

PROTECTING THE GREAT LAKES AND ST. LAWRENCE

Part 1: Great Lakes Action Plan 2030

June 2019

The Great Lakes and St. Lawrence Collaborative



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EXECUTIVE SUMMARY

Protecting a system of water and a region as vast and as valuable as the Great Lakes requires an ambitious plan, new and innovative approaches using new tools and data, mobilization of many individuals, businesses, communities, and organizations on the ground as well as significant sustained investment.

That is why five organizations - the [Great Lakes and St. Lawrence Cities Initiative](#), the [Council of the Great Lakes Region](#), the [Great Lakes Fishery Commission](#), [Freshwater Future Canada](#), and [Stratégies Saint-Laurent](#) - proposed to Environment and Climate Change Canada (ECCC) to undertake a stakeholder led process to find new and innovative ways to protect the Great Lakes and St. Lawrence in these changing times.

With funding support from ECCC, the Great Lakes and St. Lawrence Collaborative was established in October 2018. The 18-month process is delivering recommendations on new and innovative approaches to protect the Great Lakes and St. Lawrence. This report is focused on the first part, the Great Lakes. The second part, on the St. Lawrence, will be completed by the end of 2019. ECCC asked that the Collaborative focus on four challenges:

1. How to adapt to climate change along the Great Lakes shoreline;
2. How to reduce our exposure to harmful pollutants;
3. How to reduce nutrients entering waterways;
4. How to make all of our beaches free from sources of chronic bacteriological contamination.

To develop these recommendations, an Expert Panel was established, led by Gord Miller, former Environmental Commissioner of Ontario, and Jean Cinq-Mars, Québec's former Sustainable Development Commissioner. The Expert Panel was supported by four issue tables who provided strategic advice on the four challenges above. Through political engagement and place-based technical advice, the Collaborative process and recommendations have benefited from Indigenous counsel and knowledge.

The following Action Plan proposes 15 key actions to protect the Great Lakes and those who live in the region.

When implemented, these actions will:

- protect Great Lakes shoreline communities that are most vulnerable to high water levels by making them more climate resilient;
- act more quickly to prevent and reduce environmental and human exposure to harmful chemicals in the Great Lakes region;
- accelerate actions to reduce agricultural and urban nutrient runoff in priority areas that cause harmful algal blooms, and to improve the health of our waters;
- ensure that all Great Lakes beaches are clean and protect public health.

Implementing these 15 key actions will require substantial, sustained investment. While not all the needed investments should be born by government, it is proposed that the federal government should lead the charge by providing \$100 million per year, for ten years, leveraging contributions from other levels of government and other sources of financing.

Summary of Recommendations

It is recommended that:

Climate Change

1. The Governments of Canada and Ontario commit to establishing and funding shoreline resiliency priority zones to identify and address significant threats from climate change (high water levels, stronger wind/wave energy, erosion, sudden spring thaws, ice jams) impacting natural and built infrastructure on Great Lakes shorelines, with an emphasis on naturalization and green infrastructure solutions, beginning with five shoreline priority zones:

- i. Central Western Lake Erie (Chatham-Kent, Leamington)
- ii. Central Lake Huron (Amberley to Grand Bend)
- iii. Central Lake Ontario (Toronto to Prince Edward County)
- iv. North Central Lake Superior (Fort William First Nation, Thunder Bay)
- v. Southeastern Georgian Bay (Penetanguishene, Tiny Township)

2. The Government of Canada create a climate data sub-portal for Great Lakes priority zones be created within the Canadian Centre for Climate Services portal.
3. The Ontario Government, through the Ontario Ministry of Natural Resources and Forestry, and Conservation Authorities, invest further in the development of Light Detection and Ranging (LIDAR), flood plain mapping, and monitoring/modelling data to benefit shoreline communities.
4. The Governments of Canada and Ontario offer ongoing guidance and funding (on a competitive basis) to all shoreline municipalities and Indigenous communities to support actions to make their shorelines more climate resilient.

Toxics and Other Harmful Pollutants

5. The Federal Government, through Environment and Climate Change Canada (ECCC) and Health Canada, develop a targeted environmental and human health effects monitoring, human biomonitoring and surveillance program to provide early detection of unexpected effects in The Great Lakes Basin that feeds directly into a regulatory and non-regulatory response plan to reduce exposure.
6. ECCC and Health Canada develop guidelines to guide the generation and communication of data collected through the surveillance program and develop Guidance on the Appropriate Response to Exposure and Effects surveillance program data.
7. ECCC and Health Canada introduce a Strategy to Promote Substitution of Harmful Chemicals in Products, including a Centre for Chemical Substitution, and a Chemical Substitution Recognition Program.

Nutrients

8. The Governments of Canada and Ontario adopt a targeted, geographically specific approach to reducing nutrients entering the Great Lakes, employing precision conservation and stormwater optimization, to bridge the gap between farm scale conservation implementation and urban stormwater management with broader water quality impacts.
9. The Government of Ontario, with support from the Government of Canada, develop a data management

strategy and tools be developed to support the precision conservation approach and to facilitate the collection and use of datasets (e.g. elevation, soil type, property boundaries, land use) needed to prioritize properties, and best practices, and to coordinate monitoring and modelling data at a watershed level.

10. The Governments of Canada and Ontario, together with partner universities, Indigenous communities, and relevant organizations, create a Centre for Water Quality and Nutrient Management to generate and coordinate information to support precision conservation and stormwater optimization approaches in the Great Lakes Basin.

11. Agriculture and Agri-food Canada and the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) work with the Centre for Water Quality and Nutrient Management to designate a dedicated network of extension workers, through existing organizations or a new institution, that receive standardized training, and provide consistent technical advice to farmers.

12. Where subwatershed modelling and monitoring identifies urban areas as significant contributors of phosphorus loading, the Ontario Ministry of Environment, Conservation and Parks (MECP) require the relevant municipalities in consultation with conservation authorities to develop an urban stormwater optimization/ plan with steps to achieve measurable phosphorus reductions.

Beaches and Bacteriological Contamination

13. The Ontario Government introduce a new risk-based categorization system for Ontario beaches, and require actions of owners of 'impaired' beaches that have chronic bacteriological contamination issues.
14. The Ontario Ministry of Health and Long-Term Care (MOHLTC) create and maintain a central portal with beach quality information, including information on the 'status' of the beach (based on four categories: impaired, fair-good, good-excellent, under CSO advisory)
15. MOHLTC amend Public Health Ontario's Public Beach Water guidance on test methods for *E. coli* be amended to allow for alternate testing methods other than membrane filtration as per Ontario Ministry of Environment, Conservation and Parks (MECP) guidance on drinking water testing methods.

MESSAGE FROM EXPERT PANEL CO-CHAIRS

Nine months ago, we were tasked by the Federal Minister of Environment and Climate Change, the Honourable Catherine McKenna, to give her and her provincial counterparts advice on new and innovative approaches to tackle four of the most compelling and complex problems facing one of the largest systems of fresh water in the world, the Great Lakes and the St. Lawrence.

We would like to thank Minister McKenna and Environment and Climate Change Canada for the faith they put in us and in our stakeholder-led process to rise to this challenging task. This report, focused on the Great Lakes, is the first of a two-part series, which will also include recommendations on St. Lawrence protection, to be completed in the Spring of 2020.

We are very pleased to be delivering on the first part of our commitment. This report outlines recommendations that, if adopted by the Governments of Canada and Ontario and embraced by local authorities, Indigenous communities, the private sector and non-governmental stakeholders, and lake lovers across the basin, would have a transformative effect on the Great Lakes region and all of us who live in it and rely on its waters to sustain our quality of life.



This Great Lakes Action Plan charts a course to:

- protect the most vulnerable shoreline communities from damages caused by climate change and high water levels;
- proactively investigate our exposure to toxic chemicals in the environment and in products, and require immediate action where exposure to unhealthy levels of harmful pollutants is found;
- stop nutrient runoff from agricultural and urban areas that contribute the most, reducing the proliferation of harmful algal blooms in our waterways;
- make beaches and recreational waters on Great Lakes shorelines free from known sources of sewage and other sources of bacteriological contamination.

We strongly believe that this is an agenda worth embracing by all. Protecting our Great Lakes is a Canadian non-partisan issue. We have seen political adversaries set aside their differences and come together in common cause to protect the Great Lakes on the U.S. side of the border under the Great Lakes Restoration Initiative. We expect the same leadership from our Canadian political leaders.

We would like to take this opportunity to thank all those who contributed to this Action Plan, including the members of the Collaborative Expert Panel, Issue Table co-chairs and members, the Collaborative Steering Committee, Indigenous advisors, researchers, the Collaborative Secretariat, and all those who participated in our webinars and the Great Lakes Summit to provide critical feedback.

Finally, we would like to thank Environment and Climate Change Canada for its financial support of the Collaborative.

Gord Miller

Jean Cinq-Mars

DEDICATION



Many Great Lakes advocates have been moved and inspired by the dedication of Anishinabek Water Walker Josephine Mandamin's campaign to bring attention to the Great Lakes and our responsibility to protect them.

Josephine Mandamin, head of the Anishinabek Women's Water Commission, who was from Wikwemikong First Nation, led Mother Earth Water Walks beginning in 2003, and eventually walked 17,000 km around all five of the Great Lakes.

Josephine passed away on February 22, 2019. She leaves behind her husband, eight children, 13 grandchildren and 16 great-grandchildren, as well as many people inspired by her, and a legacy for us to carry forward.

In her own words, "When we carry that water, we are telling people that we will go any lengths for the water. We'll probably even give our lives for the water if we have to."

This report is dedicated to Josephine's spirit and her contribution to our awareness and appreciation of the value of the Great Lakes.

ACKNOWLEDGEMENTS

The Great Lakes and St. Lawrence [Steering Committee](#) wishes to express its sincere gratitude to all the volunteers who devoted their time, energy and expertise to developing and fine tuning the recommendations in this report, including the Collaborative [Expert Panel](#), co-chaired by Gord Miller and Jean Cinq-Mars, as well as four [Issue Tables](#), co-chaired by Al Douglas and Ewa Jackson (climate change), Dale Cowan and Gayle Wood (nutrients), Dr. John Carey and Helen Doyle (toxics), and Sandra Cooper and Bernard Mayer (beaches), and supported by [issue table members](#).

This report was written by the Collaborative Secretariat, Nicola Crawhall of [Westbrook Public Affairs](#) and Korice Moir. Background research was prepared by a [research team](#) led by [Dr. Gail Krantzberg](#) of McMaster University, including Ginni Dhaliwal, Danish Karmally, Bridget McGlynn, Mozafar Niroomand, and Dr. George Uzonwanne. Dave Thompson of [PolicyLink](#) prepared the economic analysis of the Action Plan and its recommendations.

INTRODUCTION

The Great Lakes and St. Lawrence Region, stretching across Ontario and Quebec, is home to 14 million Canadians. The Great Lakes and St. Lawrence River are a globally significant resource and ecosystem. Holding 20% of the world's surface fresh water, the lakes provide drinking water to over 40 million Canadians and Americans living near the shoreline. The waters of the Great Lakes and St. Lawrence and the basin's many rivers and streams also play a critical role in sustaining the health of aquatic, riparian and terrestrial ecosystems, supporting more than 3,500 of plants and animals, including one-fifth of all fish species in North America.

The Great Lakes and St. Lawrence Region is also a critically important economic region to both countries, accounting for 30% of combined Canadian and U.S. economic activity and employment, or 51 million jobs across a diverse range of sectors that rely on, and/or have an impact on water quality and ecosystem health, notably manufacturing, agriculture, maritime transportation, energy generation, land use development, tourism, and recreational and commercial fishing. In fact, with economic output valued at US\$5.8 trillion in 2015, if the region were a country, it would be the third largest economy in the world.

Protecting a system of water as vast as the Great Lakes is laborious work with slow progress measured over decades. To add to this complexity, we are confronted with new challenges, primarily driven by the effects of climate change, and population and development pressures. These changes drive so-called nonpoint sources of pollution that have proven to be difficult to mitigate effectively. Progress on reducing such diffuse sources of pollution has confounded authorities and communities alike.

That is why five organizations - the Great Lakes and St. Lawrence Cities Initiative, the Council of the Great Lakes Region, the Great Lakes Fishery Commission, Freshwater Future Canada, and Stratégies Saint-Laurent - came together to propose to Environment and Climate Change Canada (ECCC) to undertake a stakeholder led process to find new and innovative ways to protect the Great Lakes in these changing times. In response, ECCC asked that the Collaborative focus on four specific challenges:

1. How to adapt to climate change in the Great Lakes basin;
2. How to identify and act to reduce our exposure to harmful pollutants;
3. How to reduce nutrients entering waterways;
4. How to make all of our beaches free from sources of chronic bacteriological contamination.

Interestingly, the four issue tables tasked with developing recommendations in these four areas independently arrived at similar conclusions. Firstly, there was a consensus that with limited resources, a risk-based approach was required to focus on those sources that contribute the most to the problem and those people or parts of the environment most impacted. Secondly, there was a recognition that new tools and technologies at our disposal, from big data to more precise monitoring methodologies, fit perfectly with this risk-based approach, allowing for a surgical precision to



interventions that was not available to us 20 years ago. Finally, given the complexity of the issues, and the large geography involved, collaborative efforts are needed involving a range of parties, from senior governments and Indigenous communities, to municipalities and conservation authorities, to private businesses, to non governmental and community groups, to those who live in and visit Great Lakes communities.

The result is a set of 15 recommendations presented in this report, that, if adopted, would make a great leap forward in Great Lakes protection, one that would provide more immediate, more precise, more measurable results for the benefit of those who live in this extraordinary region.

None of these recommendations will get off the ground without adequate investment. The economic case for increasing investment in the Great Lakes is compelling. [A Brookings Institute cost benefit analysis](#) showed a 2:1 return on Great Lakes investments. This helped convince U.S. legislators to approve the [Great Lakes Restoration Initiative](#), which has delivered over \$2 billion to projects on the U.S. side of the Great Lakes over the last decade. Now is the right time for Canada to step up and show a similar level of commitment.

What is the Collaborative?

The Great Lakes St. Lawrence Collaborative is a two-year, stakeholder-led process made possible through financial support from Environment and Climate Change Canada. From the outset, its objectives have been to influence and increase investment in Great Lakes and St. Lawrence protection, promote new and innovative approaches that can accelerate and make more precise interventions, and to engage a broad cross section of stakeholders in the development of the recommendations.

The Collaborative acknowledges and recognizes First Nation and Métis peoples as aboriginal and treaty rights holders in the Great Lakes region.

The Collaborative process has two phases, a nine-month Great Lakes phase beginning in November 2018, followed by a nine-month St. Lawrence phase beginning in May 2019, and a three-month period between January to March 2020 to integrate the findings and recommendations into one Great Lakes St. Lawrence Plan. This plan will be presented to the federal Minister of Environment and Climate Change, and her counterparts across relevant departments and at the provincial level.

The end result will be an Action Plan for the Great Lakes and St. Lawrence Basin that makes a great leap forward by modernizing the way we protect our health, communities, and the environment in four strategic areas: climate change, nutrients, and toxics and other harmful pollutants, and beaches and bacteriological contamination.

This report presents the recommendations of the first part of the Collaborative process, an Action Plan focused exclusively on the Great Lakes basin.

Engaging Interested Parties

The Collaborative has engaged interested parties in the Great Lakes region through direct representation on the Expert Panel, the Steering Committee, Indigenous advisors, and the four Issue Tables, involving about 75 people. The recommendations contained in this report are the product of their deliberations.

In order to solicit feedback from the broader community, the Collaborative held two webinars in March and April of 2019 to present draft recommendations at different stages of their development and to hear comments from those online. About 150 people were consulted through these webinars. A webinar was also held with staff from the Chiefs of Ontario and several Indigenous communities on the draft recommendations to solicit their feedback.

On May 1, 2019, a Great Lakes Summit was held in Toronto. With over 100 participants at the Summit and via livestream, the Collaborative received detailed written comments and feedback on the draft that were incorporated into the recommendations.

All feedback was considered carefully by the issue tables and the Expert Panel before the recommendations were finalized.

Interested parties were also kept informed of developments through a monthly newsletter and information posted on the Collaborative's website: <https://westbrookpa.com/glsicollab/>.



COLLABORATIVE PROCESS AND STRUCTURE

Part 1 of the Collaborative, focused on the Great Lakes, was launched on October 26, 2018. A structure was established that consisted of:

- an [independent expert panel](#) with representatives from Indigenous communities, business, academia, NGOs and municipalities, co-chaired by Gord Miller, former Environmental Commissioner of Ontario, and Jean Cinq-Mars, Québec's former Sustainable Development Commissioner.
- four [issue tables](#) for the Great Lakes Phase tasked with developing recommendations on climate change, nutrients, toxics and other harmful pollutants, and beaches and bacteriological contamination.
- a [steering committee](#) to oversee the administration and financing of the Collaborative process, consisting of representatives from the five founding partners: the Council of the Great Lakes Region, Freshwater Future Canada, the Great Lakes and St. Lawrence Cities Initiative, the Great Lakes Fishery Commission, and Stratégies Saint-Laurent.
- a [secretariat](#) to facilitate day-to-day operations, organize events and engagement of interested parties, and to prepare reports.

Indigenous Engagement

First Nations and Métis peoples have systems of government and aboriginal and treaty rights protected under the Canadian constitution in the Great Lakes region. In recognition of this status, the Collaborative invited Indigenous political representation to the Expert Panel. As a member of the Expert Panel, Regional Deputy Grand Council Chief Edward Wawia of the Anishinabek Nation provided advice to the Collaborative on respecting and acknowledging Indigenous peoples as rights holders and governments within the Great Lakes Basin.

In addition to recognizing Indigenous peoples as aboriginal and treaty rights holders, the Collaborative also sought out place-based advice and expertise from select Indigenous communities living within the Great Lakes basin that informed the recommendations of the issue tables.

The Collaborative reached out to Aamjiwnaang First Nation to understand the experience of a First Nation community exposed to industrial chemicals in Sarnia.

With respect to nutrients, the Collaborative welcomed advice from Six Nations on the Grand River about datasets and GIS-based platforms being used to track nutrient runoff from their territory.

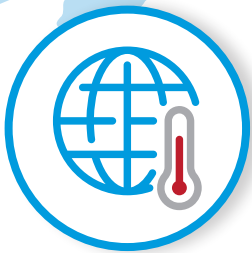
On climate change and priority shoreline zones, Fort William First Nation highlighted the vulnerability of properties along its shoreline, as well as the location of a contaminated soils containment berm in close proximity to the shoreline.

A briefing was held for staff from Chiefs of Ontario and several Indigenous communities on May 23rd to review and solicit feedback on the draft recommendations.

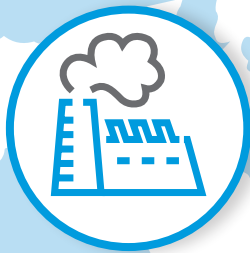
Through political engagement and place-based technical advice, the Collaborative process and recommendations have benefited from Indigenous counsel and knowledge.



KEY CHALLENGES FACING THE GREAT LAKES



Climate Change



Toxics and Other
Harmful Pollutants



Nutrients



Beaches and
Bacteriological
Contamination

While the Great Lakes have been coping with climate change, polluted beaches and recreational waters, nutrients and harmful algal blooms and exposure to toxics for a number of years, their impact on those who work and live by and play in the Great Lakes and their tributaries has reached a level of disruption that demands new, modernized approaches.

A. Climate Change

The Collaborative recognizes unique shoreline risks in the Great Lakes Basin and proposes to provide direct assistance and funding to municipal and Indigenous communities in shoreline resiliency priority zones hardest hit by extreme flooding and erosion associated with climate change.

B. Toxics and Other Harmful Pollutants

The Collaborative proposes to actively investigate ways we are exposed to harmful toxic chemicals and require more immediate and dedicated action to reduce our exposure.

C. Nutrients and Harmful Algal Blooms

The Collaborative seeks to harness the power of big data to identify nutrient hotspots and work directly with landowners, municipalities, Indigenous communities, and others in priority areas to reduce nutrient runoff that causes harmful effects, such as algal blooms, and to improve the health of our water.

D. Bacteriological Contamination of Beaches

Using a risk-based approach, the Collaborative proposes to identify beaches with chronic bacteriological contamination problems, and require action to clean up the source of contamination, including untreated sewage.

A. CLIMATE CHANGE



Climate change continues to put significant pressure on communities, businesses, natural heritage and ecological integrity in the Great Lakes Basin. Changes in temperature and precipitation are adversely affecting the hydrology

of the basin, altering water supplies, and causing fluctuations in lake levels. These changes, combined with growing infrastructure deficits, poor planning decisions, and disparate levels of adaptive capacity, will sustain levels of vulnerability and increase future risk for communities within the basin.

In the Great Lakes, shoreline communities face unique climate change impacts. Shoreline communities are particularly vulnerable to the effects of fluctuating water levels on natural and built infrastructure assets. Water levels determine the features of a shoreline such as beaches, bluffs, and wetlands. Many of these natural features have been altered by wetland drainage, shoreline hardening, and as well as recreation, shipping, and other land and water uses.

Climate change increases the probability of intense storms, the amount of snow melt precipitation and ice cover contributing to high water levels, as well as increased wind and wave energy. This has resulted in damaged property, washed out beaches and marshes, disrupted public works including shoreline roads and stormwater and sewage outfalls, and damage to recreational facilities like marinas and bike paths.

The issue table chose to focus its recommendations on high water levels, as experienced in 2017, given the level of damage and the lack of preparedness of shoreline areas most affected. It is recognized that there are other climate pathways for which shoreline communities must prepare, including low water levels, as experienced for a number of years in the early 2000s.

In some cases the impacts on shorelines have crossed critical tolerance thresholds leaving communities with high costs of recovering from damage caused by flooding and erosion. Great Lakes shoreline communities are in a

unique position of having to adapt to the combination of high shoreline water levels, riverine and inland flooding. Unfortunately recent high water levels and flooding were not predicted.

In 2017, the Great Lakes and St. Lawrence River system experienced [unanticipated high water levels with significant impacts](#) including:

- extensive shoreline flooding,
- residential property damage,
- leaking septic systems,
- infiltration into shoreline wells,
- blocked access roads,
- debris causing damage to boats,
- shoreline erosion,
- vegetative damage due to high winds and waves.



In the spring of 2019, the Great Lakes basin has also seen water levels well above the seasonal average in Ontario and Québec. With climate change contributing to a greater likelihood of extreme weather and flooding events, we can anticipate future periods of extreme high water levels, and fluctuations over time.

Shoreline communities require a collaborative approach to assessing and managing the climate change risks by building shoreline resilience.

Building Shoreline Climate Resiliency - Who Does What

Shoreline climate risk assessments and adaptation measures involve multiple jurisdictions with roles and responsibilities for shoreline management and resiliency.

Municipalities are responsible for land use planning decisions, and water and wastewater infrastructure design along the shoreline, as well as emergency response in the event of flooding.

Shoreline decisions in Indigenous communities are made by First Nations councils.

Ontario Conservation Authorities are responsible for watershed and riverine flood protection and floodplain mapping that extends to shoreline risk mapping.

The Ontario Government recently committed to “improve understanding of how climate change will impact the province” and “help Ontarians prepare for impacts of climate change, such as extreme weather events” in its [‘Made-in-Ontario Environment Plan’](#). As part of this effort, it will undertake a province-wide climate impact assessment.

The Government of Canada’s [Pan-Canadian Framework on Clean Growth and Climate Change](#) includes actions to move forward on climate change adaptation and build resilience to climate impacts, as well as [Climate Lens](#) for infrastructure funding to support a “risk management approach to anticipate, prevent, withstand, respond to, and recover from a climate change related disruption or impact.”

The [Canada-Ontario Agreement \(COA\) on Great Lakes Water Quality and Ecosystem Health](#) is a federal-provincial agreement that supports the restoration and protection of the Great Lakes basin as committed to in the Canada-U.S. [Great Lakes Water Quality Agreement](#). Binational efforts in [Annex 9 Climate Change Impacts](#) involve “coordinating efforts to identify, quantify, understand, and predict the climate change impacts on the quality of the waters of the Great Lakes, and sharing information that Great Lakes resource managers need to proactively address these impacts.”

The International Joint Commission regulates water levels and flows in Lake Superior, through the [Lake Superior Board of Control](#), and in Lake Ontario and the St. Lawrence River through [Regulation Plan 2014](#).





Desired Outcome and Recommended Actions

The desired outcome of the following climate change recommendations is to support shoreline communities with special vulnerability to high water levels to become more climate resilient.

Four key actions are proposed:

1. Designate shoreline resiliency priority zones to identify and address significant threats from climate change associated with high water levels, with emphasis on naturalization and green infrastructure solutions.
2. To support the priority zone process, create a climate information sub portal for Great Lakes shoreline priority zones.
3. Invest further in the development of Light Detection and Ranging (LIDAR), flood plain mapping, and monitoring/modelling data to benefit shoreline communities.
4. Provide technical guidance and make funding available to support actions by municipalities and Indigenous communities to address shoreline hazards associated with climate change.

It Is Recommended That

1. The Governments of Canada and Ontario commit to establishing and funding shoreline resiliency priority zones to identify and address significant threats from climate change (high water levels, stronger wind/wave energy, erosion, sudden spring thaws, ice jams) impacting natural and built infrastructure on Great Lakes shorelines. Emphasis should be placed on naturalization and green infrastructure.

Begin with five shoreline priority zones with a focus on adapting and creating resiliency to high water levels along shorelines:

- i. Central Western Lake Erie (Chatham-Kent, Leamington)
- ii. Central Lake Huron (Amberley to Grand Bend)
- iii. Central Lake Ontario (Toronto to Prince Edward County)
- iv. North Central Lake Superior (Fort William First Nation, Thunder Bay)
- v. Southeastern Georgian Bay (Penetanguishene, Tiny Township)

The list of priority zones may evolve or be expanded over time. While the initial focus is on high water levels, zones may explore different climate pathways (e.g. low water levels) or other climate risks/hazards and implementation measures.

Proposed Shoreline Resiliency Priority Zones

As this report was being finalized, it was reported that Lake Ontario water levels along the Toronto shoreline had reached their highest levels in recorded history, surpassing the high water levels of 2017.

With these looming circumstances setting the stage for another year of high water levels threatening shorelines, the following five shoreline resiliency priority zones are recommended based on: the severity of impacts they experienced during and following the 2017 high water levels; their geographic location across the Great Lakes region; their particular climate risk exposure or vulnerabilities; their unique assets and features at risk; and their varying levels of capacity to adapt.

Given the severity of impacts in 2017, these zones are proposed for immediate action and funding. Additional zones may be added in the future.

i. **Central Western Lake Erie** shoreline zone (Chatham-Kent, Leamington)

The Central Western Lake Erie shoreline zone includes the shorelines of Chatham-Kent and Leamington. These two communities represent some of the most productive agricultural and food processing areas in Ontario. Chatham-Kent alone generates several billion in agricultural produce annually and Leamington is known as the tomato capital of Canada.

This stretch of shoreline is a proposed priority zone due to the low lying land in relation to the shoreline around Rondeau Bay, and in the northwestern area closer to Lake St. Clair. These areas are currently being protected through a series of berms and dikes.

[In 2017](#), a dike was breached, and [again in early 2019](#), a state of emergency was declared when the Thames River dike failed in multiple locations around Poppe Road and Buchanan Line in Tilbury, flooding the downtown area as well as agricultural land. Thousands of acres of agricultural land are at risk of flooding due to high water levels and outdated dikes and berms that require rehabilitation, representing a significant economic risk in one of the most agriculturally productive areas in Ontario.

ii. **Central Lake Huron** shoreline zone (Amberley to Grand Bend)

The stretch of shoreline between Amberley and Grand Bend, including Central Huron, Bayfield and Goderich, is a prime tourist and seasonal cottage destination due to its beautiful beaches (Grand Bend, Bayfield) and high bluffs overlooking Lake Huron (Central Huron, Goderich).

This is a proposed priority zone because the shoreline is being battered by strong wave action, high winds, and occasionally tornados. The result is some of the worst [shoreline erosion](#) anywhere in Ontario, imperiling properties on the top of bluffs and compromising the quality of beaches that are significant tourist destinations.

iii. **Central Lake Ontario** shoreline zone (City of Toronto to Prince Edward County)

The most densely urbanized area in Ontario, the Central Lake Ontario stretch of shoreline between Toronto and Clarington, including communities like Whitby, Ajax and Bowmanville, has a mix of naturalized areas, including the Toronto Islands, recreational paths along much of the shoreline, residential properties, and industrial facilities, including the Pickering Nuclear plant and cement production facilities.

This shoreline is a priority zone given significant impacts experienced during record high water levels in 2017. Lake Ontario's daily level peaked at [75.88 m \(248.95 ft\)](#) in late May, the highest recorded level since records began in 1918. Impacts included eroded bluffs, sunken docks, collapsed breakwalls, flooded basements and washed out roads.

In 2017, a local state of emergency was declared for a portion of the Clarington shoreline as well as all of [Prince Edward County](#).

[The Toronto Islands](#), a favoured recreational area for the city of 2.6 million, were closed to the public for an extended period due to extensive flooding impacting residents, infrastructure, and sensitive natural areas.

In the spring of 2019, water levels along Lake Ontario were notably high as well, increasing the risk and exposure to flooding and erosion.

iv. **North Central Lake Superior shoreline zone** (Fort William First Nation, Thunder Bay)

Lake Superior is known for its rugged, rocky shoreline. However, the soft shoreline just to the side of Chippewa Park in Fort William First Nation has been significantly impacted by high water levels and increased wind and wave action. Residences were built on the shoreline that is often flooded in the spring thaw and during the 'gales of November' when storms roll in from Lake Superior.

There is a 50-year-old containment berm that holds contaminated sediment from the Northern Harbour clean up in the Thunder Bay area of concern. It is located just outside of Chippewa Park, right beside a river that flows into Lake Superior. With rising water and stronger wave action, there is concern that the containment berm could be damaged, sending creosote contaminated sediment into Chippewa Park, into the river, and into Lake Superior.

Top priorities in this priority zone process are an evaluation of the berm system, additional evaluation of residences at risk, and improved resilience of 'riprap', that is, boulders that have been placed where the river meets the lake that serves as a barrier to protect a sawmill and a solar farm. This area flooded two years ago, and is at risk in the future.

v. **Southeastern Georgian Bay shoreline zone** (Penetanguishene, Tiny Township)

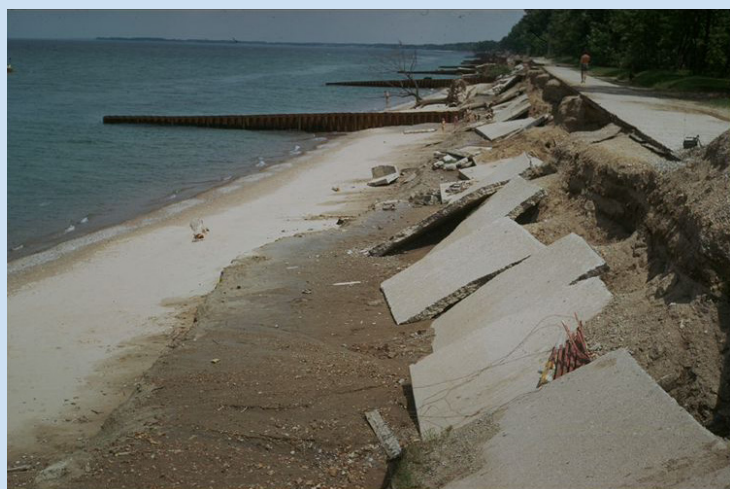
The southeastern tip of Georgian Bay, comprised of the Township of Tiny and the Town of Penetanguishene, jutting out into Georgian Bay, makes it a favoured destination in all seasons.

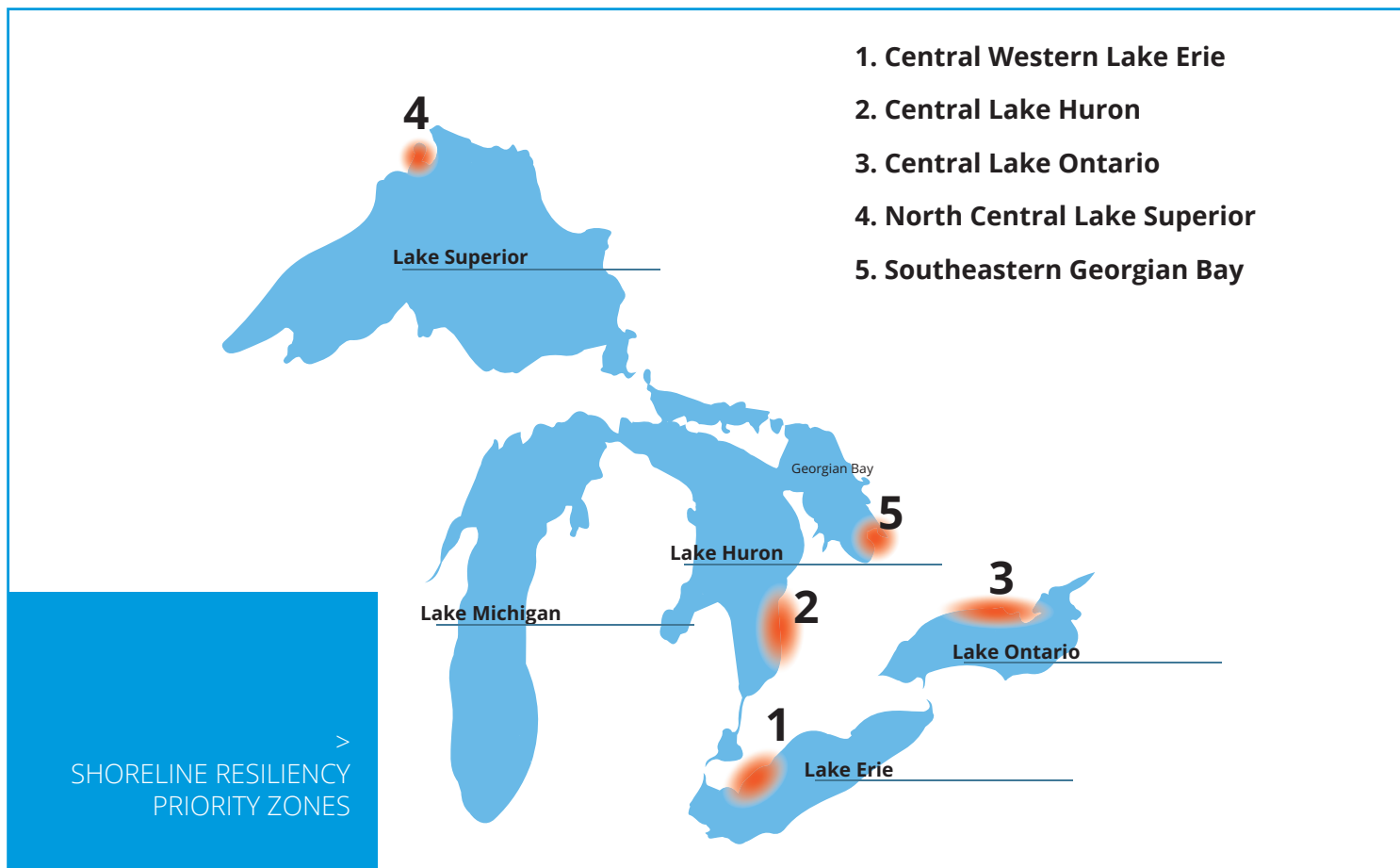
This shoreline has been identified as a priority zone due to the significant development and redevelopment projects in recent years, which are transforming the natural shoreline. Small seasonal cottages are being converted to larger permanent dwellings with accompanying requests for dredging, vegetation removal, fill placement, and hardscaping like paved driveways and manicured lawns. Additional commercialization pressure of marinas, recreational features, etc. has also been occurring. This trend of development shows no sign of abating.

Communities are struggling with hardened surfaces along the shoreline that reduce infiltration and cause drainage and flooding problems in their communities. In addition, engineered shorelines for development purposes have altered the natural landscape.

Watershed flooding is an increasing occurrence as well as the risk of sewage treatment plant bypasses which impacts shoreline water quality. There are also concerns about the unknown impacts of changing water levels on the introduction, spread and management of invasive species, like phragmites. Significant changes to water levels (both high and low) also impact commercial operations such as marinas and boat launches.

This area has experienced significant impacts from high/fluctuating water levels and expects continued development pressures.





1.1 It is further recommended that collaboratives of local communities, conservation organizations, businesses, and Indigenous communities, among others, be created. These would build on collaboration and work already under way.

Each zone collaborative would:

a) Establish partners and guiding process

- Identify zone partners, develop a partner map and/or conduct social network analysis, and identify a lead partner organization for each zone.

b) Conduct ongoing stakeholder and Indigenous engagement

- Communicate risks to infrastructure, industry, properties, and recreation, including risk of repeated flooding that may require changes in flood plain designation and building restrictions in these areas.

c) Complete risk assessments

- Assess specific shoreline hazards and risks based on local expertise and Indigenous knowledge

- Use modelling, mapping, and predictive tools
- Integrate assessments of shoreline, riverine and overland flooding
- Gather information on current vulnerabilities, future threats
- Evaluate historic trends and projections of climate change
- Update hazard/risk maps to visualize and communicate threats
- Take into consideration watershed influences and the importance of green infrastructure and low impact development to support shoreline resiliency.

d) Develop and implement shoreline resiliency plans

- Develop shoreline resiliency plans based on risk assessment
- Conduct cost benefit analysis
- Consider restrictions on new development along shoreline

- Secure necessary approvals, including environmental assessment where required
- Negotiate funding for adaptation measures with senior governments
- Invest in adaptation measures to address hazards based on risk assessments, with emphasis on naturalization and green infrastructure.
- Integrate measures into existing adaptation plans, watershed-based and/or regional decision-making.
- Evaluate the effectiveness of adaptation measures.
- Improve emergency response protocols.

1.2 It is further recommended that support be provided across zones by ECCC and MECP to:

- Assist with access to relevant climate information
- Document the work of the collaboratives and share lessons learned across zones and in other areas in the Great Lakes region.
- Assist with building and supporting the capacity of Indigenous communities to assess risk and implement shoreline resiliency, including the use of traditional knowledge.

2. It is recommended that the Government of Canada create a climate data sub-portal for Great Lakes priority zones within [Canadian Centre for Climate Services portal](#).

The subportal would provide climate information to community members and partners to support a range of climate change shoreline risk management activities. This includes spatially appropriate historical trends and future projections of climate change, as well as information and resources accessible to community members and local partners to improve knowledge and provide frameworks for adaptive action.

3. It is recommended that the Ontario Government, through the Ontario Ministry of Natural Resources and Forestry, and Conservation Authorities, invest further in the development of Light Detection and Ranging (LIDAR), flood plain mapping, and monitoring/modelling data to benefit shoreline communities.

How long is Ontario's Great Lakes shoreline?

There are [7,606 km of shoreline](#) around the Ontario portion of the Great Lakes. To put this in perspective, the longest highway in the world, the TransCanada highway, stretching from Victoria, British Columbia to St. John's, Newfoundland, is only slightly longer, at 7,821 km long. In other words, if you were to stretch out Ontario's Great Lakes shoreline, it would nearly reach from coast to coast. That is a tremendous amount of shoreline to protect.

Length of Great Lakes Shoreline in Ontario

Lake	Shoreline (km)
Lake Huron	3,888
Lake Superior	2,493
Lake Ontario	636
Lake Erie	589
TOTAL	7,606

4. To build shoreline resiliency right around the Ontario Great Lakes, it is recommended that the Governments of Canada and Ontario offer ongoing guidance and funding (on a competitive basis) to support individual projects to help municipalities and indigenous communities make their shorelines more climate resilient.

4.1 Ontario Ministry of Natural Resources and Forestry (MNRF), Infrastructure Canada, and Crown-Indigenous Relations and Northern Affairs Canada should prepare and circulate to interested municipalities and Indigenous communities a community-specific self-assessment survey of shoreline hazards (e.g. beach and shoreline recession, bluff failure).



The State of Wisconsin's Coastal Management Program

The State of Wisconsin's Coastal Management program administers [a grant program](#) that provides a total of US\$1.5 million for:

- Coastal wetland protection and habitat restoration
- Nonpoint source pollution control
- Coastal resource and community planning
- Great Lakes education
- Public access and historic preservation projects

A more regional specific project has been created called the [South-East Wisconsin Coastal Resilience Project](#), which serves the counties of Ozaukee, Milwaukee, Racine, and Kenosha. Counties are encouraged to form communities of practice to inform and direct shoreline resilience work. The State of Wisconsin developed a [self-assessment survey](#) and [resources](#) that help communities on the South-East coast weigh the effects of coastal hazards associated with fluctuating water levels, and increased wave and wind action, and consider planning and mitigation actions to increase coastal resilience. The assessment contains a tool to prioritize coastal hazards issues, a series of yes/no questions related to common planning and mitigation actions and a summary to reflect on the top actions of interest to your community. Once the survey is completed, the communities can identify project ideas appropriate for funding. A particular emphasis is put on adapting to natural processes, restoring natural shoreline, moderating coastal erosion, stabilizing bluffs and banks, and building environmentally friendly shore protection structures.

Funding for SEWI is provided by the US National Oceanic and Atmospheric Administration's [Coastal Resilience Grants program](#).

A guidance document for Wisconsin coastal communities and property owners, [Living on the Coast](#), has been developed by the Army Corps of Engineers and Wisconsin Sea Grant.

4.2 Based on the shoreline hazard assessments, the Governments of Canada and Ontario should identify priority needs (e.g. improvements in the naturalization and design of beaches, protection of marshlands), that would be eligible for funding under Federal-Provincial infrastructure funding (Green Infrastructure stream, Culture and Recreational stream). Special emphasis should be placed on naturalization and green infrastructure.

4.3 Ontario MNRF and Crown-Indigenous Relations and Northern Affairs Canada should develop and provide guidance to participating municipalities and Indigenous communities on how to make shorelines more climate-resilient. This could be informed by the experience and lessons learned from shoreline priority zone collaboratives.

B. TOXICS AND OTHER HARMFUL POLLUTANTS



The United States Environmental Protection Agency (U.S. EPA) estimates that there are approximately 7,700 chemicals widely used in large amounts in North America. Environment and

Climate Change Canada will complete assessments of 4,300 chemicals by 2021. These assessments, undertaken under Section 64 of the Canadian Environmental Protection Act (CEPA), evaluate the toxicity of individual substances and require a response plan to limit further exposure.

The CEPA process regulates individual 'legacy' substances once they have been introduced into the environment. Unlike medication that must be approved by government following trials before being introduced to the market, chemicals are introduced to the market without any government scrutiny until evidence accumulates that suggests that they are having a harmful effect.

There are numerous examples of the effects of toxic substances that have gone undetected for years before prompting a response. For example, an investigation into [the collapse of bee colonies](#) was traced to neonicotinoides, the [feminization or intersex effects in some aquatic species](#) was traced to certain endocrine disrupting chemicals, a [decline in salmon population](#) in New Brunswick was traced to aerial spraying of DDT against spruce bud worm, [microplastics](#) that have accumulated in fish and other species in the Great Lake were linked to personal care products, to name a few.

While the CEPA process has laid a strong foundation for chemicals management in Canada, the next step is to take action in a more immediate and proactive way, to reduce human and environmental exposure to the chemicals and chemical mixtures that are in use but have not yet been identified as causing harm, and to prevent new harmful chemicals from being introduced in products and into the environment every year.

While existing environmental and human health monitoring data has been instrumental in efforts to reduce the discharge of toxic substances through the federal chemicals management plan under CEPA, there remain challenges with respect to communicating the meaning of the data to at-risk individuals and communities in a way that can inform their choices to reduce their exposure, particularly more vulnerable populations including pregnant women and children. Even when data is available that indicates adverse effects from exposure to chemicals, response from authorities can be slow and sporadic.



Finally, products are a leading source of exposure to harmful pollutants, particularly pharmaceuticals and personal care products that contain endocrine disrupting chemicals.

With the review of the federal Chemicals Management Plan in 2020 and the anticipated renewal of the Canada-Ontario Agreement Respecting the Great Lakes Water Quality and Ecosystem Health, this is an opportune time to consider how these challenges related to exposure to chemicals can be most effectively addressed.



Toxics Legislative and Regulatory Landscape - Who Does What



Legislation and regulation governing the management of toxic chemicals falls largely in the federal domain. The Canadian Environmental Protection Act 1999, administered jointly by Environment and Climate Change Canada and Health Canada, is the legislative framework for the program

that identifies and conducts a risk assessment of chemicals deemed 'toxic'. In 2016, ECCC and HC committed to completing the assessment of the remaining 1550 of the 4300 substances identified under CEPA by 2020, through [the Chemicals Management Plan](#) (CMP). The CMP is undergoing a review in 2020.

Other relevant legislation includes the Pest Control Products Act, which regulates pesticides and their application, administered by Health Canada; the Food and Drugs Act, which regulates substances in food, including Great Lakes fish, as well as substances in drugs and cosmetics, administered by Health Canada; and the Consumer Products Safety Act, under Health Canada, governs consumer products that are imported, and requires that safety information and appropriate labelling be provided on imported products.

ECCC and Health Canada also have important roles in research and monitoring of toxics and harmful pollutants in the environment and in people. There is also an important enforcement role under the Federal Fisheries Act, administered by Fisheries, Oceans and the Coastguard and Environment Canada. Section 36 of the Act prohibits the deposit of deleterious substances into waters frequented by fish, unless authorized by regulations under the Fisheries Act or other federal legislation.

Binational cooperation over chemicals management in the Great Lakes Region is largely directed by commitments under [Annex 3](#), Chemicals of Mutual Concern, of the Canada-US Great Lakes Water Quality Agreement (2012). The Parties make commitments to address specific chemicals of mutual concern from all sources in the Great Lakes basin, including the management of mercury, PCBs, PFOA, PFCA, PBDEs, HBCD and SCCPs.

Notable reports on toxics management in Canada

On March 22, 2016, the House of Commons passed a [motion](#) designating the Standing Committee on Environment and Sustainable Development to undertake a comprehensive review of CEPA. Environment and Climate Change Canada issued a [discussion paper](#) outlining some key issues that were relevant to the review.

In 2017, the Standing Committee released [its report](#) "Healthy Environment, Healthy Canadians, Healthy Economy: Strengthening the Canadian Environmental Protection Act, 1999". The [federal government](#) [responded](#) to the standing committee's report a year later.

The federal Commissioner of Environment and Sustainable Development plays an important role in evaluating the effectiveness of the Government of Canada's chemicals management plan and other aspects of chemical safety and exposure. In 2016, Commissioner Julie Gelfand released her audit on Chemicals in Consumer Products and Cosmetics, and in 2018, a report on toxics substances including aspects of CEPA. The report examined six toxic chemicals in detail and evaluated the progress of managing the chemical with the objectives. The results of the audit stated that ECCC still had significant work to do to achieve their objectives, and that many of the recommendations made by a previous audit had not yet been met.



Desired Outcome and Recommended Actions

The desired outcome is to act more quickly to prevent and reduce environmental and human exposure to harmful chemicals in the Great Lakes region. This will be done in three ways:

5. Establish a targeted 'exposure and effects' environmental and human health biomonitoring program in the Great Lakes region that will provide early detection of effects from harmful pollutants.
6. Use information from this targeted program to reduce exposure, through effective communication and involvement of at-risk individuals and communities, and to drive appropriate responses by enforcement officials, regulators, and those responsible for the release of the pollutant.
7. Create a Chemical Substitution Strategy that supports the substitution or elimination of toxic chemicals and harmful pollutants in products and processes in the Great Lakes region, based on a comprehensive review of function and use of a substance of concern and its likely alternatives.

It Is Recommended That

5. The Government of Canada develop a targeted environmental and human health effects monitoring, human biomonitoring and surveillance program to provide early detection of unexpected effects in the Great Lakes basin that feeds directly into a regulatory and non-regulatory response plan to reduce exposure.

EEM and Human Biomonitoring in Canada

Environmental effects monitoring and human biomonitoring are both well established in Canada. EEM is used by ECCC as a science-based performance measurement tool to evaluate the adequacy of effluent regulations in protecting fish and fish habitats. Both the [pulp and paper](#) and [mining](#) sectors are subject to requirements to conduct environmental effects monitoring.

There are a number of [human biomonitoring initiatives](#), including the Canadian Health Measures Survey

conducted by Statistics Canada in cooperation with Health Canada, involving over 5,000 Canadians, and includes a [biomonitoring component](#); and the [Maternal-Infant Research on Environmental Chemicals](#) (MIREC), a five-year study evaluating the exposure to heavy metals of 2,000 pregnant women and their babies; and the [First Nations Food, Nutrition and Environment Study](#), a study funded by Health Canada, led by researchers at the Universities of Ottawa and Montreal, involving over 6,000 individuals in 93 First Nation communities across the country.

5.1 It is further recommended that ECCC and Health Canada establish a taskforce that includes external expertise, to i) identify the priority areas and data sets that would determine the scope of the surveillance program; and ii) determine appropriate trigger in terms of what effects would instigate this process. Selection of the targeted areas would be guided by five criteria:

5.1.1 effects from toxic chemicals on aquatic ecosystems, building on the [Canadian Aquatic Biomonitoring Network](#) (CABIN) data & other water monitoring data.

5.1.2 human health response/effects/exposure to harmful pollutants in the environment, both in the air and water, building on ongoing National Biomonitoring Initiatives, including the Canadian Health Measures Survey, the Maternal-Infant Research on Environmental Chemicals, and the First Nations Biomonitoring Initiative, or where a community-driven environmental biomonitoring program is already in place.

5.1.3 specific geographic hotspots, where people live in close proximity to areas where it can be reasonably assumed that chemical mixtures are found.

5.1.4 Indigenous participation in surveillance program essential, e.g. select 1 or more Indigenous communities as priority areas, incorporate community-based monitoring in Indigenous territory, and traditional knowledge.

5.1.5 effects at critical developmental life stages in humans and other organisms, e.g. exposure to endocrine disrupting chemicals at embryonic stage of development.

5.2 ECCC should establish a research program to identify causes, sources of effects identified, using Effects Detected Analysis.

5.3 Once Effects Detected Analysis is complete, ECCC and Health Canada should integrate above environment effects and human health monitoring and surveillance results into an enhanced pollutant assessment and response process (Chemical Management Plan).

5.3.1 The current assessment process must be updated to place high priority on multiple exposure, including analysis of cumulative effects or exposure to chemical mixtures.

5.3.2 ECCC and Health Canada should conduct a jurisdictional review on best practices in assessing impacts to chemical mixtures and cumulative effects, and share publicly and with interested parties, including Indigenous communities.

The European Union's Solutions Program



The [Solutions program](#), under the EU's Water Framework Directive, links chemical assessment with ecological assessment, using effects detection in monitoring followed by effects interpretation. The EU has adopted such an approach because it has concluded that relying on chemical status alone based on a small number of priority substances does not reflect the actual risk nor does it provide solutions to exposure. It is therefore complementing chemical status monitoring with monitoring of complex mixtures of contaminants. It then uses spatial effects and mixture risk modelling to consider the direct toxic pressure on aquatic organisms caused by a mixture of contaminants as well as human health exposure through drinking water and fish consumption.

As a final step to reduce exposure, guidance and accountability measures are needed for polluters, and regulatory and enforcement agencies to ensure that the data is used to direct their actions to stop the release of the pollutants and hold polluters accountable.

6. It is recommended that ECCC and Health Canada develop guidelines to guide the generation and communication of data collected through the surveillance program described in Recommendation 1, which outlines:

- i. An integrated environmental health monitoring and knowledge translation approach to data generation;

- ii. Adopts a collaborative approach which involves affected communities directly; and
- iii. Ensures broad multidisciplinary collaboration throughout the process – from the development of monitoring program, through to dissemination of information for informed decision-making and response.

This recommendation underlines the importance of empowering those at risk to reduce their exposure to harmful pollutants. Rather than gather and analyze data internally within government agencies, this targeted surveillance program must involve at-risk individuals and communities in the collection, interpretation and communication of the data.

Those at-risk typically have little control or input into the type of monitoring and surveillance conducted in order to address their concerns and priorities. Furthermore, if they are given data without explaining its relevance, those at risk cannot make informed decisions to limit their exposure. It is not just data that should be communicated. Information could also include surveys, research studies, as well as information products like reports interpreting monitoring results, health protection messages and health promotion material explaining risks of exposure to toxic substances.

6.1 It is further recommended that ECCC and Health Canada, with their provincial counterparts, and with stakeholder input, develop Guidance on the Appropriate Response to Exposure and Effects surveillance program data, including guidance on steps to take, agencies to involve, how to engage the community or individuals-at-risk and appropriate timelines.

In some cases, even when those at-risk participate in the collection of data and they are made aware of what they are exposed to, they still lack the power to reduce their exposure, or to ensure that those responsible for the release of the pollutants are held accountable.

This guidance would be followed when developing case-by-case action plans and response, developed in consultation with the impacted community, relevant government agencies, including provincial enforcement agencies, and parties responsible for the source of the pollutant(s).

UN Rapporteur on Toxics asked to investigate combined exposure to air and water pollutants on Aamjiwnaang First Nation

Aamjiwnaang First Nation is located in Southwestern Ontario, near the city of Sarnia. It is home to 850 community members living on reserve – about one quarter of whom are children.

Sarnia's chemical industry has grown around Aamjiwnaang First Nation, with sixty-two chemical producing facilities within 25 kilometers of the community, surrounding it on three sides. With approximately 10 tons of pollutants discharged into the St. Clair River and an average of 100 spills a year, the River was declared an Area of Concern in 1985. Of particular concern is mercury contamination in the sediment of the St. Clair River. Progress has been made in remediating the sediment in some areas but three areas remain contaminated.

In addition to concerns over their water quality, residents are exposed to air emissions from chemical production, including benzene, a known carcinogen, and sulphur dioxide, which can contribute to respiratory and cardiovascular disease.

Community members who grew up swimming in the waters and harvesting fish and traditional medicines now report negative health effects from engaging in these traditional activities, which are constitutionally protected aboriginal and treaty rights under section 35 of the Constitution Act, 1982.

In response to these concerns, Aamjiwnaang First Nation invited the University of Michigan School of Public Health to conduct a 'Biomarkers of Chemical Exposure to Aamjiwnaang First Nation' study, involving 43 mother-child pairs. The study concluded that mothers and their children are exposed to multiple environmental pollutants, with higher trends than the Canadian average of cadmium, some perfluorinated chemicals (PFCs), some polychlorinated biphenyls (PCBs), Hexachlorohexane (HCH) and DDT.

In April 2019, Aamjiwnaang First Nation requested that the [UN Special Rapporteur on Human Rights and Toxics](#), Mr. Baskut Tuncak, investigate the environmental contamination in and around Aamjiwnaang First Nation and 'seek clarification on what if any remediation efforts are being taken, and most importantly to remind the Government of its obligations under international law and request information, where relevant, on steps being taken by the authorities to redress the situation in question. The UN Rapporteur has also been asked by First Nations elders to investigate the [connection between aerial spraying of forests](#) with glyphosate and a decline in deer and moose populations.

The UN rapporteur undertook a fact finding mission to Canada in May and June of 2019. In his preliminary findings, Mr. Tuncak said that Canada showed a 'blatant disregard for Indigenous rights' in its handling of toxic chemicals and industrial discharges, and called on the federal government to improve the speed with which it responds to situations where indigenous Peoples are disproportionately exposed to pollutants.

6.2 A regular progress report on results of the Targeted Surveillance Program, communication and engagement with the at risk community, and any response taken by authorities as a result of the information generated by the Program, should be prepared jointly by ECCC and Health Canada in collaboration with community stakeholders and Indigenous partners, and meeting(s) with impacted community.

6.3 Progress reports should be posted on the [Environmental Registry of Ontario](#) and an equivalent federal registry.

6.4 To ensure accountability, it is recommended that the federal Commissioner of Environment and Sustainable Development be tasked with reviewing the progress reports and evaluating the effectiveness of the program

in identifying effects of harmful pollutants, communicating information to reduce exposure, and addressing the source of pollutants in a timely manner.

7. It is recommended that ECCC and Health Canada introduce a Strategy to Promote Substitution of Harmful Chemicals in Products.

The Chemical Substitution Strategy should employ an alternatives assessment methodology that focuses on alternate ways to achieve the function of the harmful chemical rather than simply replacing a chemical with another chemical, to ensure that the replacement chemical does not share the same harmful characteristics of the one it has replaced. (regrettable substitution)

There should be public engagement in the development and implementation of the Chemical Substitution Strategy. Progress should be documented on an annual basis and made public.

Alternatives Assessment and Regrettable Substitution

By employing an alternative assessment methodology that considers the function of the chemical, it may be concluded that the chemical should be removed and not replaced, as its function was found to have little value. For example, producers of toothpaste have agreed to remove rather than replace plastic microbeads added to their products to ‘whiten’ our teeth.

A notable example of regrettable substitution occurred when ECCC undertook an assessment under the CEPA process of [Nonyl phenol ethoxylates](#). As a result of the assessment, NPEs were found to be toxic, but manufacturers replace them with octophenol ethoxylates. Overtime, these were found to have the same toxic characteristics as NPEs.

7.1 It is further recommended that a Centre for chemical substitution be designated and appropriately resourced by ECCC to lead chemical substitution efforts in the Great Lakes basin, including:

- Assist ECCC in developing list of harmful pollutants detected in Great Lakes that should be prioritized for chemical substitution efforts.
- Bring together manufacturers, retailers, governments to support chemical substitution.
- Provide technical support to manufacturers to substitute harmful chemicals and assess alternatives.
- Develop consistent methods for evaluating alternatives to priority chemicals.
- Establish training programs for government and related stakeholders along supply chain on alternatives assessment, chemical substitution and green chemistry.
- Review available hazard data and identify information gaps that impede further progress with chemical substitution.

Making Hazard data available



To be effective, chemical substitution relies on full product hazard data. Under Section 70 of CEPA, manufacturers, importers, distributors or users of products that have information on the toxicity of the product are obligated to provide the information to ECCC. Section 71 further allows ECCC to request that further toxicological tests be conducted by manufacturers. These provisions are essential tools that must be employed by ECCC to support a successful chemical substitution strategy.

7.2 It is further recommended that ECCC create a voluntary chemical substitution recognition program to recognize industry leaders in chemical substitution, similar to [U.S. EPA’s Safer Choice program](#).

7.3 To ensure promotion of chemicals substitution in products on both sides of the border, it is recommended that the Parties to Great Lakes Water Quality Agreement (GLWQA) review and revise binational commitments on chemicals substitution in [Chemicals of Mutual Concern Annex](#).

7.3.1 ECCC should make a request to the International Joint Commission to provide recommendations on a binational Great Lakes Coordination plan on chemical substitution that would inform changes to GLWQA annex.

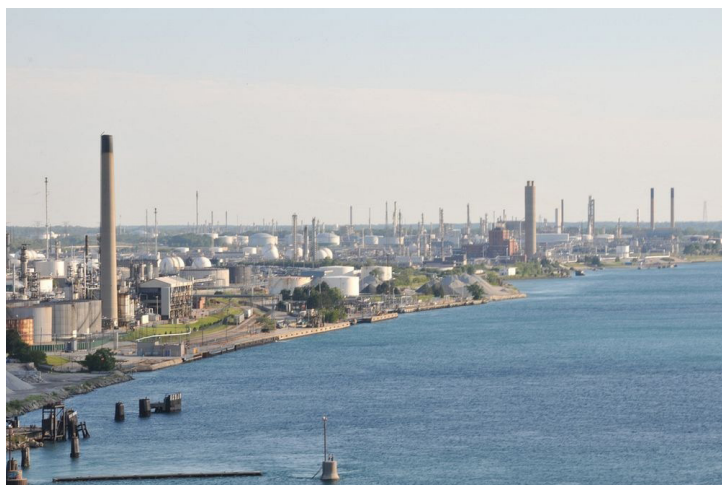
Impact of Chemicals in Products in Great Lakes Region

Chemicals that are used in products, particularly those in detergents, antibacterial products, pharmaceuticals and personal care products, are of growing concern to Great Lakes water quality because of the concentration of their discharge in the Region and the evidence of their accumulation in sediment and aquatic organisms. As these products are used, the chemicals in them are discharged through agricultural runoff, industrial effluent, and the bulk of sewage generated by the 40 million residents in the Great Lakes basin.

Hormone disrupting chemicals are of concern due to their potential to alter hormones in fish and other aquatic organisms at critical life stages, resulting in reproductive,

behavioural and developmental problems. Three separate studies have shown widespread distribution of alkylphenols, which are hormone disrupting chemicals used in detergents, cleaning products and adhesives, throughout the Great Lakes basin. There is added concern of the impact of exposure to multiple hormone disrupting chemicals, including estrogenic birth control.

The growing trend to add antibacterial and antimicrobial agents in cosmetics and personal care products has also become a serious concern. Triclosan, an antibacterial agent, also identified as an endocrine disrupting chemical that accumulates in the organs of fish, has been identified as a priority chemical to be assessed under the Canadian Environmental Protection Act (CEPA) process. A 2010 study showed widespread presence of Triclosan in the Great Lakes, in 89% of surface water samples and in a separate study, in 75% of people tested. In 2009, the Canadian Medical Association called on the Government of Canada to ban household antibacterial products due to the risk of bacteriological resistance.



C. NUTRIENTS



The frequency and severity of harmful algal blooms (HABs) are increasing within the Great Lakes Basin. Nonpoint sources of nutrients, including phosphorus (P), from agriculture and urban stormwater runoff are key

contributors to the growth of HABs. A [2019 report by the Environmental Law and Policy Centre](#) notes that HABs are further exacerbated by greater frequency of intense storms and precipitation as well as changes in water temperature associated with climate change. It should be noted that the need to reduce HABs across the Great Lakes must be balanced with maintaining nutrient inputs to sustain productive fisheries.

While some agricultural nonpoint contributions of nutrients, including individual farms, may be at very low concentrations, their cumulative impact is significant. It is therefore difficult to determine where to focus efforts for the greatest and most immediate impact given limited funding. The problem demands a different approach to what has been offered to date, in terms of broad-based agricultural education and incentive programs. We need to be more strategic in prioritizing areas in which to focus our efforts to reduce nutrients impacting our waterways.

There is also the added challenge of evolving nutrient management advice, and coordinating those providing advice and assistance to reduce nutrient loss, including extension workers, researchers, certified crop advisors, as well as drainage superintendents and Conservation Authority staff. Greater consistency in messaging will better assist farmers on making decisions affecting nutrient loss from their fields.

Urban stormwater presents a different set of challenges to agricultural runoff. Urban stormwater is often collected and discharged into waterways without treatment. While retention and collection infrastructure is in place, stormwater management facilities (such as wet ponds) must be maintained to remain effective at achieving required reduction in total suspended solids. Attention is being paid to improve planning and absorb more runoff with green infrastructure and low impact development, rather than it being discharged into waterways.

Targeted geographically-focused data and analysis are needed to identify which agricultural and urban

properties are likely to be contributing the most nutrients and to customize best management practices (BMPs) to reduce nutrient loss. Data privacy must also be respected. In Ontario, there are barriers to collecting farm data. Lessons on data management and protection of data confidentiality can be learned from the U.S. Geological Survey, and the U.S. Department of Agriculture. At the same time, we also need to improve how we coordinate, analyze and share monitoring and modelling to accelerate and implement more precise interventions in priority areas.

It is important to acknowledge and build on Ontario's progress to date in reducing nutrients entering waterways through the promotion of best management practices and low impact development for urban and agricultural sources, including existing programs like the 4R Nutrient Stewardship Program, Environmental Farm Plans, nutrient management plans, Sustainable Technology Evaluation Program (STEP), and wastewater treatment modifications. Periodic cost share programs such as the Great Lakes Agricultural Stewardship Initiative (GLASI), Lake Erie Agriculture Demonstrating Sustainability (LEADS) and the Canadian Agricultural Partnership have also advanced knowledge and understanding of best management practices in the Great Lakes region.

Wastewater is a point source of nutrients, and while important, these recommendations are focused on the challenge of nonpoint sources only, as these make up an estimated 87% of total phosphorus load in the Thames River basin.

Non Point sources contribute most to total phosphorus load

In the Thames River watershed, long term water quality and flow monitoring programs, and recent phosphorus load monitoring has provided information on the scale and timing of phosphorus loads at subwatersheds. Across the watershed, [87% of total phosphorus load](#) comes from nonpoint sources, with 13% from wastewater treatment plant point sources. Although it is estimated the majority of nonpoint source total phosphorus loading comes from agriculture, urban nonpoint loads must also be addressed. Findings also show that phosphorus and sediment loads are highest in winter and spring runoff/ highest flow conditions and that phosphorus loads come from individual properties and tributaries across the Thames watershed. As such, the focus to date has been on promoting the implementation of key strategic practices across the watershed.

Great Lakes Nutrient-Related Agreements and Plans

Great Lakes Water Quality Agreement

Under [Annex 4](#) (Nutrients) of the binational [Great Lakes Water Quality Agreement](#) (GLWQA), Canada and the United States have committed to reducing nutrients entering the central and western basin of Lake Erie by 40% based on 2008 levels.

Lake Erie Action Plan

Canada and Ontario have agreed to a strategy to achieve Canada's share of this target, as outlined in the Canada-Ontario "[Lake Erie Action Plan: Partnering on Achieving Phosphorus Loading Reductions to Lake Erie from Canadian Sources](#)". Within the Lake Erie basin, the Thames River has been identified by Canada and Ontario as a priority watershed for phosphorus reduction with a target of 40% reduction from 2008 levels. The Thames watershed has highly productive farmland with about 80% of the land used in agriculture.

Canada-Ontario Agreement

The [Canada-Ontario Agreement \(COA\) on Great Lakes Water Quality and Ecosystem Health](#) is a federal-provincial agreement that supports the restoration and protection of the Great Lakes basin. COA's Annex 1 on Nutrients is designed to address the issue of excess nutrients and reduce harmful and nuisance algal blooms.

International Joint Commission's Lake Erie Ecosystem Priority

In 2014, the International Joint Commission (IJC) released a report entitled [A Balanced Diet for Lake Erie](#) with a series of recommendations on actions needed to reduce nutrients entering Lake Erie.

Thames River Shared Waters Approach

A water management plan (Thames River [Shared Waters Approach to Water Quality and Quantity 2019 draft](#)) has been developed by the partners of the Thames River Clear Water Revival which includes key issues on addressing phosphorus in the Thames watershed and recommendations for implementation by its various partners including Indigenous communities, the City of London, Environment and Climate Change Canada, Ontario MECP, Ontario MNRF, and MAFRA, and Upper Thames River and Lower Thames Valley Conservation Authorities.

Lake Simcoe Protection Act/Plan

Canada and Ontario have also coordinated funding and actions to monitor and reduce nutrients entering Lake Simcoe under the [Lake Simcoe Protection Act](#), and the [Lake Simcoe Protection Plan](#).

Nutrient Management Act

Ontario's [Nutrient Management Act](#) provides a framework for the management, application and storage of agricultural source materials (such as manure) and non-agricultural source materials (such as sewage biosolids) applied to agricultural land as nutrients.

Desired Outcome and Recommended Actions

The desired outcome is to reduce agricultural and urban nutrient runoff in priority areas contributing to harmful algal blooms, and to improve the health of our waters. The following actions are proposed:

8. Adopt precision conservation and urban stormwater optimization approaches.
9. Develop data management strategy and tools to identify priority properties and strategic best practices.
10. Create a 'Water Quality and Nutrient Management Centre' to support nutrient management through precision conservation and urban stormwater optimization.
11. Designate a 'network' of extension workers with standardized training to provide consistent technical advice on phosphorus loss reduction.
12. Where urban areas are identified as significant contributors of phosphorus loading, require municipalities to develop an urban stormwater optimization/prioritization plan.

It Is Recommended That

8. The Governments of Canada and Ontario adopt a targeted, geographically-specific approach to reducing nutrients entering the Great Lakes, employing precision conservation and stormwater optimization, to bridge the gap between farm scale conservation implementation and urban stormwater management with broader water quality impacts.

8.1 This requires embedding precision conservation and urban stormwater optimization approaches within

agricultural and infrastructure investments and extension programs to support farmers, municipalities, First Nations, and others in their efforts to reduce phosphorus loss on a subwatershed basis and improve water quality within the Great Lakes Basin.

This targeted, geographically-specific approach does not preclude nor replace strategic practices that should be widely implemented across watersheds (for example, the timing of manure spreading to avoid spreading while land is frozen, planting cover crops, etc.).

8.2 Precision conservation is defined as a targeted, geographically-specific approach that identifies properties in priority subwatersheds and recommends a set of specialized practices, technologies and procedures at sufficient scale to enable landowners to make decisions yielding the greatest benefit from resources allocated to reduce nutrient loss.



Importance of Identifying Priority Subwatersheds

The Great Lakes Water Quality Agreement Annex 4 on Nutrients identified 14 large watersheds in both Canada and the United States as a priority in the Lake Erie Basin, including the Thames River basin and creeks in the Leamington area in Ontario. Areas were chosen based on their relatively high nutrient loads flowing into Lake Erie, and whether an algal bloom was appearing at the mouth of the tributary that drained into the watershed.

Loads coming out of tributaries at the mouths were documented. The Heidelberg approach, involving three samples per day at the mouth of tributaries for 365 days across 15 different parameters, is considered the most effective, but is data intensive. Annex 4 opted for 50 to 100 samples per year. However, this approach could miss large storm events that contribute to 70-90% of phosphorus loss.

On the U.S. side, in Ohio, an Annex 4 subcommittee on tributary loadings documented monitoring results from the mouths of tributaries in key priority watersheds. They also moved upstream to document loads in small tributaries. Ohio monitors total load and flow weighted mean concentration, which shows more consistent concentrations in both dry and wet years, avoiding the conclusion in dry years that phosphorus levels have dropped, or the reverse in wet years.

In 2018, Governor Kasich of Ohio issued an executive order designating eight Maumee subwatersheds as “impaired” based on three years of this type of monitoring. A strategy to identify priority subwatersheds, and eventually down to the property level, must be based on sampling stations at the mouth of tributaries at a frequency capturing the largest storms.

The Governments of Canada and Ontario have started to look at prioritizing subwatersheds in the Thames River basin. This exercise would help identify where to focus precision conservation and stormwater optimization activity.

Key steps in precision conservation

The Governments of Canada and Ontario identify priority subwatersheds where precision conservation should be focused. This should be based on contributions of higher levels of nutrients, or the sensitivity of the receiving water body.

- Identify customized conservation practices that have the greatest impact on nutrient loss in specific circumstances.
- Use GIS-based decision support platforms to identify specific properties contributing phosphorus.
- Engage farmers directly to discuss options for conservation practices, customization and placement.
- Best practice advice continues to evolve and remains unclear to many farmers. Customized best practice information and extension support is required.
- Assist farmers applying conservation practices targeting location/timing.
- While Ontario Conservation Authorities and agricultural extension programs exist, there is not enough capacity and coordination needed to make progress.

Building on Existing Agricultural Stewardship Programs and Initiatives

Precision conservation must be integrated into whole farm operations by ‘stacking’ a suite of best management practices, and build on progress achieved to date on reducing nutrient loss through a number of existing and past programs and initiatives:

The [Canadian Agricultural Partnership](#) is a federal-provincial cost share program continues to advance knowledge and understanding of best management practices as well as support customized edge-of-field conservation practices (restored wetlands, saturated buffers, bioreactors, drainage modifications, placement of ponds, etc.) and technologies (e.g. passive or active phosphorus removal systems).

The [4 R Ontario Nutrient Stewardship](#) is an industry-led program that promotes the application of the right source of fertilizer at the right rate and time to the right



place. The 4R voluntary certification program trains crop advisors and agricultural retailers to explore and document strategies to improve nutrient management on farms. The 4R Nutrient Stewardship program also serves as a protocol for carbon reduction.

OMAFRA recently convened a Soil Health Working Group to gather advice on developing [Ontario's Agricultural Soil Health and Conservation Strategy](#).

[Environmental Farm Plans](#) are planning tools to help farmers identify potential risks and implement good site-specific field practices, such as cover crops, limited tilling practices, among other stewardship actions. Farmers have also developed site-specific nutrient management plans for individual farms.

[Farmland Health Check-Up](#) facilitates on-farm risk assessments of soil health and water quality, with specific attention paid to erosion, compaction, organic matter, and soil chemistry.

Lake Erie Agriculture Demonstrating Sustainability (LEADS) was a cost share program that supported the implementation of best management practices on farms within the Lake Erie and Lake St Clair watersheds using risks identified through the Farmland Health Check-Up.

Other cost share programs such as the Great Lakes Agricultural Stewardship Initiative (GLASI) helped farmers improve soil health and stewardship practices through promotion and monitoring of best management practices, as well as providing long-term data and valuable information for farmers and decision makers.

The [Thames River Phosphorus Reduction Collaborative](#) (PRC) is a joint project of the Ontario Federation of Agriculture and the Great Lakes and St. Lawrence Cities Initiative, aimed at developing, testing and promoting a suite of effective land management and drainage solutions for agriculture, developed cooperatively with partners, for reducing or removing phosphorus from agricultural run-off and improving water quality in the Thames River.

Different Approaches to Precision Conservation

Chesapeake Bay

Lessons can be learned from thirty plus years of nutrient management in the [Chesapeake Bay watershed](#). After sporadic adoption of best management practices, a targeted 'precision conservation' approach was adopted in the Chesapeake area focusing best practices at the lot level where they can have the greatest impact.

The availability of high resolution (one metre spatial resolution) land cover information has improved the potential for precision conservation. These efforts have been spearheaded by the Chesapeake Conservancy who worked partners to identify new cost-effective practices and technologies that can accurately determine high-functioning natural landscapes and help guide conservation targeting in the Chesapeake Bay watershed.

[Spatially Referenced Regression on Watershed](#)

[Attributes](#) (SPARROW) is a modelling tool that utilizes in-stream water quality measurements and spatially referenced characteristics of watersheds to estimate the origin and fate of contaminants in rivers. Pennsylvania has embraced this watershed prioritization approach as integral to the development of their watershed clean-up plan to meet the Chesapeake Bay wide pollution caps for nitrogen, phosphorus and sediment.

The SPARROW model is intended to be used by water managers to plan watershed management and implement best management practices throughout the United States, including the Great Lakes region. Results of this prioritization effort are summarized in the [Chesapeake Progress report](#) by the U.S. Department of Agriculture's Natural Resource Conservation Service. This advanced targeting helps focus efforts on properties that will provide ecosystem services and deliver the greatest amount of benefits with limited funding.

Illinois and Kentucky

[Precision conservation management](#) (PCM) is a farmer-led effort developed to address natural resource concerns on a field-by-field basis by identifying conservation practices that effectively address environmental issues in a financially viable way. The mission of the PCM program in Illinois and Kentucky is to increase adoption of voluntary conservation practices by commodity crop farmers and animal producers in the Mississippi River Basin by assisting farmers with selection of financially-favourable best management practices for their unique farming enterprise.

9. It is recommended that the Government of Ontario, with support from the Government of Canada, develop a data management strategy and GIS-based tools to support the precision conservation approach and to facilitate the collection and use of datasets (e.g. elevation, soil type, property boundaries, land use) needed to prioritize properties and best practices.

9.1 As part of the data management strategy, establish confidentiality protocols to protect landowner data, e.g. in aggregated form.

9.2 Relevant layers of GIS-based data need to be made available to identify areas contributing high levels of phosphorus, such as field boundary data, soils data, land use data, and elevation data.

Using big data to support precision conservation

Examples of big data supporting precision conservation in other jurisdictions:

Agricultural Conservation Planning Framework

The [Agricultural Conservation Planning Framework](#) (ACPF) is a decision support model and set of tools for precision conservation employed in the U.S. midwest. ACPF takes a watershed approach to conservation planning and scenario building using layers of data such as digital elevation, field boundaries, soils, and crop cover. Maps are generated with this geographically specific data to identify priority subwatersheds and a decision support platform helps determine site-specific opportunities to implement agricultural conservation practices. ACPF can also evaluate the effectiveness of multiple practices in meeting nutrient reduction targets. According to the [experience in Minnesota](#), it is easy to tailor to specific

local needs. The decision support tool not only provides a framework for prioritization and implementation, but also offers [lessons from the U.S. midwest](#) in producer engagement and coordination of conservation efforts.

Nutrients Tracking Tool

Another example of using big data is the [Nutrients Tracking Tool](#) developed by Tarleton State University in Texas to estimate nutrient loss from crop and pasture land.

Building on existing decision support tools/data platforms in Ontario

Existing data platforms and tools in Ontario that could be integrated to support the adoption of a precision conservation approach:

OMAFRA's **Phosphorus Loss Assessment Tool for Ontario (PLATO)** is designed to assess the risk of P loss from agricultural fields. The tool considers soil texture, slope, and proximity to surface water, transport of nutrients, as well as phosphorus application techniques, timing and rates.

AAFC's **Indicator of Risk of Water Contamination by Phosphorus (IRWOC-P)** in an internal platform that assesses the risk associated with Canadian agricultural practices at a watershed scale.

Ontario's [Watershed Flow Assessment Tool](#) is an accessible open data and mapping portal used to visualize hydrology and water flow and data within Ontario.

Ontario's [AgMaps Geographic Information Portal](#) is an online application that allows users to search for agricultural data on soils and drainage, and create customized maps.

[Water Information Systems KISTERS](#) (WISKI) are being developed through Conservation Authority nodes across Ontario to incorporate water data from multiple sources and agencies.

9.3 It is recommended that a watershed-level nutrients data portal be created to ensure accessibility and coordination of Great Lakes nutrients monitoring/modelling data and analysis (both agricultural and urban stormwater) at the watershed level to inform precision conservation and stormwater optimization.

The watershed-level nutrients data portal would include:

- A Great Lakes map of the greatest nutrient losses, pressures, and priority areas.
- A comprehensive list of monitoring stations and parameters.
- A list of agencies responsible for monitoring and modelling.
- Monitoring and modelling data, interpretation, and visualization.
- Tools and strategies for nutrient loss mitigation, including advice on best management practices, and expertise to apply at a site-specific property level.
- A list of ongoing partner initiatives and projects outlining who is doing what and identifying linkages in order to coordinate efforts.
- Required bandwidth for Indigenous communities to ensure accessibility
- Both agriculture and urban data to support precision conservation in agriculture, and stormwater optimization approach in urban environments.

10. It is recommended that the Governments of Canada and Ontario, together with partner universities, Indigenous communities, and relevant organizations, create a Centre for Water Quality and Nutrient Management to generate and coordinate information to support precision conservation and stormwater optimization approaches in the Great Lakes Basin.

10.1 The Centre would offer the following functions supporting both agricultural and urban nutrient management:

Overarching Process

- Coordinate overall prioritization process.
- Promote a sustainable cycle of nutrients, including the production, use, recovery, reuse and recycling of phosphorus.

Data Collection

- Support open data mapping and portal/inventory of watershed-level monitoring, modelling, data visualization, projects, and support commitment to open data.
- Promote community of practice that shares models (proprietary, costly modeling exercises).
- Develop a data confidentiality protocol.
- Implementation Advice and Training
- Communicate methods and practises in agriculture and stormwater to reduce phosphorus loss, and provide best management practice advice (e.g. managing non-growing season).
- Promote action on the ground for the adoption of best management practices, green infrastructure, low impact development, and restoration projects.
- Develop and train a dedicated network of extension workers/delivery nodes and training.

Policy and Finance

- Explore new policy tools, approaches, and guidelines.
- Conduct cost benefit analysis, incorporating externalities.
- Explore and support investment options, e.g. serve as an aggregator for green bonds, payments for ecosystem services, stormwater fees, and/or other financial mechanisms.

Evaluation

- Develop improved methods to measure and track progress through modelling, monitoring of water quality levels, and validation of practices on the landscape.
- Evaluate the effectiveness and cost-efficiency from water quality/nutrient loss perspective and other co-benefits, and aim for continuous improvement.

Opportunities to manage a sustainable phosphorus cycle from production and use to recovery

Many countries are now recognising the integrated nature of the phosphorus cycle and the need to improve many aspects of how we produce, distribute, use, recover, reuse and recycle phosphorus. The development of a Center focused on nutrient management would allow for 'new thinking' around a circular economy of phosphorus.

In the future, it is likely that phosphorus may be seen much more as a precious, increasingly scarce and expensive commodity that is too valuable to waste, and therefore efforts to recover phosphorus from agriculture and urban stormwater, as well as wastewater, will increase. This has the multiple benefits of reusing phosphorus, potentially saving farmers and municipalities money, creating jobs, reducing greenhouse gases, and improving water quality.

Examples of similar initiatives developed in other countries include the [Sustainable Phosphorus Alliance](#), the [Dutch Nutrient Platform](#), and the [European Phosphorus Platform](#).

11. It is recommended that Agriculture and Agri-food Canada (AAFC) and the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) work with the Centre for Water Quality and Nutrient Management to designate a dedicated network of extension workers, through existing organizations or a new institution, that receive standardized training, and provide consistent technical advice to farmers.

This extension network would support a range of partners including farmers and farm groups, Conservation Authorities, certified crop advisors, engineers, drainage superintendents, extension workers (e.g. Ontario Soil and Crop Improvement Association (OSCIA)), governments, and non-profit organizations such as Ducks Unlimited Canada (DUC) and Alternative Land Use Services (ALUS).

11.1 The network would receive training on providing advice to priority property owners in priority subwatersheds on the most effective practices that reduce P loss, especially during peak times during the year.

Agricultural stewardship extension and training

Agricultural Extension and Training Success Factors

- Bringing together a suite of agricultural extension workers to deliver consistent advice.
- Connecting trusted experts and farmers face-to-face, in addition to written materials and online tools.
- Support peer review approach with local farmers and experts making decisions.
- Providing ongoing training of trainers on the latest technology, innovative approaches, policies/regulations, and incentives
- Target training relevant to certain times of year for specific key actions, subwatersheds and/or properties (relevant to winter spring runoff).
- Ensuring the long-term sustainable funding of extension and training specialists.
- Supporting market-based opportunities for certified crop advisors to deliver services that provide public benefits, including extending the business service model to phosphorus loss reduction.
- Including accountability mechanisms such as monitoring, evaluation and reporting criteria.

What agricultural extension and training is required?

- Support soil BMP implementation and a feedback loop to researchers for continuous improvement.
- Foster expansion of known practices that improve water management and reduce overland flow (i.e. cover crops).
- Promote existing erosion assessment, prevention and mitigation tools.
- Expand on-farm soil health planning tools such as 4R Nutrient Stewardship certification, Environmental Farm Plan, Farmland Health Check-up, etc.
- Deliver consistent messaging on soil care practices.

Who needs training? Farmers, certified crop advisors in agriculture retail and agricultural consultants, equipment manufacturing, input supply companies, engineers, drainage contractors, Conservation Authority field staff, and financial service experts, among others.

Who would train? Ontario Ministry of Agriculture, Food and Rural Affairs field extension/environmental branch, Agricultural and Agri-food Canada, university extension groups at the universities of Guelph, Waterloo, Western University, Windsor. Also experienced contractors, engineers, drainage superintendents, and other partners.

12. It is recommended that, where subwatershed modelling and monitoring identifies urban areas as significant contributors of phosphorus loading, the Ontario Ministry of Environment, Conservation and Parks (MECP) require the relevant municipalities in consultation with Conservation Authorities to develop an urban stormwater optimization/prioritization plan with steps to achieve measurable phosphorus reductions.

12.1 Prioritization would be based on urban stormwater management optimization modelling, at a watershed scale where appropriate. Plans would need to consider the use of grey and green stormwater infrastructure and natural assets, and explore financial tools that municipalities and Conservation Authorities can use, such as stormwater management fees, offset programs, and green/blue bonds.

12.2 Education and training support needs to be provided as well. [The Sustainable Technologies Evaluation Program](#) (STEP) could be expanded to deliver professional training on the effective design, construction, inspection and maintenance of grey and green stormwater infrastructure. It is important to support the continued evolution of university and/or college curriculum so that new and innovative green infrastructure approaches are taught. It is also recommended that green infrastructure certification programs be explored as such as the [U.S. National Green Infrastructure Certification program](#).

Lake Simcoe Urban Stormwater Optimization

The Lake Simcoe Region Conservation Authority, in partnership with the Government of Ontario, municipal and Indigenous communities, has completed subwatershed plans and implementation plans for a select number of urban stormwater priority projects.

“Urban stormwater optimization” is being explored as a pilot project within the Lake Simcoe watershed. This approach seeks to determine the potential of system-based, watershed-wide stormwater management planning to achieve optimal performance (in this case, phosphorus reduction) of stormwater infrastructure using both green and grey infrastructure as well as natural assets in the most cost-efficient way.

A continuous simulation model is coupled with a decision support tool developed by the U.S. Environmental Protection Agency called [SUSTAIN](#) that runs thousands of stormwater management options. Each spatially derived management option includes associated costs and benefits. Plots of management options are then used to create ‘optimization curves’ which help determine the most cost-effective strategy for a given targeted area.

Once established, this stormwater optimization model will test the efficacy of various economic principles such as equitable responsibility, aggregation, and scale. Equitable responsibility is the term being applied to the concept of cost and resource sharing for stormwater management planning (and potentially design, construction and operation) amongst municipalities and Indigenous communities within a watershed.



D. BEACHES AND BACTERIOLOGICAL CONTAMINATION



For many Ontarians and visitors, our beaches are where we spend the most time enjoying the Great Lakes. Beaches are valuable community assets, bringing in thousands of visitors to large cities and small towns each year, contributing to

our quality of life and to local economies. There are 800 beaches in Ontario, many of them on the shoreline of the Great Lakes. Beach owners, including municipalities, Indigenous communities, provincial parks, Conservation Authorities, and private resort owners, working with public health units, have generally maintained a strong track record of preventing waterborne diseases from people enjoying these recreational waters.

Notwithstanding Ontario's good track record, between 15-20% of Ontario's beaches have chronic bacterial contamination issues. According to public health data compiled by [Swim Drink Fish](#), of the 800 beaches regularly monitored in Ontario, approximately 15-20% of these exceed the *E. coli* standard 20% of the swimming season. It should be noted that this estimate is based on pass/fail testing results in 2017 and 2018, for beaches with varying frequency of testing and varying monitoring start and end dates. Taking these variations into account, it is estimated that the recommendations presented below with regard to 'impaired beaches' would impact around 120 beaches. To determine which beaches would be categorized as 'impaired' according to the recommendations below, a more thorough analysis of data over several years would need to be conducted.

Bacteriological contamination at beaches may be caused by one or more of a number of sources including untreated sewage, waterfowl feces, leaking septic tanks, domestic animals, and urban and agricultural run-off. All are important to track and assess as contributors to beaches contamination. However, from a risk-based approach, due to its high concentration of pathogens, and its potentially serious health effects including gastroenteritis, febrile respiratory illness, or skin illness,

addressing untreated sewage is a top priority. Untreated sewage may be released directly as a bypass, or it may be gathered through cross connections to the stormwater collection system that is discharged at an outfall close to a beach. During heavy rainfalls, these sources of bacteriological contamination may increase significantly.

The persistent nature of this bacteriological contamination in 15-20% of beaches in Ontario suggests its sources are unknown and/or not being addressed. While public health units monitor the quality of beaches, they are not vested with the authority to require action to be taken by the beach owner to identify and addresses these sources. The public health unit's authority is limited to protecting public health by requiring public posting of the beaches as unsafe for swimming. It is the responsibility of the environmental and water quality regulator, the Ontario Ministry of Environment, Conservation and Parks to ensure that sources of bacteriological contamination are identified and addressed.

The number of chronically impaired beaches in Ontario is not commonly known because there is no system to track beaches performance. Currently, if a member of the public would like to look up the beach quality test results, s/he must look them up on each of the relevant municipalities' websites. Unlike the United States, the European Union, and a number of other jurisdictions, there is no central database to keep track of overall beach quality across the Province, nor is there a system to rank or categorize beaches to provide a relative evaluation of beaches to the public.

In Ontario, there is also a challenge in communicating test results in a timely manner. Public Health Ontario's '[Public Beach Water guidance on test methods for *E. coli*](#)' requires membrane filtration testing as per [the Ontario Ministry of Environment's drinking water testing methods E3371](#). Weekly testing using this method is paid for by the Province. Samples are sent to Ontario laboratories for analysis. Using this required testing method, analysis takes 24 to 48 hours. If a sample exceeds the *E. coli* standard, Public Health will require that the beach be posted as unfit for swimming. However, given the length it takes to evaluate the results of membrane filtration testing, by the time it is posted, the information often no longer reflects the quality of the water. From a public health protection point of view, it is of little value as it is posted 24-48 hours after the sample was originally taken. Other sampling methods used in the U.S., Québec, and Europe, provide more

timely information. However, these are not permitted nor are they paid for by the Ministry of Health and Long Term Care in Ontario.

The need to address these deficiencies is all the more urgent given the impacts of climate change. Over the next 30-40 years, it is projected that the lower Great Lakes region will be transformed from its current temperate climate to a subtropical climate. This will bring longer and hotter beach seasons, attracting many more people to the shoreline. It will also bring more intense and extreme storms which will [worsen episodes of bacteriological contamination](#) of beaches that go unaddressed. The impact of high water levels and strong wind and wave energy may degrade beach and shoreline integrity.

Regulating and Managing Beaches - Who Does What

There are two aspects to the monitoring, regulation and enforcement of beaches quality. The first, protection of public health through regular monitoring and public notification of water quality, is the responsibility of the Ontario Ministry of Health and Long Term Care through local public health units. The authority of public health officials only extends to informing the public of a public health risk.

The second aspect is the quality of the recreational waters. Recreational water quality is evaluated based on the best indicator of bacteriological contamination, the *E. coli* standard. Where there are repeated exceedances of the *E. coli* standard, the water quality must be addressed, and any enforcement activity to address the source of contamination is the responsibility of the Ontario Ministry of the Environment, Conservation and Parks, under the Ontario Water Resources Act.

The Government of Canada, through Health Canada, maintains national guidelines for the management of the recreational waters, [Guidelines for Canadian Recreational Water Quality](#). These standards, or more stringent ones, have been adopted at the provincial and territorial level through public health programs.

The Guidelines for Canadian Recreational Water Quality recommends *Escherichia coli* (*E. coli*) as an indicator of fecal contamination in freshwaters and sets a standard limit of 200 *E. coli*/100mL for recreational water use. Up until 2018, the Government of Ontario maintained a more

stringent standard of 100 *E. coli* per/100mL. In 2018, this was changed to 200 *E. coli*/100 mL to harmonize with the Federal Guideline.

In most provinces including Ontario, municipalities take all the day-to-day decisions related to the operation and maintenance of public beaches within their boundaries. Under the Ontario Health Protection and Promotion Act, public health units are responsible for monitoring beach water quality. Responsibility for beach monitoring in Ontario Parks lies with the Ministry of the Environment, Conservation and Parks (MECP) and the Ministry of Natural Resources and Forestry (MNRF). Indigenous Services Canada is responsible for ensuring the quality of recreational water on reserve. The First Nations and Inuit Health Branch (FNIHB) is ultimately responsible for monitoring recreational water quality in the First Nations. In First Nations, recreational water quality is tested in the on-reserve water lab or the samples are sent to provincial or contracted labs. FNIHB's Environmental Public Health program provides equipment and training for recreational water quality monitoring in First Nations.

The Ontario Ministry of Health and Long-Term Care (MOHLTC) publishes two key guidance documents related to beaches, the ['Recreational Water Protocol'](#) and the 'Beach Management Guidance' Document. The 'Recreational Water Protocol' (2018) provides the Boards of Health with details on the delivery of recreational water programs and services. The 'Beach Management Guidance' Document supports the Boards of Health (BOHs) in the implementation of 'Recreational Water Protocol' and describes task-specific best practices. The 'Operational Approaches for Recreational Water Guideline' (2018) provides direction to Boards of Health about the manner in which to approach the requirements described in the 'Recreational Water Protocol' (2018).

The Ontario Water Resources Act (OWRA) deals with sewage works and prohibits or regulates the discharge of sewage and stormwater into water bodies. The ['Stormwater Management Planning and Design Manual'](#) provides technical and operational support in planning, designing and reviewing the stormwater management practices. [Guideline F-5-5](#) under the OWRA outlines rules for treating municipal and private combined and partially separated sewage systems, and specifies that plants with a history of combined sewage overflows must meet the *E. coli* standard 95% of the swimming season.

Notable Beach Programs

The [Blue Flag program](#), administered in Canada by the non-profit organization Environmental Defence is an international beach quality certification program. Blue Flags are awarded to beaches and marinas that meet stringent criteria for beach water quality, environmental education, cleanliness and accessibility, safety standards, environmental protection, and management.

[The Healthy Lake Huron – Clean Water, Clean Beaches Partnership](#) is a collective effort of various levels of government to reduce the amount of phosphorus and bacteria (such as *E. coli*) entering the water due to failing private septic systems, municipal wastewater, and natural sources such as waterfowl.

[Swim Drink Fish](#) (SDF) is a non-profit organization dedicated to building a movement of active, informed and engaged individuals working in their communities to make their recreational waters swimmable, drinkable and fishable. SDF's [Swim Guide](#) provides the most comprehensive online information on weather, water and beaches quality in Ontario.

Desired Outcome and Recommended Actions

The desired outcome is to ensure that Great Lakes beaches are clean and protect public health by moving from a public notification approach to a risk-based, centrally monitored pollution reduction and prevention approach, involving both MOHLTC and MECP.

Adopting a risk-based, science-based approach, the Collaborative is recommending that a more robust response to beaches with chronic bacteriological contamination be adopted, involving targeted action to identify and address the sources of bacteriological contamination. This will require the involvement of communities who benefit from beaches as community assets. As this is both a public health and water quality problem, it demands coordination and collaboration between the Ontario Ministries of Health and of Environment, Conservation and Parks. To the extent that some of the contamination can be attributed to sewage and stormwater, it will also require financing where costly infrastructure upgrades may be necessary.

This new approach would involve three key actions:

1. Ontario would adopt a risk-based, science-based approach to beach management that would target beaches with chronic bacteriological contamination issues and require action to track and address the persistent sources of bacteriological contamination, with funding support.
2. Both the Governments of Canada and Ontario would modernize their guidelines on the use of new techniques and technologies that allow for more time-sensitive monitoring, assessment and reporting of beach quality.
3. Ontario would create a centralized portal to communicate beach quality information, making beach quality categorization, testing and survey results easily accessible to the public.

It Is Recommended That

13. The Ontario Government introduce a new risk-based categorization system for Ontario beaches, that would require those beaches categorized as 'impaired' to trace the source of the chronic bacteriological contamination and take action to address it.

This new system would require coordination, collaboration and information sharing between the Ontario Ministry of Health and Long Term Care and the Ontario Ministry of Environment, Conservation and Parks to identify chronically impaired beaches and to determine the appropriate actions to bring beaches with chronic *E. coli* exceedances into compliance. It would also require a collaborative approach locally where chronic beaches are identified, to determine the right course of action and to build support to take these actions. It would serve to provide beach users, beach owners, public health units, and the Ontario Ministry of Environment, Conservation and Parks, an indication of the comparative quality of beaches and progress in addressing bacteriological contamination where it exists.



This new beaches categorization system is modelled on similar systems in [Europe](#) and the US.

Categorization would be based on the following criteria:

- a. Percentage of the swimming season when beach samples met or exceeded the *E. coli* standard, based on minimum of 20 data points over 3-5 yrs of testing.
- b. Bacteriological contamination has been traced to its source/s.
- c. A beach management plan is in place to address these sources and communicate publicly on progress.
- d. Beach is known to be impacted by combined sewage overflows, and therefore subject to F5 guideline's more stringent requirements re: meeting *E. coli* standard.

Summary of Beaches Categorization System

(n/a=not applicable)

	1-Combined Sewer Overflow (CSO)-impacted beaches	2-Impaired beaches	3-Fair-Good beaches	4-Good-Excellent beaches
Exceedance of <i>E. coli</i> standard	>5% of swimming season	>20% of swimming season	>20% of swimming season	< 20% of swimming season
Response plan	yes	required but not in place	yes and showing progress	yes
Source tracking	n/a	required but not undertaken	yes	yes
Subject to F55 guidelines	yes	n/a	n/a	n/a

13.1 For impaired beaches (including in Indigenous communities, areas of concern and provincial parks)

a) MECP, in consultation with public health units (Indigenous Services Canada in the case of First Nations) would be responsible for introducing requirements for the beach owner to track and address sources of bacteriological contamination, and to prepare a beaches management plan.

i) the beach owner would be required to undertake the tracking and address the sources of contamination and develop and implement beaches management plan, in consultation with community and with federal and provincial financial support; The beach owner would have up to three years to identify the sources of contamination and prepare a source tracking and response plan to address the sources.

ii) In extreme cases, where the beach owner is not able to mitigate the chronic source of bacteriological contamination, the beach owner would be permitted to undertake an assessment of the suitability of the site for a beach in consultation with the community. If sufficient evidence that mitigation of pollution sources is not possible, the beach owner, in consultation with Public Health, MECP and the community, would be permitted to close the beach.

b) Where the party responsible for the contamination is not the beach owner, MECP would take action to require responsible party to mitigate source of contamination.

13.2 For those ‘fair-good’ beaches open under 80% but implementing a risk management plan, beach owners would be required to continue to put beach management actions in place that were known to protect the public, e.g. automatic rain rules.

13.3 For those ‘good-excellent’ beaches that have reduced testing frequency requirements, (e.g. once a month), recommend the criteria of Blue Flag beach be adopted (80% of the geometric mean results must fall below the limit value).

13.4 For those beaches designated under MECP’s F5 guideline (CSOs), beaches must meet the *E. coli* standard 95% of the time during the swimming season.

13.5 For all beaches, annual environmental health and safety surveys should be completed, as well as regular short field surveys when taking samples throughout the beach season.

While the Collaborative was asked by Environment and Climate Change Canada to focus bacteriological contamination, it is not the only threat to public health on beaches. Other threats, such as cyanobacteria in harmful algal blooms, high waves, or rip currents, can pose an equal or greater threat to human health. For this reason, it is recommended that conditions beyond the presence of *E. coli* as an indicator of bacteriological contamination should be documented through regular field surveys.

14. It is recommended that Ontario Ministry of Health and Long-Term Care (MOHLTC) create and maintain a central portal with beach quality information, including information on the ‘status’ of the beach (based on above four categories: impaired, fair-good, good-excellent, under CSO advisory)

Once the categorization system is established, it will then be important for MOHLTC and MECP to keep track of the relative performance of beaches across the province, the number of beaches that are categorized ‘impaired’, and to make beach quality information easily available to the beach goers. In the U.S. and a number of other jurisdictions, this is done through a central portal.

- MOHLTC should prepare guidelines for municipalities on required standardized format of data to upload to a centralized portal
- Require beach owners or public health unit to upload verified beach testing data to central portal in compatible format as it becomes available (e.g. following weekly sampling and verification of data; less frequent in provincial parks or northern or remote beaches).
- Allow for registration for text service linked to portal, that would send individuals texts of water/beach quality at specific beaches.
- Include *E. coli* testing info as well as other risks, including presence of cyanobacteria, red tide, and common daily information like water temperature, wind direction, wave action.

15. It is recommended that MOHLTC amend the Public Health Ontario's Public Beach Water guidance on test methods for *E. coli* to allow for alternate testing methods other than membrane filtration as per Ontario MECP's drinking water testing methods E3371. Federal recreational water guidelines (2012) currently under review should likewise include a review and revisions to testing methods.

Testing methods that have been commonly used in other jurisdictions over the last decade should be permitted. This would allow for more timely communication of actual water quality to beach goers rather than a retrospective test that is 24-48 hours out of date by the time it is communicated publicly. There are also other efficiencies to be gained, in terms of reduced 'hands on' time for staff undertaking the testing, and simpler methods that can be conducted in-house rather than sending samples to a lab.

- a. Both provincial and federal guidelines should allow for other testing methods and predictive modelling.
- b. The cost of these additional methods would be subsidized by Province at same rate as membrane filtration. Additional cost for testing by labs borne by beach owner.
- c. Guidelines should allow for 'in-house' testing of samples by public health units.
- d. Any methods that have received USEPA approval for analysis of fecal indicator bacteria in recreational waters OR is a method that has been reasonably validated (e.g. by CSA or NSF) and used appropriately, should be permitted at cost to beach owner, and may be sent to accredited labs.
- e. Further research should be conducted on sampling and testing methods for other water-borne risks to human health, including cyanobacteria toxins. In areas where harmful algal blooms are a common occurrence, funding should be made available to public health units to test for cyanobacteria.



4. INVESTING IN THE GREAT LAKES

The Action Plan to protect the Great Lakes will require significant and sustained investment to be implemented. The benefits of protecting the world's largest freshwater system, that supports over one third of Canada's population, and one third of Canada's GDP, ensure that the return on investment will be substantial. Investments through the U.S. Great Lakes Restoration Initiative realized a [3:1](#) return on investment.

Level of investment needed

It is estimated that the level of investment needed to implement the recommendations over ten years, as outlined in this plan, is in the order of \$1.5-3 billion. This is a preliminary estimate, and requires further analysis based on actual needs of shoreline communities, beach owners, communities impacted by toxics and harmful pollutants, and agricultural and urban actions to reduce phosphorus run-off.

As a catalyst for the investment needed, and to lay the foundation for many of the recommendations, it is proposed that the Federal Government invest \$100 million a year, over ten years. This should be new investment, above and beyond the current level of investment in Great Lakes programs, public infrastructure and climate adaptation- related funding. This amount will serve as leverage for further investment from provincial and municipal governments, as well as investment from other private and non-governmental sources, including pension funds, the private sector, foundations, and alternative finance mechanisms like green bonds and pollution trading.

The Case for Great Lakes investment

The business case for investments in Great Lakes protection is strong. [A Brookings Institute cost benefit analysis](#) showed a 2:1 return on Great Lakes investments. A follow up report that specifically assessed the return on investment of investments by the federal government under the Great Lakes restoration initiative found a [3:1](#)

return. Some individual investments under GLRI realized a [6:1](#) ROI.

A [2007 Canadian study](#) undertaken by Dr. Gail Krantzberg of McMaster University provided some valuation of key sectors that would be impacted in the absence of action to protect the Great Lakes, including:

- Recreational bathing - \$250m
- Recreational boating- \$2.2B
- Sports fishing- \$7.5 B
- Commercial fishing- \$95 m, direct and indirect (sales, employment)

While it was beyond the scope of this report to quantify the value of the anticipated benefits of the Action Plan's 15 recommendations, an illustrative list points to broad based, extensive benefits to the Great Lakes and all who live within the region, including:

- Improved water quality to benefit fish and wildlife habitat, commercial and recreational fisheries;
- Improved nearshore water quality, to improve water-based recreational experiences;
- Improved drinking water quality, particularly in areas susceptible to harmful algal blooms;
- Avoided damage to shoreline natural assets, public infrastructure and private property;
- Enhancing the value of green infrastructure and naturalization of shorelines for the benefit of biodiversity, shoreline species, recreational amenities, and stormwater/flood water management;
- More geographically relevant and accurate climate information on which to base land use planning and public works decisions will avoid costs associated with climate impacts;
- Reduced toxics loadings in our waters;
- Reduced exposure in our bodies, particularly in those communities most at risk, including select indigenous communities
- Lower cost of morbidity and mortality, including health care costs and higher productivity;
- Improved water quality in great lakes tributaries, particularly those impacted by urban and agricultural run-off;

- Improved agricultural yield at lower cost (less phosphorus, improved soil health)
- Avoided public health costs associated with harmful algal blooms, waterborne diseases from bacteriological contamination;
- Avoided lost revenue of current beach closures, including tourism revenue, and added value of beaches in the future as information on the high quality of great lakes beaches is made more widely available.

Current Funding Available

The Government of Canada has a number of funding mechanisms that contribute to some of the areas identified in the Action Plan. Some of these funds could be topped up and have a portion of their funding directed specifically to Action Plan recommendations. As some of these existing programs are time-limited, or have specific eligibility criteria, they would have to be reviewed and updated to align with the Action Plan funding needs.

These include:

Investing in Canada Infrastructure Program (ICIP)

: \$9.2 B between 2018-2028, cost-shared with the Government of Ontario; through the Green Infrastructure Stream, for projects that support public infrastructure including Sub-streams for climate change mitigation and adaptation, resilience and disaster mitigation, and environmental quality (primarily water and wastewater).

Federal Gas Tax Fund: Over \$2 billion every year to 3600 communities across the country, supporting a range of projects including public transit, wastewater infrastructure, and drinking water. The Federal Government announced a one-time top up of the Gas Tax Fund of an additional \$2.2 B in 2019.

Disaster Mitigation and Adaptation Fund (DMAF): \$2 billion to support large-scale infrastructure projects (>\$20M) to help communities manage risks of disasters triggered by natural hazards.

National Disaster Mitigation Program (NDMP): \$200 million over five years, from 2015 to 2020, to identify disaster risks and costs, conduct shoreline flooding assessment, flood mapping, mitigation planning and non-structural mitigation projects.

Canada Infrastructure Bank (CIB): Funding up to \$35 billion for investment in transformative infrastructure

projects to 2028. At least \$5 billion will be invested through CIB in green infrastructure projects

Municipalities for Climate Innovation Program (MCIP), Federation of Canadian Municipalities (FCM), \$75 million program (2017-2022), funded by the Federal Government, supporting more than 600 municipalities in updating infrastructure and address climate change, including assessing flood risks.

Green Municipal Fund (GMF), (Federation of Canadian Municipalities): funding from the Federal Government, to reduce municipal greenhouse gases, with opportunity to support municipal natural asset management.

Canadian Agriculture Partnership: \$3B over five years (CAP) across Canada, with \$61.2M over 5 years for agricultural environmental work in Ontario.

Great Lakes Protection Initiative: Environment Canada and Climate Change's fund that supports, among other things, preventing toxic and nuisance algae, assessing and enhancing the resilience of Great Lakes coastal wetlands, evaluating and identifying at risk nearshore waters; reducing releases of harmful chemicals; and engaging Indigenous Peoples in addressing Great Lakes issues

Provincial and Municipal investment

While this report is primarily focused on federal actions and investment to benefit the Great Lakes, investments by the Government of Ontario and municipal governments will be critical to the successful implementation of Action Plan 2030. These investments could range from direct provincial programs, as outlined in the Action Plan's recommendations, to provincial prioritization of capital projects to be funded through ICIP (see above), to capital plans, utility fees and other charges at the local government level.

Alternative Sources of Investment

Financing from other sources of non-government investment is also essential, particularly over the longer term. This could come in the form of:

- Privately funded reserve funds or endowment funds financed by companies that contribute to some of the challenges identified in the Action Plan;
- Investments by pension funds or by other green-oriented investment firms
- Innovative pay-for-performance, outcome-based impact bonds, green bonds, water bonds
- Direct payments for ecosystem services
- Pollution offsets or water quality trading
- Voluntary carbon offsets

Investment by private and other non-government sources should follow these general principles:

- Be sensitive to market conditions: companies that benefit from the great lakes, or that impact the great lakes, should make bigger investments in protecting the lakes when their revenues are highest;
- Externalized costs: those companies that profit from activities or products that contribute to pollution should address the gap between the market price and the environmental impact of their activities.
- Cost-effectiveness: a cost-benefit analysis can demonstrate the value of specific investments over others.

Delivering and financing Action Plan 2030 will take a collaborative approach. While the Federal Government needs to take a leadership role in protecting these globally significant, binationally-managed waterways, provincial, municipal and private interests must step up to the challenge and match the federal foundational investment.

CONCLUSIONS



Protecting a system of water and a region as vast and as valuable as the Great Lakes requires an ambitious plan, new and innovative approaches using new tools and data, mobilization of many individuals, businesses, communities, and organizations on the ground, and significant, sustained investment.

This Action Plan proposes 15 key actions to protect the Great Lakes and those who live in the region, in order to:

- Protect Great Lakes shoreline communities that are most vulnerable to high water levels and prepare them to be 'climate resilient and climate ready';
- Act more quickly to prevent and reduce environmental and human exposure to harmful chemicals in the great lakes region;
- Accelerate actions to reduce agricultural and urban nutrient runoff in priority areas that cause harmful algal blooms to improve the health of our waters, and
- Ensure that all Great Lakes beaches are clean and protect public health.

Implementing these 15 key actions requires an investment of between \$2-3 billion. A foundational investments of \$100 million a year over ten years by the Federal Government will serve as leverage for further investment by provincial and municipal government, and private and non-governmental interests.

Protecting and restoring the Great Lakes provides immediate and long-term benefits to all Canadians. It is time for all levels of government to show leadership by committing to the necessary investments and by delivering on this innovative and bold action plan.

APPENDIX 1

Members of the Expert Panel

Gord Miller, Co-Chair; former Environmental Commissioner of Ontario

Jean Cinq-Mars, Co-Chair; Québec's former Sustainable Development Commissioner

Regional Deputy Grand Council Chief Edward Wawia, Anishinabek Nation

Mayor Walter Sendzik, City of St. Catharines

Denis Lapointe, Former Mayor of the City of Salaberry-de-Valleyfield; Co-Chair, Table de Concertation Montreal

Hélène Lauzon, President, Conseil Patronal de l'environnement du Québec (CPEQ) (Québec Business Council on the Environment)

Theresa McClenaghan, Executive Director and Counsel, Canadian Environmental Law Association (CELA)

Denise Cloutier, Executive Director, Centre d'interprétation de l'eau (C.I. EAU) (Water Interpretation Centre)

Dr. Robert Slater, Professor, Environmental Policy, Carleton University

Dr. Ariane Plourde, Director, Institut des sciences de la mer de Rimouski (ISMER), Université du Québec à Rimouski (UQAR)

Members of the Steering Committee

Mark Fisher, President and CEO, Council of the Great Lakes Region

Tony Maas, Manager of Strategy, Freshwater Future Canada

John Dickert, President and CEO, Great Lakes and St. Lawrence Cities Initiative

Sarah Rang, Deputy Director, Great Lakes and St. Lawrence Cities Initiative

Scott McKay, Québec Manager, Great Lakes and St. Lawrence Cities Initiative

Bob Lambe, Executive Secretary, Great Lakes Fishery Commission

Marc Gaden, Legislative and Communications Director, Great Lakes Fishery Commission

Jacques Durocher, Chairman, Stratégies Saint-Laurent

Issue Table Co-Chairs

Climate Change

Al Douglas, Executive Director, Climate Risk Institute; former Director, Ontario Centre for Climate Impacts and Resources (OCCIR)

Ewa Jackson, Managing Director, International Council on Local Environmental Initiatives (ICLEI) Canada

Toxics and Other Harmful Pollutants

Dr. John Carey, former Director General, National Water Research Institute, Environment Canada

Helen Doyle, Chair of Ontario Public Health Association's Environmental Health Work Group, recently retired from York Region Public Health

Nutrients

Dale Cowan, Senior Agronomist and Sales Manager, AGRIS and Wanstead Cooperatives

Gayle Wood, Interim Chief Administrative Officer and Secretary-Treasurer, Niagara Peninsula Conservation Authority


Beaches and Bacteriological Contamination

Sandra Cooper, Former Mayor of Collingwood; Immediate Past Chair, Great Lakes and St. Lawrence Cities Initiative

Bernard Mayer, Safe Water Program Manager, Haliburton Kawartha Pine Ridge Public Health Department

For full list of issue table members, [click here](#).





Nine months ago, we were tasked by the Minister of Environment and Climate Change, the Honourable Catherine McKenna, to give her and her provincial counterparts advice on new and innovative approaches to tackle four of the most compelling and complex problems facing one of the largest systems of fresh water in the world, the Great Lakes and the St. Lawrence.