## 2. SWIMMING AND RECREATIONAL USE

### GENERAL OBJECTIVE 2

*The Waters of the Great Lakes should allow for swimming and other recreational use, unrestricted by environmental quality concerns.*

### SOGL Indicator

**Beaches** for the overall Great Lakes Basin:  
status fair to good, trend unchanging

Sub-indicator across the basin:

- *Beach Advisories*: status fair to good, trend unchanging.



Summary of the status and trend of the State of the Great Lakes Swimming and Recreational use sub-indicator and each Great Lake (Source: SOGL, 2017)

Sub-Indicator	Lake Superior	Lake Michigan	Lake Huron	Lake Erie	Lake Ontario
Beach Advisories	Unchanging	Unchanging	Unchanging	Deteriorating	Unchanging

Status:	GOOD	FAIR	POOR	UNDETERMINED
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### Overview

Public beaches of the Great Lakes are open and safe for swimming an average of 96 percent of the season in the United States and 78 percent of the season in Canada. However, analysis of trends and comparison between countries is difficult because monitoring and criteria that support beach closing decisions vary across jurisdictions. In Canada, for example, Ontario uses more stringent standards that result in additional beach closings. This difficulty in comparing data was noted in the 16th Biennial Report by the IJC

in 2013, where the IJC recommended that the governments develop binational, standardized, basinwide surveillance and monitoring protocols and adopt binational standardized criteria for beach postings. Because recreation is a prime way that people identify with the Great Lakes, water quality monitoring at beaches and maintaining and improving healthy recreational opportunities is key to engaging the public in the protection of the Great Lakes.



## Background

The public beaches of the Great Lakes and connecting waterways are a source of recreation to many of the 40 million residents of the basin and to tourists as well. Coastal and in-lake recreation in the Great Lakes has many benefits. However, swimming, boating and beach use also have the potential to adversely affect human health through exposure to biological hazards such as bacteria or viruses, which may be present in the water. Epidemiological studies have shown several adverse health effects, including gastrointestinal and respiratory infections, to be associated with recreational water in marine and freshwater systems polluted by human and animal waste. These effects can result in a significant burden of disease and economic loss. Sources of this fecal pollution include combined sewer overflows (CSOs), sanitary sewer overflows, urban and agricultural stormwater runoff, as well as septic system discharge and leakage.

### YOUR VOICE

"I recently moved to the St. Catharines area and was pleasantly surprised that the Lake Ontario water at the Port Dalhousie Beach was clear. I even chose to swim in it last summer. I also swam at Crystal Beach in Lake Erie. Ten, fifteen or twenty years ago I wouldn't have dreamed of swimming in either of these two lakes. But, because of the monitoring and cleanup of the Great Lakes, I felt comfortable enough to submerge myself in these waters."

Suzanne V. Tilley, St. Catharines, Ontario, letter via email, March 31, 2017

## Assessment

Determining the extent to which programs and measures are achieving the GLWQA's recreational use general objective is complicated by the lack of a specific corresponding annex that directly supports the implementation and reporting of programs to achieve this objective. Numerous GLWQA activities relate to beach health and indirectly work to protect and improve recreational water quality: work under Annex 1 includes improvement of beaches at Areas of Concern (AOC); recreational water quality is considered under Annex 2; lakewide management, and design and monitoring of the indicator for beach health to support SOGL reporting falls under Annex 10 (Science). However, this level of indirect attention is insufficient considering the importance of recreational water quality to the Great Lakes public.



As the PROP is organized around annex-by-annex reporting, there is little attention to swimming or the use of Great Lakes waters for recreation. The discussion of swimming and recreational water quality that does occur relates to the nutrients annex and Ohio, Pennsylvania and US federal actions to monitor and manage harmful algal blooms (HABs) and risks associated with the release of cyanobacterial toxins in recreational waters. Canadian action on the Hamilton Harbour AOC mentions improved recreational waters as a byproduct of AOC cleanup.

The Parties reporting on recreational waters and human health could be improved to address specific initiatives related to beach improvement and maintenance as well as the numerous activities under the different annexes that impact the quality of recreational waters and beach health. No provision currently exists for routine identification and reporting of emerging issues related to human health general objectives, and to coordinate annex activities related to recreational water and human health. For example, there is no connection made between recreational waters and the need to address sewer overflows. Also, the path for recognizing HABs as a recreational water issue and incorporating new HABs monitoring technologies into recreational water reporting under the GLWQA is unclear.

SOGI reporting on recreational waters includes an indicator addressing the frequency of beach advisories in both countries. The indicator status and trends are reported for the basin overall and for each Great Lake. This reporting has two main weaknesses.

First, lake-by-lake assessments, which average indicator levels across an entire lake, do not give the public information about local beaches. The averaging obscures the positive impacts of local improvements and the negative impacts of compromised local water quality, thus preventing feedback to communities on successes or failures in their efforts to keep individual beaches swimmable. Mapping of beach closing data to show its spatial distribution around each lake should be pursued. Second, Great Lakes beach closures are determined by First Nation and Tribes, states, provinces and local governments. One jurisdiction's beach advisory statistics cannot be accurately compared to or averaged with those of another jurisdiction because consistency in monitoring and criteria do not exist. This makes trends difficult to interpret.

Improved focus and coordination to achieve the swimming and recreational water use objective could result in improved reporting on progress, better identification and examination of emerging issues specific to recreational water quality, and enhanced public understanding of the Parties' efforts to address recreational water use issues.

Canadian Great Lakes beaches that demonstrate they have met strict international criteria for monitoring and reporting based on applicable water quality standards and other education and management criteria can hold Blue Flag certification. The number of beaches achieving this certification in Canada increases each year. The Parties could consider and work toward a goal of achieving blue flag, or similar, certification at beaches throughout the basin.

## Blue Flag Beaches

Blue Flag status has been awarded to many beach sites around the world. Blue Flag offers an attractive model for beach certification that promotes beach safety, environmental monitoring, and public communication of water quality to protect public health, using standardized activities and practices.

Blue Flag's emphasis on public outreach and education is instructive, and useful to consider given the challenges of effectively communicating beach status to visitors and residents of the Great Lakes basin in both countries.

In the United States, the Environmental Protection Agency (USEPA) implemented the health-protective Beach Action Value, which serves as a precautionary benchmark for making swimming safety decisions. A high exceedance rate of Beach Action Values indicates that coastal recreational waters are contaminated. Using this benchmark, the [Natural Resources Defense Council \(NRDC\)](#) reports that the Great Lakes region is consistently reported to be the US region with the highest percentage of beach water samples that exceed these recreational water quality criteria. The percentage of exceedance

for the Great Lakes narrowly surpasses other US regions, such as the Gulf Coast and New England, due in part to the high rate of criteria exceedance at Ohio beaches. According to the NRDC, chronically high bacteria counts indicate that beach water is probably contaminated with human or animal waste.

## Indicators and monitoring

Given the lack of consistency in the indicator reported by the Parties, the IJC recommended two indicators in 2014 for recreational water that could be sub-indicators in the new SOGL structure. The first, *Risk of Illness from Great Lakes Beaches*, calls for continued measuring of *E. coli* levels in Great Lakes recreational waters. The second indicator, *Identified Risks at Great Lakes Beaches*, includes two measures: one supporting an assessment of the sources of contamination for Great Lakes beaches; and one to show how many beaches adhere to best practices by using a beach survey tool. While new indicator reporting will incur additional costs by the Parties, there are also significant costs associated with illnesses attributable to swimming and other activities at Great Lakes beaches.

The US Beaches Environmental Assessment and Coastal Health Act places a strong emphasis on bacterial monitoring for recreational waters. It requires all coastal states, including Great Lakes states, to develop programs for effective water quality monitoring and public notification of health risks at coastal recreational beaches.



All eight states in the Great Lakes basin have signed onto the act. These programs are implemented through state health or natural resources departments. Local and state health departments in the United States have experienced major budget and staff reductions since 2008, however, and funding for the act historically has been tenuous. Continued Congressional support is by no means certain.

In Ontario, the Safe Water Program requires boards of health to conduct surveillance of public beaches and assess factors and emerging trends related to illnesses and injuries. Ontario Public Health Standards for recreational water monitoring protocols are based on authority from the Ontario's *Health Protection and Promotion Act*. This approach presents challenges for the health units with limited funding because beach monitoring represents only one component of a wide-ranging mandate for public health.

Ongoing work by NOAA, the USEPA and the US Geological Survey holds promise for *E. coli* source tracking, predicting real-time water quality conditions and increasing the accuracy of beach closure notifications. These programs are particularly valuable given that the lag time in availability of *E. coli* data can be up to 24 hours, meaning that human exposure to unsafe levels of *E. coli* can occur when there is no advisory.



## Conclusion

Great Lakes public beaches are open and safe for recreational use most of the time in both countries. Governments at all levels must strive to further improve safety and beach health. Given the importance of lake recreation to the Great Lakes public and to local economies, the Parties should increase their attention to recreational waters in GLWQA implementation. Standard monitoring approaches in both countries and adoption of indicators previously recommended by the IJC are steps that could improve reporting, protect beaches, and increase public safety when using Great Lakes beaches. Improved focus and coordination around achievement of the objective for recreational water use could enhance progress reporting on this topic, identify emerging issues specific to human health and recreational waters, and support policies and programs to create blue flag beaches, or its equivalent, throughout the basin.

### 3. CONSUMPTION OF FISH AND WILDLIFE

#### GENERAL OBJECTIVE 3

*The Waters of the Great Lakes should allow for human consumption of fish and wildlife unrestricted by concerns due to harmful pollutants.*

#### SOGL Indicator

**Fish Consumption** for the overall Great Lakes Basin: status fair, trend unchanging

Sub-indicator across the basin:

- *Contaminants in Edible Fish*: status fair, trend unchanging.



Summary of the status and trends of the State of the Great Lakes Fish Consumption sub-indicator and each Great Lake (Source: SOGL, 2017)

Sub-Indicator	Lake Superior	Lake Michigan	Lake Huron	Lake Erie	Lake Ontario
Contaminants in Edible Fish	Unchanging	Improving	Unchanging	Deteriorating	Improving

Status:	GOOD	FAIR	POOR	UNDETERMINED
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#### Overview

The Parties' efforts since the 1970s have resulted in steep declines in legacy chemicals in commonly consumed Great Lakes fish. However, fish consumption advisories remain in place for some species in all Great Lakes and a lack of standardized methodologies for collection, analysis and reporting of data across jurisdictions undermines creation of a reliable indicator.

#### Background

Many people in the Great Lakes basin consume fish from the Great Lakes. Legacy toxic substances and emerging contaminants have triggered health advisories recommending limited human consumption of some species in some locations. Fish consumption advisories exist for particular fish species in each of the Great Lakes. These advisories vary across the region and are most notable for long-lived top predators that have more fat, such as walleye, lake trout and salmon. Polychlorinated biphenyls (PCBs) are responsible for the majority of advisories, followed by mercury and dioxins.



Health advisories related to Great Lakes fish consumption are of greatest concern for those who consume large amounts of fish, such as subsistence anglers, many African Americans, indigenous communities, and some minority and immigrant communities, and those who are most vulnerable to the impact of toxic substances, such as women of childbearing age and young children.

## Assessment

Differences in collection, analysis and reporting of data pose challenges in developing a Great Lakes sub-indicator on contaminants in edible fish to support the basinwide indicator for fish consumption. A common set of fish species, chemicals and standardized methods is needed for comprehensive SOGL reporting.

Fish consumption advisories for Canadian portions of the Great Lakes vary by lake and are related primarily to PCB levels and secondarily to dioxins or furans and mercury levels. Ontario has also developed a comprehensive fish consumption advisory program, including in recent years consumption advice for subsistence or frequent consumers (for example, a maximum of 32 meals per month). The US Environmental Protection Agency (USEPA) has published general guidance for fish consumption based on contaminant concentrations in fish tissues. State agencies also provide fish consumption guidance at their discretion and its distribution varies from state to state. However, concern remains about the persistence of contaminants in fish at elevated levels and their human health impact when consumed, either by high-volume fish consumers or populations that are susceptible to impacts from contaminants. Greater collaboration among federal, state and provincial agencies and Tribes, First Nations and Métis governments is needed on fish consumption guidance.

In 2014, the IJC recommended standardized methods to assess contaminant levels in the edible portions of fish for use as an indicator. The Parties have partially implemented this recommendation, reporting basinwide and lake-by-lake levels and trends for select contaminants in five species of top predator and sports fish deemed of interest for human consumption. The IJC continues to support the Parties' use of the new sub-indicator, contaminants in edible fish, but notes that broadening the emphasis of reporting beyond sports fish, as suggested by the IJC, would enable the inclusion of fish from



different trophic levels in the ecosystem that may be caught by a broader population of fishers. The IJC also supports binational methods and standards for determining the safety of Great Lakes fish consumption.

Both countries maintain long-running programs to examine levels of chemicals in Great Lakes fish commonly consumed by humans and there are multiple drivers for monitoring contaminants in fish. Data from Ontario's Fish Contaminant Monitoring Program, individual state monitoring programs, and results of the USEPA's 2010 Great Lakes Human Health Fish Tissue Study were used to screen edible fish portions for legacy and emerging contaminants across multiple fish species, which are included in binational Great Lakes reporting. However, differences in data collection, analysis and reporting pose challenges in developing a Great Lakes basinwide indicator for fish consumption. For instance, a common set of fish species and chemicals is needed for future data collection and assessment.

The only discussion of fish consumption in the PROP relates to the potential for exposure to persistent and bioaccumulative chemicals through fish consumption. No actions directly related to fish consumption are listed.

Greater focus and coordination around achievement of the objective for fish consumption could improve progress reporting on this topic, improve the standardization of data across jurisdictions, and improve communication of fish consumption advisories across the basin.

### Communicating Advisories

Ensuring the proper communication of fish consumption advisories can be challenging. In 2004, the IJC's Health Professionals Task Force (now the Health Professionals Advisory Board) noted that 38 percent of fish eaters surveyed used only conventional sources of information, most often the media, when deciding whether to eat their catch. Jurisdictional fish advisories



should consider the perception of those being advised and site-specific data, as well as cultural and socio-economic factors. Agencies developing advisories aimed at restricting meals of local fish should keep in mind the social, cultural and health consequences of these advisories for First Nations, Tribes and Métis communities.

## YOUR VOICE

"Fishing isn't like it was a century ago anywhere in the lakes, which reflects sickness in water... Subsistence fishing is essential for our people, we've changed which parts we feed our children to protect from contaminants, and we're trying to get the message out to more of our community about which fish are safe to eat. The size of fish have declined dramatically, which is a huge economic impact for the Native fishing industry."

Jennifer McLeod, Tribal Councilwoman, Sault Ste. Marie Tribe of Chippewa Indian. March 2, 2017, Sault. Ste. Marie, Ontario IJC Listening Session with First Nations and Tribes



An understanding of knowledge gaps in advisories along with message refinement and alternative outreach efforts are needed to increase compliance with fish consumption guidelines, particularly among subpopulations that exceed the guidelines frequently. A study of women of childbearing age who purchased fishing licenses in Great Lakes states found that one quarter exceeded fish consumption guidelines, with rates as high as 41 percent exceeding the guidelines in Michigan and Minnesota. Certain subpopulations who consume more fish such as women, older people and urban anglers, especially many African American and immigrant communities, may be at increased risk for exposure to potentially contaminated fish. Advisories to these communities may be best targeted by using locally based programs to communicate fish consumption advice.

Risks and benefits should be considered in decisions whether to consume Great Lakes fish. Fish supply healthy unsaturated fats and high-quality protein, but may contain contaminants at high enough levels to impact human health. Common alternative foods to fish may provide health promoting nutritional value, but also saturated fats or sugars and contaminants of their own.

## Consumption of Wildlife

Although this GLWQA objective also addresses human consumption of wildlife unrestricted by concerns due to harmful pollutants, the PROP does not mention programs related to wildlife consumption. SOGL reporting does not connect human health with consumption of species dependent on Great Lakes waters.

Information regarding the widespread consumption of Great Lakes wildlife is limited and the level and spatial distribution of consumption patterns may not justify binational activities. Some Great Lakes states have active health advisories for certain game species of waterfowl and snapping turtles due to concerns over levels of contamination by mercury and organic chemicals such as PCBs.

## Conclusion

Most Great Lakes fish are safe to eat if consumers follow guidelines from state and provincial agencies and First Nations, Tribal and Métis governments. When issued, more effort is needed to make people aware of advisories and concerns about the human health impact of contaminants in fish consumed at relatively high rates such as subsistence anglers and those vulnerable to contaminants such as women of childbearing age. Improvements in data collection, reporting and information sharing would help in discerning trends and communicating risks for contaminants found at levels of concern.

## Recommendation

To improve progress toward the objective that the waters of the Great Lakes allow for human consumption of fish, the IJC recommends that:

- The Parties set a goal of reaching all populations vulnerable to health impacts from fish consumption with accessible and protective fish consumption advisories, and draw up a plan to do so. Populations include frequent consumers of Great Lakes fish such as subsistence anglers, many African Americans, indigenous communities, and some immigrant and other minority communities. It also includes those vulnerable to contaminants such as women of childbearing age and young children. In developing a plan to reach this goal, the Parties should collaborate more closely with representatives of these communities.



## 4. POLLUTANTS

### GENERAL OBJECTIVE 4

*The Waters of the Great Lakes should be free from pollutants in quantities or concentrations that could be harmful to human health, wildlife, or aquatic organisms, through direct exposure or indirect exposure through the food chain.*

### SOGL Indicator

**Toxic Chemicals** for the overall Great Lakes Basin: status fair, trend unchanging to improving.

Sub-indicators across the basin:

- *Chemicals in Great Lakes herring gull eggs:* status good, trend improving.

- *Toxic chemical concentrations in open water:* status good, trend unchanging.
- *Atmospheric deposition of toxic chemicals:* status fair, trend improving.
- *Toxic chemicals in sediment:* status fair, trend improving.
- *Toxic chemicals in Great Lakes whole fish:* status fair, trend improving.

Summary of the status and trends of the State of the Great Lakes Toxic Chemicals sub-indicators and each Great Lake (Source: SOGL, 2017)

Sub-Indicator	Lake Superior	Lake Michigan	Lake Huron	Lake Erie	Lake Ontario
Toxic Chemical Concentrations	Improving	Unchanging	Unchanging	Unchanging	Unchanging
Toxic Chemicals in Sediments	Unchanging	Unchanging	Unchanging	Improving	Improving
Toxic Chemicals in Great Lakes Whole Fish	Unchanging	Improving	Unchanging	Unchanging	Improving
Toxic Chemicals in Great Lakes Herring Gull Eggs	Improving	Improving	Improving	Unchanging	Unchanging
Atmospheric Deposition of Toxic Chemicals	No lake was assessed separately Great Lakes Basin assessment is Fair and Improving				

**Status:** GOOD FAIR POOR UNDETERMINED

### Overview

The IJC values the principle of prevention, so progress to prevent pollutants from entering the lakes weighs heavily in the Commission's assessment of the extent to which programs and measures are achieving objective 4. Although the development of procedures and processes to nominate and scientifically review

chemicals of mutual concern (CMCs) was a positive step in the new approach to chemicals under the 2012 GLWQA, delays in identifying CMCs and the failure to complete binational strategies for action in the first three years of the Agreement means that no new binational actions to prevent the input of pollutants



Historically, intense industrial activities in the Great Lakes region and long-range atmospheric transport and deposition of chemicals from out-of-basin sources have contributed to chemical pollution of the Great Lakes. In addition to harming aquatic life, certain chemicals pose human health risks, primarily through consumption of contaminated fish.

## YOUR VOICE

"The pollution of the Great Lakes and its detrimental effects on the populace are well documented and supported by scientific data. The longer we discuss without corrective action the larger the problem becomes...Inaction is equivalent to poisoning our offspring."

Jim Clark, Erie Pennsylvania, email,  
January 24, 2017

into the lakes have been implemented. As governments work to target CMCs for action in the next triennial cycle, they should implement the GLWQA principles of zero discharge, virtual elimination, accountability and public engagement, as well as Extended Producer Responsibility.

## Background

The Great Lakes are uniquely vulnerable to chemical contamination because they have a large surface area and flush slowly, which means many chemicals can enter the lakes via multiple pathways and collect in fish, wildlife and sediment. This is especially true for chemicals such as PCBs and DDT that build up (bioaccumulate) in the food web and break down slowly in the environment. Thus, chemical concentrations decline only gradually once controls are put in place.

The 2012 GLWQA introduced a new way of addressing pollutants. As opposed to addressing long lists of hazardous (and potentially hazardous) polluting substances as per the 1987 GLWQA, the 2012 GLWQA focuses action on chemicals of mutual concern (CMCs). CMCs are to be designated by governments, followed by the development and implementation of binational strategies for action.

## Assessment

Levels of legacy toxic chemicals such as PCBs and dioxins are generally declining across the Great Lakes (Figure 1), yet levels of several new and emerging toxic chemicals such as the fire retardants dechlorane plus and hexabromocyclododecane (HBCD), which saw greater use after the phase out of another flame retardant, PBDEs, appear to be increasing. Mercury levels in some species of Great Lakes fish are stable or increasing but still well below levels of the 1970s.

During the first triennial cycle of GLWQA implementation, the governments developed a binational process for designating CMCs and selected eight chemicals (or chemical classes) in May 2016. The governments also created a process for public nomination of chemicals for consideration as CMCs. Nominations of radionuclides by the public and sulfates, lead and polycyclic aromatic hydrocarbons (PAHs) by government agencies are currently under consideration. Draft binational strategies for risk management for the first two CMCs (PCBs and HBCD) designated in May 2016 were not released until February 2017.

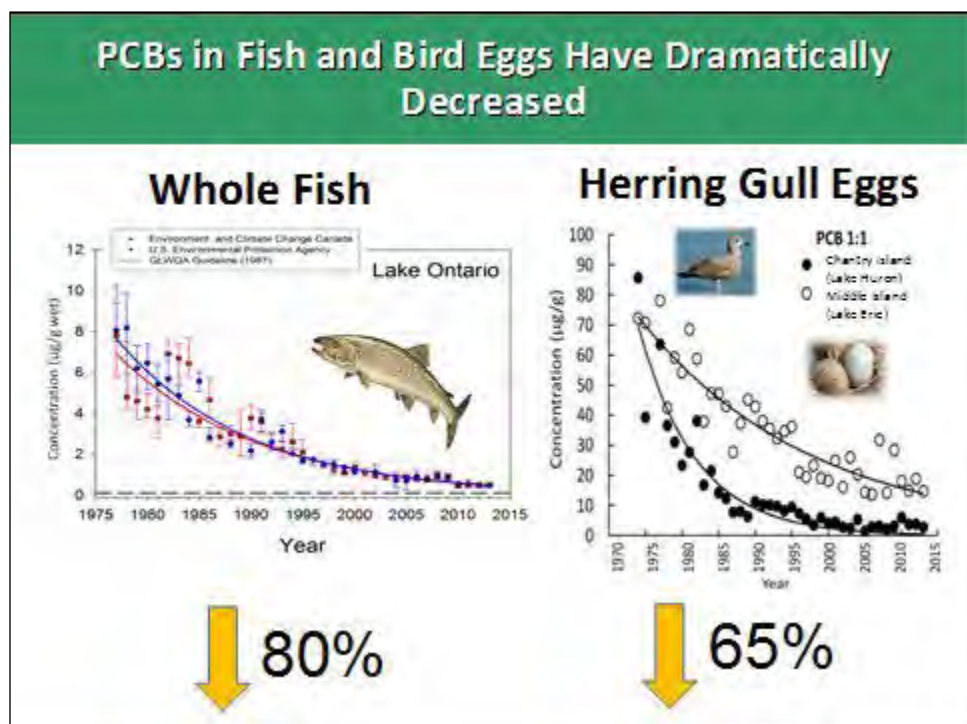


Figure 1. Levels of PCBs have declined in herring gull eggs and fish (Source: Draft State of the Great Lakes Report as presented at the Great Lakes Public Forum)





The Parties are to be commended for developing a binational process and designating the first set of eight CMCs under the GLWQA. This met their basic commitments under Annex 3. However, they fell well short of their own 2014-2016 priorities for science and action, which called for designation of the first CMCs in spring 2014 and completion of binational strategies for management by summer 2015.

Environmental organizations have expressed concerns to the governments and the IJC about the slow pace of the CMCs annex implementation. The IJC shares these concerns. Without strategies in place, there are no new binational actions to prevent chemicals from entering the lakes, though each country continues its individual efforts. Targets for strategy development and implementation must be set and met by the governments for each triennial cycle.

Looking forward to the development and implementation of strategies for action on CMCs, the IJC notes the principles of zero discharge and virtual elimination in Article 2 of the Agreement. The strategies developed must be aimed at implementing these principles for maximum protection of the lakes from persistent toxic CMCs. Lessons learned from past programs and initiatives related to virtual elimination and zero discharge, such as the Great Lakes Binational Toxics Strategy and Lake Superior Zero Discharge Demonstration Program, should be incorporated into the binational strategies developed for CMCs and used as a basis for discussion of the path towards achieving this general objective. Implementation of zero discharge and virtual elimination principles for CMCs would also answer the many public comments received by the IJC calling for a chemical-free Great Lakes. Strategies must also contain clear timelines for the implementation of actions to put these principles into effect.

## YOUR VOICE

"The Agreement's methodology for CMCs is simply impractical. With 80,000 chemicals in commerce and hundreds detected in the Great Lakes, it makes no sense to creep along a few chemicals at a time. The governments should carry out the Agreement mandate to eliminate all chemicals detected in the Great Lakes known to have or suspected of having toxic effects."

Michigan League of Conservation Voters, West Michigan Environmental Action Council, Lone Tree Council, letter via email, October 6, 2016

Moving toward zero discharge of CMCs means eliminating discharge of chemicals during manufacturing and industrial processes and addressing the release of pollutants into the Great Lakes throughout the life cycle of a product. The GLWQA's Annex 3 stresses the "importance of a life-cycle management approach."

In November 2016, based on the work of its Great Lakes Water Quality Board, the IJC issued a report to governments on PBDEs in the Great Lakes basin. PBDEs are a family of chemicals used as fire retardants and designated by the governments as a CMC. The IJC report recommended a combination of approaches to prevent and reduce the release of PBDEs during the life cycle of products containing PBDEs and during end-of-life management. While specific to PBDEs, these approaches can be adapted for other CMCs and their binational strategies.

In particular, the IJC report on PBDEs made recommendations regarding Extended Producer Responsibility (EPR). EPR is a policy approach in which a producer's responsibility for a new product extends to the post-consumer stage of its lifecycle. EPR shifts responsibility (fully or partially) upstream to producers and away from municipalities and provides incentives to producers to incorporate environmental considerations in the design of their products. Further work by the Water Quality Board in 2017 explored the concept of EPR with key Great Lakes stakeholders and recommended a cooperative approach to EPR, with government giving it the force of law if required for purposes of accountability. Such an EPR program should include products

made with alternative flame retardants and could become a model for EPR programs for other products containing toxins.

## YOUR VOICE

"Adopting these principles [of EPR] for chemicals of mutual concern, as advanced in the [draft TAP] Report, would advance a prevention-first approach to managing chemicals that impact source water."

Erin Mahoney, Commissioner,  
Environmental Services, The Regional  
Municipality of York, letter via email, April 13, 2017



In Canada, the Canadian Council of Ministers of the Environment (CCME) established a Canada-wide Action Plan for EPR in 2009, with common coordinated policies, commitments for government action, and common key elements for building producer responsibility for priority products across Canada. Based on local needs and priorities, provincial governments also are responsible for developing regulatory approaches and setting performance measures and targets under the framework. Ontario and Quebec both have legislated EPR programs in place for electronics. Environment and Climate Change Canada has also identified EPR as a risk management option for products containing substances that are considered toxic under the Canadian Environmental Protection Act of 1999.

In the United States, state governments bear responsibilities similar to Canadian provinces to put in place legislation and implement EPR programs. US federal government action has largely focused on removing barriers to state initiatives. Opportunities exist for collaboration between Canada and the United States for joint identification and designation of products and materials for EPR action. The Canadian approach to EPR could be explored as a potential model for further implementation of EPR in the United States.

Review of Annex 3 implementation also demonstrates the need for more accountability and transparency in the work of the annex committee and how it makes decisions. Improved transparency will be especially important as the governments consider the public's nomination of radionuclides as a CMC and respond regarding their eventual decision. During IJC public input sessions, concerns about radionuclides and nuclear activity and the desire to have radionuclides designated as a CMC were heard repeatedly across the basin. The IJC also heard from the nuclear industry that radionuclides should not be designated as a CMC given the rigorous federal regulations, standards and licensing requirements for nuclear facilities that are already in place to protect human health and the environment. Independent of what the governments decide, the evaluation criteria and supporting information considered, the reasoning behind decision making, and any alternative or additional actions to be taken must be very clear to all concerned to maintain the integrity of the designation process and uphold the principles of the GLWQA.

Now that the public has been engaged in the implementation of Annex 3 through the public nomination of CMCs, the governments will need to think constructively and strategically about how this public interest is maintained and what it can bring to the CMC process.



## Conclusions

Progress in reducing levels of legacy chemicals is encouraging, but levels of emerging contaminants are of concern. Expediting the process to select CMCs and develop binational strategies for their elimination or control are among the most important improvements needed to meet GLWQA objectives. Strategies to address

CMCs need to be aimed at achieving zero discharge of these persistent toxic substances. Extended Producer Responsibility is an approach that should be further implemented in the Great Lakes basin to prevent pollutants from entering the Great Lakes during product use and disposal.

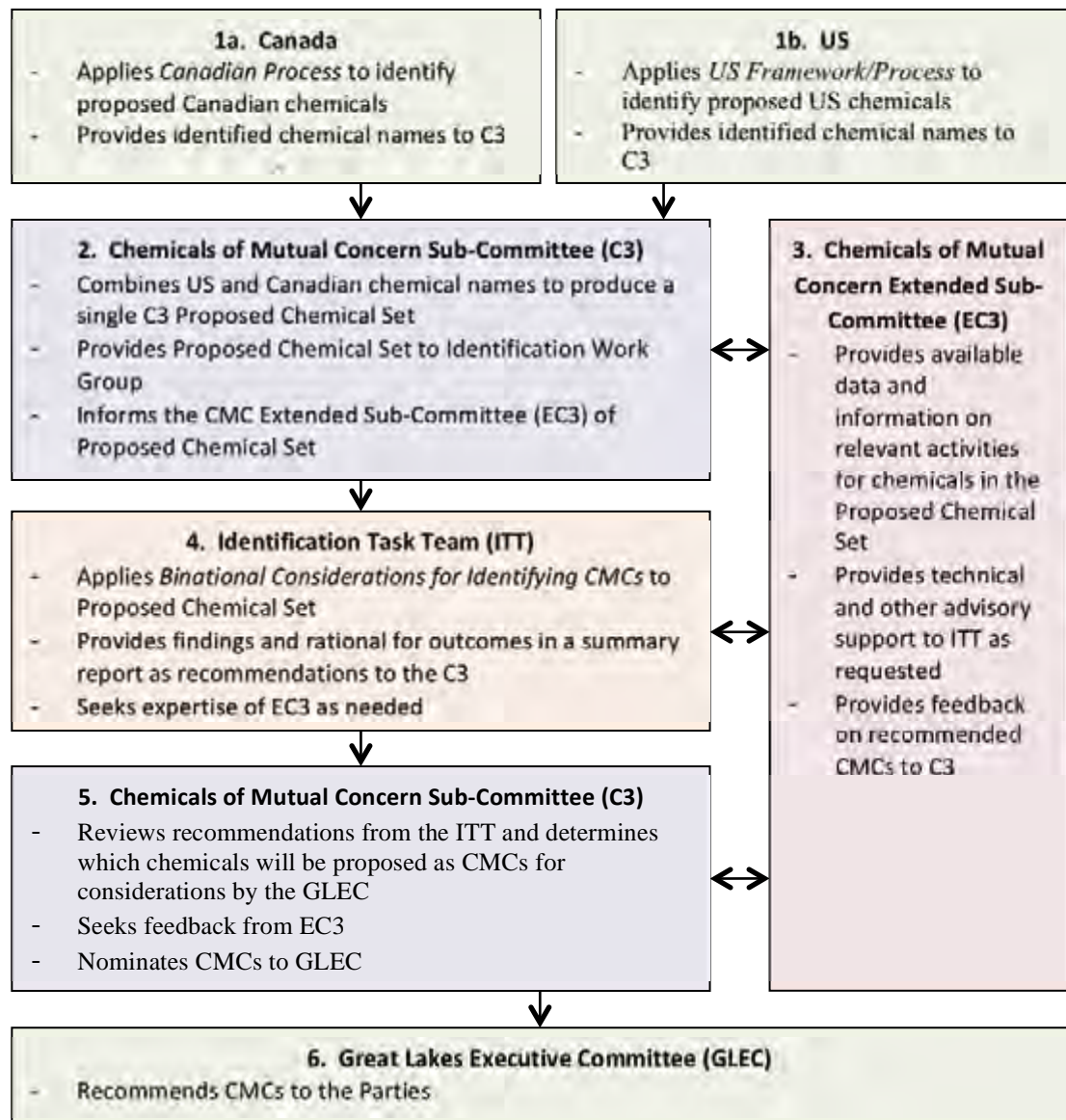
## Recommendations

To improve progress toward achievement of the pollutants objective, the IJC recommends that:

- The Parties accelerate work on binational strategies for elimination or continual reduction of chemicals of mutual concern with clear timelines set and met for strategy development and implementation.
- The Parties develop strategies that have at their core the principle of zero discharge.
- The Parties adopt and extend policies and programs based on the principles of Extended Producer Responsibility (EPR) on a broad range of products, including flame retardants, to prevent introduction of toxic and non-toxic contaminants into the Great Lakes. The Parties should include status reports on EPR programs and policies in the triennial Progress Report of the Parties.



Summary of Annex 3's Process for Recommending Chemicals of Mutual Concern to the Parties



## 5. WETLANDS AND OTHER HABITATS

### GENERAL OBJECTIVE 5

*The Waters of the Great Lakes should support healthy and productive wetlands and other habitats to sustain resilient populations of native species.*

### SOGL Indicator

**Habitats & Species** for the overall Great Lakes Basin: status fair, trend unchanging.

Sub-indicators across the basin:

- *Coastal Wetlands*: status fair, trend unchanging.
- *Aquatic Native Species*: status fair, trend unchanging.

Summary of the status and trends of the State of the Great Lakes Wetlands and Other Habitats sub-indicators and each Great Lake (Source: SOGL, 2017)

Sub-Indicator	Lake Superior	Lake Michigan	Lake Huron	Lake Erie	Lake Ontario
Coastal Wetland Amphibians	Unchanging	Unchanging	Unchanging	Unchanging	Unchanging
Coastal Wetland Birds	Unchanging	Unchanging	Unchanging	Deteriorating	Improving
Coastal Wetland Fish	No lake was assessed separately Great Lakes Basin assessment is <b>Fair</b> and <b>Improving</b>				
Coastal Wetland Invertebrates	No lake was assessed separately Great Lakes Basin assessment is <b>Fair</b> and <b>Deteriorating</b>				
Coastal Wetland Plants	Undetermined	Undetermined	Deteriorating	Deteriorating	Unchanging
Coastal Wetlands: Extent and Composition	No lake was assessed separately Great Lakes Basin assessment is <b>Undetermined</b>				
Aquatic Habitat Connectivity	Improving	Improving	Improving	Improving	Improving

Status:	GOOD	FAIR	POOR	UNDETERMINED
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### Overview

The Parties have made important progress in addressing the general objective for wetlands and other habitats through implementation of the Habitat and Species Annex. Building on many years of experience, the Parties have made considerable effort to assess the status and trends of the health of the Great Lakes related to this objective and prepare useful SOGL indicator information. The development of binational habitat conservation

strategies is a significant contribution towards achievement of this objective. The ecological condition of wetlands can be improved through strengthening existing binational, domestic and local habitat restoration and protection programs, and supporting new initiatives.

The SOGL 2017 report shows that the overall trend of food web sub-indicators varies by lake, with some showing improvements and others deteriorating. Under the SOGL indicator for aquatic native species, lower food web



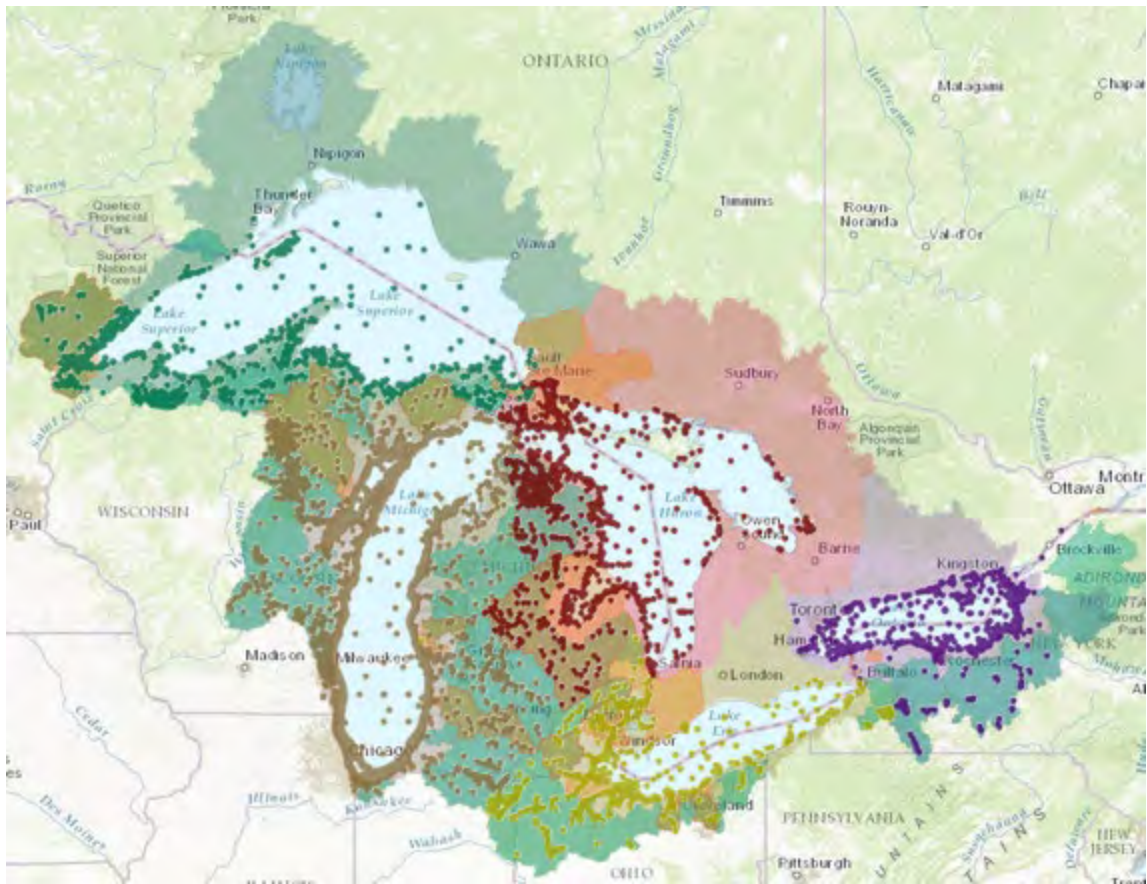


Figure 2: The USGS Science in the Great Lakes Mapper helps researchers and managers communicate, and analyze monitoring and restoration activities by providing easy access to project data. (Source: <https://sigl.wim.usgs.gov/sigl/>)

component sub-indicators (phytoplankton and *Diporeia*, a small shrimp-like crustacean) show a deteriorating trend in three or four of the lakes, whereas lake sturgeon populations are improving in all five lakes.

The Parties concluded that the overall health of coastal wetlands is unchanging, though no individual lake assessments have been conducted for coastal wetland fish and coastal wetland invertebrate sub-indicators. The extent and composition of coastal wetland sub-indicator is undetermined, although it

was estimated that over half of Great Lakes wetlands have been lost basinwide, with losses of up to 90 percent in some areas. Aquatic habitat connectivity is the only sub-indicator showing improvement for all five lakes.

## Background

The Great Lakes consist of more than 121,406 hectares (300,000 acres) of coastal wetlands, 16,431 km (10,210 miles) of shoreline, 246,049 km<sup>2</sup> (95,000 mile<sup>2</sup>)

water surface area, and 22,925 km<sup>3</sup> (5,500 mile<sup>3</sup>) water volume. These features provide critically important habitats for plants, insects, reptiles, amphibians, fish, waterfowl, water birds and mammals. Coastal wetlands also play an essential role in maintaining the health of Great Lakes aquatic ecosystems and improving water quality through the trapping and filtration of sediment and pollutants, and by storing and cycling nutrients and organic material derived from the land. Although healthy wetlands have always provided essential functions to support thriving plant and animal communities, their value has not always been understood and appreciated.

Other habitats such as non-wetland shoreline ecosystems and coastal tributaries and habitat features, such as connectivity to Great Lakes tributaries, coastal shoreline characteristics, lake substrates composition, water current movement and energy, and water quality and quantity, are also critically important to aquatic life, ecosystem function and human uses of the Great Lakes.

## Assessment

The Parties' lakewide habitat and species protection and restoration conservation strategies have been important achievements in support of the objective for wetlands and other habitats. In addition, the Parties have developed a consistent basinwide approach for surveying Great Lakes habitat and measurement of net habitat gain.

To comprehensively measure coastal wetlands and the food web, the Parties used 16 sub-indicators. As a result, data collection and management is a key challenge to strengthening future assessments of progress towards this GLWQA objective. The data available for coastal wetland extent and composition assessment are the data generated in 2004 by the Great Lakes Coastal Wetlands Consortium, over 12 years ago. Hence, according to the SOGL report, the current areal extent and composition of coastal wetlands across the entire Great Lakes basin cannot be accurately



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reported. An improved wetland data collection strategy is needed to ensure the detection of trends of this sub-indicator. Weaknesses in the current approach are associated with a reliance on short-term monitoring programs that are vulnerable to being discontinued, lack of standardized assessment methods, lack of continuity and transparency in data collection, and the absence of a mechanism for coordinating the data collection undertaken by various individuals and agencies.

## YOUR VOICE

"We know so much about wetland values and ecosystem services whether it's flood mitigation, water quality improvement specifically related to phosphorus as well as carbon sequestration. Despite all of that knowledge, despite our collective efforts, we still lose wetlands."

Kevin Rich, Ducks Unlimited, IJC Public Comment Session at the Great Lakes Public Forum, Toronto, October 5, 2016



Figure 3: Habitat Restoration Huron-Erie Corridor Sturgeon spawning sites and Reef Construction projects (Source: [http://www.habitat.noaa.gov/pdf/restoring\\_fish\\_habitat\\_in\\_the\\_stclair\\_river.pdf](http://www.habitat.noaa.gov/pdf/restoring_fish_habitat_in_the_stclair_river.pdf))



The Parties established the Habitat and Species Annex subcommittee and task teams in 2013 to address the above tasks. As reported in the PROP, the most significant achievements during the past three years are the development and implementation of lakewide habitat and species protection and restoration conservation strategies in each lake, and establishing a consistent basinwide approach to surveying Great Lakes habitat and measuring net habitat gain. The strategies, which have been developed for all five lakes as of 2015, assess the status and threats to lakewide biodiversity and recommend conservation priority for native species and their habitats.

The development of these surveys is a positive step for habitat and species protection. However, an effective data management system and coordination mechanism to facilitate sharing of survey data among partner agencies is needed.

In addition to their own direct work towards this objective, the Parties have facilitated a range of binational collaborative partnerships and programs in support of the Habitat and Species Annex, along with domestic and local collaborative programs. These partnerships have engaged federal, state, provincial, Tribal, First Nations, municipal government watershed management agencies and nongovernmental organizations. Opportunities are emerging from the annex process to promote and support new binational collaborative actions to reduce the loss of native species and habitat, recover populations of native species at risk, and restore degraded habitat.

The concurrence of the Parties with the IJC's Plan 2014 for the regulation of flows and levels through the Moses-Saunders dam at Cornwall, Ontario and Messina, New York will help to restore the diversity and health of the remaining coastal wetlands on Lake Ontario and the upper St. Lawrence River. These wetlands represent over 20 percent of the existing coastal wetlands covered by the GLWQA.

Further restoration activities to protect wetlands should involve the adoption of protective planning and zoning policies. Green infrastructure can also be used not just to protect wetlands but also start the process toward meeting the GLWQA's commitment to net habitat gain.

## Conclusion

The Parties have done commendable work in developing habitat measurements and collaborating with a variety of actors in developing habitat conservation strategies. Further improvements in data collection and management could strengthen reporting and assessment of this objective. Recognizing the importance of maintaining existing wetlands and restoring degraded or lost wetlands, more efforts are needed to prioritize restoration activities and establish collaborations amongst all levels of government, indigenous peoples, stakeholders and nongovernmental organizations. Protective planning and zoning policies along with funding are also needed to ensure that coastal wetlands remain healthy.

## 6. NUTRIENTS

### GENERAL OBJECTIVE 6

*The Waters of the Great Lakes should be free from nutrients that directly or indirectly enter the water as a result of human activity, in amounts that promote growth of algae and cyanobacteria that interfere with aquatic ecosystem health, or human use of the ecosystem.*

### Draft SOGL Indicator

**Nutrients & Algae** for the overall Great Lakes Basin: status fair, trend deteriorating.

Sub-indicators across the basin:

- *Nutrients in Lakes*: status fair, trend deteriorating.
- *Cladophora*: status fair to poor, trend undetermined.
- *Harmful Algal Blooms*: status fair, trend deteriorating.
- *Water Quality in Tributaries*: status poor to fair, trend unchanging.

Summary of the status and trends of the State of the Great Lakes for Nutrients sub-indicators and each Great Lake (Source: SOGL, 2017)

Sub-Indicator	Lake Superior	Lake Michigan	Lake Huron	Lake Erie	Lake Ontario
Nutrients in Lakes	Unchanging	Deteriorating	Deteriorating	Deteriorating	Deteriorating
Cladophora	Unchanging	Undetermined	Undetermined	Undetermined	Undetermined
Harmful Algal Blooms	Undetermined	Undetermined	Undetermined	Deteriorating	Deteriorating
Water Quality in Tributaries	Unchanging	Undetermined	Unchanging	Unchanging	Unchanging

Status:	GOOD	FAIR	POOR	UNDETERMINED
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### Overview

With the exception of Lake Superior, all Great Lakes are experiencing significant water quality issues related to nutrients. Due to excess phosphorus runoff from both agricultural lands and urban areas, soluble reactive phosphorus concentrations are above objectives in the western and central basins of Lake Erie, fueling record harmful and nuisance algal blooms. Similar symptoms of eutrophication are being observed in Saginaw Bay of Lake Huron

and Green Bay of Lake Michigan. [As reported in the PROP](#), excess nutrients also undermine water quality in the nearshore waters of lakes Michigan, Huron and Ontario by supporting excessive growth of the nuisance algae, *Cladophora*, along shorelines and beaches. In contrast, open water total phosphorus concentrations are below target and show declining trends in lakes Michigan, Huron and Ontario. The probable explanation for this open water trend is alteration of the nearshore zone food web due to the proliferation of non-

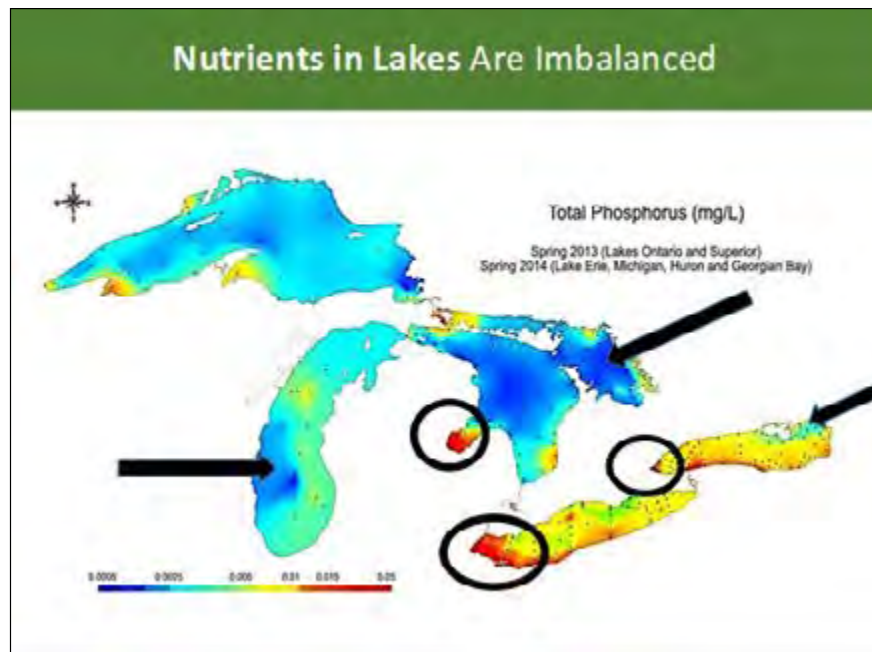


Figure 4: Imbalanced nutrient levels. Some areas are nutrient-rich (eutrophic) while others are nutrient-poor (oligotrophic). Differences have always existed, but they have been exacerbated recently. (Source: SOGL 2017 report)

native species that are sequestering nutrients and organic matter. This is undermining valuable fish populations that depend on a stable food web.

The Parties have made commendable efforts to develop phosphorus load reduction targets and to begin developing plans to reduce harmful algal blooms (HABs) and cyanobacteria biomass in the western Lake Erie basin and hypoxia (low or depleted oxygen) in the central basin. Work is also underway to develop phosphorus targets to reduce *Cladophora* in the eastern basin of Lake Erie. Attainment of ambitious phosphorus load reduction targets of 40 percent is unlikely without the addition of enforceable standards for agriculture and other sources to supplement voluntary stewardship.

## Background

Phosphorus is the primary growth-limiting nutrient in the Great Lakes, as is the case in most temperate freshwater systems. Limits on phosphorus in detergents and improved wastewater treatment helped to make nutrient management a success story under the 1972 and 1978 iterations of the GLWQA. Total phosphorus loads and the occurrence of algal blooms declined, particularly in Lake Erie. However, since the mid-1990s excess phosphorus, especially the highly bioavailable fraction known as soluble reactive phosphorus or dissolved reactive phosphorus, has led to a recurrence of severe HABs, nuisance algae and hypoxia affecting nearshore zones and shallow embayments and basins of several of the lakes, particularly Lake Erie.



In 2014, the IJC issued a report entitled, [\*A Balanced Diet for Lake Erie: Reducing Phosphorus Loadings and Harmful Algal Blooms\*](#) under its Lake Erie Ecosystem Priority (LEEP). The LEEP report, as it is called, included 16 recommendations to governments for addressing nutrients in Lake Erie. Recommendations related to setting phosphorus loading targets, addressing agricultural and urban sources of nutrients, restoring wetlands and strengthening monitoring and research.

## Assessment

The Parties have met the timetable they set in the GLWQA for establishing phosphorus load reduction targets for Lake Erie. The targets are for total and dissolved phosphorus to address harmful algal blooms (HABs) in the western basin and hypoxia in the central basin. The Annex 4 Nutrients Subcommittee responsible for development of these targets continues to work on phosphorus targets to address nuisance algal blooms in the eastern basin of Lake Erie. The subcommittee is also developing a strategy to achieve the anticipated nutrient reduction targets needed to control *Cladophora*. Efforts are also underway to develop concentration objectives and loading targets for phosphorus for Lake Ontario.

## Domestic action plans

The Parties are also on track to meet the deadline to develop binational phosphorus reduction strategies and domestic action plans to identify and prioritize implementation measures to manage

phosphorus loadings toward these targets. Although the GLWQA deadline to develop these strategies and action plans is not until February 2018, there are two concerns about the process thus far. First, the Annex 4 Nutrients Subcommittee has not considered the possibility of recommendations for new regulatory authorities in domestic action plans. This is despite the fact that the GLWQA commits the Parties to “assess and, where necessary, develop and implement regulatory and non-regulatory programs to reduce phosphorus loading from agricultural and rural non-farm point and nonpoint sources.” New authorities – or at least the option of new authorities – could be critical to domestic action plans. Over the past ten to 15 years, governments at all levels have focused on incentive-based and voluntary programs to reduce nutrient loadings to the western basin of Lake Erie. These voluntary programs include funding and support for implementing best management practices on agricultural lands, the leading source of phosphorus in the western Lake Erie basin. However, frequent HABs in the last ten years suggest that the voluntary programs alone are not sufficient to achieve target loadings set by the Parties in 2016.

Second, the Annex 4 Nutrients Subcommittee has discussed endorsing plans developed by Ohio, Michigan and Ontario pursuant to their Western Basin of Lake Erie Collaborative Agreement as the state and provincial component of domestic action plans. The contention that these plans, in all cases, are sufficient to achieve the 40 percent phosphorus load reductions envisioned in the three-party agreement and the Parties’ targets is not persuasive.



The success of the domestic action plans is critical to restoring water quality in Lake Erie and to protecting the waters for millions of people who rely on the lake for their drinking water. If domestic action plans are not sufficiently rigorous and rely solely on incentive-based and voluntary approaches, they are unlikely to deliver the phosphorus loading target reductions. The Parties have stated that they are evaluating existing programs in Canada and the United States to identify opportunities to maximize phosphorus reduction and may propose new programs or approaches to manage phosphorus loadings. Careful analysis of agricultural programs, especially the effectiveness of promoting voluntary adoption of best management practices, is critical.

The IJC further notes that domestic action plans need to include enforceable standards and regulatory actions. The plans must also show timelines for the implementation of actions, project leads, or teams responsible for expected deliverables and outcomes and quantifiable performance metrics in order to ensure accountability.

The PROP provides information about on-the-ground US activities during the first triennial cycle, especially on agricultural lands, and expected phosphorus loading reductions to be achieved. However, comparable detail is not provided for Canadian programs. The report also provides little discussion of declining nutrient levels in the open waters of most of the lakes, and no plans are provided to address the issue. The high nearshore nutrient levels and

offshore low nutrient problem may be due to the establishment of abundant zebra and quagga mussel populations along coastlines that filter feed on phytoplankton in the water column, excrete bioavailable forms of phosphorus in the substrate of the nearshore, and thereby stimulate algal growth in the nearshore and reduce the flow of nutrients to the offshore. The low offshore levels affect the availability of phosphorus that can be incorporated into the food web, which ultimately can affect fish community composition and abundance.

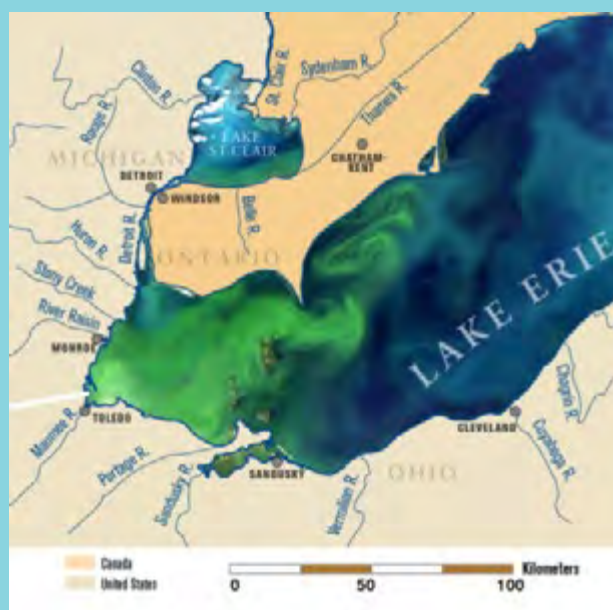
### Sources of phosphorus

Phosphorus loads to Lake Erie are not distributed evenly across the basin. Using data from the 2003-2013 period, the western basin receives the highest loadings: around 60% of the total load entering the lake, while the central and eastern basins receive 28% and 12%, respectively. Two of the largest watersheds that contribute nutrients to the western basin of Lake Erie are the Maumee River in Ohio and the Thames River in Ontario, which discharges into Lake St. Clair upstream of the Detroit River. The Maumee River phosphorus concentration is substantially greater.



Algae growth in Lake St. Clair from nutrient inputs from Thames River basin, which then flow into Lake Erie. (Source: NASA 2015)





TRIBUTARY	TP LOAD
LOADS TO LAKE ST. CLAIR:	
St. Clair River	399
Thames River	235
LOADS TO LAKE ERIE:	
Maumee River	3812
Detroit River	1987
Sandusky River	1101
Cuyahoga River	452
Grand River	447
Portage River	369
River Raisin	262
Huron River	205

#### Top 10 Contributors for 2008 – Metric Tons TP

Figure 5: Comparison of Total Phosphorus (TP) Tributary Loads to Lake St. Clair and Lake Erie  
Sources: Michigan Sea Grant, M. Maccoux, Contractor ECCC, S. Wortman, USEPA, D. Obenour, NCSU, M. Evans, USGS.

The western basin of Lake Erie experienced a particularly severe HAB in 2011. The IJC 2014 LEEP report noted that half of the loadings to Lake Erie that year came from tributaries draining agricultural areas and rural communities. One of the major sources of nonpoint loadings of phosphorus to Lake Erie is agricultural operations, including the application of fertilizers and manures to the land. A significant source of nutrient inputs to the western Lake Erie basin is concentrated animal feeding operations (CAFOs). These are livestock confinement facilities that house large

numbers of animals, generating significant quantities of animal waste. [The Sierra Club, Michigan Chapter](#) reports that between the US states of Michigan, Indiana and Ohio there are 146 CAFOs in the watershed of the western Lake Erie basin, housing almost 12 million dairy, hog and poultry animals. Their estimated waste output is over 2,385 million liters (630 million gallons) annually.

Ohio legislation to curb the application of animal waste on frozen, snow-covered or saturated ground is a positive step towards reducing nutrient runoff from CAFOs

as well as conventional farm operations. Ontario's *Nutrient Management Act 2002* also prevents application of nutrients to agricultural land when the soil is snow covered or frozen. In addition to the designated CAFOs mentioned above, there are thousands of animal feeding operations operating in Ontario, Michigan and Ohio that do not require any permit registration with local authorities.

Fertilizers and manure are typically applied to the production of all types of crops, though the amount and type may vary by region and by crop type. According to a [modeling study](#) conducted by the US Department of Agriculture (USDA), over half of the total phosphorus input, as well as some of the highest rates of phosphorus application in the United States, are for corn and corn silage, the former averaging 30 kilograms per hectare (27 pounds per acre) and the latter 60 kilograms per hectare (54 pounds per acre). Approximately 71 percent of phosphorus applied to corn silage is in the form of manure. The same modeling effort found that both corn and corn silage also had the highest average phosphorus loss rate through runoff. This USDA study highlights areas where policy changes may have a significant, positive impact on reducing phosphorus loss from cropping systems.

Failing septic systems are considered to be a nonpoint source of nutrients to the Great Lakes. Maintenance of onsite septic systems and replacement of failing systems by homeowners are elements of proper stewardship. Recognizing the potential significance of this source of phosphorus to Lake Erie, the 2014 LEEP report

recommended the enactment of legislation requiring inspection of septic systems at regular intervals and expanding community education initiatives promoting homeowner awareness of the need for septic system maintenance.

Urban sources of phosphorus, including point source discharge from wastewater treatment plants and stormwater runoff and nonpoint source inputs from lawn and garden activities, can be significant. In 2011, direct point sources such as water treatment plants and combined sewer overflows accounted for approximately 16% of nutrient loadings to Lake Erie. However, over the past 40 years, discharges from most urban point sources have declined significantly. To continue this decline, the IJC 2014 LEEP report recommended that the governments work with municipalities to promote and accelerate the use of green infrastructure (such as filter strips, rain gardens, bioswales and engineered wetlands) in urban stormwater management in the Lake Erie basin.

### Contributing factors

An unintended consequence of renewable fuels (or “biofuels”) policies and mandates is the role they play in the eutrophication of the western Lake Erie basin and other basins and embayments of the Great Lakes that have predominantly agricultural watersheds. Ethanol is the main biofuel in the US and Canada, which creates strong incentives for corn production across the region. A high demand for corn ethanol may influence farmers to use more acreage to grow corn over other crops and intensify efforts to increase yields.

The USDA statistics on phosphorus inputs and applications rates noted above are evidence of intensive corn production. Biofuel policies that increase the demand for corn production to supply the ethanol industry are also stimulating demand by the livestock industry for silage.

The question is whether the environmental consequences of increased corn production can be mitigated by conservation practices. In northwestern Ohio, only five percent of Lake Erie's original approximately 125,000 hectares (307,000 acres) of wetlands remain. Similar patterns of wetland loss exist throughout the rest of the lake's western basin. The draining of coastal wetlands and most of the approximately 300,000-hectare (736,000-acre) Great Black Swamp in the Maumee River and Portage River watersheds "eliminated most of the capacity to prevent pollutants and sediments generated in the upland portions of the watershed from entering the lake," according to the Ohio Department of Natural Resources. Wetlands have proven successful in capturing and filtering pollutants such as nutrients from the water. Achieving the Lake Erie phosphorus loading targets will require substantial wetland restoration and construction.

There is no existing phosphorus daily load limit specific to the western basin of Lake Erie. The State of Ohio should, under the United States Clean Water Act, list the waters of the western basin of Lake Erie as impaired because of nutrient pollution. The State of Michigan has now done so. This would trigger the development of a tri-state phosphorus total maximum daily load (TMDL) involving those states with Indiana,

with US EPA oversight. The TMDL process entails calculation of the maximum amount of daily loading that the impaired waterbody can receive from both point and nonpoint sources and still meet water quality standards for the particular pollutant. Following development of a TMDL, its implementation should proceed in a way that meets water quality standards and restores impaired water bodies.

### IJC activities

While making commendable efforts to fulfill their commitment under the GLWQA with respect to monitoring and modeling of phosphorus and other nutrients in the Great Lakes and their tributaries and connecting rivers, the Parties could enhance modeling with the measurement of nutrients at critical locations and specific times of the year.

Through its Great Lakes advisory boards, the Commission is investigating several nutrient-related topics that will result in advice to governments in the next triennial period:

- The Science Priority Committee of the Science Advisory Board has just completed an analysis of the relative influence of different agricultural sources of phosphorus (including commercial fertilizers and manure) in the western basin of Lake Erie.
- The Water Quality Board is examining policies related to confined animal feeding operations.
- The Research Coordination Committee of the Science Advisory Board is analyzing how progress towards phosphorus reduction goals can be measured and communicated in an adaptive management framework.



- The Science Priority Committee of Science Advisory Board is studying the juxtaposition between nearshore nutrient enrichment and declining offshore lake productivity.

In addition, the IJC is examining the influence of ethanol policies on agricultural nutrient loadings.

## Conclusion

Excess phosphorus loadings are affecting the nearshore zones and shallow embayments and basins of several of the lakes. Critical problem areas include the western Lake Erie basin, Saginaw Bay of Lake Huron and Green Bay of Lake Michigan. While the Parties are meeting GLWQA deadlines for nutrient targets and domestic action plans for Lake Erie, a greater sense of urgency is needed. Additionally, inclusion of regulatory protections in draft and forthcoming domestic action plans is critical. Another problem requiring greater attention is the nutrient-poor (oligotrophic) conditions in the offshore of most lakes, which are affecting fish abundance and fisheries.



© Pascal Huot - Fotolia

## Recommendations

To achieve steep reductions in phosphorus loadings and harmful algal blooms and improve progress toward achievement of the nutrients objective, the IJC recommends that:

- Domestic action plans to achieve phosphorus loading reduction targets include details on the timeline, who is responsible for actions, and expected deliverables, outcomes and quantifiable performance metrics to assure accountability.
- The Parties further act on advice from the IJC's 2014 report on Lake Erie, most notably with respect to the need for enforceable standards governing the application of agricultural fertilizer and animal waste, along with better linkage between agricultural subsidies and farm operator use of conservation practices that are demonstrably effective at curbing phosphorus runoff.
- The State of Ohio should, under the United States Clean Water Act, list the waters of the western basin of Lake Erie as impaired because of nutrient pollution. The State of Michigan has now done so.
- Periodic testing be required and enforceable standards for maintenance and replacement of septic systems be instituted in the United States and Canada.
- All levels of government provide adequate resources to implement better stormwater management systems in urban areas and accelerate the use of green infrastructure.

## 7. INVASIVE SPECIES

### GENERAL OBJECTIVE 7

*The Waters of the Great Lakes should be free from the introduction and spread of aquatic invasive species and free from the introduction and spread of terrestrial invasive species that adversely affect the quality of the Waters of the Great Lakes.*

### SOGL Indicator

**Invasive Species** for the overall Great Lakes Basin: status poor, trend deteriorating.

Sub-indicators across the basin:

- *Impacts of Aquatic Invasive Species*: status poor, trend deteriorating.
- *Dreissenid Mussels*: status fair to poor, trend improving to deteriorating.
- *Sea Lamprey*: status fair to good, trend improving.
- *Terrestrial Invasive Species*: status poor, trend deteriorating.

Summary of the status and trends of the State of the Great Lakes for Invasive Species sub-indicators and each Great Lake (Source: SOGL, 2017)

Sub-Indicator	Lake Superior	Lake Michigan	Lake Huron	Lake Erie	Lake Ontario
Impacts of Aquatic Invasive Species	Deteriorating	Deteriorating	Deteriorating	Deteriorating	Deteriorating
Dreissenid Mussels	Unchanging	Deteriorating	Deteriorating	Improving	Deteriorating
Sea Lamprey	Improving	Improving	Improving	Improving	Unchanging
Terrestrial Invasive Species	Deteriorating	Deteriorating	Deteriorating	Deteriorating	Deteriorating

Status:	GOOD	FAIR	POOR	UNDETERMINED
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### Overview

The introduction of invasive species has irreversibly changed the Great Lakes ecosystem. Preventing new invasive species and controlling or if possible eradicating existing species are amongst the biggest challenges facing the Great Lakes. In the 2012 GLWQA, Canada and the United States established annex committees to address aquatic invasive species (AIS) and ship source pollution (an important vector for AIS introduction). These annex committees acted to meet the priorities

for science and time-bound commitments established in the Agreement. The Parties have made significant progress in prevention, risk assessment, early detection and response planning for invasive species, committing extensive resources to the task. Most notably, the Parties have implemented vigorous, joint enforcement of requirements to exchange ballast and to flush empty ballast tanks with salt water prior to allowing sea-going ships to enter the Great Lakes. These requirements have proven successful in stopping the introduction of AIS to the Great Lakes from ballast water discharges

since 2006. However, with new invasive species threatening through other pathways and continued devastating impacts of the spread of invasive species already in the lakes, continued vigilance and binational action are required.

## Background

More than 180 aquatic non-native species have become established in the Great Lakes due to human activities over the past 175

years. Most aquatic non-native species, such as Rainbow trout and Coho salmon, do not cause problems and some were intentionally introduced; however, about a quarter of the non-natives in the Great Lakes are considered invasive because they negatively impact the ecosystem, the economy, or human health. Aquatic invasive species such as sea lamprey and zebra and quagga mussels (i.e., dreissenids) have had basinwide, irreversible impacts on the Great Lakes ecosystem.

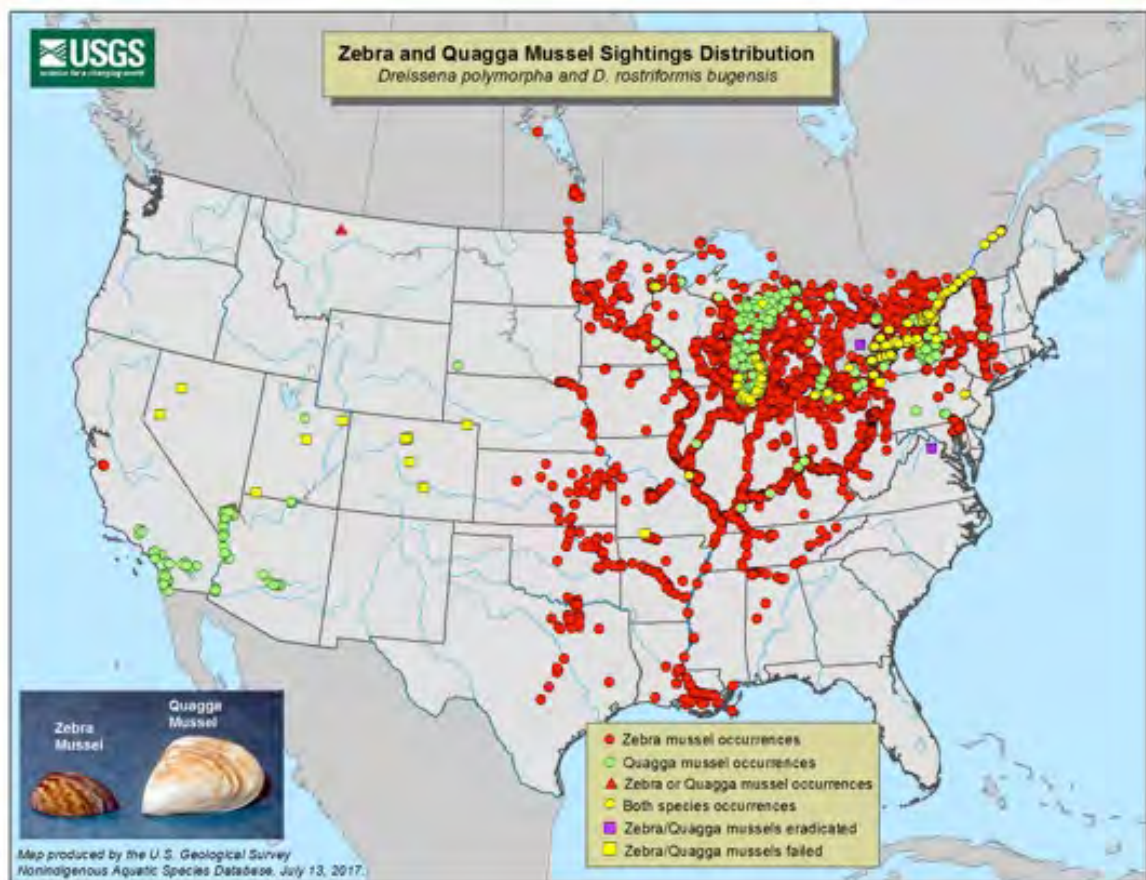


Figure 6: Distribution of Zebra and Quagga Mussels, Source: USGS



Terrestrial invasive species also affect the quality of Great Lakes waters through impacts to wetland function and changes to surface runoff.

Invasive species are among the toughest challenges facing the Great Lakes basin. They not only out-compete native species, altering food webs and habitats, but also exacerbate the spread of chemical contaminants and flow of nutrients in the Great Lakes ecosystem. Invasive species provide new mechanisms for magnifying and transmitting toxins to fish and wildlife, and concentrating nutrients in nearshore waters. Many other direct and indirect impacts are detailed in the SOGL technical report. The IJC has been reporting on the topic and providing a forum for binational collaboration on aquatic invasive species issues for over 28 years.

## Assessment

Meeting the GLWQA objective for invasive species means stopping the introduction of new invasive species and successfully controlling the spread of existing species. The rate of discovery of new non-native aquatic species in the Great Lakes has declined sharply from an average of one new species discovered every eight months, with over 70 percent attributed to ballast water discharges, to no new discoveries of aquatic invasive species attributed to ballast water discharges since 2006. With the possible exception of a zooplankton species *Thermocyclops crassus*, no additional introductions from other pathways have resulted in establishment of a non-native species since 2006.

### *Thermocyclops crassus*



#### USEPA

*Thermocyclops crassus*, a type of zooplankton referred to as a Cyclopoid copepod, was discovered in water samples taken from western Lake Erie in 2014. Numbers found indicated a small but established population exists in Lake Erie. The size ranges from 0.7 to 1.1mm in length (Fischer 1853). They are like a native cyclopoid copepod *Mesocyclops edax*, but slightly smaller. *Thermocyclops crassus* is present throughout Europe, Asia, Africa and Australia, but is generally considered Eurasian in origin (Ueda and Reid 2003). The species is considered to be non-native but not invasive.

This decline in new introductions can be attributed to the fact that both governments have mature invasive species prevention programs that are institutionalized in domestic legislation and regulations.



Sea Lamprey  
Credit: US Fish and Wildlife Service

The Parties have instituted the most stringent ballast water management inspection regime in the world, taking into account the international ballast water discharge standard issued by the International Maritime Organization. These regulations require all ships entering the Great Lakes – St. Lawrence Seaway from outside the [Exclusive Economic Zone](#) (a zone extending out up to 200 nautical miles from the territorial sea) to conduct ballast water exchange or flushing. Both governments have coordinated enforcement programs to achieve nearly 100 percent compliance.

The IJC supports the joint efforts of the two governments to prevent the introduction of new invasive species through the strict enforcement of ballast water exchange and flushing requirements for seagoing vessels entering the Great Lakes through the St. Lawrence Seaway. Measures called for by Canadian, United States, state regulators and Tribes and First Nations to maintain

the strict enforcement regime of mandatory ballast water exchange and flushing, in addition to ballast water discharge treatment, would be a significant added measure of safety.

Even though the rate of new invasions has slowed, the impact of invasive species on the Great Lakes is identified as deteriorating because the spread of previously established invasive species across the lakes is having a negative impact on the ecosystem. For example, quagga and zebra mussels have increased in abundance over time and spread across the Great Lakes, with the exception of Lake Superior. They have effectively re-engineered the nearshore zone of many Great Lakes coasts and altered the availability of nutrients to offshore food webs in some of the lakes. Populations of *Diporeia* – an important link in the open water native food web – have plummeted while the growth of *Cladophora*, a nuisance alga, has benefitted from increased mussel populations and the corresponding increase in water clarity and nutrients they provide. These mussels have significantly changed the amount and types of phytoplankton available. Additionally, their filtering and nutrient excretion favors the production of cyanobacteria which may also lead to increased frequency, distribution and severity of harmful algal blooms.

To address the spread of aquatic invasive species, Transport Canada and several states are considering the regulation of ballast water discharges from “Lakers,” ships that remain within the Great Lakes. US Lakers are currently exempt from US Coast Guard ballast water requirements and are not

subject to the same regulations as seagoing vessels entering the Great Lakes – St. Lawrence Seaway system due to their unique operating characteristics, which currently makes ballast treatment challenging. Such characteristics include ballast capacity that may be three times larger and ballast pumping rates over ten times faster than seagoing ships, short voyages that are a matter of days, lack of tank coatings and less than one day in port. Instead, Lakers currently adhere to a set of best management practices required by USEPA's vessel general permit and founded on practices developed by the industry in 1993. Recognizing that Lakers may facilitate the spread of invasive species that are already present in the Great Lakes, any regulations should take into account the nature of Laker operations. The two federal governments have agreed to seek consistency and compatibility between United States and Canadian ballast water requirements in the 2017-2019 priorities for science and action, and this should provide a path towards harmonious joint implementation of regulations for Lakers and seagoing vessels.

The waters of the Great Lakes are also affected by the introduction and spread of terrestrial species. These species can cause an array of ecosystem impacts, including choking out native wetland plant species and deforestation leading to increased sediment, and chemical and nutrient loading to the Great Lakes. Sub-indicators associated with terrestrial invasive species include the species of common reed non-native to North America (*Phragmites australis*), Asian longhorned beetle, emerald ash borer, garlic

mustard and purple loosestrife. The poor status and deteriorating trends associated with the spread of previously established terrestrial and aquatic invasive species have overshadowed progress made in prevention of new invasive species, resulting in an overall SOGL status of poor and deteriorating.

#### *Phragmites* Infestation



Photo of *Phragmites* measuring up to 6 meters (19 feet) tall. (Source: Ontario *Phragmites* Working Group)

#### Prevention

To prevent newly introduced species from becoming established and spreading in the Great Lakes, the governments have initiated a first-ever aquatic invasive species warning system through the use of environmental DNA (e-DNA) for monitoring and detection. This innovation by the Parties has significantly improved the scope, frequency and number of target species for



early detection activities. Recent approaches to eradicate and control AIS include application of pheromones, chemicals, acoustic interference, carbon dioxide and electrical barriers. These approaches show exciting potential, but much more research is needed for field testing and implementation.

The use of information-sharing tools, including the NOAA [Non-indigenous Aquatic Species database](#) and the [Early Detection & Distribution Mapping System](#) used extensively in both the US and Ontario, have significantly improved the understanding of aquatic invasive species impacts and have helped to inform management actions. Significant investments have also been made in public outreach and education to address the spread of aquatic invasive species by activities such as recreational boats, bait fish, aquariums, and commercial and internet trade.

The IJC received significant public concern regarding invasive species and frustration that not enough is being done to prevent their introduction and spread. Species mentioned in particular were Asian carp, *Phragmites* and zebra and quagga mussels (dreissenids).

## YOUR VOICE

"For invasive species, decisions should be based on science to get them out of the ecosystem. It's essential that Asian carp not enter Lake Michigan through Chicago."

Caroline Moellering, Little Traverse Bay Bands of Odawa Indians, IJC Listening Session with First Nations and Tribes, Sault Ste. Marie, Ontario, March 2, 2017



US Fish and Wildlife Service  
(Zebra mussels infesting a native clam.)

## Asian Carp

There has been noteworthy progress in preventing Asian carp from entering the Great Lakes system. The Great Lakes Mississippi River Interbasin Study and Chicago Area Waterways Study have identified options for preventing the migration of Asian carp through canals and other interbasin connections. These options range from complete physical separation of the waterways, to less complex control measures aimed at eradicating invasive species as they attempt to move between the basins. Public comments received by the IJC on the draft assessment included many comments in support of closing the Chicago Sanitary and Ship Canal, although representatives of the marine transportation industry oppose physical separation of a navigable waterway. Although a final decision has not been made on Chicago waterways, other actions to close pathways between the Great Lakes and Mississippi systems are being put into place.

In particular, a physical barrier was constructed to eliminate the risk of AIS movement through Eagle Marsh, Indiana to the headwaters of the Maumee River and Lake Erie. This is a significant accomplishment that shut the door on what was a high-risk pathway to the Great Lakes. However, other potential pathways for carp to enter the Great Lakes exist. The challenge to control AIS was illustrated when it was confirmed in 2016 that Grass carp, a species of Asian carp, are spawning in the Sandusky River, a tributary of Lake Erie. Grass carp have also been discovered in Lake Ontario and the St. Lawrence River.

The work to keep Asian carp out of the Great Lakes has involved significant investments and strong collaborative efforts, within and between various government jurisdictions.

### Phragmites

Common reed (*Phragmites australis*) may grow up to 6 meters (19 feet) tall and can quickly crowd out native wetland species by exuding a compound that kills the roots of neighboring plants. Its dense mass blocks light to other plants, changes wetland hydrology, alters wildlife habitat and increases fire potential. It spreads by seed dispersal and by the spread of vegetative fragments of rhizomes that break off and take root in new locations. ***Phragmites* was branded the worst invasive plant species in Canada by Agriculture and Agri-food Canada.**

## YOUR VOICE

"Our biggest threat to our coastal areas right now are Phragmites. We are losing our habitat, we are losing our biodiversity, we are losing our species."

Janice Gilbert, Public Meeting on the Great Lakes, St. Catharines, Ontario, March 29, 2017

As shown in the SOGL reports, the distribution of this highly invasive plant has increased dramatically around the Great Lakes basin since 1961. The need for further binational collaboration on measures to control its spread becomes apparent when comparing United States and Canadian efforts to control invasive aquatic plants. While many chemical control agents are approved for use in the United States, only one is approved for use in Canada. Similarly, binational aquatic invasive species control efforts lack a shared or integrated approach to the safe and environmentally responsible use of all types of chemical, physical and biological control measures among jurisdictions.

The Parties are encouraged to find common ground on the safe and environmentally responsible use of all types of these measures. This includes harmonizing permitting and regulations, removing administrative barriers, adopting integrated hazard assessment and implementing critical path controls. For *Phragmites* in particular, chemical control used in the United States is not permitted in Canada, though trials are currently underway to evaluate chemical

use. In the meantime, this leaves manual cutting and drowning as the primary tools for control.

Comments received by the IJC during its public consultation process support providing resources to identify sources and locations of infestations, improve mechanical and chemical controls, and expand public awareness campaigns to share how invasive plants are spread and can be controlled. An intensive, well-focused, binational control and eradication program for effective basinwide practices and new tools that can control and eradicate *Phragmites* could draw public support. Such a program could identify new control technologies and methodologies that may be used to control and eradicate other invasive plants. It was notable that the comments about *Phragmites* as an invasive species came largely from Canadians.

Other “[watch list species](#)” are also getting closer to the Great Lakes, such as Tench (*Tinca tinca*), a fish found in the Richelieu River in Quebec, a tributary to the St. Lawrence River that may be moving upstream from the Quebec section of the St. Lawrence River.

## Aquatic Nuisance Species Panel

The [Great Lakes Aquatic Nuisance Species \(ANS\) Panel](#) - With funding from the USFWS and staff support from the Great Lakes Commission, this panel plays an important role in preventing and eliminating invasive species in the Great Lakes region. The Great Lakes ANS Panel was created as a regional advisory panel for the U.S. ANS Task Force by the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990. The panel is binational, with members representing U.S. and Canadian federal agencies, the eight Great Lakes states and the provinces of Ontario and Québec, nongovernmental organizations, local communities, tribal authorities, commercial interests, and the academic community. Working with subcommittees of the Great Lakes Executive Committee, it helps achieve progress towards the goals established in the Great Lakes Water Quality Agreement. For more information see: <http://www.glc.org/work/glpans>.



Figure 7. *Phragmites* Observations in the Great Lakes (1948-1961)



Figure 8. *Phragmites* Observations in the Great Lakes (1948-2015)

Source: SOGL 2017; EDDMapS



## Progress

Much of the progress on invasive species made in the United States since 2010 can be credited to US Great Lakes Restoration Initiative (GLRI) grants. For the first five years of the GLRI, total expenditures for aquatic invasive species were US \$276.7 million for over 1,775 projects. This funding has included grants for Tribes to develop Great Lakes Tribal Aquatic Invasive Nuisance Species Management Plans. For example, in November 2016 the Grand Traverse Band of Ottawa and Chippewa Indians developed an AIS Management Plan to prevent and/or minimize the impact of AIS on the natural resources critical to the band.

Canada has also made significant investments in AIS initiatives with departmental funding from Fisheries and Oceans Canada, Environment and Climate Change Canada, the Ontario Ministry of the Environment and Climate Change, the Ontario Ministry of Natural Resources and Forestry, Canada's federal granting council Natural Science and Engineering Research Council, the nonprofit Invasive Species Centre and numerous other sources.

Most existing aquatic invasive species prevention and control programs continue to be funded and new collaborative efforts are focusing resources on specific vectors of invasive species movement and on high-risk species. Efforts to manage the discharge of ballast water, stop the spread of Asian carp, zebra and quagga mussels, and *Phragmites* and halt illicit trade of invasive species on the internet are models of multi-jurisdictional collaboration and innovation.

Leveraging the existing, extensive network of federal, state, provincial, First Nation and Tribal governments, local municipal agencies and nongovernmental organizations with deep AIS-related experience in annex implementation has been another reason for successes achieved in the first triennial cycle of the 2012 GLWQA. The need for effective multi-organizational coordination cannot be overstated. A 2012 study commissioned by the IJC found that in just a small portion of the Great Lakes basin, 100 Canadian and US public and nongovernmental organizations were involved in some way with AIS response. Close cooperation with the Great Lakes Panel on Aquatic Nuisance Species (ANS Panel) was a key element in harmonizing national and binational efforts through a network it developed over the past 25 years. The Parties' efforts and funding have resulted in an impressive list of accomplishments over the past several years.

However, funding for work on invasive species is largely on a project-by-project basis. There is little sustained base program funding for binational AIS monitoring, control and technology development in either country. Binational efforts to combat invasive species lack the important elements of certainty and long-term planning facilitated by uninterrupted program funding. A long-term strategic approach to combating AIS by moving to a sustained program funding model for binational AIS monitoring, prevention, control and technology development, would strengthen efforts.

The level of effort and funds spent on Asian carp control are well justified by the fact that programs have curtailed their spread. The

response procedures and control technology developed for Asian carp may be applied to the eradication and control of many other species. A similar level of funding and effort should be considered for a visible, high-impact terrestrial invasive species such as *Phragmites*, where broad multi-jurisdictional collaborative efforts are already taking place.

Developing effective control measures is critically important. The Parties' 2017-2019 priorities for science include determining the feasibility and effectiveness of aquatic invasive species eradication and containment methods; developing technology and methods to achieve effective barriers that prevent the migration of aquatic invasive species, while allowing the movement of beneficial species; and evaluating and enhancing aquatic invasive species early detection technologies and methods. Sharing the results of this work among members of binational collaboratives established by the Great Lakes ANS Panel and the Annex 6 subcommittee could accelerate progress in this area.



© Tip of the Mitt Watershed Council

## Conclusion

The success of rigorously enforced binational requirements for ballast water exchange and saltwater flushing in preventing the introduction of aquatic invasive species to the Great Lakes is encouraging, as is the significant investments and strong collaborative efforts to keep Asian carp out of the Great Lakes. However, significant threats related to introduction and spread of both aquatic and terrestrial invasive species remain and the public is calling for greater on-the-ground action with respect to this objective. Moving towards sustained program funding for binational aquatic invasive species monitoring, control and technology development would strengthen long-term planning and protections. The threat of Asian carp introduction and the impact of the spread of terrestrial invasive species on Great Lakes water quality are of significant concern.

## Recommendations

To improve progress toward achievement of the invasive species objective, the IJC recommends that:

- The Parties continue to devote significant resources to prevent Asian carp from invading the Great Lakes.
- The Parties continue to require ballast water exchange and flushing in addition to discharge treatment for seagoing vessels. Governments and industry should also dedicate sufficient research and testing to develop an effective binational approach to the regulation of ballast water discharge from “Lakers” within the



- next triennial reporting period.
- The Parties reach agreements on permitting the use of safe and effective control measures to reduce the spread of invasive species consistent across all jurisdictions within the next triennial reporting period.
- The Parties put in place long-term, sustainable funding mechanisms to support work on the fight against invasive species.
- Within the next triennial reporting period, the Parties invest significant resources to create an intensive, well-focused binational program for effective basinwide practices and new tools that can control and eradicate the threat of *Phragmites* and prove useful in controlling other invasive plants.



## 8. GROUNDWATER

### GENERAL OBJECTIVE 8

*The Waters of the Great Lakes should be free from the harmful impact of contaminated groundwater.*

### SOGL 2017 Indicator

**Groundwater Quality** for the overall Great Lakes Basin: status fair, trend undetermined.



Summary of the status and trends of the State of the Great Lakes for Groundwater sub-indicators and each Great Lake (Source: SOGL, 2017)

Sub-Indicator	Lake Superior	Lake Michigan	Lake Huron	Lake Erie	Lake Ontario
Groundwater Quality	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined

Status:	GOOD	FAIR	POOR	UNDETERMINED
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### Overview

The Parties have made excellent progress, completing a comprehensive report on groundwater science under the GLWQA and undertaking work on a groundwater quality indicator for future SOGL reporting.

### Background

Groundwater in the Great Lakes basin is a critical part of the region's water resources, providing direct and indirect flows (as a

component of streamflow) to the Great Lakes. Groundwater and surface waters are inextricably linked in terms of quality and quantity (Figure 9). Reductions in groundwater quantity due to over-pumping, for example, can reduce base flow to streams, negatively affecting surface waters and degrading groundwater dependent habitats and ecosystems. Groundwater quality can be degraded by point and nonpoint sources of pollution such as leaking underground storage tanks, leaching from cropping and livestock operations and urban lands, and failing septic systems. Contaminated

groundwater can be a source of surface water contamination when it directly or indirectly discharges to the Great Lakes. Conversely, if groundwater is of higher quality than the receiving surface waters, it can enhance surface water quality.

The 2012 GLWQA includes an updated groundwater annex that recognizes the interconnection between groundwater and surface water and that preventing groundwater contamination in the Great Lakes basin is critical in protecting the

physical, chemical and biological integrity of the waters of the Great Lakes. The annex seeks to support the achievement of the groundwater general objective by promoting the coordination of groundwater science and management actions. There are still many gaps in the understanding of how groundwater affects the quality of Great Lakes waters, including the scale of groundwater discharges to the Great Lakes and the spatial distribution of known and potential groundwater contaminants.

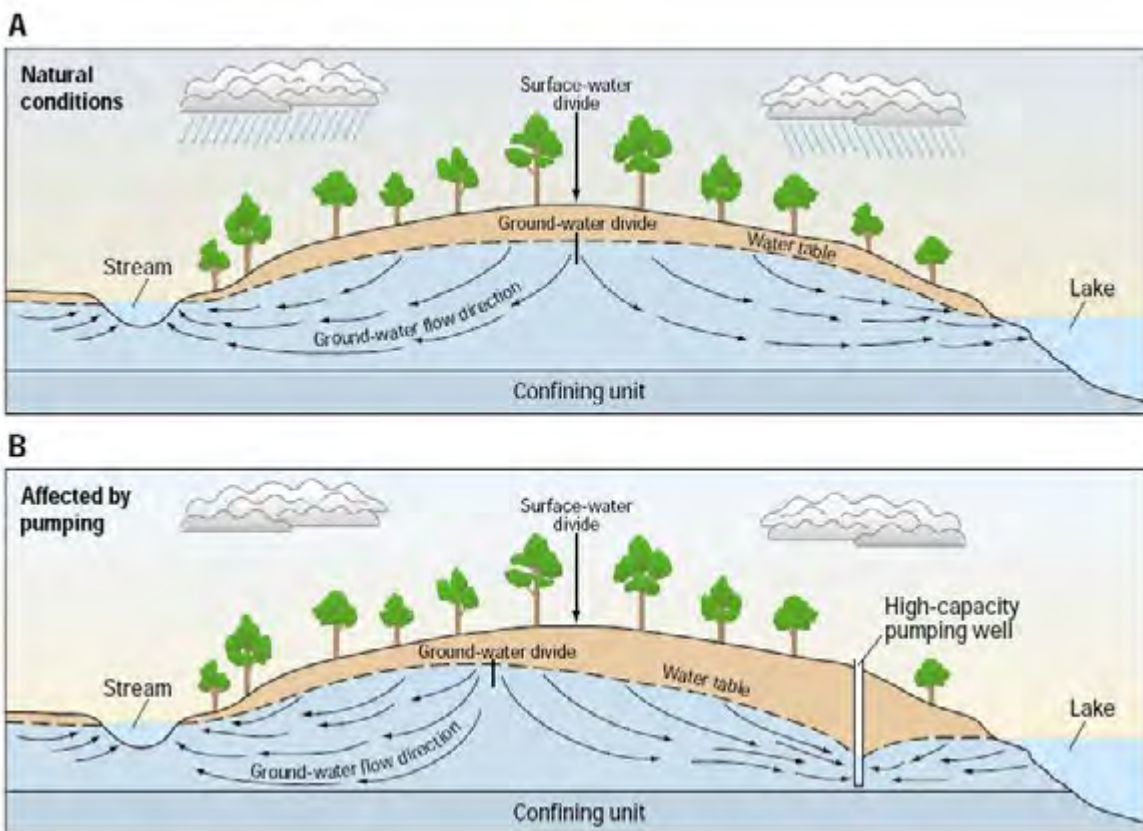


Figure 9: Generalized Groundwater - Surface Water Interactions (A) under natural conditions and (B) affected by pumping (Source: USGS, 2000)

## Assessment

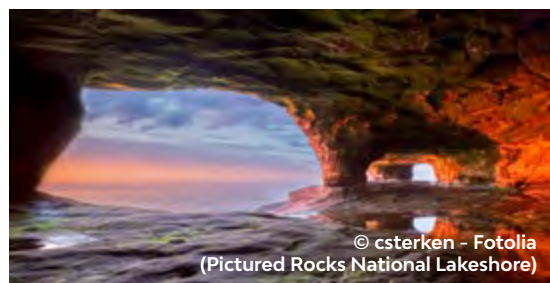
The Parties established five binational priorities for science and action for groundwater for 2014-2016. Three of these five priorities were accomplished with the release of the report on [Groundwater Science Relevant to the Great Lakes Water Quality Agreement: A Status Report](#) (May 2016), which examines threats and stresses to groundwater quality as well as the impacts of groundwater quantity and flows on the lakes.

The Parties' groundwater report identifies eight overarching priority science needs, including improved groundwater research and monitoring to better understand and manage groundwater quality; impacts of groundwater on the surface waters of the Great Lakes, and groundwater quantity and its interactions with surface waters. Three of these priority science needs are reflected as "actions" for groundwater in the [2017-2019 Priorities for Science and Action](#) produced by the Parties. These actions are: developing better tools to assess groundwater-surface water interaction; assessing the geographic distribution of known and potential groundwater contaminants; and advancing the monitoring and assessment of groundwater quality. However, it is not clear why these particular priorities were selected, nor is it clear when or how the remaining priority science needs will be addressed.

The priority science needs identified in the governments' Groundwater Science report are consistent with recommendations made in recent reports by IJC advisory boards and reports from the IJC to governments. In general, the reports identify the need

for improved groundwater research and monitoring to better understand and manage groundwater quality and subsequently its impacts on surface waters of the Great Lakes. This includes groundwater quantity and its connection to surface waters, which is not well understood.

According to the 2017 SOGL report, the overall status of groundwater quality in the Great Lakes basin is fair with an undetermined trend. In regions of the Great Lakes basin where there is more development (such as the basins of lakes Michigan, Erie and Ontario) the individual lakes are assessed as fair. Lake Huron, where there is less development, has a groundwater quality assessment of good. The status of groundwater in the Lake Superior basin is undetermined due to an insufficient number of wells for monitoring. This assessment is based on the available groundwater monitoring points in the basin and does not necessarily reflect what is discharged to the Great Lakes. The "undetermined" trends are the result of limited long-term groundwater data. Compared to previous SOGL groundwater indicators, the 2017 groundwater indicator more appropriately reports progress towards the achievement of the groundwater general objective by reporting on the quality of shallow groundwater in the basin, specifically the contaminants chloride and nitrate.





Future reporting of this indicator is expected to expand the number of parameters to be analyzed and the Parties are encouraged to consider the parameters proposed by the IJC as ecosystem indicators for groundwater.

The potential impacts of withdrawals on groundwater quality and ultimately the waters of the Great Lakes are increasingly important. The 2008 Great Lakes Compact and the parallel Great Lakes-St. Lawrence River Basin Sustainable Water Resources Agreement prohibit most new or increased diversions of water outside of the basin. If the compact and agreement are fully implemented, they will provide a solid foundation for managing Great Lakes diversions and consumptive uses into the future. Further, the IJC's 2016 *Protection of the Waters of the Great Lakes* report advocates that Great Lakes states and provinces fully factor the adverse ecological and water quality impacts of groundwater withdrawals into water use permitting procedures and decisions regarding consumptive use. For example, Michigan has developed a Water Withdrawal Assessment Tool to determine the potential impacts of large quantity water withdrawals on nearby water sources, including potential impacts to fish habitats and populations. This tool is currently being evaluated by other Great Lakes states for potential implementation.

## YOUR VOICE

"I wish you would look at deforestation as a primary cause of groundwater pollution entering the waterways of the Great Lakes. In nature trees provide a cleansing effect. Every waterway in the Great Lakes watershed has experienced deforestation. The addition of impervious surfaces contributes to runoff."

Barry Johnson, The Greening of Detroit, Public Meeting on the Great Lakes, Detroit, Michigan, March 21, 2017

## Conclusion

The Parties have worked diligently to identify scientific gaps in the understanding of connections between groundwater and Great Lakes water quality. The Parties are now working to close those gaps through the establishment of their 2017-19 Binational Priorities for Science and Action. Reporting on the status of groundwater quality in the Great Lakes basin has improved through the inclusion of groundwater contaminant levels.

## 9. OTHER MATERIALS, SUBSTANCES AND CONDITIONS

### General Objective 9

*The Waters of the Great Lakes should be free from other substances, materials or conditions that may negatively impact the chemical, physical or biological integrity of the Waters of the Great Lakes.*

Several topics are included in this assessment, including Areas of Concern (Annex 1), Lakewide Management (Annex 2), the Cooperative Science and Monitoring Initiative (CSMI) (part of Annex 10) and microplastics.

### Areas of Concern (AOCs)

Areas of Concern (AOCs) are locations where environmental impairments resulting from local human activities prevent certain uses of the lakes. These impacts are termed beneficial use impairments, or BUIs. Since AOCs were created by the governments under the 1987 GLWQA, 43 AOCs have been identified in the Great Lakes basin – 26 in the United States, 12 in Canada, and five that are binational and shared between both countries. Each AOC has a defined set of BUIs. When the governments can show that a BUI no longer exists, due in most cases to remedial action, the BUI is removed. When all the BUIs at an AOC are removed, the site is eligible for delisting (no longer being considered an AOC). AOCs can also be designated as “Areas in Recovery” while BUIs recover following the completion of all remedial actions. The tables below show the status of BUIs and AOCs across the lakes.

### Beneficial Use Impairments

The 43 AOCs around the Great Lakes are locations where valued uses of the lakes could not be enjoyed due to specific environmental impairments. These are termed beneficial use impairments (BUIs). Fourteen types of BUIs are listed in the GLWQA. Two examples include restrictions on fish consumption due to contaminant concentrations, and loss of fish and wildlife habitat. Once all the BUIs that apply to a particular AOC are remediated and delisted (or removed), the AOC is considered ‘cleaned up’ and can be delisted (or removed) from the list of AOCs.



Plastic Soup Foundation (jars with microbeads)

**Table 9.1 Status of Beneficial Use Impairments**

	Beneficial Use Impairments (BUIs)		
	Total number designated	Number removed	Number remaining
Canada	146	65	81
United States	255	62	193
TOTAL	401	127	274

Source: Progress Report of the Parties (2016)

**Table 9.2 Status of Areas of Concern**

	Areas of Concern (AOCs)					
	Total designated	Delisted	In recovery	Remedial actions complete but not yet delisted	Total with remedial actions remaining	Further areas expected to have remedial actions completed by 2019
Canada	12	3	2	1	6	2
United States	26	4	-	3	19	8
Binational	5	-	-	-	5	-
Canadian half	5	-	-	-	5	2
US half	5	-	-	1	4	1
Total	43	7	2	4+(1/2)	25+9(1/2)	10+3(1/2)

Source: Progress Report of the Parties (2016)



The greatest concern that the IJC heard from the public about the AOC program was the need to maintain government funding levels to continue this work. For example, at IJC consultations in Toronto, the IJC heard that progress in the Toronto Harbour AOC is contingent on substantial infrastructure investments. Resources are required to characterize and understand impairments, monitor recovery following implementation of remedial actions, and increase public and stakeholder awareness of remedial action plan (RAP) issues. Approximately one-third of the annual US \$300 million US Great Lakes Restoration Initiative funding has been directed towards AOC cleanup. Canada has made significant recent investments at the Hamilton Harbour AOC (CDN \$139 million, over approximately eight years for sediment remediation and CDN \$484 million, over approximately ten years, for wastewater treatment infrastructure) and the Port Hope Harbour AOC (CDN \$1.28 billion, over ten years for contaminated sediment remediation).



## YOUR VOICE

"There's been much progress locally for addressing Areas of Concern. Moving forward, it's imperative that funding is provided to employ talented and dedicated professionals within the local/regional organizations to continue testing/researching, reporting, sharing data with organizations, pursuing improvements through legal channels, and engaging and educating the public and citizen scientists/volunteers."

Elizabeth Oldfield, Amherst, New York, letter via Participate IJC, April 4, 2017

Although base funding for AOC remediation through Canada's Great Lakes Action Plan has remained constant, investment in remediation activities also can occur through other programs such as the Investing in Green Infrastructure program announced in the Canadian Budget 2016. Increased investments by the Government of Canada in Canadian AOCs could further accelerate progress towards AOC remediation. The Remediating Contaminated Sediments indicator in the State of the Great Lakes 2011 report noted an increasing trend in remediation between 1997-2010, which is encouraging and reflects implementation of projects that were planned and permitted in earlier RAP processes.

**This year, 2017, marks the thirtieth anniversary of the AOC program. It is now time for the Parties to look towards its completion. The Parties should assess the remaining BUIs and determine a management and funding plan to complete all necessary remedial actions in the next 15 years. BUI removal and AOC delistings can be maximized, in response to these actions, as the sites respond and recover.**

AOC stakeholders and the numerous communities of practice associated with AOCs – including science and monitoring, project implementation and community engagement – would benefit from more meaningful opportunities for binational dialogue and interaction for technical transfer and coordination opportunities. Unlike all the other GLWQA annexes, no committee structure exists for the AOC Annex.

For the five binational AOCs, parallel domestic processes are in place and progress towards completion of management actions is generally uneven between them. This is inconsistent with the ecosystem approach principle included in the GLWQA. There is limited formal, contemporary guidance to inform BUI removal or site delisting in binational AOCs.

A report completed for the IJC in 2016 on ‘life after delisting’ found that several challenges exist for communities

transitioning beyond delisting. These challenges include a loss of momentum following delisting due to the absence of a tangible reason to organize, diffuse sources of funding for stewardship projects with uneven eligibility requirements, and less frequent environmental monitoring than existed prior to delisting, which in turn makes it more difficult to detect backsliding of environmental conditions. Additional support to public advisory councils and promotion of alternative funding and organizational models for environmental stewardship post-delisting would improve the likelihood that these local councils could successfully transition to other activities, such as playing an ongoing monitoring and watchdog role in the community and perhaps acting as a focus for local engagement in lakewide management.

## YOUR VOICE

Much credit [for progress in addressing AOCs] should also be given to strong multi-jurisdictional cooperation and good science but the major reason for these successes is simple – money.

Healing Our Waters -  
Great Lakes Coalition, Ann Arbor, Michigan  
Participate! IJC, April 14, 2017

Although the public praised the action by governments on AOCs, they also often referred to AOCs as a cautionary tale. Large amounts of financial and human resources are now being spent to clean up errors from the past. To the extent that governments have avoided policies that could create new AOCs, they are to be commended. The Parties must remain committed and invested in prevention efforts and a precautionary approach to preserve the Great Lakes for future generations.

### Lakewide Management

The IJC lauds the Parties for elevating the prominence of lakewide management in the GLWQA. The 2012 GLWQA includes lakewide management as a stand-alone annex, and assigns ambitious programs and measures to that annex. In 2015, the Parties released for comment the draft Lake Superior Lakewide Action and Management Plan (LAMP), the first LAMP issued under the current GLWQA. The LAMP was revised following a period of public input and the final Lake Superior LAMP was issued in September 2016.

Concurrent with LAMP preparation, implementation of priority actions in all lakes is ongoing. Projects focused on nutrient reduction, invasive species control and habitat restoration have received attention in Canada and the United States. Although these projects involve a diversity of partners and stakeholders, it is notable that nearly four years after the 2012 GLWQA came into effect, the LAMP partnerships have only recently established their outreach and engagement work groups to engage the public and affected communities.

In accordance with their Annex 2 commitments in the GLWQA, the Parties released a draft Integrated Nearshore Framework for review in March 2016 and a final framework in September 2016. The nearshore framework aims to identify nearshore areas of high ecological value or subject to high stress and identify the factors causing stress or threatening high value areas. Completion of the framework was the result of substantial efforts by the Parties and other partners. The guiding principles included in the framework are appropriate and comprehensive. Restoration and protection of sections of the coastline identified in the framework will require the allocation of adequate resources.

### YOUR VOICE

"In 2006, our website attracted over 5,000 visits, we have over 600 subscribers to our newsletters... We have a tremendous amount of people who are interested and we can manage that, but we cannot do it alone. Without local AOCs, how will LAMPs be coordinated throughout the Great Lakes? Local advocacy will continue to be vitally important but will also be very challenging given the geographic expanse of the LAMPs."

Kris Lee, St. Clair River BPAC, Port Huron, Michigan, email, October 13, 2016



## Nearshore Issues, Local Solutions

When the IJC held its public input sessions around the Great Lakes basin, it heard from many individuals, stakeholders and organizations about local water quality challenges in the nearshore area and along the tributaries that bring water to the lakes. However, there were also stories of local successes where local stewardship has greatly improved environmental quality. Turnout and participation in the IJC's call for public input showed the degree of interest and enthusiasm for Great Lakes protection and local action. The challenge is how to harness and focus this enthusiasm to move from a story of local impact to a story of local stewardship success.

A review of some of the local stewardship programs around the Great Lakes showed that the largest component of local approaches to nearshore improvements relies on knowledge transfer and educating communities about ways to mitigate nearshore water pollution and maintain coastal health. Informing local groups and individuals helps to foster a sense of responsibility and offers opportunities for "home-grown" action. It is also important to identify the socio-economic benefits that a healthy coastline has for the region. Objectives of such programs must be directly relevant to the immediate area in which they are being applied to foster local interest.

Pilot application of the Integrated Nearshore Framework between Long Point and Fort Erie, Ontario involved the integration of data from disparate sources to provide a cumulative assessment of the state of the nearshore waters. The datasets and visuals created to link stresses and threats to nearshore conditions and to assess change over time provide vital information to communities in the area and empower them to identify and create any needed change. In anticipation of the rollout of the Integrated Nearshore Framework across the lakes, the availability of funding programs to support local stewardship should be reviewed. Sufficient capacity is needed to support local interest in applying the knowledge and tools that the framework will provide.

## Cooperative Science and Monitoring

The development of LAMP management activities relies heavily on science information developed through the Cooperative Science and Monitoring Initiative (CSMI). The CSMI coordinates binational priority science activities in the Great Lakes basin with an emphasis on enhanced monitoring and research field activities, which are conducted on the basis of one lake per year on a five-year rotating cycle. Such coordination reduces monitoring costs and focuses data collection efforts.

The CSMI is intended to complement ongoing monitoring conducted by the Parties in coordination with state and provincial agencies and others for various environmental components, including nearshore and offshore water quality, sediment quality and fish tissue contaminant concentrations. The CSMI focuses primarily on the lakes with limited focus on their associated connecting river systems. Given that these systems can act as sources of stressors to the downstream lake and modify in-lake processes, the binational lake partnerships and Annex 10 Cooperative Science and Monitoring Task Team should fully include the connecting river systems in the CSMI cycle.



The CSMI has significantly improved coordination among federal science agencies and some progress has been made coordinating involvement with state and provincial agencies. The encouraging progress made by the CSMI towards research and monitoring coordination could be built upon in other areas, including through partnerships with academic institutions. Reporting also could be improved through greater consolidation of findings as reporting is currently spread across various reports, articles and presentations. The consolidation of preliminary findings is needed on a timely basis to inform management decisions that follow the CSMI field year.

The year 2016 marked the ten-year anniversary of the CSMI's expansion to include research coordination in addition to the coordination of monitoring. Two cycles of the CSMI have occurred since then. Therefore, it is an opportune time to review the program and assess its success and the extent to which it has provided new data and information otherwise lacking or absent. As part of any review, the Parties should consider the need for adequate and dedicated funding for monitoring and research completed through the CSMI, given that understanding the lakes is critical to effective management.

### Microplastics

Numerous studies have documented the presence of plastic debris, such as plastic bags, bottles, boxes, fibers, microbeads, and cigarette filters, in marine and fresh waters, including the Great Lakes. Larger plastic debris can

degrade into smaller particles. Particles smaller than 5-mm in diameter are known as microplastics. There are several categories of microplastics, including preproduction plastic pellets and flakes, microfibers, breakdown materials from larger plastics and microbeads. Microbeads, the most well-known of these categories, are small plastic beads that are added as an abrasive to personal care products, including cosmetics, face washes, toothpastes, deodorants, hair coloring, shaving creams and sunscreens.

These smaller plastic particles, the microplastics, are of special concern. Little is known about the fate of microplastics in the environment but they can foul aquatic habitats, can be ingested easily by organisms, and there is concern about their potential human health impacts through consumption of fish.

Though relevant under general objective 9, no annex or specific provision of any annex in the GLWQA explicitly addresses microplastics. However, one of the principles and approaches outlined in the GLWQA, the *precautionary approach*, does have implications for addressing the issue. The GLWQA defines precaution as set forth in the 1992 Rio Declaration on Environment and Development: "Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation." The potential impacts of microplastics on the Great Lakes ecosystem are significant enough to warrant action at the earliest possible opportunity.



Recognizing that the emerging issue of microplastics pollution in the Great Lakes was not adequately captured in the GLWQA, the IJC worked with governments at all levels, stakeholders and nongovernmental organizations in the Great Lakes basin to review the state of knowledge regarding the issue and develop recommendations that could be provided to the Parties. Following public consultation, the [IJC's recommendations on microplastics in the Great Lakes](#) were transmitted to the Parties under the Agreement headings of Binational Plan, Science, Pollution Prevention, and Education and Outreach.

Due to widespread knowledge of plastic pollution in marine waters, the Parties have undertaken several activities related to marine debris including researching, understanding and developing program and policy options to deal with microplastics. Efforts underway to address plastic pollution in the Great Lakes, such as NOAA's Great Lakes Marine Debris Action Plan, Alliance for the Great Lakes' Adopt-a-Beach program and the Great Canadian Shoreline Clean-up. These efforts and others, including banning single-use plastics and other Extended Producer Responsibility efforts, should continue to be promoted and supported as tools to prevent and reduce microplastic pollution.

In December 2015, the [Microbeads-Free Waters Act](#) became law in the United States. It prohibits soaps, body washes, toothpaste and other personal care products from containing the traditional plastic or biodegradable plastic beads as of July 1, 2017. The law also prohibits the sale of products containing microbeads as of July 1, 2019. In

November 2016, the Canadian government announced a ban on the manufacture and sale of shower gels, toothpaste and facial scrubs containing microbeads. The prohibition of the manufacture of these products comes into effect on January 1, 2018, with the prohibition on their sale beginning July 1, 2019.

The US and Canadian governments are to be commended for the great strides they have made addressing the issue of microbeads. However, microbeads are only a subset of the much broader issue of microplastics, which is a problem requiring more complex policy responses.

## Recommendations

To address Areas of Concern, the IJC recommends that:

- The Parties set a goal of completing remedial actions for all Areas of Concern in the next 15 years, and maximize beneficial use impairment removals and AOC delisting during that time period.
- The Parties continue to advance implementation of remedial actions in all remaining Areas of Concern (AOCs) by maintaining recent Great Lakes Restoration Initiative investments in the United States and by accelerating cleanup at Canadian AOCs.
- The Parties enhance robust public engagement through the remedial action program by creating meaningful opportunities for binational dialogue between AOC stakeholders, and supporting public advisory councils when they transition to 'life after delisting' in their AOC.











## 6. ADVICE ON CRITICAL ISSUES

The GLWQA states that the IJC Triennial Assessment of Progress report may include “other advice and recommendations, as appropriate.” This chapter discusses and provides advice and recommendations on a number of critical issues that don’t neatly align with a single GLWQA objective. These include implementation of the 2012 Agreement, human health, climate change, and engagement.



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## 1. IMPLEMENTATION OF THE 2012 AGREEMENT

The Great Lakes are a precious resource shared by two great nations. Though each nation can work individually on the restoration and maintenance of the Great Lakes, they make the best progress when they work with each other and with their states, provinces and other orders of government, including indigenous governments. In a review conducted in 2006, the IJC found that the 1987 GLWQA was no longer an important driver for programs and actions in the Great Lakes. The 2012 GLWQA has addressed many of the gaps, deficiencies and issues associated with the 1987 version and provided innovative approaches and commitments across a much greater range of issues. More binational attention than ever before is being given to Great Lakes aquatic invasive species, habitats and species, and climate change, with full GLWQA annexes dedicated to these areas. This is in addition to annexes on topics such as pollutants and nutrients that remain of high importance to the lakes and the communities on their shores.

In this first triennial cycle of GLWQA implementation, the Parties devoted considerable effort to institutionalizing processes and procedures and meeting deadlines for initial GLWQA commitments. For example, the Parties successfully met deadlines for developing priorities for science and action, proposing a nearshore framework, and setting targets for Lake Erie binational phosphorus load reduction

targets. The first reporting cycle under the Agreement shows notable progress on accountability. Although the presentation and content of the Progress Report of the Parties (PROP) should be improved in future rounds of reporting to make it a better tool for public engagement, its creation and publication are praiseworthy.

### YOUR VOICE

"Reports tend to be critical and make the case for where actions are needed or failures occurred. Ok, I can accept that as a method to push improvements. But we, must recognize success, we must build upon actions that have delivered, we must say thank you to the people and groups who have volunteered, please acknowledge the positives."

David Shortt, Sarnia, Ontario, letter via email,  
March 27, 2017

Work under the Agreement is conducted through binational annex committees and task teams under the leadership of the Great Lakes Executive Committee. The PROP shows evidence of the extensive binational, interagency and intergovernmental cooperation on issues addressed in the GLWQA Annexes. Coordination with indigenous governments could be better demonstrated. On GLWQA objectives where specific annexes do not exist, such as the objectives for drinkability, swimmability and fishability, the degree of coordination, focus

and progress is not as evident. In the next triennial cycle of GLWQA implementation, the IJC will be looking to governments to build on the processes, procedures and institutions they have established to make greater strides in the restoration and protection of the lakes.

## Recommendation

To continue and improve successes in GLWQA implementation, the IJC recommends that:

- The governments' financial investment in improving the water quality of the Great Lakes continue at current or higher levels.

## 2. HUMAN HEALTH

The Commission has consistently expressed concern about the need to increase attention to the human health implications of the quality of Great Lakes waters. In its 16<sup>th</sup> biennial report, the IJC observed, "One of the most vital concerns of the public is the safety or risk to human health of exposure to Great Lakes contaminants through

fish consumption, drinking water and swimming. Developing indicators of disease resulting from Great Lakes environmental exposures that reflect the best science and communicate meaningful information to the public is an important task for the governments." The 2012 Agreement refers to the importance of human health protection.





While the 2017 State of the Great Lakes report notes that many people benefit from the lakes that have high quality drinking water and open beaches, the Commission sees many areas that need additional work. The 2014 “do not drink” advisories by Toledo, Ohio and Pelee Island, Ontario in response to unsafe levels of microcystins in treated drinking water heightened the public’s attention to this concern. Long-standing boil water advisories in some indigenous communities, fish advisories to limit consumption to avoid toxic contaminants and beach closings after some storm events are evidence that more government action is needed to meet the Agreement objectives.

Yet the position of human health within GLWQA implementation is paradoxical. On the one hand, the Agreement sets three high priority human health general objectives often summarized as “swimmable, fishable and drinkable.” On the other hand, the GLWQA contains no annex dedicated to the coordination of implementation activities associated with these objectives.

## YOUR VOICE

“We need to better connect human health and the impact it has on waterways and the environment; protecting the Great Lakes as a whole must also come back down to the household level.”

Syliva Orduño, Michigan Welfare Rights Organization and Member, EPA’s National Environmental Justice Action Council, Public Meeting on the Great Lakes afternoon roundtable, Detroit, Michigan, March 21, 2017

The Progress Report of the Parties (PROP) illustrates the lack of attention to human health issues in the GLWQA implementation in this first triennial cycle:

- Drinking water is discussed only in the context of nutrients, where actions by the federal government in the US, the State of Ohio and the Province of Ontario related to microcystins and harmful algal blooms are reported. Yet the GLWQA highlights the need to restore nearshore waters given that they are a major source of drinking water.
- There is little attention to swimming or the use of Great Lakes waters for recreation in the PROP. The discussion of swimming and recreational water quality that does occur is relative to the nutrients annex and it relates to US federal, Ohio and Pennsylvania actions to monitor and manage harmful algal blooms in recreational waters. Canadian action on an Area of Concern (AOC) mentions improved recreational waters as a byproduct of AOC cleanup.
- The only discussion of fish consumption in the PROP relates to the potential for exposure to persistent and bioaccumulative chemicals. No actions directly related to fish consumption are listed. The PROP does not mention programs related to wildlife consumption. As well, SOGL reporting does not connect human health with consumption of species dependent on the waters of the Great Lakes.



A greater focus on human health and improved reporting on domestic and binational actions related to the drinking water, recreational water and fish consumption objectives could foster better analysis of progress toward objectives achievement. Health data specific to exposures related to the waters of the Great Lakes should be collected and reported by ecosystem, as opposed to political boundaries. This would support analysis of connections between water quality and human health and be more likely to prompt appropriate action. Displaying the spatial distribution of impacts, such as beach closings, would facilitate public understanding and analysis of affected populations.

The IJC takes special note of the health implications of combined sewer overflows (CSOs). Combined sewer systems are wastewater collection systems that convey stormwaters, untreated sewage and industrial wastewater through a single pipe. These systems transport all the water to a wastewater facility for treatment before discharge to a water body. However, during periods of intense

rainfall or snowmelt, the volume of water collected by a combined sewer can exceed its capacity or that of the treatment plant. The systems will then overflow to a nearby water body from a CSO. These discharges can contain contaminants such as pathogens, sediment, toxics and nutrients. Discharges from CSOs can affect not just drinking water supplies, requiring greater and more costly treatment, but also the recreational use of the waters. Outflows from CSOs often result in the closure of beaches in order to protect human health. The size of the problem is shown by the fact that in one year, 20 Great Lakes cities in the US and Canada released a combined total of 92 billion gallons of untreated sewage and stormwater to the Great Lakes mostly via CSOs.

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*“No garbage, excretia, manure, vegetable or animal matter or filth shall be discharged into or be deposited in any of the lakes, rivers, streams or other waters in Ontario, or on the shores or banks thereof.”*

-Ontario Public Health Legislation, 1906

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*“Civilized people should be able  
to dispose of sewage in a better  
way than by putting it in the  
drinking water.”*

-Theodore Roosevelt, 1910

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Constructing and maintaining public infrastructure adequate to prevent these impacts is one of governments’ most basic – and expensive – responsibilities. Meeting the costs to maintain and update these systems is a major challenge. Infrastructure investments will continue to place considerable demands on public budgets and planning for future needs is essential. Ensuring the adequacy of existing infrastructure to meet GLWQA objectives for future generations and assessing anticipated costs to provide this infrastructure requires continual attention from governments. Additional stressors such as more frequent and intense storm events due to climate change and cyanotoxins in source water affected by algal blooms further compound this challenge.

In the Great Lakes states, 184 communities have combined sewer systems and permits to discharge their overflow to surface waters, with eight of these communities discharging directly to the Great Lakes and the remainder to a tributary of the lakes. The highest densities of CSO communities in the United

States are found in the Lake Erie and Lake Michigan basins, with 92 and 72 communities, respectively. Ontario has 107 combined sewer systems. No new combined sewer systems have been permitted in Ontario since 1985. The IJC recognizes that the considerable time and money required to end CSO discharges of sewage to Great Lakes waters means that ending this risk to human health cannot happen immediately. However, plans need to be put in place now and adequate funds allocated to ensure that the end of these discharges is in sight. Zero discharge of inadequately treated or untreated sewage into the Great Lakes needs to be achieved.

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*“We hold almost a quarter  
of all the fresh water in the  
world. And yet we are having  
problems with quantity and  
quality. That’s ridiculous  
and it’s fixable.”*

-Bob McDonald

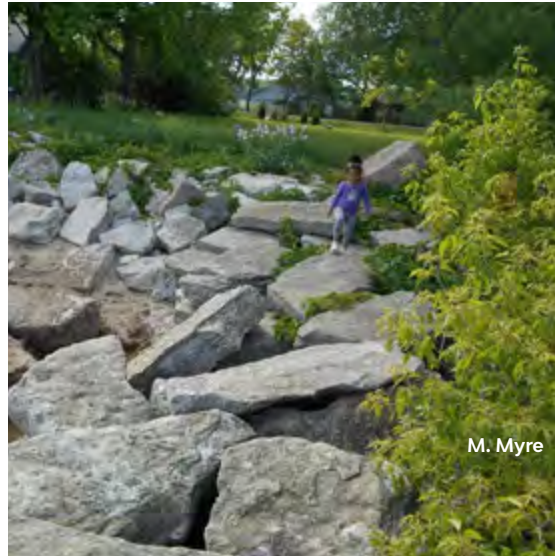
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Both governments invested heavily in infrastructure in the 1970s, which led to significant improvements in water quality. In Ontario, infrastructure investments waned in the 1980s and 1990s but have been accelerated since the early 2000s leading to some recovery in the average age of municipal wastewater infrastructure and sewers and significant recovery in the average age of municipal water supply infrastructure. The United States has not experienced the same level of recent spending on Great Lakes water and wastewater infrastructure. However, in both countries infrastructure spending needs exist and it is encouraging to note that both governments have taken steps to identify the capital needs to improve drinking water and wastewater infrastructure. A return to the former level of investment by the Parties, as well as steps to reduce the burden from municipal governments, would be welcomed.

As communities try to address the issue of storm overflows in the face more frequent and intense storm events due to climate change, the burden on steel and concrete infrastructure can be reduced through the use of land use planning, zoning and green infrastructure. These tools can decrease the volume of storm runoff and increase the time it takes for stormwater to reach the sewerage system. Applying these tools has the potential to reduce the necessary capacity, and therefore the costs, of traditional infrastructure approaches to eliminating overflows.

Meeting challenges related to new development and climate change is not just about steel and concrete infrastructure.



Land use planning and zoning are also tools that can be used to prepare for and manage current and future challenges. Land use planning creates goals for how communities develop into the future, based on analyses of a community's present and future needs. Well-developed land use plans can protect a community's environmental and human health, implement robust infrastructure plans, and promote economic development. Land use plans also guide the development of zoning ordinances, which provide the legal framework to regulate land use. Zoning ordinances establish permitted land uses, differentiate between different land use types, and ensure that incompatible land uses are not located next to one another. For example, zoning ordinances can set restrictions on building on flood plains or wetlands, which can support a community's land use planning goal of improving resiliency to severe storm events and protecting residents' safety.



When used together, land use plans and zoning ordinances can protect the health of the communities' environment and its residents. These tools can be used to achieve goals such as decreasing the volume and increasing the quality of stormwater runoff to the lakes and helping coastal communities adapt to changes in lake levels.

## Recommendations

To improve progress toward achievement of the human health objectives, the IJC recommends that:

- The Parties establish an accelerated and fixed period of time by which zero discharge of inadequately treated or untreated sewage into the Great Lakes will be effectively achieved and dedicate sufficient resources to accomplish the task.
- To reduce human exposure to untreated and inadequately treated sewage, the Parties increase funding directed to infrastructure improvement and provide support to communities to proactively and systematically improve the capacity to respond to extreme storm events, especially as related to combined sewer overflows, planning, zoning and adaptation.
- The Parties enhance reporting on progress toward achievement of the GLWQA's human health objectives by collecting and reporting on health data specific to the waters of the Great Lakes. The Parties should display binational health and environmental data on an ecosystem rather than domestic basis to facilitate public understanding and enable the analysis of affected populations and the distribution of impacts, such as beach closings.
- The Parties fix their fragmented approach to achieving the GLWQA human health objectives by developing mechanisms to enhance focus on objective achievement, increase coordination among jurisdictions and improve accountability, including more specific goals and timelines and a formalized approach to eliminate the silo effect across the Agreement annex committees.

### 3. CLIMATE CHANGE

Looming over all challenges to the Great Lakes is the unprecedented threat of climate change. Although its effects cannot be precisely forecast, climate change will continue to alter profoundly the characteristics of the ecosystem.

Phenomena observed in the Great Lakes over the last several decades have been linked to climate change, including reduced winter ice cover, altered stratification patterns, increased summer temperatures, and more frequent and intense storms. Climate change has emerged as a stressor to fish populations in large lakes, driven by processes including warmer temperatures throughout the water column, less ice cover, longer periods of stratification, and increased bottom hypoxia.

Biodiversity in general is being affected by climate change by shifting many species' distributions, and outpacing their adaptive capacities. As one example, the Commission has learned that climate change may be altering the traditional range of manoomin (wild rice) in the Great Lakes due to warming winters and changing water levels, affecting indigenous peoples' culture, health and well-being.

Although there is near unanimous scientific consensus that climate change is occurring, there continues to be uncertainty in establishing cause and effect linkages in the Great Lakes with climate change, and quantifying climate-induced effects is one of the grand challenges for Great Lakes research.

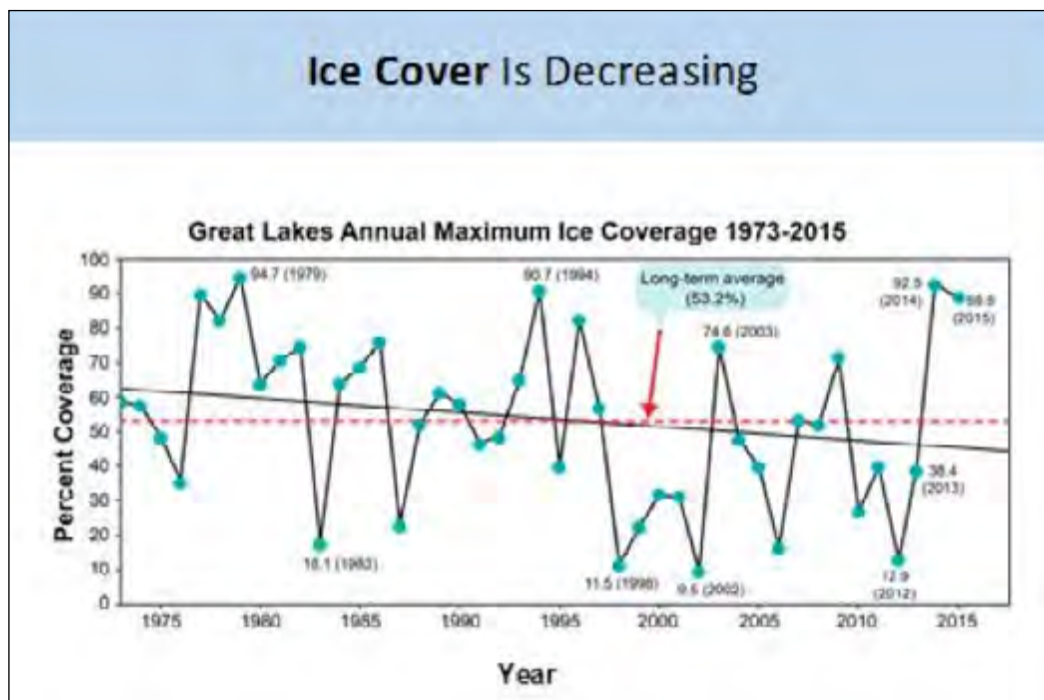


Figure 10: Ice coverage of the Great Lakes fluctuates from year to year but there is a downward trend over the past 40 years, possibly due to global climate change. (Source: SOGL 2017 Technical Report)



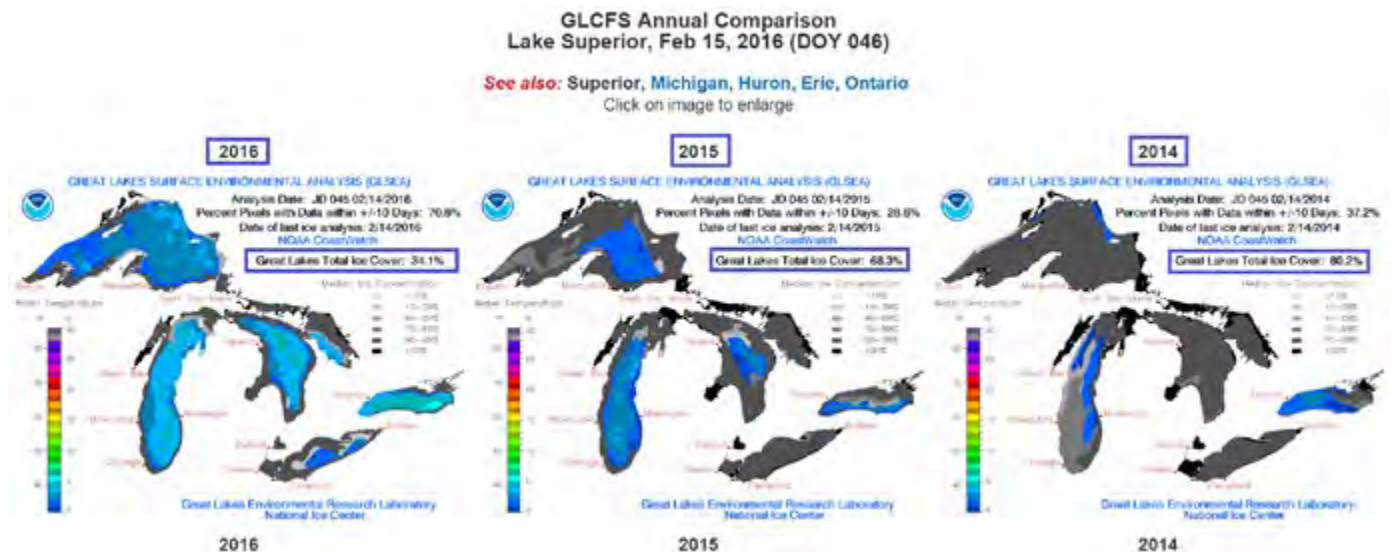


Figure 11: Comparison of Ice Cover 2014-2016. NOAA – Great Lakes Environmental Research Laboratory

Annex 9 of the GLWQA (Climate Change Impacts) commits the Parties “to identify, quantify, understand, and predict the climate change impacts on the quality of the Waters of the Great Lakes,” and to “sharing information that Great Lakes resource managers need to proactively address these impacts.” The annex also commits the Parties to coordinating actions where appropriate with water quantity management actions taken by or in conjunction with the IJC.

The Progress Report of the Parties identifies a significant number of domestic actions taken in the implementation of Annex 9. For example, Canada is developing Regional Climate Change models for the Great Lakes – St. Lawrence River system. Canadian federal agencies and organizations in Quebec are also conducting a coordinated evaluation of the impacts of climate change on the levels and flows of the St. Lawrence River from 1961-2100. In the United States, the National Oceanic and Atmospheric

Agency (NOAA) developed and released a basinwide Water Level Dashboard in 2014. The dashboard is an interface for visualizing projected, measured, and reconstructed surface water elevations on the earth’s largest lakes. The dashboard reflects relationships between hydrology, climate, and water level fluctuations in the Great Lakes.



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Binationally, the Quarterly Climate Impacts and Outlook: Great Lakes Region, jointly prepared by NOAA and Environment and Climate Change Canada, provides a brief bulletin of the latest season's weather and water level conditions and impacts over the Great Lakes and provides an outlook for the upcoming quarter.

One of the most important actions the governments have taken to fulfill the Agreement's commitments on climate change was publication in 2015 of the [\*State of Climate Change Science in the Great Lakes Basin Report\*](#). The report captures available science on impacts of climate change in the Great Lakes basin and inventories the climate change assessment methods applied in the region. It also includes a companion database with summaries of more than 250 recent climate change studies.

## YOUR VOICE

"All the stakeholders need to acknowledge climate change and the need to adapt to it. Climate change is an environmental justice issue for citizens across the globe which will only increase over time."

Katie McKibben, Public Meeting on the Great Lakes, Toledo, Ohio, March 23, 2017

In implementing Annex 9, the Parties have satisfactorily addressed the science commitments related to climate change impacts, cooperated successfully on numerous measurement

and communications projects and met implementation timelines. However, greater emphasis must be placed on moving from a science focus (identification of climate impact) to an action-oriented focus (actions supporting climate adaptation and resiliency) based on an adaptive management approach.

To better understand the capacity of governments to confront the realities of climate change, a project completed under the auspices of the IJC's Great Lakes Water Quality Board looked at climate projections and their likely environmental impacts in the Great Lakes region. The project also examined the preparedness of governments for adaptation and resilience. Analysis from the project found that although most jurisdictions have a climate change policy or plan in place, mitigation is more common than climate change adaptation or resiliency planning. Newer plans are placing greater focus on adaptation measures and their implications for water quality. In most cases, adaptation planning remains a distinct activity, not fully integrated into broader government planning. Most adaptive actions are not adopted in light of climate change alone. It is therefore important to integrate climate change adaptation initiatives with other programs, such as resource management and sustainable development, coastal zone management, watershed management, and community development.

Municipalities in particular will face formidable water quality challenges resulting from climate change. With more frequent and intense storms, municipal combined sewer overflows can be expected to increase,

promoting eutrophication and hypoxia and exposing the public to pathogens through recreational contact or drinking water. The Water Quality Board found that stormwater management is not advancing with sufficient speed across all jurisdictions to address the changing climate. The importance of preventing combined sewer overflow discharges to the Great Lakes and their tributaries will only increase in the coming decades as the climate changes due to historic and ongoing greenhouse gas emissions. Governments need to invest in solutions that either increase storage within combined sewer systems or result in sewer separation.

The Water Quality Board project also showed the likelihood of increasing variability in lake levels and frequency of extreme precipitation events related to climate change. These events could lead

to loss of valued ecosystem services from coastal damage, pose challenges to the integrity of coastal water infrastructure and degrade wetlands and other nearshore habitats. The IJC, as part of its mandate on water levels and flows in the Great Lakes through the Boundary Waters Treaty, has a record of making recommendations to governments related to the wise management of shoreline and coastal land use as the principal component of mitigation strategies meant to alleviate the adverse consequences of constrained water level fluctuations. This includes consideration of land use planning and zoning as ways to safeguard shoreline and coastal regions and provide protection to fish and wildlife habitat from development that would negatively impact estuaries and wetlands.



Métis Nation of Ontario – [www.metisnation.org](http://www.metisnation.org)



## Climate Projections And Likely Environmental Impacts In the Great Lakes Region

Climate-related Projections in the Great Lakes Region	Likely Environmental Impacts
Warmer air temperatures (esp. warmer nights; warmer winters: even warmer water temperatures)	<ul style="list-style-type: none"> <li>• Less ice cover; less stratification and oxygen distribution in the lakes</li> <li>• More lake evaporation year-round (trending to lower lake levels) up by 25 percent since 1980</li> <li>• More favorable conditions for algae and bacteria</li> <li>• Loss of habitat and/or increased stress for cool and cold-water fish</li> <li>• Increased likelihood of heat waves and urban heat-island effects; heat-related illnesses</li> <li>• More warm weather pests, including invasive species</li> <li>• Stress on livestock and crops; reduced productivity</li> <li>• Loss of valued ecosystem services (flood buffers, water filtration, erosion stabilization, coastal habitat including nesting/nursery areas) from coastal erosion, damage to streamside habitat; loss of important populations</li> <li>• Challenges to coastal water infrastructure (drinking water intake and discharge disposal infrastructure not easily adaptable to high lake level variability)</li> <li>• Exposed contaminated areas from lower levels, dredging harbors to support shipping in low water years</li> <li>• Risks for coastal development during low water years and "hardening" shorelines</li> </ul>
More precipitation and more extreme precipitation events	<ul style="list-style-type: none"> <li>• Increased polluted runoff, especially from intense spring storms</li> <li>• Sediment and nutrient "flushes; " rapid increased loading in Great Lakes watersheds and the lakes themselves</li> <li>• Algal blooms oxygen depletion, dead zones, cyanobacteria</li> <li>• Loss of safe drinking water supplies</li> <li>• Degraded wetlands and coastal habitat</li> </ul>

More extreme swings between periods of drought and drench	<ul style="list-style-type: none"> <li>• Loss of valued ecosystem services (flood buffers, water filtration, erosion stabilization, coastal habitat including nesting/nursery areas) from coastal erosion, damage to streamside habitat; loss of important populations</li> <li>• Challenges to coastal water infrastructure (drinking water intake and discharge disposal infrastructure not easily adaptable to high lake level variability)</li> <li>• Exposed contaminated areas from lower levels, dredging harbors to support shipping in low water years</li> <li>• Risks for coastal development during low water years and “hardening” shorelines</li> </ul>
Increasing variability in lake levels	<ul style="list-style-type: none"> <li>• Loss of valued ecosystem services (flood buffers, water filtration, erosion stabilization, coastal habitat including nesting/nursery areas) from coastal erosion, damage to streamside habitat; loss of important populations.</li> <li>• Challenges to coastal water infrastructure (drinking water intake and discharge disposal infrastructure not easily adaptable to high lake level variability)</li> <li>• Exposed contaminated areas from lower levels, dredging harbors to support shipping in low water years</li> <li>• Risks for coastal development during low water years and “hardening” shorelines</li> </ul>
Changes in vitality and distribution of cold-climate dependent species—both aquatic and terrestrial	<ul style="list-style-type: none"> <li>• Changes in species range and relative abundance, especially for cool and cold-water fish</li> <li>• Likely range expansion for warm-weather invasive species , including diseases crop pests, expanded ranges for zebra and quagga mussels</li> <li>• Changes in terrestrial tree and plant species along coastal areas and Great Lakes tributaries that will likely alter wildlife species distribution</li> </ul>
Nutrient and invasive species challenges exacerbated	<ul style="list-style-type: none"> <li>• Polluted runoff from extreme storms enriches nutrient and bacteria loadings into nearshore waters</li> <li>• Zebra and quagga mussels filter nearshore waters, increasing light penetration</li> <li>• Sunlight penetration and warmer air temperatures warm the waters faster, deeper, and to higher temperatures;</li> <li>• Sunlight and warm water supports growth of algae and other phytoplankton</li> <li>• With plenty of nutrients, warm water and sunlight, algae growth “explodes”</li> <li>• Massive blooms die off and use up dissolved oxygen = dead zones</li> </ul>
Changes in seasonal wind directional (vector) patterns	<ul style="list-style-type: none"> <li>• Reduced exchange between waters in bays with low oxygen levels and open lake waters; potential increase in dead zones, especially Green Bay, western Lake Erie</li> </ul>

Negative synergies from multiple effects	<ul style="list-style-type: none"> <li>• Polluted runoff from extreme storms enriches nutrient and bacterial loadings into nearshore waters</li> <li>• Zebra and quagga mussels filter nearshore waters, increasing light penetration</li> <li>• Sunlight penetration and warmer air temperatures warm the waters faster, deeper, and to higher temperatures</li> <li>• Sunlight and warm water support growth of algae and other phytoplankton</li> <li>• With plenty of nutrients, warm water and sunlight, algae growth “explodes”</li> <li>• Massive blooms die off and use up dissolved oxygen = dead zones</li> </ul>
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[IJC WQB Emerging Issues Work Group, Climate Change and Adaptation in the Great Lakes \(2017\)](#)

The Water Quality Board report provides recommendations to the IJC calling for the Canadian and US governments to demonstrate global leadership by jointly developing a binational approach to climate change adaptation and resilience in the Great Lakes. The report also calls on governments to make investments in research, information sharing and knowledge management to carry out a vulnerability assessment, to engage stakeholders and rights holders, and to identify priorities for responsive actions in the Great Lakes region.

The Commission agrees that the unprecedented threat of climate change should compel both community and basinwide responses. All levels of government are implicated. All people can contribute.





## Recommendations

To better consider and adapt to climate change impacts, the IJC recommends that:

- The Parties demonstrate global leadership by jointly developing, in cooperation with other government jurisdictions, including indigenous governments and organizations in the Great Lakes, a binational approach to climate change adaptation and resilience in the Great Lakes.
- The Parties invest in a binational vulnerability assessment, defining the risks posed by climate change and providing technical support for measures to adapt to climate change, to engage stakeholders and all orders of government, and to identify priorities for responsive actions in the Great Lakes region.
- The Parties recognize the impacts of climate change on water infrastructure and provide support to communities to proactively and systematically improve the capacity to respond to extreme storm events, especially as related to combined sewer overflows, planning, zoning and adaptation.

## 4. ENGAGEMENT

Under the GLWQA, the Parties agree to be guided by principles and approaches that include public engagement, which is defined as “incorporating Public opinion and advice, as appropriate and providing information and opportunities for the Public to participate in activities that contribute to the achievement of the objectives of this Agreement.”

In the preamble to the 2012 GLWQA, the Parties recognize that the involvement and participation of state and provincial governments, Tribal governments, First Nations, Métis, municipal governments, watershed management agencies, local public agencies, and the public are essential to achieve Agreement objectives. The public is defined in the GLWQA as “individuals and organizations such as public interest

groups, researchers and research institutions, and businesses and other nongovernmental entities.” As noted throughout this assessment report, the Parties have set an ambitious pace in undertaking implementation of many commitments under the GLWQA. In some cases, however, they have not incorporated robust public engagement into their activities.

### YOUR VOICE

“Opportunities for industry to engage in scientific studies and development of resource management policy are essential; we would like to see more opportunities.”

Kathryn Buckner and Dale Phenicie, Council of Great Lakes Industries, letter via email, April 3, 2017

For example, LAMPs are meant to be a key mechanism for public engagement in the implementation of the GLWQA, but the Parties have been slow in providing public engagement opportunities and related activities for Annex 2, Lakewide Management. LAMP partnerships took more than three years to begin establishing their outreach and engagement work groups – after the existing committees were disbanded. For example, at the Sault Ste. Marie, Ontario public meeting, participants called the Lake Superior LAMP very beneficial but expressed frustration with the elimination of citizen forums. In the absence of these forums, the public had to start over again to get involved in development and implementation of the plan. Perhaps the most telling detail about public engagement was the near absence of comment on LAMPs in response to the Commission's request for public input on progress in Agreement implementation. Engagement in the LAMP process was not evident.

In contrast, there has been significant public engagement over the long history of the Area of Concern (AOC) program, with public advisory groups established and active for most of the AOC locations. However, there is no clear route for people engaged in AOC activities in a local area to provide input on the binational implementation and decision-making process for Annex 1, Areas of Concern. This GLWQA annex is the only one without an annex committee for implementation and therefore no extended subcommittee for public involvement in annex activities. Consequently, status reports and guidance prepared under this annex do not benefit from the input of engaged people or the broader public.

## YOUR VOICE

"The IJC should stress to the governments that public involvement is important, and should be respected particularly in Areas of Concern."

Saul Simoliunas, Public Meeting on the Great Lakes, Detroit, Michigan, March 21, 2017



IJC (Detroit meeting)

The PROP was intended, in part, to serve as a vehicle for public engagement. However, the 2016 report had limited value for public engagement because it was released to the public too close to the Great Lakes Public Forum to generate significant dialogue from Forum participants. The report was not mentioned at the Forum and was not marketed by the Parties to the general public, either through traditional or social media opportunities.

The Great Lakes Public Forum provided an opportunity for the Parties to encourage the public to learn about Great Lakes issues and to include people from all sectors of society in the GLWQA implementation process. Although the Forum was well attended and there were many informative presentations, this opportunity for public engagement was not fully utilized due to limited promotion, a venue that was difficult to access by public transit and a format that did not adequately encourage strong public interaction.

## YOUR VOICE

"This Public Forum was not conducive to true public participation. We need to do better. We need to be having conversations in the communities across the Great Lakes, rather than just one or two each year."

Kristy Meyer, Ohio Environmental Council, IJC public comment session, Great Lakes Public Forum, Toronto, Ontario, October 5, 2016

A successful aspect of the Forum was live video streaming of the event through Detroit Public Television and TV Ontario. As outlined in the [Summary of Public Consultation Appendix](#), at least 8,600 people from 14 countries watched the Forum via the livestream and another 16,000 have watched portions of the meeting via videos provided on the Participate IJC website, the Detroit Public Television links, or via IJC Twitter and Facebook postings. These figures illustrate the keen interest the public has in learning more about the lakes and how they can contribute to their restoration and protection. They also reflect the quality of the presentations at the Forum itself, which conveyed the status of Great Lakes water quality in clearly understood graphics and language.

## YOUR VOICE

"We express our sincere appreciation for the livestreaming...We hope the number of people who participated in the livestreaming justifies further similar efforts."

Andrew McCammon, Ontario Headwaters Institute, IJC public comment session, Great Lakes Public Forum, Toronto, Ontario, October 5, 2016



In every community where the IJC held public meetings about progress on the Agreement, residents expressed sincere appreciation that the Commission came to them. The Parties' Great Lakes Executive Committee and annex committee meetings can provide the same opportunity for public understanding,



appreciation and interaction if they are held throughout the Great Lakes basin at easily accessible locations. The meetings can be designed and promoted to provide opportunities for everyone to learn about Agreement programs, to interact with those working on Great Lakes issues, and to discover sources of information within their own communities. An enhanced presence on social media through Twitter and Facebook pages devoted specifically to the Parties' GLWQA programs as well as an interactive website would provide additional opportunities to update the public about initiatives and the many ways the public can become involved in restoring and protecting the lakes.

Community-based meetings and communication methods that encourage two-way conversations, rather than webinars, formal hearings and large conferences in which information is presented but little opportunity is provided for feedback or interaction, will more fully reflect the essential role the public plays in achieving the goals and objectives of the GLWQA. Greater inclusiveness would garner immediate results in terms of awareness of key Great Lakes issues, vocal support for programs to address them, and positive involvement in the GLWQA process.

## YOUR VOICE

"All water pollution is connected to land use and management issues; policy and funding needs to focus on this. It's a process and getting public involvement is important."

Ronald Fadoir, Oakland County Water Resources Commission, Public Meeting on the Great Lakes, Detroit, Michigan, March 21, 2017



IJC (Milwaukee meeting)

Another public engagement issue identified in the public meetings is the absence of a strong connection between GLWQA processes and many affected communities. The Parties should embrace the principle of fair treatment and meaningful involvement of all people regardless of race, color, national origin or income, with respect to public engagement and environmental policy setting for the Great Lakes. Past workshops and conferences, public meetings and outreach efforts carried out by the IJC and the Parties frequently have not been successful in engaging some minority and indigenous populations in the Great Lakes basin. Therefore, the water quality issues important to these groups may not be heard or understood. Through the IJC public consultation process, people confirmed that whether they live in urban or rural communities, they value the lakes according to how they can use and enjoy them. At a minimum, hearing new voices and meaningfully engaging people historically outside of traditional outreach efforts will enrich everyone with a better understanding of the breadth of issues facing the basin and its shared waters.

## YOUR VOICE

"First Nation people have lived in peace and harmony with the Great Lakes basin since time immemorial...From the sleeping giants of Manitoulin Island to the Bays of Quinte and the Gulf of the St. Lawrence and all points in between, our creation stories, our songs, our ceremonies, our traditions and the voices of our ancestors echo ripples across the waters...We will continue to assert the need for respect, equity and empowerment through the voices of our ancestors."

Grand Chief Abram Benedict, Chiefs of Ontario,  
IJC comment session at the Great Lakes Public  
Forum, Toronto, Ontario, October 5, 2016

## Recommendations

To better uphold the principle of engagement in GLWQA implementation, the IJC recommends that:

- The governments accelerate and deepen their approach to public engagement in Lakewide Action and Management Plans (LAMPs), including inbasin opportunities for participation and the use of social media and online participation mechanisms.
- The Parties include more opportunities for public engagement with diverse communities and more thoroughly engage Tribal, First Nations and Métis governments in GLWQA implementation, incorporating greater contributions from these groups in the triennial Progress Report of the Parties.



IJC (Milwaukee meeting)

## ENGAGING FIRST NATIONS, TRIBES AND MÉTIS

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In the 2012 GLWQA, there is recognition in the preamble that the involvement and participation of Tribal governments, First Nations and Métis are essential to achieve its objectives. The GLWQA also directs the governments to work in cooperation and consultation with Tribes, First Nations and Métis on many aspects of Agreement implementation. However, the degree to which this is occurring is unclear. The Progress Report of the Parties does not provide details on engagement of indigenous governments or set out many of the actions that these governments undertake to value, restore and maintain the integrity of the Great Lakes. The number and volume of indigenous voices at forums like the Great Lakes Executive Committee are growing, but there is a distance to go before indigenous governments are full partners in the decision making about Great Lakes environmental stewardship. Particularly at the Great Lakes Public Forum, the IJC heard from Indigenous Peoples who want their sovereignty and rights to water respected. Indigenous Peoples' stewardship of the Great Lakes for cultural, ceremonial and subsistence practices should be protected and their traditional ecological knowledge valued in decision making. Tribal, First Nations and Métis peoples need to be engaged as rights holders by the governments with recognition and appreciation of their governance, identity, cultures, interests, knowledge and traditional practices.

*First Nations in Ontario's treaty relationships make certain that decision-making processes related to use and care of the waters is a right maintained by the First Nations and not handed over with the making of Treaties...First Nations in Ontario have seen the need to declare, retain and assert our relationship with the waters to ensure that there is clean waters for the future generations*

Excerpts from Water Declaration of the First Nations in Ontario, October 2008

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The IJC has responsibilities under the GLWQA for analyzing and disseminating data and information obtained from Tribal governments, First Nations and Métis, among others and tendering scientific advice in return. The IJC also has responsibilities for consulting with and engaging the public. The IJC has valued the indigenous voices that have contributed to its call for public comment on progress under the GLWQA. Looking forward, the IJC will need to work to ensure that the voices of indigenous members of the public are heard and further consider how it can implement its responsibilities for engaging with indigenous governments on data and science, including through learning exchanges to better understand indigenous science and knowledge and how it can contribute to GLWQA implementation.







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*There is no greater medicine than water –  
it is foundational, our very beginnings, it  
reminds us where we came from, our first  
environment in the womb.*

-Elder, Chiefs of Ontario 2006

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## 7. FINDINGS AND RECOMMENDATIONS

This first IJC assessment of progress under the 2012 GLWQA finds many accomplishments by the Parties and other governments. The GLWQA is once again a framework for meaningful binational effort to restore and protect the Great Lakes. However, in some instances the Parties have moved slowly in implementing actions. In other instances, the Parties have not yet fully embraced the GLWQA principles in their activities.



The most important of these principles, in the judgment of the IJC, is prevention. Preventing harm to Great Lakes water quality is not only a duty of good ecological stewardship but also sound public health and fiscal policy. The Parties should do more to anticipate problems and forestall them through action. A surge in dissolved reactive phosphorus in western Lake Erie, raw or poorly treated sewage flushing into the lakes, and contamination by flame retardants that replaced earlier toxins are examples of issues that the Parties could have averted, had there been forward looking policies at that time. To achieve GLWQA objectives, the Parties need to do a better job of preventing harm.

Two other GLWQA principles weigh heavily in the IJC's analysis. First, the Commission strongly supports the accountability envisioned by the GLWQA.

The Parties are to be commended for building accountability mechanisms into the 2012 GLWQA and for implementing them in the first triennial work cycle. However, accountability can be further improved as we move forward. Second, the Commission agrees with the GLWQA drafters that public engagement is vital. In preparing this report, the IJC consulted with the Great Lakes public across the basin and considered all of the input received in formulating these findings and recommendations. The Great Lakes public must be engaged more thoroughly by the governments if implementation of the GLWQA is to have maximum impact.

This chapter presents key findings from the IJC's first triennial assessment of progress, as well as recommendations for moving boldly into the next triennial cycle and beyond.

## 1. IMPLEMENTATION OF THE 2012 AGREEMENT

The Commission finds that the 2012 GLWQA galvanized new energies, activities and binational cooperation over a larger span of issues than were addressed under previous versions of the Agreement. The Parties are to be commended for authoring the new GLWQA, for giving it momentum and for harmonizing implementation activities amongst not just two countries, but eight states, two provinces and indigenous nations and hundreds of municipalities. In just three years the Parties have made remarkable progress formalizing mechanisms by which the new GLWQA can be implemented and

meeting deadlines for initial Agreement commitments. The Commission salutes the Parties for these achievements.

### Recommendation

To continue and improve successes in GLWQA implementation, the IJC recommends that:

- The governments' financial investment in improving the water quality of the Great Lakes continue at current or higher levels.



## 2. PROTECTING HUMAN HEALTH



In the Preamble to the 2012 GLWQA, the Parties acknowledge “the close connection between quality of the Waters of the Great Lakes and the environment and human health, as well as the need to address the risks to human health posed by environmental degradation.” Progress in addressing human health is synonymous with progress in achieving the GLWQA objectives for drinking water, recreational water use and the consumption of fish and wildlife. Therefore achievement of these objectives is of paramount importance to the people of the Great Lakes basin.

However, the IJC finds that the Parties have not demonstrated sufficient progress toward achieving the human health objectives in their implementation of the GLWQA. Unfortunately, there are no annex or implementation committees devoted exclusively to these human health objectives. Reviews of the Progress Report of the Parties and the most recent State of the Great Lakes report show a lack of reporting specific to

programs in support of these objectives, and gaps exist in measuring and reporting key indicators to assess progress. Reporting indicators on a basinwide or even lake-by-lake scale also obscures the small minority of cases where source water or drinking water quality has been unacceptable and masks the distribution of impacts to beaches. The GLWQA objectives for drinking water and recreational water uses need to be met for everyone across the basin.

The Commission also finds that the continued input of inadequately treated and untreated sewage into the Great Lakes is unacceptable. Sewage overflows must be addressed to reduce the risk of human illness from Great Lakes waters. In this 21<sup>st</sup> century, after more than 100 years of water treatment, the public can no longer be asked to tolerate the dumping of raw sewage into the Great Lakes except under extremely rare conditions.

### Recommendations

To improve progress toward achievement of the human health objectives, the IJC recommends that:

- The Parties establish an accelerated and fixed period of time by which zero discharge of inadequately treated or untreated sewage into the Great Lakes will be effectively achieved and dedicate sufficient resources to accomplish the task.
- To reduce human exposure to untreated and inadequately treated sewage, the Parties increase funding directed to infrastructure improvement and provide support to communities to proactively

and systematically improve their capacity to respond to extreme storm events, especially as related to combined sewer overflows, planning, zoning and adaptation.

- The Parties enhance reporting on progress toward achievement of the GLWQA's human health objectives by collecting and reporting health data specific to the waters of the Great Lakes. The Parties should display binational health and environmental data on an ecosystem rather than domestic basis to facilitate public understanding and enable the analysis of affected populations and the distribution of impacts, such as beach closings.
- The Parties fix their fragmented approach to achieving the GLWQA human health objectives by developing mechanisms to enhance focus on objective achievement, increase coordination among jurisdictions and improve accountability, including more specific goals and timelines and a formalized approach to eliminate the silo effect across the Agreement annex committees.



Specifically to improve progress toward the objective that the waters of the Great Lakes should be a source of safe, high-quality drinking water, the IJC recommends that:

- The Parties monitor and report on source water quality for drinking water, and the United States match the Ontario requirement for source water protection plans to protect drinking water supplies.
- The Parties address infrastructure needs to eliminate all longstanding boil water advisories and persistent drinking water violations for communities everywhere in the Great Lakes basin.

Specifically to improve progress toward the objective that the waters of the Great Lakes allow for human consumption of fish, the IJC recommends that:

- The Parties set a goal of reaching all populations vulnerable to health impacts from fish consumption with accessible and protective fish consumption advisories, and draw up a plan to do so. Populations include frequent consumers of Great Lakes fish such as subsistence anglers, many African Americans, indigenous communities, and some immigrant and other minority communities. It also includes those vulnerable to contaminants such as women of childbearing age and young children. In developing a plan to reach this goal, the Parties should collaborate more closely with representatives of these communities.

### 3. POLLUTANTS

Progress on the challenge to address pollutants in the Great Lakes has been disappointingly slow. In the first three years of GLWQA implementation, only eight chemicals of mutual concern have been identified. No strategies for the binational management of these chemicals have been completed. Additional resources are needed to help the Parties meet the timelines they set themselves for implementation and to protect Great Lakes water quality from chemicals of concern. The IJC finds that progress on chemicals of mutual concern has been insufficient relative to the threat that toxic pollutants pose to the health of humans, wildlife and aquatic organisms in the Great Lakes basin.

An approach that holds promise for preventing some toxic chemicals from entering the Great Lakes ecosystem assigns responsibility for minimizing or eliminating their presence in the environment to producers of pollutants and the products that contain them. The Canadian Council of Ministers of the Environment (CCME) established the Extended Producer Responsibility (EPR) Task Group to provide guidance on the development and implementation of a harmonized approach to EPR that could be applied across Canada. This effort resulted in the CCME Canada-wide Action Plan for Extended Producer Responsibility, an approach that should be considered for adoption by other governments. The Commission finds that opportunities exist for closer collaboration between Canada and the United States for joint identification and designation for products and materials for EPR action.

#### Recommendations

To improve progress toward achievement of the pollutants objective, the IJC recommends that:

- The Parties accelerate work on binational strategies for elimination or continual reduction of chemicals of mutual concern with clear timelines set and met for strategy development and implementation.
- The Parties develop strategies that have at their core the principle of zero discharge.
- The Parties adopt and extend policies and programs based on the principles of Extended Producer Responsibility (EPR) on a broad range of products, including flame retardants, to prevent introduction of toxic and non-toxic contaminants into the Great Lakes. The Parties should include status reports on EPR programs and policies in the triennial Progress Report of the Parties.





## 4. NUTRIENTS



The IJC finds that the water quality of western and central Lake Erie remains unacceptable. The Commission is investigating several nutrient-related topics and looks forward to providing its advice on those topics to governments in the current triennial cycle. In its 2014 report, *A Balanced Diet for Lake Erie*, the Commission included 16 recommendations for consideration by the Parties. The Commission reiterates several of those recommendations and calls for accountability in domestic action plans. The Commission acknowledges the progress that has been made by the Parties consistent with several of the recommendations, including setting phosphorus reduction targets for the western and central basins. In particular, the IJC commends the participative approach used by

the Parties for the development of these targets. However, the poor condition of Lake Erie warrants swifter action designed to achieve the targets, including domestic action plans with enforceable standards. The State of Ohio, under the United States Clean Water Act, should list the waters of the western basin of Lake Erie as impaired because of nutrient pollution. The State of Michigan has now done so. Ohio's listing would trigger the development of a tri-state phosphorus total maximum daily load (TMDL) involving Ohio, Michigan and Indiana, with U.S. Environmental Protection Agency oversight.

### Recommendations

To achieve steep reductions in phosphorus loadings and harmful algal blooms and improve progress toward achievement of the nutrients objective, the IJC recommends that:

- Domestic action plans to achieve phosphorus loading reduction targets include details on timeline, who is responsible for actions, expected deliverables, outcomes and quantifiable performance metrics in order to assure accountability.
- The Parties further act on advice from the IJC's 2014 report on Lake Erie, most notably with respect to the need for enforceable standards governing the application of agricultural fertilizer and animal waste, along with better linkage between agricultural subsidies and farm operator use of conservation practices that are demonstrably effective at curbing phosphorus runoff.

- The State of Ohio, under the United States Clean Water Act, list the waters of the western basin of Lake Erie as impaired because of nutrient pollution. The State of Michigan has now done so.
- Periodic testing be required and enforceable standards for maintenance and replacement of septic systems be instituted in the United States and Canada.
- All levels of government provide adequate resources to implement better stormwater management systems in urban areas and accelerate the use of green infrastructure.

## 5. INVASIVE SPECIES

Prevention of new invasive species, both aquatic and terrestrial, received strengthened consideration in the 2012 GLWQA.

The Commission finds that there has been significant progress in preventing the introduction of aquatic invasive species to the Great Lakes. This includes Asian carp, where the level of effort and funds spent on Asian carp control are well justified by the fact that programs have curtailed their spread into the Great Lakes. However, continued vigilance is required to prevent new introductions and to sustain the fight against Asian carp invasion. Work is also required to control the spread of species that have already been introduced. The status of the State of the Great Lakes indicator for invasive species is poor and the trend deteriorating due to setbacks with the spread of several invasive species and the impact that this spread has had on the Great Lakes.

In particular, the IJC finds that invasive *Phragmites* is a serious threat to Great Lakes wetlands and immediate work is needed to control its spread throughout the watershed.

The Commission finds that binational efforts to combat invasive species lack the crucial elements of certainty and long-term planning

facilitated by uninterrupted program funding.

### Recommendations

To improve progress toward achievement of the invasive species objective, the IJC recommends that:

- The Parties continue to devote significant resources to prevent Asian carp from invading the Great Lakes.
- The Parties continue to require ballast water exchange and flushing in addition to discharge treatment for seagoing vessels. Governments and industry should also dedicate sufficient research and testing to develop an effective binational approach to the regulation of ballast water discharge from “Lakers” within the next triennial reporting period.
- The Parties reach agreements on permitting the use of safe and effective control measures to reduce the spread of invasive species consistent across all jurisdictions within the next triennial reporting period.
- The Parties put in place long-term, sustainable funding mechanisms to support work on the fight against invasive species.

- Within the next triennial reporting period, the Parties invest significant resources to create an intensive, well-focused binational program for effective basinwide practices and new tools that can control and eradicate the threat of *Phragmites* and prove useful in controlling other invasive plants.

## 6. ADDRESSING AREAS OF CONCERN

The Commission finds that the first work cycle of the 2012 GLWQA has been a time of great progress for Areas of Concern (AOCs). Of the 62 beneficial use impairments (BUIs) eliminated to date in the United States, half were eliminated between 2013 and 2016. In Canada, almost 20 percent of the 65 BUIs eliminated to date were removed in the triennial period covered by this report. Three US AOCs have been delisted in this work cycle, for a total of four delisted US AOCs. This compares to the total between 1987 and 2012 of one US AOC delisted, and three Canadian AOCs delisted and two AOCs in recovery. Continuing this momentum is important to achieve many of the GLWQA objectives. It will require continued, if not accelerated, funding and public engagement.

### Recommendations

To address Areas of Concern, the IJC recommends that:

- The Parties set a goal of completing remedial actions for all Areas of Concern in the next 15 years, and maximize beneficial use impairment removals and AOC delisting during that time period.
- The Parties continue to advance implementation of remedial actions in all remaining Areas of Concern (AOCs) by maintaining recent Great Lakes Restoration Initiative investments in the United States and by accelerating cleanup at Canadian AOCs.
- The Parties enhance robust public engagement through the remedial action program by creating meaningful opportunities for binational dialogue between AOC stakeholders, and supporting public advisory councils as they transition to life after delisting in their AOC.





## 7. COPING WITH CLIMATE CHANGE



A changing climate has been influencing the Great Lakes for some time. Further climatic change is built into the future, thanks to inexorably rising carbon dioxide concentrations in the atmosphere and the consequences of these concentrations for temperature and precipitation regimes. A wide variety of water quality-related impacts will occur, ranging from more favorable conditions for the growth of algae and bacteria to increases in polluted runoff from intense storms. Such dramatic change poses significant challenges to governments at all levels and to communities across the basin.

The GLWQA charges the Parties to consider climate change impacts on the integrity of the waters of the Great Lakes and in Agreement implementation. It further challenges the Parties, in cooperation and consultation with state and provincial governments, Tribal Governments, First Nations, Métis, municipal governments, watershed management agencies, other local agencies and the public, to use their domestic programs to address climate change impacts to contribute to the achievement of the GLWQA's objectives.

Many Great Lakes communities as well as federal, state and provincial agencies are engaging in aspects of climate change adaptation planning and implementation. However, the Commission finds that there is need for a Great Lakes basinwide perspective, approach or strategy.

### Recommendations

To better consider and adapt to climate change impacts, the IJC recommends that:

- The Parties demonstrate global leadership by jointly developing, in cooperation with other government jurisdictions, including indigenous governments and organizations in the Great Lakes, a binational approach to climate change adaptation and resilience in the Great Lakes.
- The Parties invest in a binational vulnerability assessment, defining the risks posed by climate change and providing technical support for measures to adapt to climate change, to engage stakeholders and all orders of government, and to identify priorities for responsive actions in the Great Lakes region.
- The Parties recognize the impacts of climate change on water infrastructure and provide support to communities to proactively and systematically improve the capacity to respond to extreme storm events, especially as related to combined sewer overflows, planning, zoning and adaptation.

## 8. ENGAGEMENT

Under the GLWQA, the Parties agreed to be guided by principles and approaches that include engagement, which is defined as “incorporating Public opinion and advice, as appropriate and providing information and opportunities for the Public to participate in activities that contribute to the achievement of the objectives of this Agreement.”

The Commission finds that the Parties have not fully incorporated robust public engagement into their activities. For example, the Parties are not showing sufficient urgency in confirming their approach to public engagement and related activities for Lakewide Management. Additionally, Lakewide Action and Management Plan (LAMP) partnerships took more than three years to begin establishing their outreach and engagement work groups – after disbanding the existing committees. Without robust engagement, connections do not always exist between GLWQA processes and many affected communities.

Looking to the future, the Commission finds that the IJC and the Parties should reach beyond the limits and audiences

typically recognized and should factor in consideration of environmental justice as a key objective. Reaching out to nontraditional populations and indigenous governments could provide lessons on how to address many of the problems facing the Great Lakes basin.

### Recommendations

To better uphold the principle of engagement in GLWQA implementation, the IJC recommends that:

- The governments accelerate and deepen their approach to public engagement in Lakewide Action and Management Plans (LAMPs), including inbasin opportunities for participation and the use of social media and online engagement mechanisms.
- The Parties include more opportunities for public engagement with diverse communities and more thoroughly engage Tribal, First Nations and Métis governments in GLWQA implementation, incorporating greater contributions from these groups in the triennial Progress Report of the Parties (PROP).



IJC (Toledo meeting)

## 9. ACCOUNTABILITY

Government accountability in GLWQA implementation is vital and reporting requirements are central to enacting this principle.

The IJC finds that the Parties have substantially improved accountability under the GLWQA by implementing a three-year reporting cycle, producing the Progress Report of the Parties, and improving the selection of indicators to support the assessment of progress toward achieving GLWQA objectives in the State of the Great Lakes report. As this has been the first reporting cycle, accountability mechanisms can be further improved in subsequent cycles.

Accountability can also be ensured through the acquisition of robust binational data that can be used to describe and quantify scientific indicators of Great Lakes water quality and track changes over time. Additional binational monitoring data are needed to make better-informed decisions about Great Lakes restoration and management strategies to restore and delist Areas of Concern and to ensure that impaired conditions do not return. Data are also needed to understand the linkages between storm events, agricultural and urban runoff, combined sewer overflows, and harmful algal blooms in order to develop effective prevention and mitigation strategies.

### Recommendations

To further improve reporting and accountability, the IJC recommends that:

- The Parties set clear, time-bound targets for action and also longer-term aspirations for improvements in the status and trends of Great Lakes indicators as measured by science-based indicators.
- The Parties strengthen support for a comprehensive binational Great Lakes monitoring program to provide the essential information and understanding needed to quantify and interpret indicators, forecast change, prevent or mitigate impacts and restore and preserve the Great Lakes ecosystem.
- In future reporting cycles, the Parties coordinate the timing of the Progress Report of the Parties and the State of the Great Lakes report and release the reports sufficiently before the Great Lakes Public Forum to ensure informed discussion at the Forum.
- The next Progress Report of the Parties, expected in 2019, and those following include reporting on how the recommendations in this triennial assessment of progress are being addressed.



## CONCLUSION



The 2012 GLWQA is a landmark in cooperative efforts to protect the Great Lakes. Its objectives, guiding principles and annexes have stimulated new scientific, programmatic and advocacy efforts on the part of the Parties and the broader Great Lakes community. These activities have renewed the reputation of the GLWQA as a globally significant framework for protecting and restoring shared freshwater resources.

A framework, however, is not enough to restore and protect the Great Lakes. Success requires much more of government: visionary goals based on strong science and a commitment to prevent degradation of the Great Lakes; long-term planning supported by adequate and consistent funding; clear and enforceable standards backed up by environmental monitoring and reporting; and a day-by-day commitment to preventing further harm. By now, it should be clear that prevention makes environmental, economic and common sense.

This report finds that the Parties have made remarkable progress on many seemingly intractable Great Lakes problems, from remediating many of the basin's worst contaminated sites, known as Areas of Concern, to slowing the introduction of aquatic invasive species to a near standstill. These are impressive accomplishments.

In other areas, this report finds that the Parties must improve performance if the Great Lakes are to be adequately protected. They must accelerate efforts and set goals and timelines to control chemicals of mutual concern and nutrient overloading; increase investment in infrastructure to prevent the discharge of inadequately treated sewage into waterways; protect and restore more wetlands to enhance ecological diversity and water quality; implement climate change adaptation strategies; and assure that waters are drinkable, swimmable and fishable for all populations in the basin. In addition to the recommendations to governments from the IJC, the input the Commission received from the public contains numerous recommendations and comments that should be reviewed and considered by the Parties and other governments, not all of which could be researched or commented upon in this report.

The Commission recognizes that without informed, active, organized public citizens, governments will fail to deliver on the GLWQA's promises. The late Dr. Jack Vallentyne, a Canadian co-chair of the IJC's Science Advisory Board and an enthusiastic educator of children, used to challenge his audiences with a friendly, "Have you been good to your ecosystem today?" Another leader, Joan Wolfe, founder of the West Michigan Environmental Action Council, frequently reminded people that, "Truly concerned citizens are the key to environmental protection."

The work done by Vallentyne, Wolfe and others continues to bear fruit. The 45 years that have elapsed since the signing of the initial GLWQA demonstrate that the people of the basin will defend these precious waters. In fact, the future of the Great Lakes depends on them.

The IJC offers this assessment of progress and recommendations to governments in the belief that an informed Great Lakes populace will insist that the Great Lakes Water Quality Agreement, and the effort to restore the Great Lakes themselves, continue to be a model to the world.



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# LIST OF ACRONYMS, FIGURES AND GLOSSARY

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## List of Acronyms

The following is a list of common acronyms used in the report:

<b>4Rs</b>	Right fertilizer, Right rate, Right time and Right place	<b>GLEC</b>	Great Lakes Executive Committee
<b>AIS</b>	Aquatic invasive species	<b>GLRI</b>	Great Lakes Restoration Initiative
<b>AOC</b>	Area of concern	<b>GLWQA</b>	Great Lakes Water Quality Agreement
<b>BUI</b>	Beneficial use impairment	<b>HABs</b>	Harmful algal blooms
<b>CAFO</b>	Concentrated animal feeding operation	<b>HBCD</b>	Hexabromocyclododecane
<b>CCME</b>	Canadian Council of Ministers of the Environment	<b>HPAB</b>	Health Professionals Advisory Board
<b>CMC</b>	Chemicals of mutual concern	<b>IJC</b>	International Joint Commission
<b>CSMI</b>	Cooperative Science and Monitoring Initiative	<b>LAMP</b>	Lakewide Action and Management Plan
<b>CSO</b>	Combined Sewer Overflow	<b>LEEP</b>	Lake Erie Ecosystem Priority
<b>DFO</b>	Fisheries and Oceans Canada	<b>NOAA</b>	National Oceanic and Atmospheric Administration
<b>DDT</b>	Dichlorodiphenyltrichloroethane	<b>OMAFRA</b>	Ontario Ministry of Agriculture, Food and Rural Affairs
<b>DWQS</b>	Drinking Water Quality Standards	<b>OMOECC</b>	Ontario Ministry of Environment and Climate Change
<b>ECCC</b>	Environment and Climate Change Canada	<b>OMNRF</b>	Ontario Ministry of Natural Resources and Forestry
<b>E-DNA</b>	Environmental DNA		
<b>EPR</b>	Extended Producer Responsibility		

<b>PAH</b>	Polycyclic aromatic hydrocarbons	<b>SDWA</b>	Safe Drinking Water Act
<b>PBDEs</b>	Polybrominated diphenyl ethers	<b>SOGL</b>	State of the Great Lakes
<b>PCBS</b>	Polychlorinated biphenyls	<b>SOLEC</b>	State of the Lakes Ecosystem Conference
<b>PROP</b>	Progress Report of the Parties	<b>SWPP</b>	Source Water Protection Plan
<b>RAP</b>	Remedial action plan	<b>TAP</b>	Triennial Assessment of Progress
<b>RCC</b>	Research Coordination Committee	<b>USEPA</b>	US Environmental Protection Agency
<b>SAB</b>	Great Lakes Science Advisory Board	<b>USGS</b>	United States Geological Survey
<b>SPC</b>	Science Priority Committee	<b>WQB</b>	Great Lakes Water Quality Board

## Glossary

**4RS NUTRIENT STEWARDSHIP PROGRAM** – A nutrient stewardship program created by the agricultural industry, state agri-business associations, The Nature Conservancy, The Ohio State University, Michigan State University, state farm bureaus, state agencies and others. The program promotes best practices through the 4Rs, which refers to using the Right Source of Nutrients at the Right Rate and Right Time in the Right Place. Definition derived from the Fertilizer Institute.

**ADAPTIVE MANAGEMENT** – A planning process that can provide a structured, iterative approach for improving actions through long-term monitoring,

modeling and assessment. Through adaptive management, decisions can be reviewed, adjusted and revised as new information and knowledge becomes available or as conditions change.

**ALGAE** – Aquatic plants that survive through photosynthesis; they can range in size from microscopic organisms to large algae, like *Cladophora*.

**ALGAL BLOOMS** – An excessive and relatively rapid growth of algae on or near the surface of water. It can occur naturally as the result of a change in water temperature and current or as a result of an excess of nutrients in the water.

**ANNEX COMMITTEE** – A committee appointed by the Great Lakes Executive Committee to implement actions to achieve the general and specific goals of an annex of the Great Lakes Water Quality Agreement.

**AQUATIC INVASIVE SPECIES (AIS)** – As defined in the Great Lakes Water Quality Agreement, AIS refers to any non-indigenous species, including its seeds, eggs, spores, or other biological material capable of propagating that species, that threatens or may threaten the diversity or abundance of aquatic native species, or the ecological stability, and thus water quality, or water quality of infested waters, or commercial, recreational, or other activities dependent on such waters.

**AREA OF CONCERN (AOC)** – A location designated by the Parties under the Great Lakes Water Quality Agreement where environmental impairments resulting from local human activities prevent certain uses of the lakes. These impacts are termed beneficial use impairments, or BUIs.

**ASIAN CARP** – A type of fish native to Asia that has been introduced to the United States. Asian carp are regarded as highly invasive species in the US and Canada and capable of causing severe economic, ecological or human health harm. They include the following species: bighead carp (*Hypophthalmichthys nobilis*), black carp (*Mylopharyngodon piceus*), grass carp (*Ctenopharyngodon idella*) and silver carp (*Hypophthalmichthys molitrix*). Hybrids of silver and bighead carp also exist. Definition derived from the Michigan Department of Natural Resources.

**BALLAST WATER** – Liquid water carried or brought onboard and stored in tanks aboard a vessel to increase the draft, change the trim, regulate the stability or maintain safe stress loads on a ship.

**BASIN** – The region or area of which the surface waters and groundwater ultimately drain into a particular course or body of water.

**BENEFICIAL USES** – Uses and benefits of Great Lakes water quality and ecosystem resources, as identified in the Great Lakes Water Quality Agreement. They include fish and wildlife health and habitat, drinking water, and recreation.

**BENEFICIAL USE IMPAIRMENT (BUI)** – Under the Great Lakes Water Quality Agreement, a BUI is a reduction in the chemical, physical or biological integrity of the waters of the Great Lakes sufficient to cause any of the 14 identified impairments. These impairments include: restrictions on the human consumption of fish and wildlife; eutrophication or undesirable algae; restrictions on drinking water consumption; and beach closings.

**BIOACCUMULATIVE** – The accumulation of a substance, such as a toxic chemical, in the tissues of a living organism. Bioaccumulation takes place within an organism when the rate of intake of a substance is greater than the rate of excretion or metabolic transformation of that substance. Definition derived from The American Heritage Science Dictionary.

**BLUE FLAG CERTIFICATION** – An international certification for beach, marina or sustainable boating tourism operators created by the Foundation for Environmental Education. Certification criteria include standards for water quality, safety, environmental education and information and general environmental management criteria. Definition derived from the Foundation for Environmental Education.

**BOUNDARY WATERS TREATY OF 1909** – The agreement between the United States and Canada that established principles and mechanisms for the resolution of disputes related to boundary waters shared by the two countries. The International Joint Commission was created as a result of this treaty.

**CHEMICALS OF MUTUAL CONCERN** – Under the Great Lakes Water Quality Agreement, the Parties agree to mutually determine those chemicals, coming from human-made sources that are potentially harmful to human health or the environment, and to take cooperative and coordinated measures to reduce the release of these chemicals.

**CLADOPHORA** – A genus of green algae found growing attached to rocks or timbers submerged in lakes and streams. *Cladophora* grows in the form of a tuft or ball with filaments that may range up to 13 cm (5 inches) in length.

**CLIMATE CHANGE** – A change of climate that is attributed directly or indirectly to human activity, that alters the composition of the global atmosphere,

and which is in addition to natural climate variability observed over comparable time periods.

**CYANOTOXINS** – Toxins which are produced and contained within cyanobacterial (blue-green algae) cells. Toxins are released during death or cellular rupture, including mechanical or chemical reactions. Cyanotoxins can be produced by a wide variety of cyanobacteria including *Microcystis*, *Anabaena* and *Planktothrix*. Definition derived from the [USEPA](#).

**DIOXIN** – A group of toxic chemical compounds that share certain chemical structures and characteristics. Dioxins are formed in the production of some chlorinated organic compounds, including some herbicides. Dioxin compounds break down very slowly and persist for long periods of time in the environment. Dioxins are known to cause cancer, reproductive and developmental problems, damage the immune system, and interfere with hormones. Definition derived from the [USEPA](#).

**DECHLORANE PLUS** – A polychlorinated chemical flame retardant used in electronic wiring and cables, automobiles, hard plastic connectors and plastic roofing materials. Dechlorane Plus has been detected in the air, fish, and sediment samples within the Great Lakes region. Definition derived from the Government of Canada.



**DEEP GEOLOGICAL REPOSITORY (DGR)** – An underground storage cavern excavated within a stable geologic formation to store waste products from the production of energy using nuclear power. Facilities are built with the objective of achieving long-term isolation of radioactive material.

**DOMESTIC ACTION PLAN** – Plans developed by the United States and Canada to combat the growing threat of toxic and nuisance algal development in Lake Erie. In 2012, through the Great Lakes Water Quality Agreement, the two governments agreed to establish binational phosphorus load reduction targets for Lake Erie by February 2016, and to develop domestic action plans that will outline strategies for meeting the new targets by 2018.

**DRINKING WATER ADVISORY** – Public health protection messages issued by regulatory authorities to inform consumers about actions they should take to protect themselves from real or potential health risks related to their drinking water supply. Advisories are generally precautionary, and typically take three forms: Do not consume, Do not use and Boil water. Definition derived from [Environment and Climate Change Canada](#).

**ECOSYSTEM** – A biological community of interacting organisms and their physical environment, including the transfer and circulation of matter and energy.

**EDGE-OF-FIELD-MONITORING** – Voluntary water quality monitoring programs that measure the amount of nutrients and sediment in water runoff from a field, and compare the improvements

under different conservation systems. Monitoring allows agricultural producers and scientists to quantify the impacts of conservation work on water quality. Definition derived from the [United States Department of Agriculture](#).

**ENVIRONMENT** – Air, land or water; plant and animal life including humans; and the social, economic, cultural, physical, biological and other conditions that may act on an organism or community to influence its development or existence.

**ENVIRONMENTAL JUSTICE** – environmental justice as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Definition from the USEPA.

**EUTROPHICATION** – The process whereby water bodies become over-nourished either naturally by processes of maturation or artificially by excessive nutrient enrichment.

**EXTENDED PRODUCER RESPONSIBILITY (EPR)** – A policy approach under which producers are given a significant responsibility – financial and/or physical – for the treatment or disposal of post-consumer products. Such practices provide incentives for manufacturers to prevent waste and may promote product design which is environmentally conscious, thereby achieving sustainable recycling and materials management goals. Definition derived from the Organisation for Economic Co-operation and Development.

**FIRST NATION** – A Canadian term used to describe an indigenous Native American community officially recognized as an administrative unit by the federal government or functioning as such without official status. Definition derived from the Government of Canada.

**FISH CONSUMPTION ADVISORY** – A recommendation to limit or avoid eating certain species of fish or shellfish caught from specific water bodies or types of water bodies (such as lakes, rivers or coastal waters) due to chemical contamination. Advisories may be issued for the general public or specific groups of people at risk, such as subsistence anglers, the elderly and pregnant or nursing women. Definition derived from the USEPA.

**GENERAL OBJECTIVES** – As defined in the Great Lakes Water Quality Agreement, General Objectives refer to the broad descriptions of water quality conditions consistent with the protection of the level of environmental quality the Parties seek to secure and which provide a basis for overall water management guidance. The Agreement identifies nine categories of General Objectives.

**GREAT LAKES BINATIONAL TOXICS STRATEGY** – The 1978 Great Lakes Water Quality Agreement committed Canada and the United States to virtually eliminate inputs of persistent toxic substances to the Great Lakes system in order to protect human health and to ensure the continued health and productivity of living aquatic resources and their human use. On April 7, 1997, Environment Canada and the United States Environmental Protection Agency signed the Great Lakes Binational

Toxics Strategy, which set forth a process to work in cooperation with their public and private partners toward the goal of virtual elimination of persistent toxic substances resulting from human activity from the Great Lakes basin.

**GREAT LAKES VITAL SIGNS** – A defined set of measures that were selected by the IJC based on their ability to inform the public about the status of the Great Lakes and whether the Great Lakes are getting better or worse. Relative to State of the Great Lakes reporting, Great Lakes vital signs are a subset of existing sub-indicators and proposed new sub-indicators.

**GREAT LAKES WATER QUALITY AGREEMENT** – The Agreement expresses the commitment of Canada and the United States to restore and maintain the chemical, physical and biological integrity of the Great Lakes Basin Ecosystem. The most recent protocol amending the 1978 Agreement was signed in 2012.

**HARMFUL ALGAL BLOOMS (HABS)** – HABs result from the proliferation of blue-green algae (including cyanobacteria) in environmentally stressed systems, where conditions favor opportunistic growth of one or more noxious species, displacing more benign ones. The blooms are considered harmful because excessive growth can harm ecosystems and produce poisons (or toxins) that can cause illness in humans, pets, livestock and wildlife.

## **HEXABROMOCYCLODODECANE (HBCD)**

– A brominated chemical flame retardant often used in furniture, automobile textiles, mattresses and polystyrene foam. Humans and animals may be exposed to HBCD from products and dust in the home, workplace and the environment. Definition derived from [Natural Resources Defense Council](#).

**HYDRAULIC FRACTURING** – A chemical and mechanical method of drilling by forcing open fissures in subterranean rocks by introducing liquid at high pressure, especially to extract oil or gas. Also called “fracking.” Definition derived from the [USEPA](#).

**HYPOXIA** – A condition of low or depleted oxygen in a water body, leading to regions where life cannot be sustained. Hypoxia occurs most often as a consequence of human-induced factors, especially nutrient pollution.

**INDICATOR** – As defined in State of the Great Lakes Technical Report, an indicator is a piece of evidence, (e.g. data or measures) that informs about current conditions. Watching the evidence over time gives an indication of trends. Doctors use specific measures such as blood pressure and temperature to assess one’s health. To assess large, complex ecosystems such as the Great Lakes, environmental indicators are a useful and accepted approach. Great Lakes indicators are used to:

- Assess conditions and track changes in the ecosystem;
- Understand existing and emerging issues;

- Guide programs and policies needed to prevent or address harmful environmental problems; and,
- Provide information to set priorities for research and program implementation.

Reporting on a suite of Great Lakes indicators produces a big picture perspective on the condition and trends of the complex ecosystem. Indicators have been used to report on Great Lakes ecosystem components since the first State of the Lakes Ecosystem Conference (SOLEC) in 1994.

## **INTERNATIONAL JOINT COMMISSION (IJC)**

– International independent binational agency formed in 1909 by the United States and Canada under the *Boundary Waters Treaty* to prevent and resolve boundary waters disputes between the two countries. The IJC makes decisions on applications for projects such as dams in boundary waters, issues Orders of Approval and regulates the operations of many of those projects. It also has a permanent reference under the Great Lakes Water Quality Agreement to help the two national governments restore and maintain the chemical, physical, and biological integrity of those waters.

**LAKERS** – Bulk carrier vessels or ships which carry cargo exclusively within the Great Lakes basin.

### **LAKEWIDE ACTION AND MANAGEMENT PLAN (LAMP) –**

Under the Great Lakes Water Quality Agreement, a LAMP is an action plan for cooperatively restoring and protecting the ecosystem of a Great Lake. LAMPs are developed and implemented in consultation with US state governments and the province of Ontario and may include participation from local government agencies. LAMPs are in place for lakes Superior, Michigan, Erie and Ontario.

### **LAKE SUPERIOR ZERO DISCHARGE DEMONSTRATION PROGRAM –**

A program designed to achieve zero release of certain designated persistent, bioaccumulative toxic substances in the Lake Superior basin.

**MERCURY** – A naturally-occurring chemical element found in rock in the crust of the earth, including in deposits of coal. Mercury becomes a problem for the environment when it is released from rock and ends up in the atmosphere and in water bodies. Human activities are responsible for most of the mercury pollution that is released into the environment, often by burning coal, oil, waste products and wood. Definition derived from the USEPA.

**MÉTIS** – A person of mixed Native American and Euro-American ancestry; in particular, one of a group of such people who in the 19th century constituted the Métis Nation in the areas around the Red and Saskatchewan rivers. Definition derived from the Government of Canada.

**MICROCYSTIN** – A naturally-occurring, potent liver toxin produced by the cyanobacteria *Microcystis*. Microcystin toxins are the most widespread cyanobacterial toxin and can bioaccumulate in common aquatic vertebrates and invertebrates such as fish, mussels and zooplankton. Definition derived from the USEPA.

**MICROPLASTICS** – Plastic particles that are smaller than 5-mm in diameter, such as preproduction plastic pellets and flakes, microfibers, breakdown materials from larger plastics and microbeads. Microbeads, the most well-known of these categories, are small plastic beads that are added as an abrasive to personal care products, including cosmetics, toothpastes, deodorants, shaving creams and sunscreens. Microplastics can be ingested by aquatic organisms, leading to a range of potential impacts including the transfer of plastics and associated toxins along the food web, potentially to humans.

**NEARSHORE** – As defined in IJC's 15<sup>th</sup> Biennial Report on Great Lakes Water Quality, the nearshore includes the relatively warm shallow areas near the shores, coastal wetlands that are dependent on lake levels, the connecting channels and virtually all of the major embayments of the system. This area is estimated to include approximately 90 percent of shallow Lake Erie, 25 percent of each of lakes Michigan, Huron, and Ontario, but only five percent of Lake Superior, which has deeper waters. The definition also describes the nearshore zone as including the land areas that are affected by the waves, wind, ice and temperature. In general, the nearshore zone extends about 16 kilometers (ten miles) into both land and water.



**NITROGEN** – A nutrient essential for plant and animal growth and nourishment which may exist in the forms of nitrate, nitrite, or ammonium. Excess nitrogen can cause the rapid growth of aquatic plants and algae.

**NUTRIENT** – A food or any nourishing substance assimilated by an organism and required for growth, repair, and normal metabolism. For example, phosphorus and nitrogen are nutrients for algae.

**ONTARIO CLEAN WATER ACT** – Ontario legislation to ensure access to safe drinking water. The act requires creation and execution of plans to protect the sources of municipal drinking water supplies. Local communities must evaluate the existing and potential threats to their water and set out and implement the actions necessary to reduce or eliminate significant threats. Definition derived from the Government of Ontario.

**ONTARIO DRINKING WATER SURVEILLANCE PROGRAM (DWSP)** – A program that monitors water quality at selected municipal drinking water systems for scientific and research purposes. DWSP is a voluntary partnership that complements the regulatory monitoring that must be done by the drinking water systems. DWSP monitors for inorganic, organic and radiological parameters. Definition derived from the Government of Ontario.

**ONTARIO SAFE WATER ACT** – An Ontario law that dictates owners and operators of drinking water systems that supply water to the public have responsibilities to ensure the water is safe

to drink. Definition derived from the Government of Ontario.

**ONTARIO SOURCE WATER ASSESSMENT PROGRAM** – A program that includes source protection plans which contain policies that either recommend or require that actions be taken to address activities identified as threats in the science-based assessment reports. Definition derived from the Government of Ontario.

**OUTFALL** – Any pipe or conduit used to carry water and either raw sewage or treated effluent to a final point of discharge into a body of water. Definition derived from the Organisation for Economic Co-operation and Development.

**PARTICIPATE IJC** – A website created by the IJC to fulfill its duties under the Boundary Waters Treaty to take into consideration views of all interested parties before the IJC makes decisions or recommendations.

**PARTIES** – The parties or signatories to the Great Lakes Water Quality Agreement. That is, the Governments of Canada and the United States.

**PHOSPHORUS** – A nutrient essential for plant and animal growth and nourishment, which exists in particulate or soluble reactive forms. The element used in a wide range of agricultural, industrial and domestic products. It is a key nutrient limiting the amount of phytoplankton and attached algae in the Great Lakes and most freshwater bodies.

**PHRAGMITES** – Genus of four species of perennial wetland grasses found in temperate and tropical regions. Specific reference to *Phragmites* in this document refers to *Phragmites australis*, a Eurasian genotype that can grow over 6 meters tall (19 feet) and can quickly crowd out native species by exuding a compound that kills the roots of neighboring plants and by blocking out light to other species.

**POLYCHLORINATED BIPHENYLS (PCBS)** – A group of human-made organic chemicals consisting of carbon, hydrogen and chlorine atoms. Because of their non-flammability, chemical stability, high boiling point and electrical insulating properties, PCBs were used in hundreds of industrial and commercial applications. PCBs were domestically manufactured from 1929 until manufacturing was banned in 1979. Definition derived from the USEPA.

**POLYCYCLIC AROMATIC HYDROCARBONS (PAHS)** – A class of chemicals that occur naturally in coal, crude oil, and gasoline. They also are produced when coal, oil, gas, wood, garbage, and tobacco are burned. PAHs can bind to, or form small particles in the air. Definition derived from the USEPA and US [Centers for Disease Control](#).

**PROGRESS REPORT OF THE PARTIES (PROP)** – Under the Great Lakes Water Quality Agreement, the Parties agree to prepare a triennial progress report documenting actions taken domestically and binationally in support of the Agreement. The government production of the PROP and the IJC review of it is a key government accountability feature under the Agreement.

**PUBLIC INFORMATION AND ENGAGEMENT** – A proactive, coordinated process of informing the public throughout the course of a study and providing opportunities to interested individuals and organizations to make their views known and to review and comment on preliminary findings.

**RADIONUCLIDES** – An atom which has excess nuclear energy making it inherently unstable. Energy is typically released in the form of radiation. Radionuclides occur naturally, but they can also be produced artificially in nuclear reactors, cyclotrons, particle accelerators or radionuclide generators. They have a number of commercial and medical uses (i.e. radioisotopes).

**REMEDIAL ACTION PLAN (RAP)** – Under the Great Lakes Water Quality Agreement, plans designed to restore beneficial uses that have become impaired due to local conditions at Areas of Concern. Developed and implemented in cooperation with state and provincial governments, RAPs include: an identification of BUIs and causes; criteria for restoring beneficial uses, established in consultation with the local community; and remedial measures to be taken.

**STATE OF GREAT LAKES REPORTING (SOGLR)** – A process in which the governments of Canada and the United States regularly report on progress towards achieving the overall purpose of the Great Lakes Water Quality Agreement through reporting on ecosystem conditions and trends.

**STORMWATER MANAGEMENT –**

Practices that help to minimize the impact of polluted agricultural and urban runoff flowing into lakes and streams, and reduce the impact of such runoff on water bodies.

**TRIBES** – A group or community of Indigenous peoples that the United States recognizes in a government-to-government relationship and exists politically in a “domestic dependent nation” status. Federally recognized Tribes possess certain inherent powers of self government and entitlement to certain federal benefits, services, and protections because of the special trust relationship. Definition derived from the Government of the United States of America.

**US BEACHES ENVIRONMENTAL ASSESSMENT AND COASTAL HEALTH ACT (BEACH ACT)** – The Beach Act addresses pathogens and pathogen indicators in coastal recreation waters.

**US SAFE DRINKING WATER ACT –** A US federal law that protects public drinking water supplies. Under the SDWA, the EPA sets standards for drinking water quality and with its partners and implements various technical and financial programs to ensure drinking water safety. Definition derived from the USEPA.

**VULNERABILITY ASSESSMENT –** Vulnerability is the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to

which a system is exposed, its sensitivity to climate change, and its adaptive capacity. Adaptation actions are needed to eliminate or reduce the vulnerability of systems to the impacts of climate change. Vulnerability Assessments can support adaptation planning in several ways: identify areas most likely to be impacted by projected changes in climate; build an understanding of why these areas are vulnerable, including the interaction between climate change, non-climatic stressors, and cumulative impacts; assess the effectiveness of previous coping strategies in the context of historic and current changes in climate; and identify and target adaptation measures to systems with the greatest vulnerability. Definition derived from Ontario Centre for Climate Impacts and Adaptation Resources.

**WETLAND** – Areas of land where water saturates the soil at or near the surface all year or for varying periods of time. Wetlands support aquatic and terrestrial plants and animals. Examples of wetlands include swamps, marshes and meadows.

**ZERO DISCHARGE** – Concept which aims to eliminate toxic liquid, solid or gaseous substance releases into an aquatic, atmospheric or terrestrial environment.

**ZONING** – Regulations and laws designed to implement developed land use plans used by municipalities. Zoning can be used to control development, improve safety and protect resources. Zoning can be divided into different categories of development which include residential, commercial, agricultural or industrial zones. Specific laws may regulate requirements for residential or commercial buildings, transportation and utilities.







~ FIRST TRIENNIAL ASSESSMENT OF PROGRESS ON~

# GREAT LAKES WATER QUALITY

INTERNATIONAL JOINT COMMISSION  
FINAL REPORT

