Thames – Sydenham and Region Source Protection Committee

Meeting Notice

Please be advised that a meeting of the Thames-Sydenham and Region Source Protection Committee has been called for the following time. Please confirm attendance with Deb Kirk by email at kirkd@thamesriver.on.ca

Meeting Date: November 5, 2021

Meeting Time: 10:00 am 12:00 p.m.

Meeting Location: **Zoom Virtual Meeting - Meeting ID:** 848 3937 8565
Passcode: 980196

Proposed Agenda

1	**Chair's Welcome, Roll Call and Certification of Quorum** **Acknowledgement of the loss of Darlene Whitecalf, Introduction to Julie Welker, SP Coordinator, the new St. Clair Conservation Authority GM and other new SPC members**	10:00-10:15
2	**Adoption of the Agenda**	
3	**Approval of March 26, 2021 SPC minutes**	
4	**Delegations** *(none scheduled)*	
5	**Declaration of Conflict of Interest**	
6	**Business arising from the minutes**	
7	**Business**	
7a	Chair's Meeting Update	10:15-10:20
7b	Presentation- Stantec	10:20-10:50
7c	Presentation- Section 48- Julie Welker	10:50-11:00
7d	SP Road Signs, Song, Webinar Series-Julie Welker	11:00-11:10
8	**Information-** 8i. Article: Ancient groundwater Why the water you're drinking may be thousands of years old 8.ii. Article: Wheatley explosion 8.iii. Article: Nunavut government to fly 80,000 litres of water to Iqualuit to address citywide crisis 8.iv Presentation slides: Phosphorus & Algal Blooms 8.v Presentation slides: Overview of Per-and Polyfluoroalky Substances	11:10-11:30
9	**In Camera Session** (not planned)	
10	**Other Business**	
11	**MECP Liaison report**	11:30-11:40
12	**Members Reports**	11:40-12:00
13	**Adjournment & Next Meeting**	12:00

SPC MEETING MINUTES
MARCH 26, 2021
Meeting #77

The Source Protection Committee Chair, Dean Edwardson called the meeting to order at 10:00 a.m. on March 26, 2021 via ZOOM. The following members and staff were in attendance;

Members

Dean Edwardson
Brent Clutterbuck
Cassandra Banting
Gary Eagleson
Carl Kennes
George Marr
Gary Martin
Earl Morwood
Christa Sawyer
John Van Dorp
Darlene Whitecalf
Joe Salter (Liaison)
Olga Yudina, MECP

Regrets:

Hugh Moran
Andrew Powell (HU Liaison)
Nich Seebach
Pat Feryn

Staff:

Jenna Allain
Deb Kirk
Steve Clark
Linda Nicks
Katie Ebel
Jason Wintermute
Mark Peacock
Donna Blue
Brian McDougall

1) Chair's Welcome

Dean Edwardson welcomed the committee. After the roll call, he acknowledged a quorum was not achieved. An email will be circulated to all the SPC members to finalize the motion on the Annual reporting recommendation.

2) Adoption of the Agenda

The agenda was approved.

Moved by George Marr-seconded by Gary Eagleson

"RESOLVED that the March 26, 2021 agenda be approved."

CARRIED.

3) Approval of October 30, 2020 SPC minutes

A motion for the approval of the October 30, 2020 minutes was not completed due to not having quorum. One correction was noted of a typo under 7.d.

4) Delegations

None.

5) Declaration of Conflict of Interest

No conflict of interest was identified.

6) Business Arising from the minutes

None.

7) Business

a) Chairs Meeting /Update

Chair Edwardson gave a presentation to the SPC Chairs meeting on February 24, 2021 titled "*Perspectives of the Southwest*". The presentation provided an overview and update of SP planning for the southwest region to include: Ausable-Bayfield Maitland Valley Region, Essex Region, Saugeen, Grey Sauble Region, Lake Erie Region and the Thames-Sydenham Region. He outlined the characterization of each area, reviewed the accomplishments, gaps or concerns, why the Clean Water act is successful and steps moving forward. The presentation was circulated to the SPC members.

b) TSR Annual Report Program Update

7bi) Staff Report

Jenna Allain gave an update and reviewed the TSR annual progress report. This report outlines the progress made in implementing policies that protect surface water and groundwater municipal drinking water sources in the region.

An online "*Electronic Annual Reporting* (EAR)" tool was used by staff to analyze the information from implementing bodies, Municipalities, provincial ministries and Risk Management Officials. Once the SPAs approve the report will be forwarded to the Ministry of the Environment, Conservation and Parks (MECP) by May 1. Katie Ebel, Source Protection Policy and Risk Management Advisor at UTRCA, was acknowledged for her valuable data analytics work that helped organize the information.

The report outlines that the TSR is progressing well and is on target –with the majority of the Source Protection Plan policies have been implemented and/or are progressing well.

December 31st, 2020 marked five years since our Source Protection Plan first took effect. Currently, 80% of the policies in the plan that address significant drinking water threats have been fully implemented, and 20% are progressing well. 2020 was a difficult year due to the COVID-19 pandemic, Risk Management Officials and Inspectors throughout the region halted all site visits for most of the spring of 2020, with mostly outdoor only visits resuming over the summer.

Municipalities planning and building decisions need to conform with the Thames-Sydenham and their Official Plan must conform with the SPP upon the next Planning Act review. Half of the municipalities in the TSR that have an official plan (9 of 18) have completed their required Official Plan conformity exercises. Of the remaining 9 municipalities, 8 are in the process of amending their Official Plan, and one has not yet started. Oxford County reported their zoning by-laws were ready to go but in person public consultation could not occur due to covid and has been postponed. Other municipalities have commented that they are in the process of system changes such as decommissioning wells in Chatham-Kent and are waiting for the SPP changes to be finalized before updating their OPs.

Under item #3 Septic systems: For ground water systems where the vulnerability score of 10, (primarily 100 meters around the well) or in a WHPA-A or WHPA-B with a 2 year time of travel septic systems require mandatory inspections every 5 years, under the Building Code. The TSR has a corresponding policy that municipalities are required to do this and it should have been completed in 2017-2018. Oxford County is on a different time table as they relate to *Issues Contributing Area* which was assessed at a later date. Most of the first inspections were completed and the municipalities are gearing up to do second inspections this year or in 2022. Cassandra Banting noted the responsibility has shifted in Oxford County to the municipalities to complete septic inspections rather the Health Unit. They hope to complete inspections this year; Covid halted this work in 2020.

Under item #4 Risk Management Plans: Risk Management Officials and Inspectors throughout the Thames-Sydenham and Region reported that 2020 was a challenging year to try and engage people to negotiate risk management plans due to the COVID-19 pandemic. There are 18 municipalities who have areas were risk management plan policies apply. In 10 of those 18 municipalities, 100% of the expected risk management plans have already been agreed to or established. Although site visits were limited in 2020, Risk Management Officials and Inspectors still carried out 86 inspections to investigate activities that could either be prohibited or require a risk management plan.

Under item # Road Signs: New, provincial standard road signs mark locations where well-used roads cross into zones where municipal drinking water sources are the most vulnerable to contamination. A question was asked about the actual number of road signs being erected as there was miss-reporting. A total estimated

163 Drinking Water Protection Zone signs have been installed on roadways in the Thames-Sydenham Source Protection Region.

Under #7. Source Protection Plan Policies: Summary of Delays. Incentive programs are not being considered by most organizations in the Thames- Sydenham Region as suggested by Policy 1.04 of the Source Protection Plan. Discretionary Septic System Maintenance Inspections programs targeting moderate and low septic system threats have not yet been considered by municipalities. Policy 3.01 Discretionary inspections are recommended, and as above, it should be noted that this is a non-legally binding policy. Municipalities have been focusing on the mandatory septic inspections as required for septic systems that pose a significant threat to drinking water. More consideration will be given to discretionary inspections once the mandatory inspections are complete.

Under #8. Source Water Quality: Monitoring and Actions: There are issues in the Assessment Report that continue to be monitored.

- Microcystin at the Wheatley and Chatham/South Kent Surface Water Intakes Harmful algal blooms of blue-green algae have been increasing in size and severity in recent years in the western basin of Lake Erie. The Conservation Authorities of the Thames-Sydenham and Region have and will continue to work with senior levels of government and other partners to implement relevant actions to reduce phosphorous in our region and consider all available data for the Wheatley and Chatham/South Kent intakes to determine whether microcystin-LR continues to be an issue for these water treatment plants.
- Nitrates at the Wallaceburg Surface Water Intake. Monitoring that was done was inconclusive and did not yield enough information to confirm the issue and delineate an *Issue Contributing Area*. Water treatment plant staff and managers for the Wallaceburg intake indicated that they no longer had any significant concerns regarding nitrate concentrations at the intake
- Nitrogen at the Woodstock Well System. Nitrate occurs in the Thornton wellfield and Tabor wellfield of the Woodstock Drinking Water. Oxford County indicated that there currently was not enough information available to determine changes to the concentration or trend of nitrates in either the Thornton or Tabor wellfields. The County will complete a review of the Thornton nitrate levels to determine whether the delineation of an Issue Contributing Area (ICA) is warranted.

7bii) TSR –was circulated**.**
7biii) TSR Implementation Status Summary- detailed report was included in the package to the committee
7iv) 2020 Supplemental Form- was included in the package.

Recommendation

That the Source Protection Committee approves the SPC comments on the annual report as drafted and direct staff to submit those comments to the Source Protection Authorities for inclusion in the Thames-Sydenham and Region Annual Progress Report submission.

Moved by –Carl Kennes seconded by George Marr

"RESOLVED that the SPC direct TSR staff to submit the comments to the Source Protection Authorities for inclusion in the Thames-Sydenham and Region Annual Progress Report Submission."

CARRIED.

c) Significant Threats vs. Environmental Issues in Vulnerable areas

Several environmental concerns have been brought forward over the past few years and although they may be located within vulnerable areas, they are NOT identified as significant drinking water threats, and are not addressed through SPP regulatory policies. Jenna Allain provided a review of Drinking water threat identification, where TSR SPP policies apply, a review environmental issues/concerns that have been brought forward such as wind turbines, NASM storage, septic systems, salt storage, geothermal wells, and transport pathways.

Discussion:

- Wind turbines- Proposed wind turbines in the Wallaceburg area were brought forward as a concern to the SPC in 2018. Wind turbines were not one of the 22 drinking water threats so it was out of the scope of the SPC mandate to act and the turbines were not in a significant threat or vulnerable area. When there was a change in government, the province cancelled the planned wind farm. There had been a municipal council resolution prior to the cancelation to look at the turbines impacts on a cluster of private wells for inclusion in the Source Protection program.

  The question was asked whether the SPC should take preemptive look at extending our mandate to include any risk that can create an issue. This can only be done in significant threat or vulnerable areas. This issue is being reviewed by the Ministry and there are still uncertainties how it can tie into the Source Protection program.

- NASM storage a new product, largely in Lambton County has resulted in concerns by the public. The storage areas are in not any in vulnerable areas at this time and to date is only *temporary* storage. This is being monitored by Steve Clark, the RMO, and he will continue to update the committee. Special policy areas can be identified and dealt with using municipal tools.

- Septics Outside of significant threat areas. Concerns have been raised about failing or flooded septic systems particularly for lakeshore properties. Many of the areas with known septic system problems are located outside of significant threat areas. One area with known issue of flooded septic systems that is located in a significant threat area is Lighthouse Cove in the Municipality of Lakeshore. However, septic systems are not a significant drinking water threat in IPZ's unless the vulnerability score is 10. Policy 3.01 recommends municipalities undertake discretionary monitoring of septic systems that are moderate or low threats. No municipalities in the TSR have done any discretionary monitoring.

- Dorchester Subdivision a new subdivision being developed within the WHPA in Dorchester was noted. The location of the subdivision is in an area that has a vulnerability score of 10 with no significant threats associated with this development except for the sanitary sewers. Variables could change the risk such as a gas tank in a house although this is not an issue in our area. Sewers are managed by prescribed instrument though the province.

- Salt Storage in Mitchell A small amount of salt storage associated with a commercial property inside the WHPA in Mitchell has recently grown to a large amount of storage. Katie Ebel, RMO identified concerns over growing storage. Salt storage is only a significant threat in a WHPA with a vulnerability score of 10. The property is located just outside the area that scores 10 and is therefore not

a significant threat and SPP policies do not apply. Salt is being packaged and sent to retail stores. The question was asked of whether chloride levels been checked and they have and the municipality has been contacted. A RMP cannot be done at this point but we will work with them to use Best Management Practices.

- Geothermal Wells. A few municipalities have contacted staff to ask whether our SPP policies prohibit geothermal wells in WHPAs. THEY DO NOT (geothermal wells are not one of the 2 threats). HOWEVER, they are a potential transport pathway. Municipalities are required to report transport pathways to the SPA's who will review whether the proposed pathway could affect vulnerability. Policy 4.05 encourages municipalities to develop by-laws to restrict private wells and septic systems in areas where significant threats can occur. Some of our municipalities are developing these bylaws.

The recent float glass plant in Stratford was noted. Information was requested for water quantity work from this region from the Tier 3 water budget. The Stratford well was reported to be in permitted capacity to handle it. Council had approved the development but backlash from the community resulted in the company pulling out.

It is uncertain and there is not a clear route to deal with pre-cautionary issues. At this time only discretionary tools only Best Management Practices and Education & Outreach can be used and ongoing monitoring.

d) SPC Membership Presentation

Jenna Allain gave a presentation on the current SPC membership terms and expiry dates. TSR SPC Members are appointed for 4 year terms. Members appointed in 2018 have a term that expires in June 2021 (7 members). Members appointed in 2019 have a term that expires in June 2023 (8 members). Existing SPC members that wish to stay on the committee are encouraged to seek reappointment. Regulation 288/07 requires Source Protection Authorities to advertise expiring SPC memberships by posting an ad on the internet. Any applications received will be reviewed and interviews will be conducted by the Striking Committee (consisting of Chairs of each of the 3 SPAs).

For municipal representatives each expiring municipal representative, the municipalities for which they represent will be consulted. If only one representative is nominated by all municipalities within a municipal grouping, that nominee will be appointed by the Striking Committee. If more than one is nominated an interview will take place.

Committee member position notices will be advertised on the Conservation Authority and Source Water websites and municipalities will be consulted in April.

8) Information

The items listed below were provided to the committee as a FYI:

a) Florida Water Supply Hack. Jenna noted the recent news reports on an incident where hackers gained access to a water treatment plant and tried to poison the water supply.

b) Update on First Nation long-term drinking water advisories. A news article was circulated in the members package by Indigenous Services Canada on Mar 10, 2021, titled "*In partnership with First Nations, more than 100 long-term drinking water advisories have now been lifted since 2015*".

9) In Camera Session

None.

10) Other Business

None.

11) MOECP Liaison Report

Olga Yudina, the MECP Liaison provided an update. The MECP is currently reviewing proposed amendments to the Director Technical rules. The changes were posted on the EBR for a 90 days period which closed November 9, 2020. There were 360 comments received with a majority of them technical in nature and some general ones about the program. All comments will be taken into consideration.

The CAs Act finalized changes were passed in December 2020 with a goal of ensuring more consistency and transparency across the CAs and to highlight the CAs core mandated programs and services which is defined into several categories including Natural hazards, Conservation and Management of CA owned lands and the roles of the CAs in their capacity of Source Protection Authorities, under the CWA. The proposed regulations to support the CA amendments are being worked on and will include details on the mandatory programs and services that CAs will be required to provide, how to transition to a new funding model with new requirements for agreements with municipalities for delivery of non-mandatory programs and how local members of the community can participate in their CAs through advisory boards.

The province has created a new working group consisting of representatives from CAs, Conservation Ontario, Association Municipalities Ontario, MNRF and MECP. The intent of the group is to provide input to the government regarding the proposed regulations and it will be

posted on EBR soon. The CA changes do not impact to Source Water Program, as SPAs under the CWA. Transfer payment agreements are being worked on for the next fiscal 2021/2022 year.

A guidance document is being created by the ministry for non-municipal drinking water systems to give people tools from existing information to use best management practices to manage risk and protect water. MECP consulted with SPAs and municipalities to review the guidance. 7 municipalities reviewed the document and feedback has been received and being reviewed with the hope of having it released in the spring.

The question was asked about whether CA funding in general has been reduced? Brian McDougall reported a 50% reduction in funding from the province under natural hazards, to include flood control, erosion control.

12) Members Report

No reports were given by members.

13) Adjournment

There being no further business, the meeting was adjourned **at 12:20 p.m.**.

Moved by Brent Clutterbuck-seconded by George Marr

"RESOLVED that the meeting be adjourned."

CARRIED.

PLEASE NOTE: The next SPC meeting will be scheduled in June.

Regulation Under the *Safe Drinking Water Act*

SPC Meeting – Friday, November 5, 2021

www.sourcewaterprotection.on.ca

Regulation 205/18

- Proposal presented and discussed at March 23rd, 2018 SPC meeting.

- A new regulation under the *Safe Drinking Water Act*, took effect July 1, 2018. This regulation applies in source protection areas identified under the *Clean Water Act*

New SDWA Regulation 205/18

- Intended to ensure sources of drinking water for new or expanding drinking water systems are protected before providing water to the public.

- Municipalities (or system owners) are required to ensure work necessary under the Clean Water Act to delineate and score vulnerable areas is completed before they can apply for a drinking water works permit.

- Important to engage SPAs early

New SDWA Regulation 205/18

- Drinking water system owner submits written confirmation notice that the SPA has, and is satisfied with, vulnerable area mapping necessary to initiate plan amendment, *with drinking water works permit application*.

- Director includes a condition in the permit that the new or altered well or intake will not supply drinking water to the users of the system until the amended source protection plan has been approved.

- Regulation includes an exemption provision for emergency situations.

New SDWA Regulation 205/18

The New Regulation applies where:

- a new municipal residential drinking water system is being located within a source protection area, or
- changes are being made to an existing municipal residential drinking water system located in a source protection area that results in:
  - the establishment of a new groundwater well
  - deepening an existing well
  - increasing the capacity at an existing well
  - the establishment of a new surface water intake
  - moving an existing intake

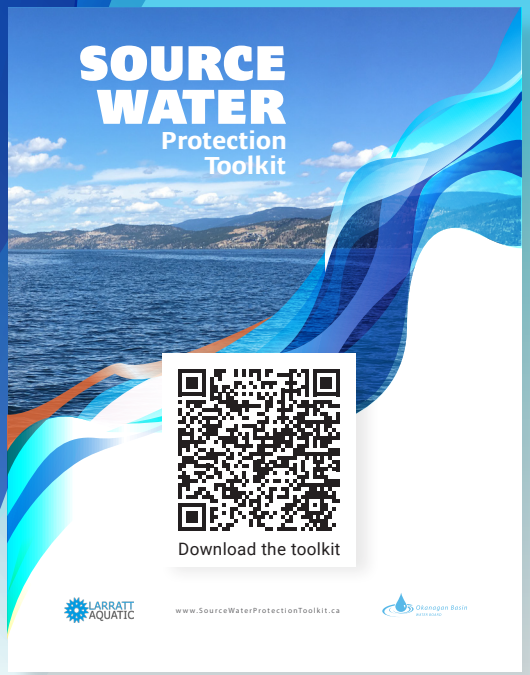
The Notice – CWA Regulation 287/07

- Section 48 of O.Reg. 287/07 under the CWA was amended to include the requirements for the 'notice' referred to in the new Safe Drinking Water Act Regulation.
- Owner of the drinking water system notifies SPA of their intention to make an application for a drinking water works permit and requests SPA to provide written confirmation that the mapping/scoring of vulnerable areas is complete.
- The notice from the SPA will:
  - Include a statement that they are satisfied with the vulnerable area work;
  - Identify the amendments required to the plan as a result;
  - Indicate when the SPA will be proposing amendments;
  - Identify whether the amendments have already been made.

Reg. 205/18 and The Notice

- Since this new regulation came into effect, UT SPA has written two notices:
  - Thamesford
  - Ridgetown

SOURCE WATER PROTECTION WEBINAR SERIES



WEBINAR SERIES

Oct. 20	Source water protection steps and tools
Oct. 27	Shared challenges, shared opportunities: transcending jurisdiction through partnerships
Nov. 3	Working together to protect water: learning from Indigenous-led projects
Nov. 10	Increasing awareness and stewardship of watersheds and drinking water resources
Nov. 17	Advancing local government policies and regulations to protect water sources
Nov. 24	Securing long-term funding for source water protection
Dec. 1	Protecting and restoring watersheds and aquifers to improve water quality
Dec. 8	Using mapping to understand and manage risks to drinking water
Dec. 15	Monitoring and reporting for source water protection

TOOLS

- COLLABORATION
- FUNDING
- POLICIES, PLANS, AND BYLAWS
- EDUCATION AND ENGAGEMENT
- NATURAL ASSETS AND GREEN INFRASTRUCTURE
- EMERGENCY PREPAREDNESS AND RESPONSE
- MAPPING
- MONITORING AND REPORTING

OVERVIEW

Join us every Wednesday for an interactive webinar series featuring OBWB's newly published Source Water Protection Toolkit. This resource was specially designed to support water utilities, local and provincial government staff, elected officials, First Nations, conservation groups and water professionals who are interested in or responsible for protection of drinking water sources in B.C. and beyond. Each webinar will consist of presentations by expert panelists followed by a moderated Q&A period.

WHEN

Every Wednesday
October 20 to December 15, 2021
11 am to 12 pm PST

REGISTER HERE

For more details, contact Kasey at k.moran@alumni.ubc.ca

www.sourcewaterprotectiontoolkit.ca

Funding for this project was provided by the Ministry of Municipal Affairs, Interior Health Authority, City of Kelowna, City of West Kelowna and the Okanagan Basin Water Board. This project is also supported through the Healthy Watersheds Initiative, delivered by the Real Estate Foundation of BC and Watersheds BC, with financial support from the Province of British Columbia as part of its $10-billion COVID-19 response.

Okanagan Basin WATER BOARD

THE CONVERSATION
Academic rigour, journalistic flair

Some of North America's groundwater is so old, it fell as rain before humans arrived here thousands of years ago. Maria Fuchs via Getty Images

Ancient groundwater: Why the water you're drinking may be thousands of years old

October 7, 2021 8.22am EDT

Marissa Grunes
Environmental Fellow, Harvard University

Alan Seltzer
Assistant Scientist in Marine Chemistry and Geochemistry, Woods Hole Oceanographic Institution

Kevin M. Befus
Assistant Professor of Hydrogeology, University of Arkansas

Communities that rely on the Colorado River are facing a water crisis. Lake Mead, the river's largest reservoir, has fallen to levels not seen since it was created by the construction of the Hoover Dam roughly a century ago. Arizona and Nevada are facing their first-ever mandated water cuts, while water is being released from other reservoirs to keep the Colorado River's hydropower plants running.

If even the mighty Colorado and its reservoirs are not immune to the heat and drought worsened by climate change, where will the West get its water?

There's one hidden answer: underground.

As rising temperatures and drought dry up rivers and melt mountain glaciers, people are increasingly dependent on the water under their feet. Groundwater resources currently supply drinking water to nearly half the world's population and roughly 40% of water used for irrigation globally.

What many people don't realize is how old – and how vulnerable – much of that water is.

Most water stored underground has been there for decades, and much of it has sat for hundreds, thousands or even millions of years. Older groundwater tends to reside deep underground, where it is less easily affected by surface conditions such as drought and pollution.

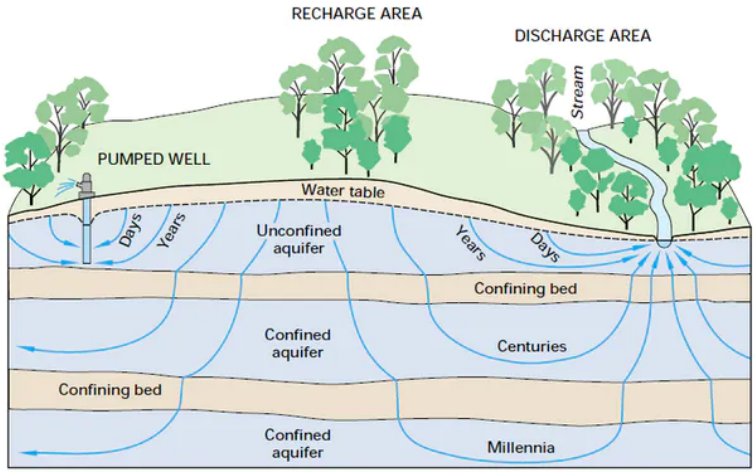
As shallower wells dry out under the pressure of urban development, population growth and climate change, old groundwater is becoming increasingly important.

Drinking ancient groundwater

If you bit into a piece of bread that was 1,000 years old, you'd probably notice.

Water that has been underground for a thousand years can taste different, too. It leaches natural chemicals from the surrounding rock, changing its mineral content. Some natural contaminants linked to groundwater age – like mood-boosting lithium – can have positive effects. Other contaminants, like iron and manganese, can be troublesome.

Older groundwater is also sometimes too salty to drink without expensive treatment. This problem can be worse near the coasts: Overpumping creates space that can draw seawater into aquifers and contaminate drinking supplies.



Flow timescales of groundwater through different layers. USGS

Ancient groundwater can take thousands of years to replenish naturally. And, as California saw during its 2011-2017 drought, natural underground storage spaces compress as they empty, so they can't refill to their previous capacity. This compaction in turn causes the land above to crack, buckle and sink.

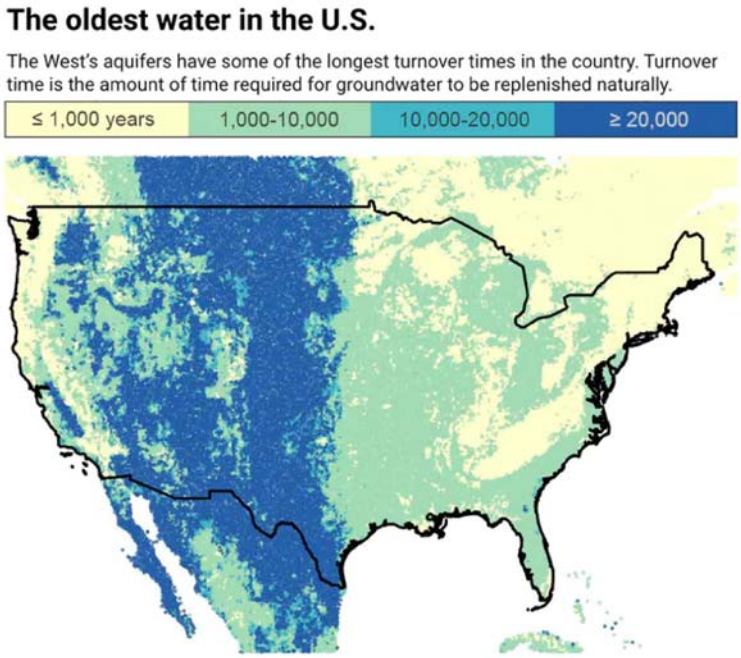
Yet people today are drilling deeper wells in the West as droughts deplete surface water and farms rely more heavily on groundwater.

What does it mean for water to be 'old'?

Let's imagine a rainstorm over central California 15,000 years ago. As the storm rolls over what's now San Francisco, most of the rain falls into the Pacific Ocean, where it will eventually evaporate back into the atmosphere. However, some rain also falls into rivers and lakes and over dry land. As that rain seeps through layers of soil, it enters slowly trickling "flowpaths" of underground water.

Some of these paths lead deeper and deeper, where water collects in crevices within the bedrock hundreds of meters underground. The water gathered in these underground reserves is in a sense cut off from the active water cycle – at least on timescales relevant to human life.

In California's arid Central Valley, much of the accessible ancient water has been pumped out of the earth, mostly for agriculture. Where the natural replenishment timescale would be on the order of millennia, agricultural seepage has partially refilled some aquifers with newer – too often polluted – water. In fact, places like Fresno now actively refill aquifers with clean water (such as treated wastewater or stormwater) in a process known as "managed aquifer recharge."



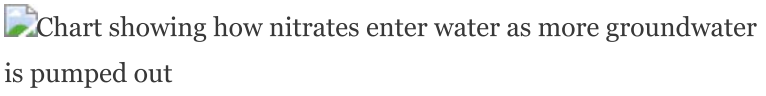
Average turnover times for groundwater in the U.S. Alan Seltzer, based on data from Befus et al 2017, CC BY-ND

In 2014, midway through their worst drought in modern memory, California became the last western state to pass a law requiring local groundwater sustainability plans. Groundwater may be resilient to heat waves and climate change, but if you use it all, you're in trouble.

One response to water demand? Drill deeper. Yet that answer isn't sustainable.

First, it's expensive: Large agricultural companies and lithium mining firms tend to be the sort of investors who can afford to drill deep enough, while small rural communities can't.

Second, once you pump ancient groundwater, aquifers need time to refill. Flowpaths may be disrupted, choking off a natural water supply to springs, wetlands and rivers. Meanwhile, the change in pressure underground can destabilize the earth, causing land to sink and even leading to earthquakes.



Pumping accelerates groundwater flow to a well, delivering dissolved chemicals. USGS

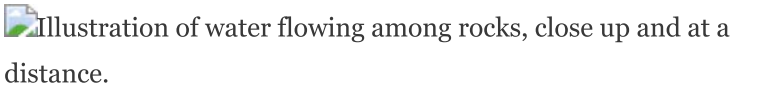
Third is contamination: While deep, mineral-rich ancient groundwater is often cleaner and safer to drink than younger, shallower groundwater, overpumping can change that. As water-strapped regions rely more heavily on deep groundwater, overpumping lowers the water table and draws down polluted modern water that can mix with the older water. This mixing causes the water quality to deteriorate, leading to demand for ever-deeper wells.

Reading climate history in ancient groundwater

There are other reasons to care about ancient groundwater. Like actual fossils, extremely old “fossil groundwater” can teach us about the past.

Envision our prehistoric rainstorm again: 15,000 years ago, the climate was quite different from today. Chemicals that dissolved in ancient groundwater are detectable today, opening windows into a past world. Certain dissolved chemicals act as clocks, telling scientists the groundwater’s age. For example, we know how fast dissolved carbon-14 and krypton-18 decay, so we can measure them to calculate when the water last interacted with air.

Younger groundwater that disappeared underground after the 1950s has a unique, man-made chemical signature: high levels of tritium from atomic bomb testing.



The various components and properties of an unconfined aquifer. USGS

Other dissolved chemicals behave like tiny thermometers. Noble gases like argon and xenon, for instance, dissolve more in cold water than in warm water, along a precisely known temperature curve. Once groundwater is isolated from air, dissolved noble gases don’t do much. As a result, they preserve information about environmental conditions at the time the water first seeped into the subsurface.

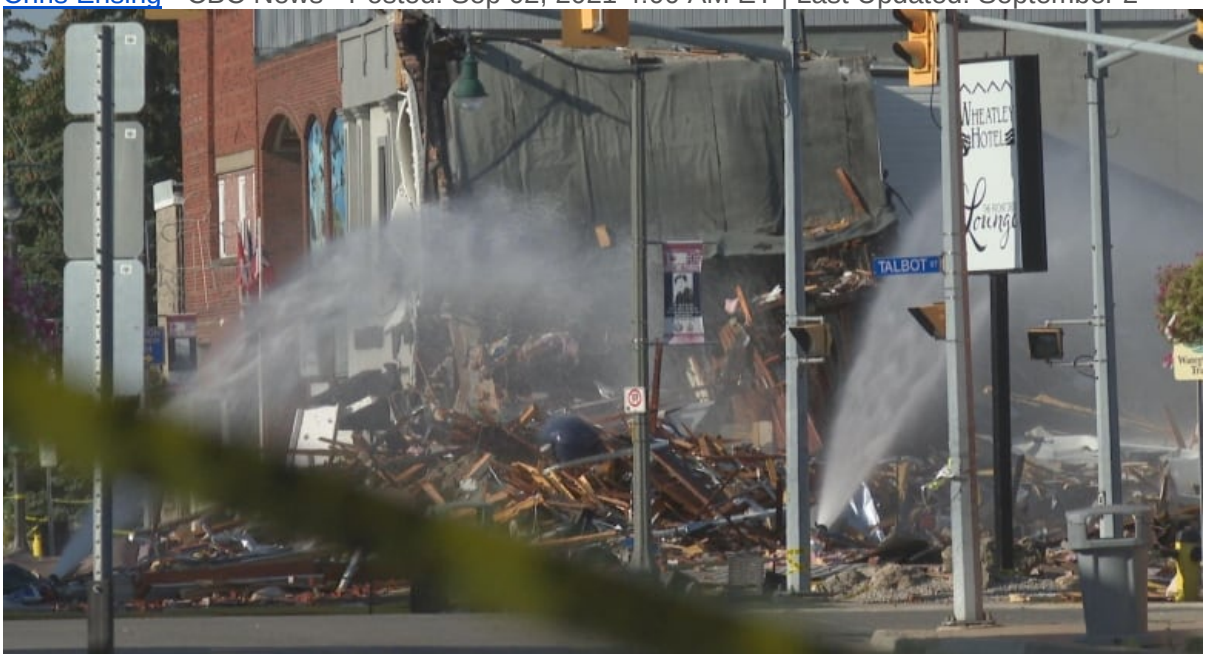
The concentrations of noble gases in fossil groundwater have provided some of our most reliable estimates of temperature on land during the last ice age. Such findings provide insight into modern climates, including how sensitive Earth’s average temperature is to carbon dioxide in the atmosphere. These methods support a recent study that found 3.4 degrees Celsius of warming with each doubling of carbon dioxide.

Groundwater’s past and future

Wheatley explosion could be 'tip of the iceberg' in Ontario given number of abandoned wells: expert

Explosion sent 7 people to hospital, reduced buildings to rubble

Chris Ensing · CBC News · Posted: Sep 02, 2021 4:00 AM ET | Last Updated: September 2



Two buildings in Wheatley, Ont., were reduced to rubble after an explosion on Aug. 26. Seven people were also sent to hospital. (Jacob Barker/CBC)

An explosion in Wheatley, Ont., believed to be caused by an abandoned gas well is the extreme example of what can happen if such wells are not properly plugged, according to an expert hydrogeologist who has researched oil and gas wells in southwestern Ontario.

"It can happen anywhere in southwestern Ontario," said Dick Jackson, an adjunct professor at the University of Waterloo, who last year gave a presentation at a national geological convention about the dangers of the province's abandoned wells.

Seven people were sent to hospital and two buildings were destroyed in Wheatley when an explosion rocked the downtown core last Thursday, just over an hour after high readings of hydrogen sulphide were recorded.

The town of 3,000, located about 65 kilometres southeast of Windsor, Ont., had experienced three previous gas leaks in the area in recent months.

Darrin Canniff told CBC News that he's hoping the Ontario government 'steps up.' 1:33

Chatham-Kent Mayor Darrin Canniff pleaded for the Ontario government to "step up" and take the lead on the investigation in the days following the explosion.

CBC has made several calls and email requests for an interview with Greg Rickford, minister of northern development, mines, natural resources and forestry. On Wednesday, his press secretary would only say in an email that, "the minister is unavailable for an interview today. I will keep you apprised of new information as it becomes available."

CBC News spoke with Jackson to get a sense of how many abandoned wells there are in the province and what kind of risk they might pose for other communities.

How many abandoned gas and oil wells are in Ontario?

"In Ontario, the province knows within 200 metres where 27,000 of these oil and gas wells are. About 3,000 are active, the other 24,000 are abandoned," said Jackson. "There are about 3,000 where we probably don't know where they are."

He found three recorded wells in Wheatley through the Oil, Gas and Salt Resources Library, which collects and publicly posts details of wells in Ontario using provincial records.

- **Ontario has thousands of abandoned gas wells. Here's where they are**

"But their location wasn't known within an area of 200 metres. Very uncertain. Clearly the town got built after these wells got built," he said.

The recorded wells include:

- An abandoned private gas well marked at Talbot Road East and Erie Street North, which records show was drilled in 1896 and plugged in 1965.
- An abandoned private gas well marked between Chestnut Street and Moor Street, which records show was drilled in 1897 and plugged in 1965.
- A private gas well marked near Little Street North and Elm Street, which does not include any details about its operating status or when it was drilled.

A fourth well sits just outside Wheatley's core:

- An abandoned natural gas well marked near Julian Street and Eastman Avenue, which records show was plugged in 2015 but there were no details on when it was drilled.

How are these wells plugged?

Anyone can access information on known wells through the Ontario Oil, Gas and Salt Resource Library.

The well that records estimate is closest to the Wheatley blast site, at Talbot Road East and Erie Street North, was plugged with cement and gravel, according to records.

Jackson said plugging practices were "very primitive" before the 1970s.

- **Framework set to find source of Wheatley explosion, but residents' return to area up in the air**

"It was a poorly understood technology. They would put tree trunks down them. Cement. Gravel. And they would pound lead in," said Jackson.

"Once we plug and abandon these wells, we figure they're not going to leak. But some of them will. No question about that."

Why are leaks so hard to find?

Jackson said the issue is twofold: eroding well casings and cement plugs create opportunities for the sites to leak, and the removal of those casings for other projects makes the sites hard to find.

"You're getting breakthrough of this deep gas coming from these depleted oil fields," said Jackson.

He said even though an oil reservoir might have been depleted through decades of pumping, it will slowly re-pressurize over time.

Finding these wells has become difficult, he said, because it was popular practice to remove the top sections of the casings in order to repurpose them for ships during the Second World War.

Dick Jackson, a hydrogeologist and adjunct professor at the University of Waterloo, said that abandoned oil and gas wells are a provincial responsibility. (Chris Ensing/CBC)
Removing the surface casing makes it extremely difficult to detect the abandoned wells.

"There's no magnetic signal that your geophysicist can hit. Then trying to re-plug them becomes horrendously expensive," said Jackson.

"The problem in a town like Wheatley is you got so much steel around the town in piping that the geophysicist isn't going to be able to figure out what's an old abandoned oil well and what's a new piece of steel piping going to a gas station."

Residents of the small town of Wheatley, Ont., are afraid a persistent gas leak might cause another explosion, a day after a huge blast destroyed part of its downtown. Locals are exasperated with the situation that has gone unsolved for months. 2:46

Where does the toxic gas come from?

The deterioration of the well casings open up pathways for methane gas trapped below the surface to mix with gypsum rock, creating the toxic and sometimes-deadly hydrogen sulphide gas.

"If you drilled 100 years ago, by now, those casings are rotted out. You're getting gas moving up from the basin," said Jackson.

Methane dissolves the gypsum, releasing sulphate, which the methane then reduces into hydrogen sulphide.

"It's like a big chemical reactor," said Jackson.

Who is responsible for these abandoned wells?

The Ministry of Natural Resources is responsible for Ontario's abandoned wells, but according to Jackson, the province is in no position to do the plugging work with speed.

"Under something called the abandoned works program, if you can satisfy the criteria of the abandoned works program and you float to the top of their hazardous criteria list, you will get your well plugged," said Jackson.

"But don't hold your breath."

Professor Dick Jackson said that the ministry of natural resources in Ontario is responsible for abandoned gas wells. 2:13

He said the ministry has a duty of care when it comes to abandoned wells in Ontario.

"They are depleted in expertise and they are depleted in funding, I believe," said Jackson, noting the most experienced people have retired in the last decade.

"I don't think the Ford government has really put a lot of money in the abandoned works program."

Jackson added, however, that funding is important because what happened in Wheatley could be the "tip of the iceberg" when it comes to issues with abandoned wells.

Costs of plugging up a well difficult to predict

Plugging abandoned wells is difficult, Jackson said, because of the toxic chemicals that can be found after years of neglect.

He recently asked a group that works in the industry for an estimate to plug an abandoned well for a project he's consulting on. "I got numbers from $30,000 to $200,000 per well.… We just don't know [the scale]," said Jackson.

Jackson said the work in Wheatley is "not going to be cheap."

"They're going to spend a million or two by the time they've found that well and essentially plugged it and figured out what they're going to do to prevent any of these other wells around Wheatley from leaking," he said.

"It's an enormous job. It's a legacy problem."

North

Nunavut government to fly 80,000 litres of water to Iqaluit to address citywide crisis, mayor says

Residents told their tap water is not safe to consume, even if boiled

CBC News · Posted: Oct 13, 2021 11:54 AM CT | Last Updated: 11 hours ago

Residents collect water from the Sylvia Grinnell River near Iqaluit Wednesday, after city staff found evidence of fuel contamination in the city's treated water supply, making it undrinkable. (Emma Tranter/The Canadian Press)

The Nunavut government is stepping in to help Iqaluit with its water emergency crisis by flying in about 80,000 litres of water over three days, said the city's mayor, Kenny Bell.

"We're grateful for that," Bell said.

Iqaluit declared a state of emergency Wednesday after city staff found evidence of fuel contamination in the Iqaluit's treated water supply.

Some residents complained last week on social media about a fuel smell in the water, but he said the water had gone through daily testing and it came back clean.

Then, on Tuesday, Bell said city staff opened a "typically sealed" tank in the water treatment plant that holds treated water before it gets distributed throughout the city.

"There was a strong smell of petroleum products," Bell said. If the water in that location is affected, he said, it would mean all of the city's water would be affected.

People in Iqaluit were buying bottled water Tuesday. A litre of water costs nearly $9, Mayor Kenny Bell said. (Matisse Harvey/Radio-Canada)

"We knew something was wrong," said Bell. "We're not 100 per cent sure if this is it but it most likely is based on the amount of smell in the tank."

The city says samples of the water have been sent to environmental laboratories out of the territory, but those results won't come back for at least five business days. CBC News has asked the Nunavut government to confirm the water-delivery plan and is awaiting a response.

In the meantime, the mayor said the city is cleaning the tank and inspecting its walls to look for cracks.

"We don't how it got there, why it's there, what it is," Bell said of the smell.

Residents were advised Tuesday the water isn't safe to consume even if boiled or filtered.

The Nunavut education department ordered schools in Iqaluit and Apex closed Wednesday, one day after an announcement that people in Iqaluit should not drink water from the tap. All territorial government buildings in the city were also to be closed for the rest of Wednesday, the territory said in a news release. They were expected to reopen Thursday at 8:30 a.m. for regular business.

WATCH | Iqaluit water not safe to consume:

Iqaluit water supply undrinkable after possible fuel contamination

13 hours ago | 2:01

Residents of Iqaluit have been told not to consume water from the taps after a possible fuel contamination at the water treatment plant, leaving people scrambling to get untreated water from the river or paying big bucks for bottled water. 2:01

With public health authorities saying the tap water wasn't safe to consume — and that pregnant women and infants should not even bathe in it — many of the city's nearly 8,000 residents were looking to find water somewhere else.

Bottled water, which can cost nearly $9 for a litre in Iqaluit, flew off the shelves Wednesday.

"Water cost money when you buy it from the store," said Iqaluit resident Johnny Mark, who was among those looking to buy clean water Wednesday. "All my life water has been free and we have never had this problem so this is something new to me."

Mano Faubert was waiting for city of Iqaluit water trucks to come back from the river Wednesday afternoon. The trucks were part of an city effort to provide alternatives to tap water.

"I'm tired and thinking about all of those elders or people who have mobility issues that cannot be here," Faubert said. "What will happen to these people?"

In Iqaluit, like all of Nunavut's communities, bottled water already sells at a high cost.

For example, a 40-pack of 500-millilitre bottles at Northmart typically sells for $48.79 before tax, while a 24-pack is $27.99.

"It is extremely expensive, everything is extremely expensive here," Bell said.

He said people in immediate need of water who couldn't afford to buy it, could contact the city, which would get it to them as soon as possible.

"We want to make sure we're delivering water to two locations in town and delivering to elders and people with needs," he said. But capacity was tight, he said.

"Right now, we're in limbo because there is not enough jugs to fill with water to give to people."

Bell said he was eagerly awaiting water-testing results.

"We are at the mercy of the lab in the south and the flight schedule," Bell said.

Ongoing water troubles

Bell said officials were working on a way to bypass the water tank that is believed to be the problem, in effort to restore some water to homes soon — though even then, it could need to be boiled.

The city has set up filling stations and it said it is working on other ways to provide clean water.

The federal NDP said Wednesday afternoon that it reached out to Bell to "offer help to find an urgent solution.

"Clean drinking water is a right and no community in Canada should go without it," the party said in a statement, on behalf of Nunavut MP Lori Idlout and Leader Jagmeet Singh. "Our thoughts are with Inuit and Nunavummiut in the face of this water crisis. All communities deserve access to clean drinking water."

City water trucks work by the Sylvia Grinnell River in an effort to provide alternatives to the tap water. (Emma Tranter/The Canadian Press)

Residents have been complaining about a diesel smell for the last week and half now. The City of Iqaluit and the Government of Nunavut had done multiple tests on multiple locations around Iqaluit, but, they were coming back clean.

The city then sent a new test to a lab in Ottawa and found some microbodies in it. Bell said that's when the city advised residents not to drink the water.

"They found one of our wells at our well treatment centre that, when they opened it there was a strong smell of petroleum, so we of course have serious concerns and that's why we put out the order to not consume," he said.

Beyond specific problem, Bell said the city has been in a water crisis for the last five years.

- **Iqaluit pitches $64M water reservoir to keep taps running**
- **Iqaluit has been going over its daily water use target by about 300,000 litres**

"We're going to be asking the government of Canada for a lot of money here soon," he said.

"Hopefully they're listening and paying attention to what's going on."

With files from Jackie McKay, CBC News Network and The Canadian Press

Ministry of the Environment, Conservation and Parks

Phosphorus and Algal Blooms

Source Protection Chair's Meeting

Sept 14, 2021

Ontario

Objectives of presentation

1. Phosphorus in surface waters
2. Algal blooms and influencing factors
3. Phosphorus and algae status and trends
    - Great Lakes
    - Inland waterbodies
4. Policy initiatives and actions to mitigate phosphorus impacts
    - Great Lakes
    - Inland waterbodies
5. Future actions

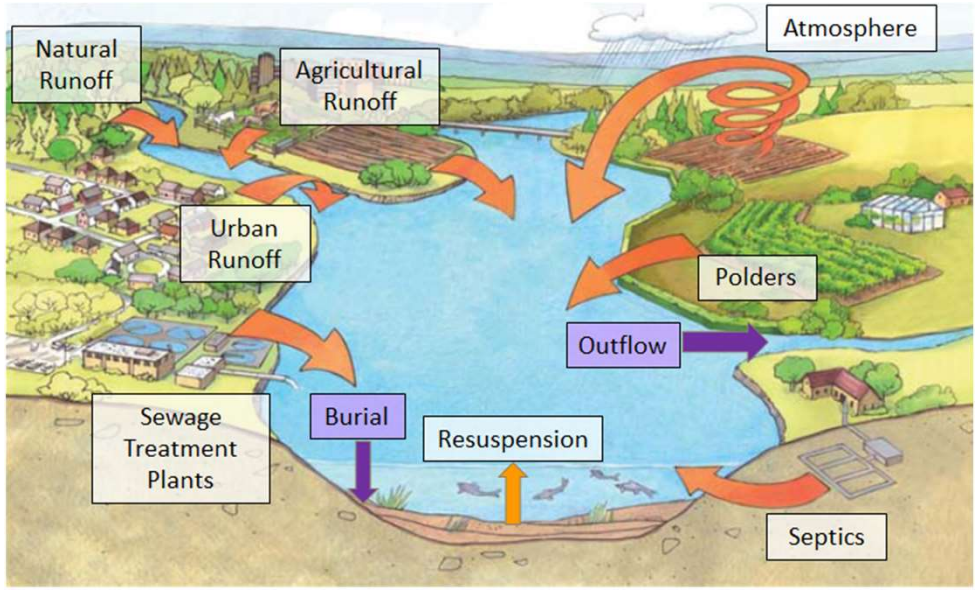
Phosphorus in Ontario's surface water

Phosphorus

- Occurs naturally and is **essential** for plant and animal life.
- Phosphorus is the primary nutrient that promotes growth of algae in freshwater

- Inputs to lakes and rivers are increased by human activities.
- Comes from point (e.g., sewage treatment plants) and non-point sources (e.g., agricultural and urban run-off)
- The link between the loads of phosphorus entering a lake and concentrations in a lake is increasingly complex.

Phosphorus balance = input (loads) - output



Ontario

What are algal blooms and are they a problem?

- Algae are an essential component of a healthy aquatic food web.
- Conditions supporting excessive growth of algae can result in a "bloom".
- Algal blooms do occur naturally, but environmental stressors such as excess phosphorus, climate change and invasive species are contributing to increased algal blooms.

When are algal blooms a cause for concern?

Nuisance blooms (e.g., *Cladophora*) – clogging of water intakes and taste/odour issues in drinking water, fouling of beaches, and impact on fish habitat.

Harmful blooms – blue-green algae blooms (also called cyanobacteria) can sometimes produce poisons called “cyanotoxins” that cause skin and eye irritation and if ingested in large quantities can cause flu-like symptoms and are potentially toxic to humans, wildlife, livestock and pets.

Ontario

Factors influencing algal blooms

Reducing excess phosphorus is a necessary step to improving the health of an over-enriched ecosystem, but it is not the only factor that influences algal growth.

Weather, light availability and water depth are important. Nuisance and harmful bloom formation is more likely in calm, hot, sunny weather and shallow water when adequate nutrients are available.

- **Possible scenarios with climate change:**
  - More algal blooms anticipated due to **higher temperatures** and **accompanying effects**, such as less lake mixing, less ice-cover, and longer growing period.
  - More severe storms expected to increase phosphorus inputs from non-point sources.
- **Invasive species** have drastically changed phosphorus cycling in lakes.
  - Invasive zebra and quagga mussels established in the Great Lakes in the mid-1990s and have spread to many inland waterbodies.
  - The effects of invasive species on harmful blooms are still unclear.

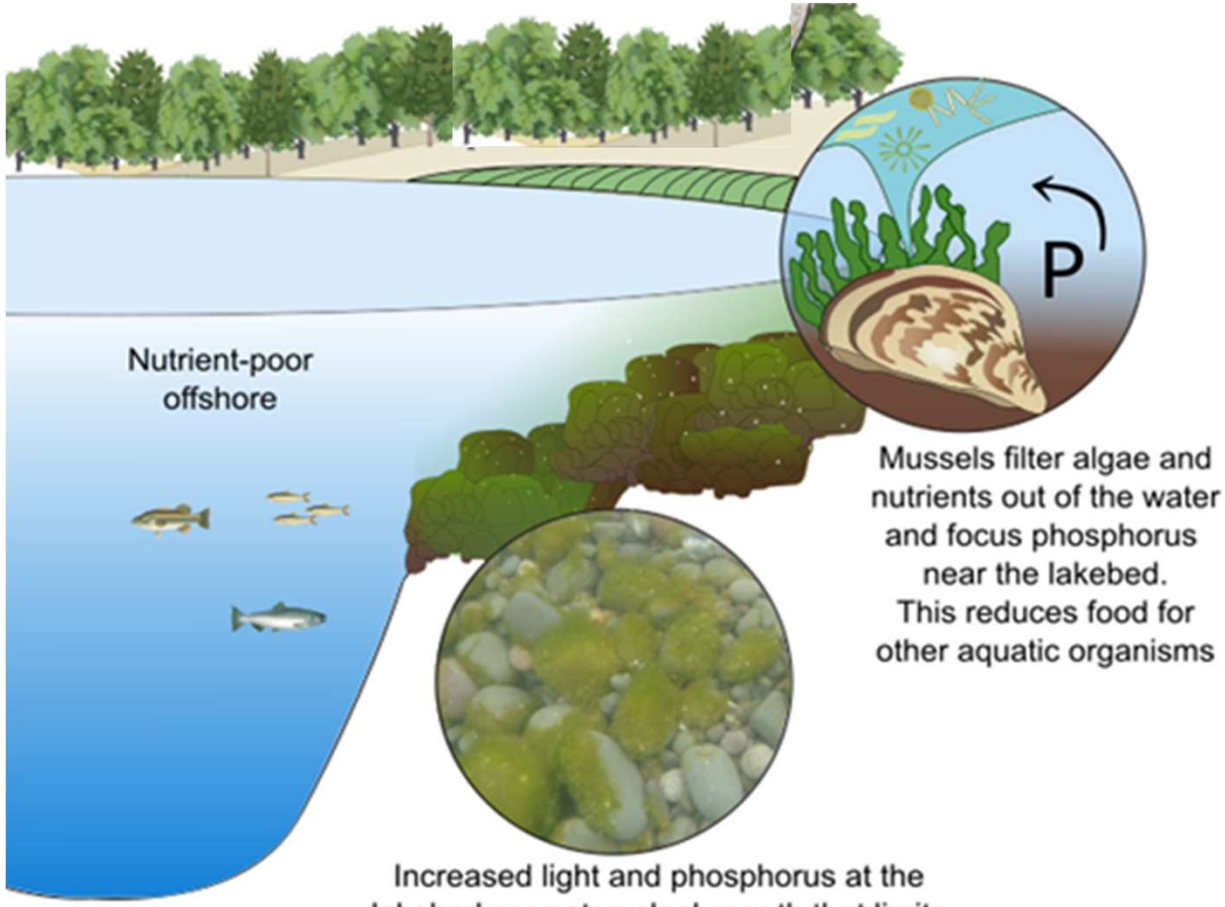

Dreissenid mussels


Starry Stonewort

Ontario

Dreissenids alter phosphorus cycling and algae

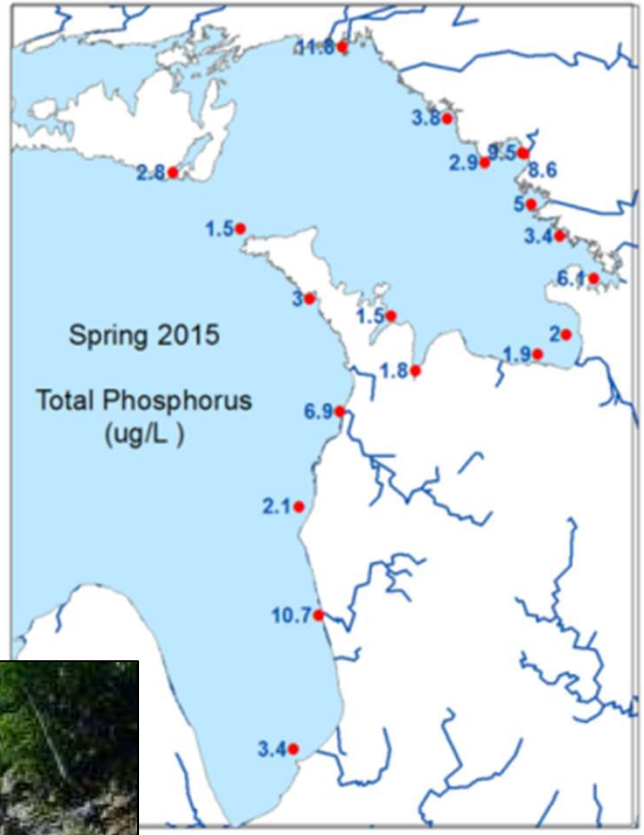
Invasive Dreissenid mussels have altered nutrient cycling by removing phosphorus from the water column and moving it to lakebed



Ontario

Issue: Phosphorus and nuisance algae

Cladophora mats



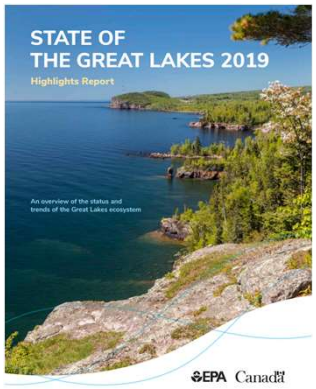
Lake Huron – very low phosphorus, undergoing "desertification"

Issue: Phosphorus and harmful algal blooms

Cyanobacteria
(blue-green algae) blooms

Great Lake 'hotspots'

Trends in phosphorus and algae - Great Lakes



State of the Great Lakes 2019 reported an overview of the status and trends in the Great Lakes ecosystem

Sub-Indicators Supporting the Indicator Assessment					
Sub-Indicator	Lake Superior	Lake Michigan	Lake Huron	Lake Erie	Lake Ontario
Nutrients in Lakes	Unchanging	Deteriorating	Deteriorating	Unchanging	Deteriorating
Harmful Algal Blooms	Undetermined	Undetermined	Undetermined	Deteriorating	Deteriorating
Cladophora	Unchanging	Unchanging	Undetermined	Unchanging	Undetermined

STATUS

Good | Fair | Poor | Undetermined

Ontario

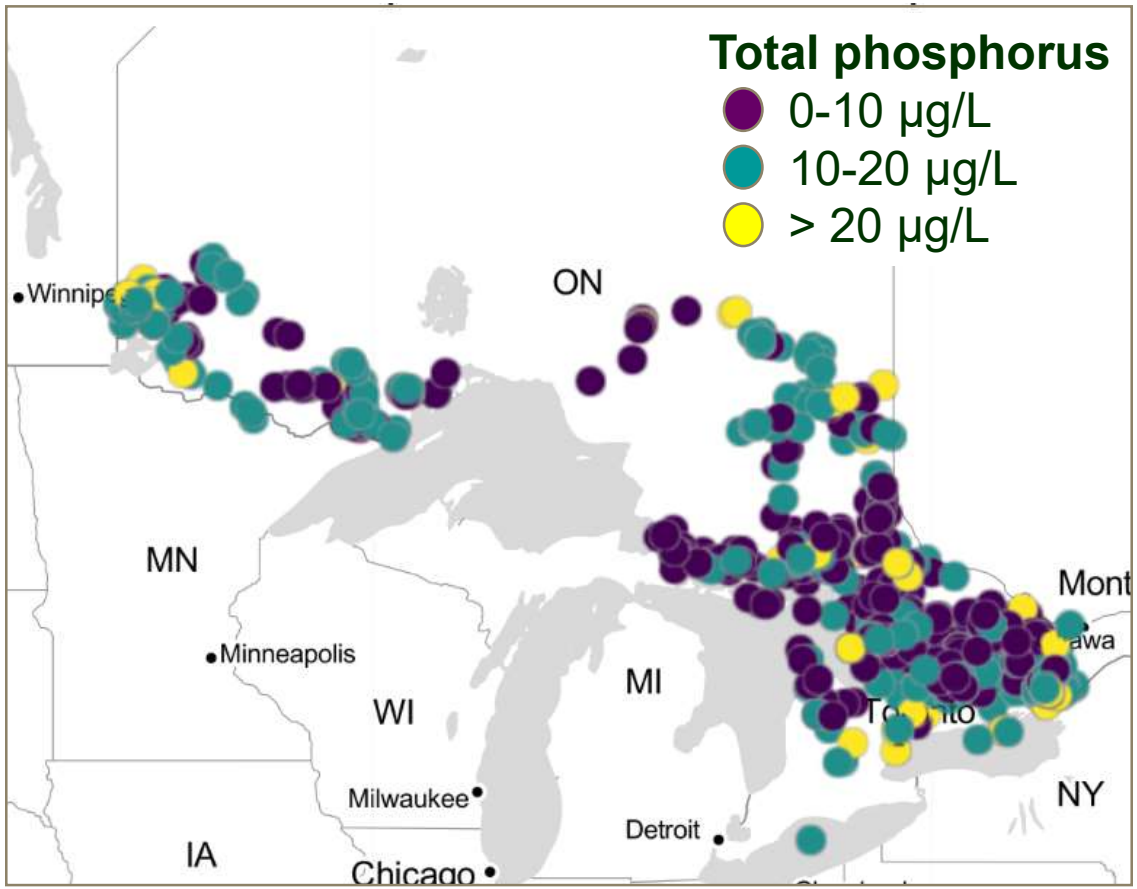
Status of phosphorus and algae – Great Lakes

Ontario

Phosphorus status – Inland Lakes

In Ontario, the Provincial Water Quality Objective (PWQO) for total phosphorus in lakes is < 20 µg/L to "avoid nuisance concentrations of algae in lakes"

- 95% of inland lakes in the Lake Partner Program meet this objective



Ontario

Phosphorus status – Inland Lakes

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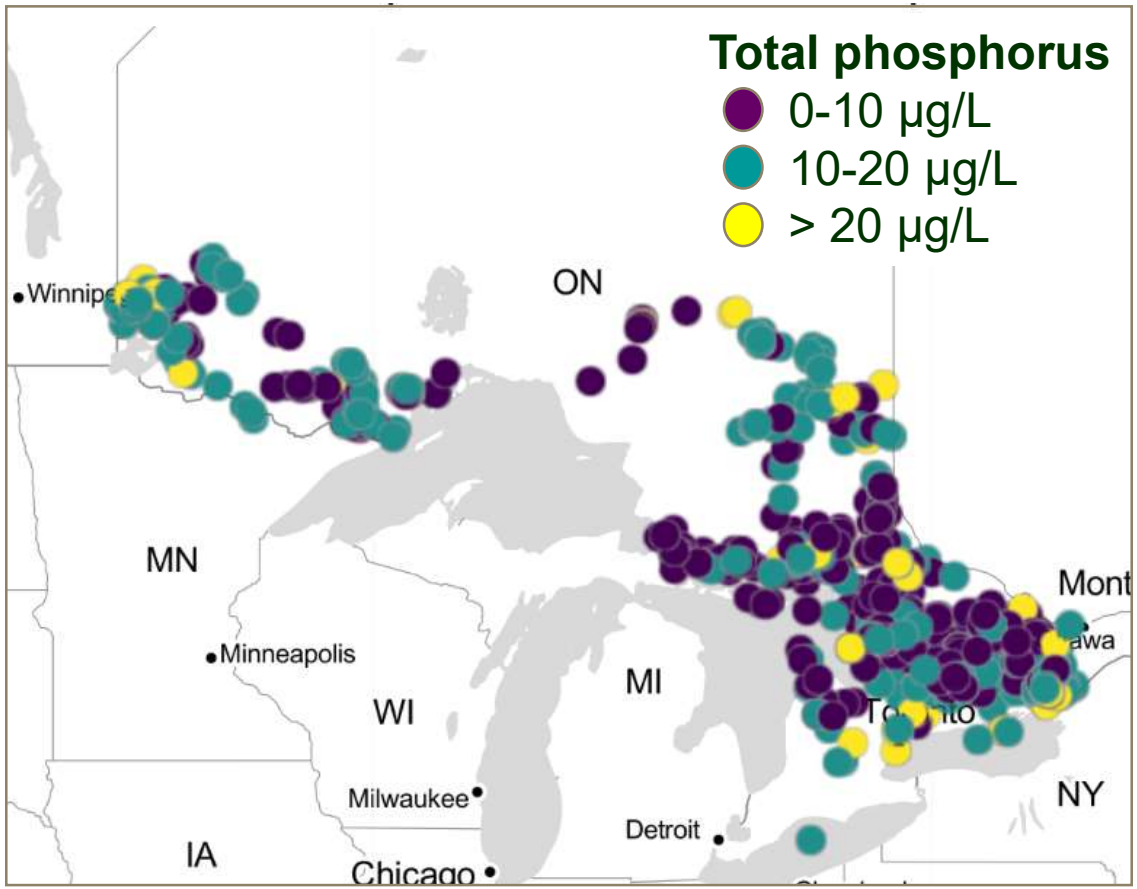
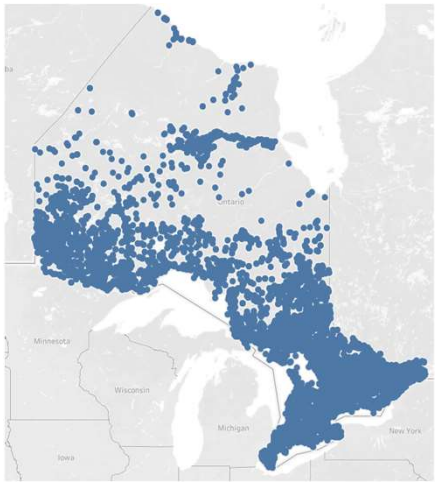


Locations with phosphorus data

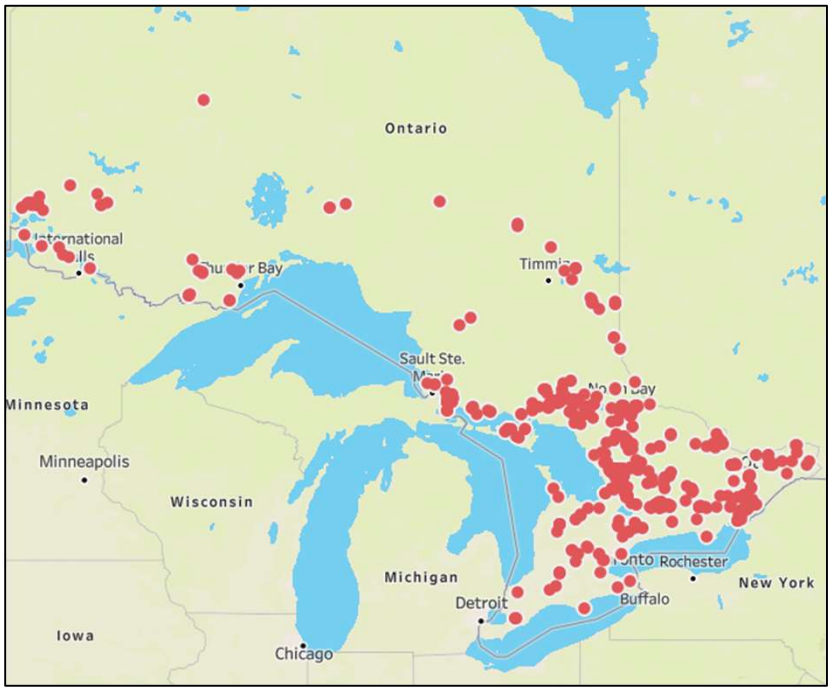


Ontario

Algae Status - Inland Lakes

- Areas of known repetitive harmful blooms include Ramsey Lake, Lake of the Woods, Muskrat Lake, Three-Mile Lake, Lake Scugog, and several bays on Lake Nipissing.
- Harmful blooms can also occur in low-phosphorus lakes (e.g., in Algonquin Park).

Inland lakes and rivers
Confirmed reports of blue-green algae blooms



Lake of the Woods

- Harmful and nuisance blooms are an ongoing public concern on both sides of the international border. Algal blooms can cover up to 80% of the lake's surface.

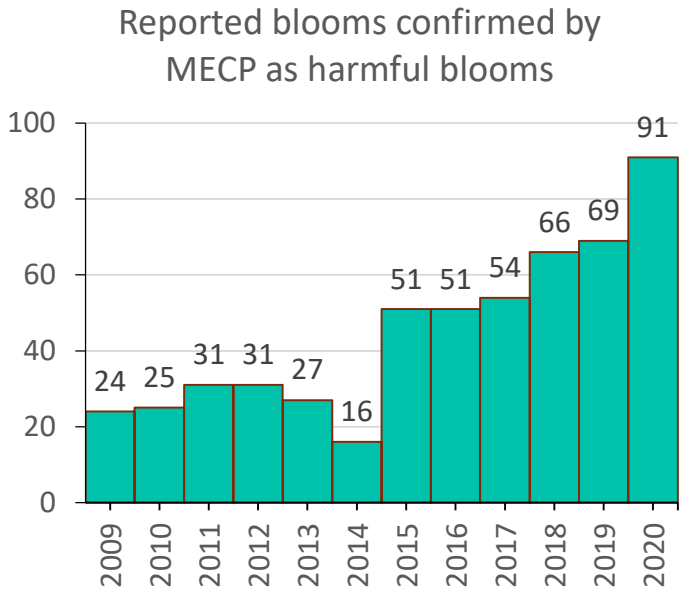
Ontario

Harmful Algal Blooms – Surface Water Trends

- In the 1960s and 1970s, harmful blooms were a concern, especially in Lake Erie.
- In the 1980s-1990s, efforts to reduce phosphorus inputs, such as banning phosphate-containing detergents, decreased algal bloom occurrences.
- Today, a pattern of increasing blooms is occurring in parts of the Great Lakes and some of Ontario's inland waters.

Number of MECP-confirmed reports of harmful blooms in inland lakes, rivers and Great Lakes bays is increasing, likely due to:

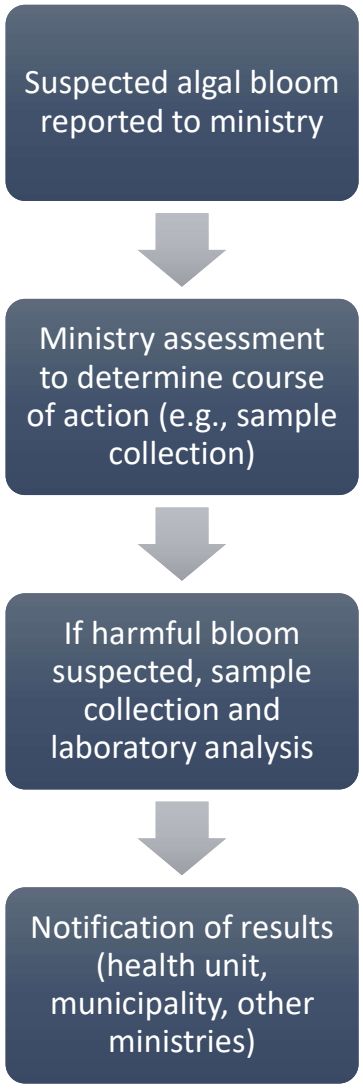
- increased public awareness and reporting of suspected blooms
- changes in climate-related factors that promote harmful algal growth
- additional nutrients, particularly phosphorus from human activities



Ontario

Ontario's Response to Harmful Algal Blooms

- Action Plan (See Appendix A) to harmful algal blooms
- Protocols in place for responding to complaints of algal blooms and work with local authorities and medical officers of health.
- The Ministry works with owners and operators of regulated **drinking water systems** to ensure compliance with Ontario's Drinking Water Quality Standards, and to ensure contingency plans are in place to keep drinking water safe from potential impacts of harmful algal blooms.
    - Since 2019, ministry has been incorporating requirements for a harmful algal bloom monitoring, sampling and reporting plan into the license of the 203 municipal residential drinking water systems that use surface water as their source; to be finalized in March 2022.



Ministry gathers, assesses and provides scientific and technical information, as appropriate.

Ministry laboratory can provide confirmation and toxin analysis within 24 h if needed.

Public health agencies provide public health messaging (beach postings and notices to residents on drinking water concerns for non-regulated systems).

Ontario

Policy initiatives and actions - Great Lakes

Great Lakes Agreements

- Ontario participates in the cooperative management of the Great Lakes guided by the Canada-Ontario Agreement on Great Lakes Water Quality and Ecosystem Health (COA) and Canada-U.S. Great Lakes Water Quality Agreement (GLWQA).
    - Under both agreements, Ontario (MECP as lead) participates in numerous science and implementation projects geared to reducing phosphorus loadings at both the lakewide (Lake Erie) and local scale (see Appendix C for Bay of Quinte).
- Recognizing that Lake Erie is the most stressed of the Great Lakes, Canada and the U.S. developed science-based targets under the GLWQA for **Lake Erie** to reduce phosphorus loads by 40% compared to 2008 levels for western and central basins of the lake.
    - Ontario target: 212 metric tonnes; U.S. is responsible for a much larger reduction.
    - Eastern basin target is pending further science.

Lake Erie Action Plan

- To help meet the bi-national phosphorus load reduction targets under GLWQA, Canada and Ontario developed the **Lake Erie Action Plan.** This also helps Canada and Ontario meet their commitments under COA.
- U.S. developed an overarching plan with individual plans from bordering Lake Erie states.
- Canada-Ontario Lake Erie Action Plan includes over 120 federal, provincial and partner actions to achieve the 40% reduction in phosphorus, e.g., encouraging effective techniques to keep phosphorus on farmland and out of the watershed, improving wetland conservation, and upgrading municipal wastewater treatment and collection systems.
- The ministry's **Multi-watershed Nutrient Study,** started in 2014, aims to quantify changes in nutrient/land use relationships since the 1970s and to assess the scope for change in agricultural nutrient inputs (e.g., phosphorus loadings) to the Great Lakes. The study has become a key action in the Canada-Ontario Lake Erie Action Plan (see Appendix D).

Policy initiatives and actions - Inland Lakes

Lake of the Woods

- In winter/spring 2021, Ontario participated in an ECCC-led consultation to examine the potential for establishing a phosphorus reduction target for the Canadian portion of the watershed. Next steps are pending discussions with ECCC.

Muskoka Watershed Conservation and Management Initiative
https://www.ontario.ca/page/protecting-muskoka-river-watershed

- The Muskoka watershed is facing pressures including due to stresses such as increased development and flooding caused by severe weather events, as well as algal blooms.
- The Muskoka Watershed Advisory Group was established in August 2019 to provide advice and recommendations to the Minister on priority areas and issues in the Muskoka watershed.
- As part of the initial $5 million commitment to protect the Muskoka River watershed, in April 2021, MECP announced $4.25 million for 16 projects. The funding will support projects that will help safeguard the region from environmental pressures, such as severe weather and flooding, while also improving the health of the watershed.

Ontario

Possible Future Actions

Some possible actions to help tackle algal blooms could include:

- Investing in wastewater and stormwater infrastructure projects aimed at reducing nutrient loadings from urban sources (e.g., improved stormwater management, sewage treatment plant upgrades and optimization).
- Update Ministry's wastewater and stormwater policies to encourage the use of innovative technologies including considering stricter pollution limits that would help reduce nutrient loadings.
- Continue to encourage low impact development and other green infrastructure initiatives to reduce urban run-off.
- Continue to work with OMAFRA, agriculture sector/other partners on best management practices and phosphorus management initiatives.

Appendix slides

Ontario

Appendix A: Ontario's Action Plan for Blue Green Algal Blooms

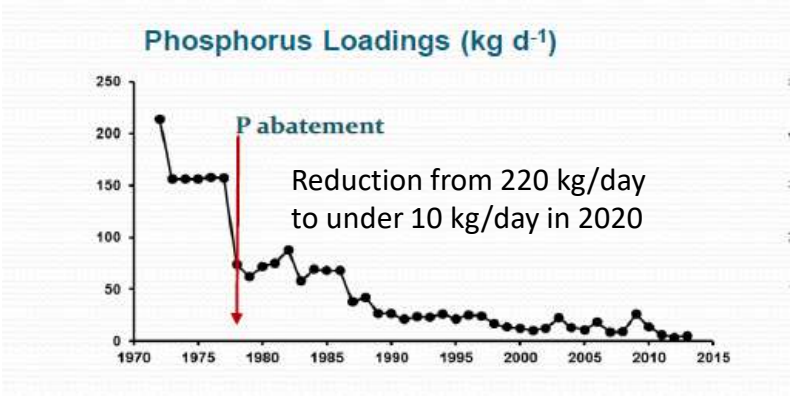
- Ontario has an action plan outlining how we are working with our partners, to fight algal blooms in the Great Lakes and other lakes and rivers:

1. Communicating, engaging and working with partners
2. Reducing nutrients
3. Protecting our drinking water sources
4. Science and innovation
5. Support and financial investment to improve water quality
6. Legislation and regulatory tools
7. Water quality standards and guidelines
8. Monitor for blue-green algal blooms at municipal drinking water systems
9. Public Health protection via Ontario's comprehensive protocol for responding to suspected blooms
10. Contingency plans at municipal drinking water systems to keep water safe
11. Analytical laboratory services to test for algal toxins
12. Drinking water system courses

Ontario

Appendix B: A Success Story: Phosphorus Load Reduction in the Bay of Quinte

- Bay of Quinte is on track to be removed from the List of Areas of Concern under the 9th COA (by 2026).
- The Bay of Quinte, a large multi-basin, Z-shaped bay in Lake Ontario, has had a long history of eutrophication and algal blooms which contributed to its designation as an Area of Concern under COA and the GLWQA.
- Municipal sewage treatment facilities were identified as a major contributing source of phosphorus.
- Work to reduce phosphorus loadings included introducing a “phosphorus wastewater load cap” in the 1990’s restricting phosphorus levels in effluent from all sewage treatment plants within the watershed.
- This reduction, in conjunction with other factors, has improved water clarity and reduced algal blooms.
- Currently, an even more stringent “phosphorus wastewater loading cap” is being considered which would further reduce phosphorus loadings by up to 60%



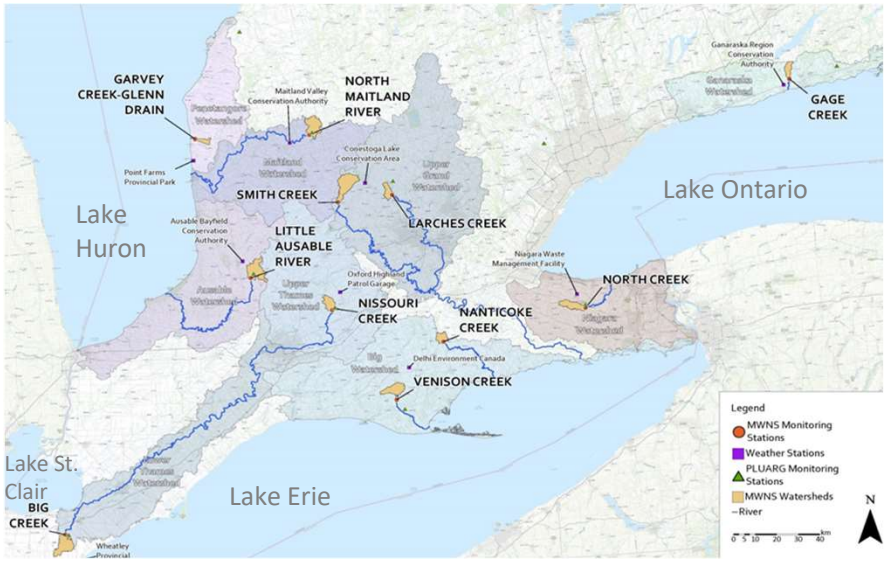
Ontario

Appendix C: Multi-watershed Nutrient Study

The resurgence of algal blooms led to the Multi-Watershed Nutrient Study (MWNS) being established in 2014. The study includes 11 small agricultural watersheds in southern Ontario.

The study was designed to address the following questions:

- Have agricultural nutrient loadings changed compared to 40 years ago (during the algal bloom surge of the 60s & 70s)?
- Has the relationship between agricultural land use and loadings changed?
- Have the most important forms of phosphorus (total vs. dissolved) changed?
- What scope/potential is there to change the diffused nutrient exports from agriculture?

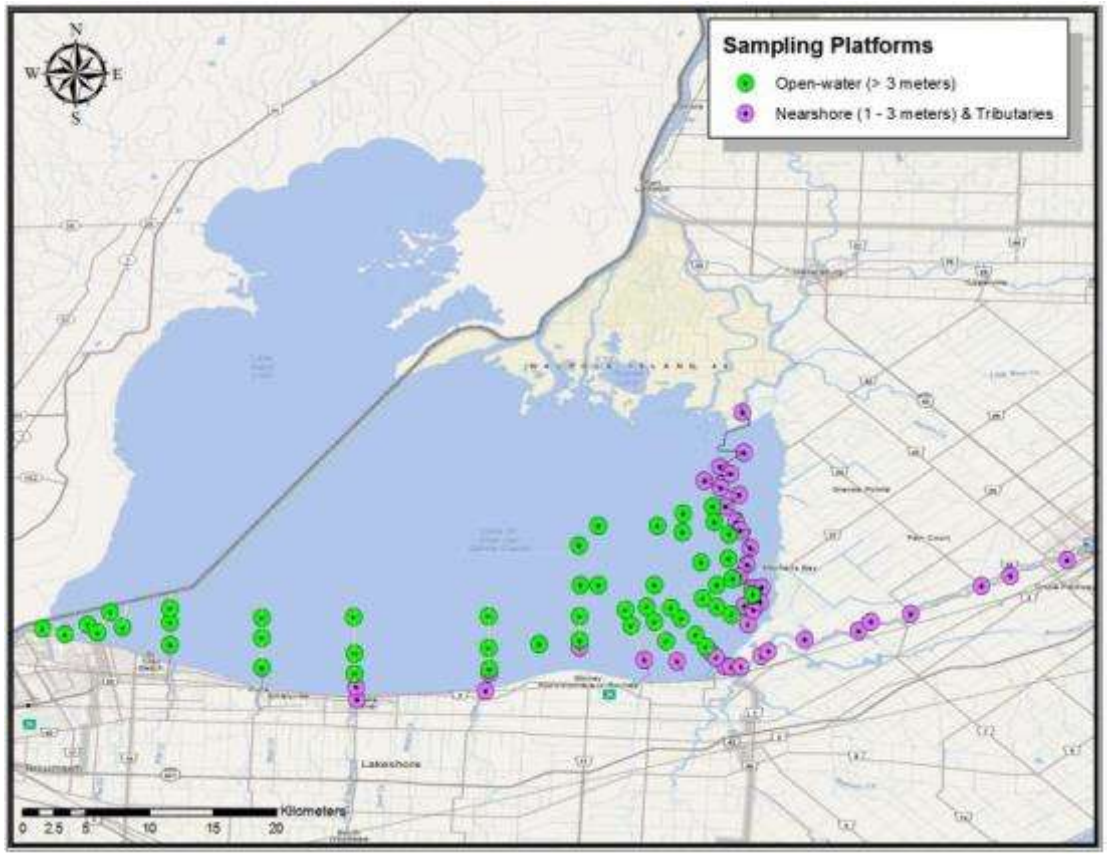


Preliminary results indicate:

- Seasonal timing of phosphorus loading shifted from spring to winter.
- Amount of many nutrients moving into streams increasing at most sites
- Scientific analyses of the data are currently underway

Ontario

Advancing Science:
Algal Blooms in Thames R and Lake St. Clair



Lake St. Clair Nearshore and Thames River Project will assess water quality conditions and harmful algal blooms in Lake St Clair and the Thames River

Ontario

Advancing Science:
Real time water monitoring buoys

Ministry of the Environment, Conservation and Parks (MECP)

Overview of Per- and Polyfluoroalkyl Substances (PFAS)

September 14, 2021

Ontario

Purpose and Outline

To provide an overview of PFAS which includes:

- Introduction to PFAS
- Environmental and Human Health Concerns
- Ministry Initiatives and Actions
- Ontario's Drinking Water Advice
- Summary

Key Messages:

- PFAS are "forever chemicals" – persist in the environment and in the human body.
- Actions have been taken to restrict PFAS in Canada and internationally.
- We have developed methods to measure PFAS and have conducted environmental monitoring:
  - Concentrations are generally low in Ontario and are decreasing over time
  - Concentrations are of concern in certain areas of Ontario, such as where fire-fighting foams have been applied
- We are working to understand effects and develop benchmarks to evaluate risks.
- We continue to track science and support efforts to address PFAS issues in Ontario.

Introduction to PFAS

- PFAS are a group of fluorine-containing carbon chemicals known as surfactants, which have lipid and water repellant properties.
- The carbon-fluorine is not a naturally occurring bond and is considered one of the strongest chemical bonds. As such, they are known as “forever chemicals” due to persistence in the environment.
- More than 4000 different PFAS have been available on the global markets since the 1950s. There are no known natural sources.
- Were primarily used in industrial and consumer products: Aqueous Fire Fighting Foam (AFFF), carpets, non-stick cookware, food packaging (Teflon™), paper coatings (foods), stain repellants (ScotchGard™, Stainmaster™).
- Compounds with 6 or more carbon atoms (C6) are generally considered to be “long chain”. The most contentious PFAS are Perfluorooctanesulfonic acid (PFOS) and Perfluorooctanoic acid (PFOA) which have 8 carbon atoms (C8).
- In Canada, PFOS (2006) and PFOA (2012) were declared “toxic” under the *Canadian Environmental Protection Act*, making them subject to a range of risk management measures (RMM) including restrictions / ban on import and use with a few exemptions.
- Production and manufacturing of PFAS have been the main sources of PFAS contamination internationally.
- **Neither PFOS or PFOA was manufactured in Canada.**

Environmental & Human Health Risks

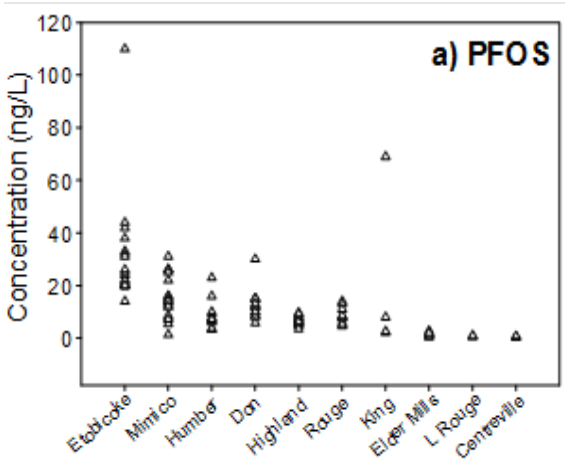
- Most PFAS are persistent, bioaccumulative and toxic (PBT) and may biomagnify through the food chain (severity related to chain length).
- PFOS has a half-life in humans of approximately four years, and up to 1,000 years in the environment.
- PFAS are ubiquitous in the aquatic environment and in humans (blood).
- They bind to proteins in the blood, influencing hormone feedback systems, causing a multitude of toxicological effects (e.g., thyroid disease, liver damage, kidney cancer).
- PFAS can reach the environment through every lifecycle step including manufacturing, industrial use, consumer products, service life and disposal.
- Exposure can occur from:
    - Dust & air - consumer products (e.g., textiles, furniture, polishing and cleaning agents) deposition from industrial emissions (long range transport);
    - Food – packaging;
    - Soils & Plants – aerial deposition, pesticides and biosolids
    - Water – industrial effluents, wastewater treatment plants, spills
- Elevated concentrations in the Ontario environment have primarily been associated with the use of PFAS-containing fire-fighting foams.

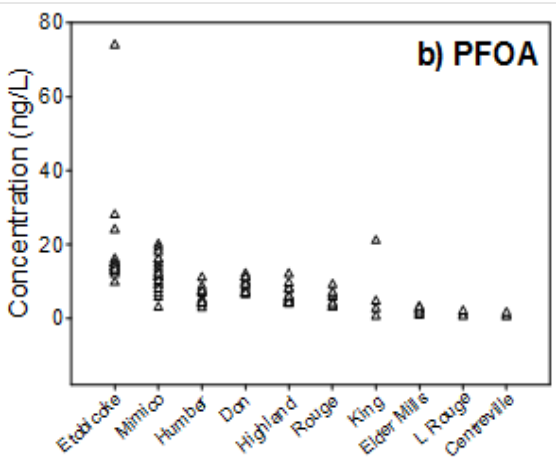
MECP Ambient Monitoring

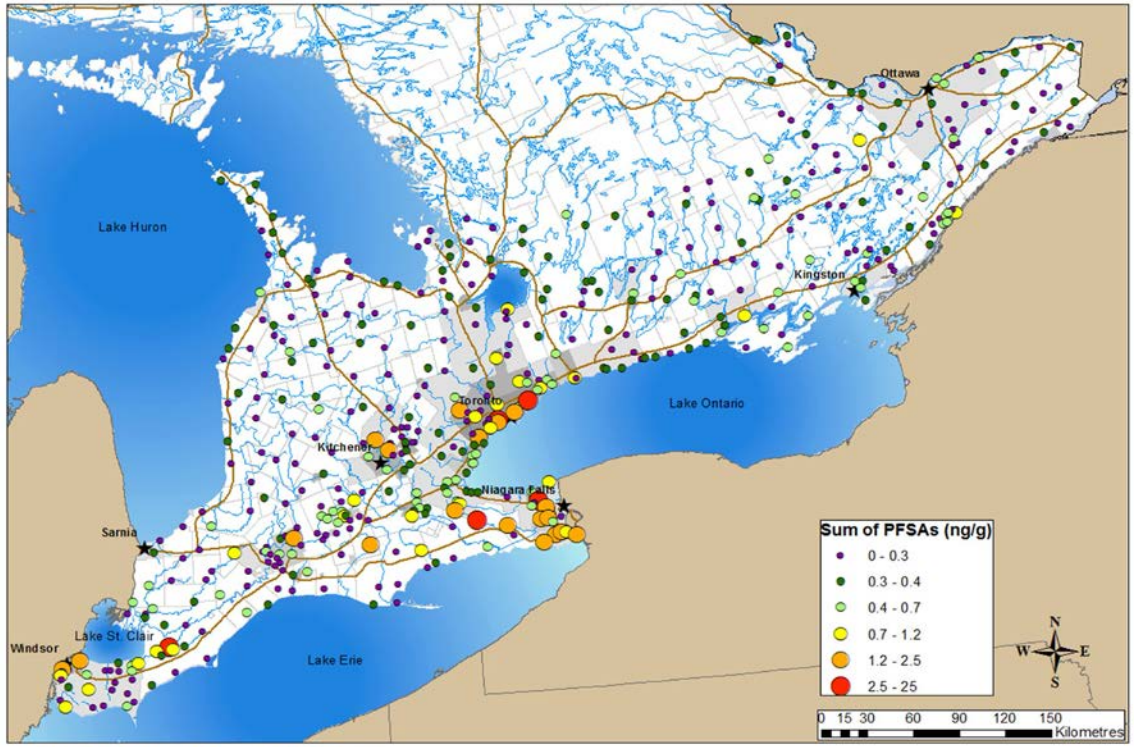
- The ministry has been monitoring PFAS in fish, sediment, surface water, ground water and drinking water since the early 2000s.
- Great Lakes Nearshore Monitoring and Assessment
  - Streams and Sediment (in partnership with Ontario Geological Service (OGS))
  - Great Lake surface water (Ontario, Erie, Superior) in 2006 and 20018-19
- Fish Monitoring
  - Fish contaminant monitoring
- Drinking Water Surveillance Program
  - Special studies have been conducted (2006 and 2012-2016) and (2017 - 2018)

2008 Streams and Sediment

- PFAS decreases from highly urbanized areas (Mimico) to rural areas (Centreville) (before RMM).
- Etobicoke creek levels due to 2002 fire at Toronto Airport
- All data below the PFOS Federal Environmental Quality Guideline (FEQG) of 6800 ng/L.







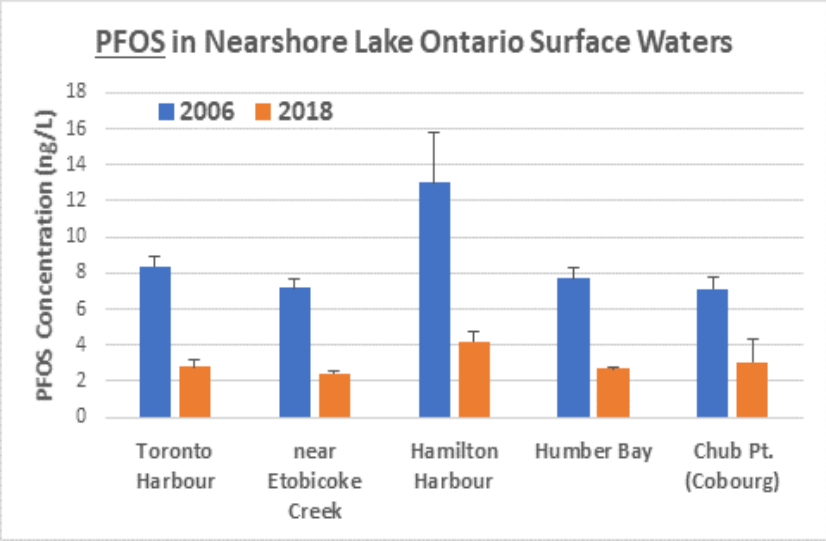
Sediment*

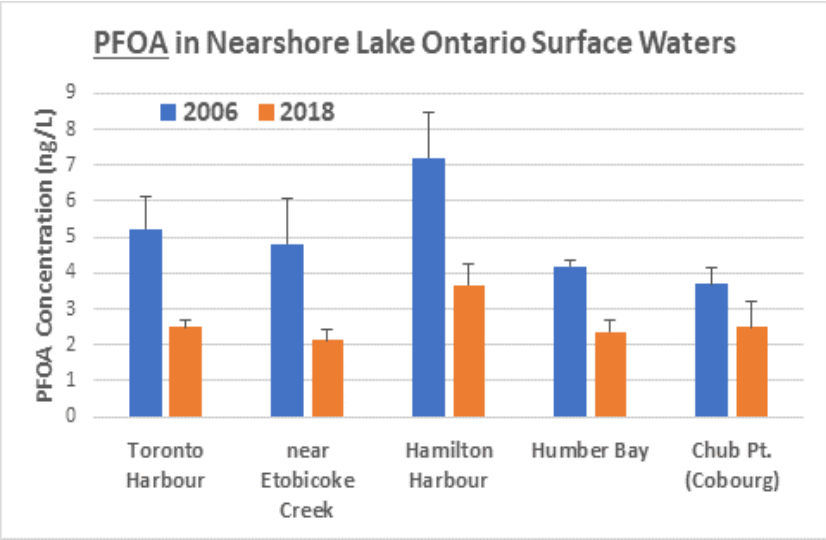
- Ambient stream sediments across Ontario had fairly low concentrations of PFAS.
- Higher concentrations observed in urban impact streams.
  - Orange <2.5 ng/L
  - Red < 25 ng/L

Ontario

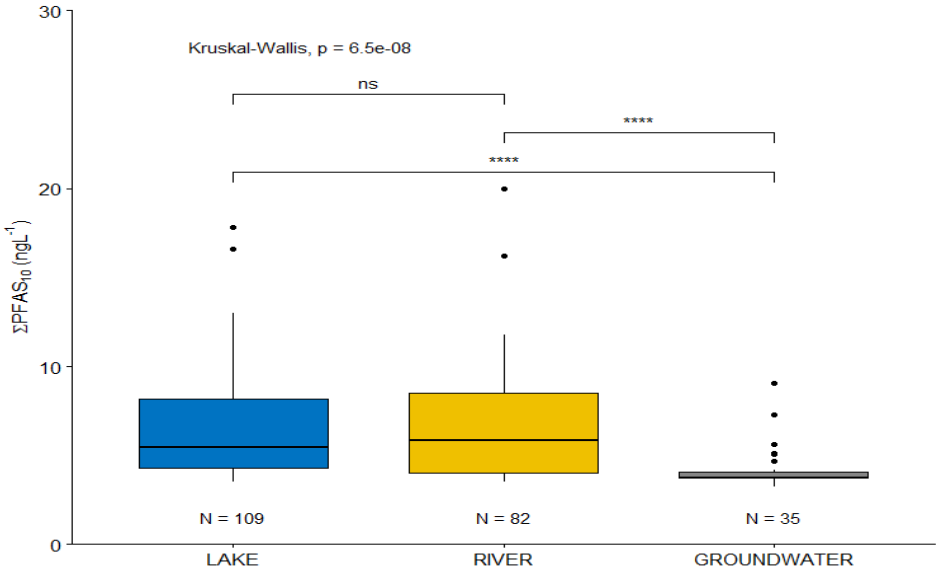
*Conducted with Ontario Geological Survey

Great Lake and Source Water Monitoring



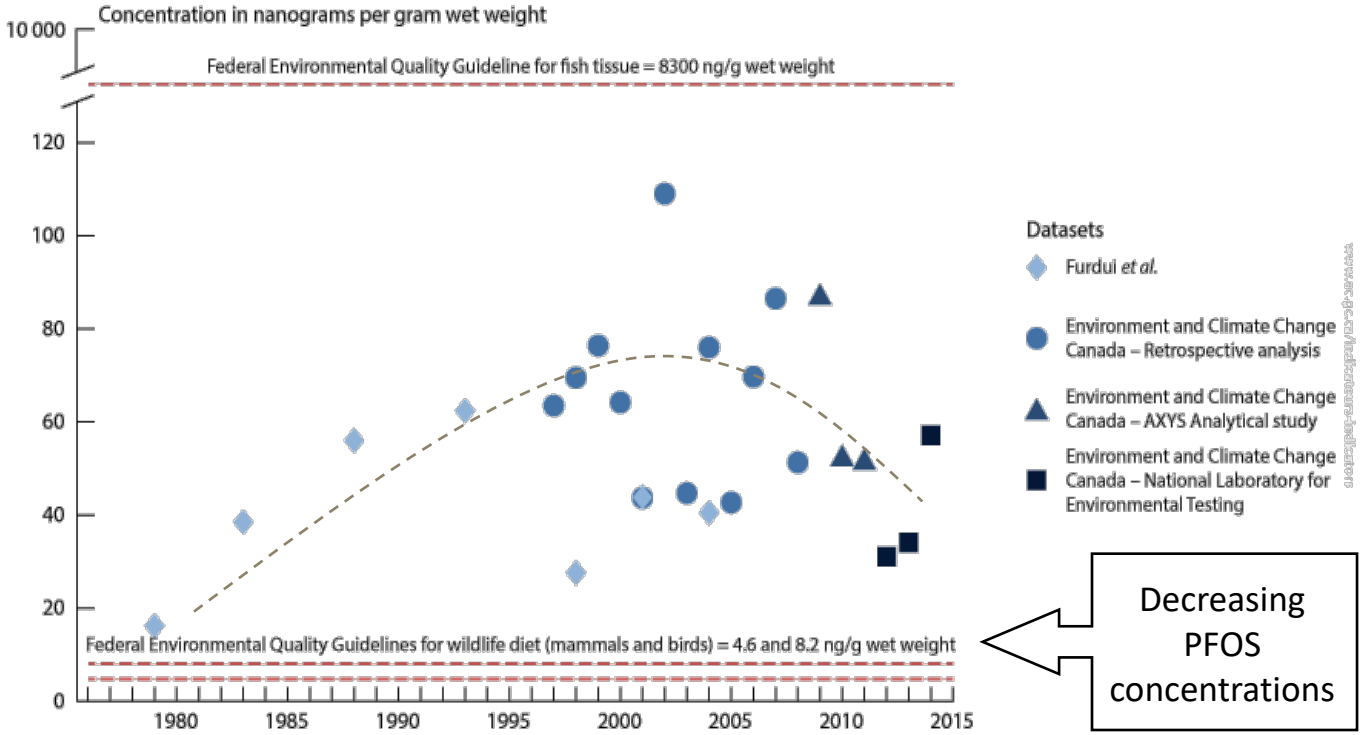


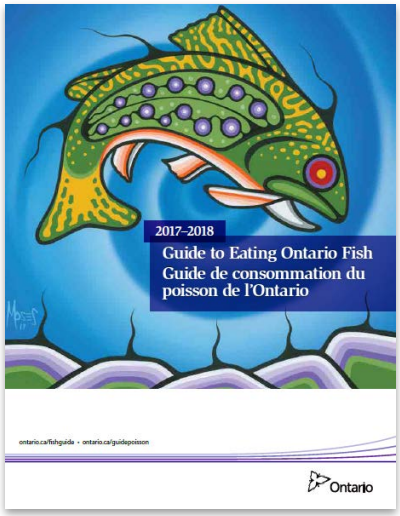
- Grab samples were collected in each year at the Lake Ontario sites, representing urban impacted waters (Toronto / Hamilton area) and a background site (Chub Pt.).
- PFOS and PFOA have declined since RMMs have come into effect.
- Concentrations are relatively uniform across Lake Ontario.
- All samples were well below FEQG of 6800 ng/L.
- Median ∑PFAS 10 for lake, river and ground water are 5.5, 5.9 and 3.85 ng/L respectively.



Fish

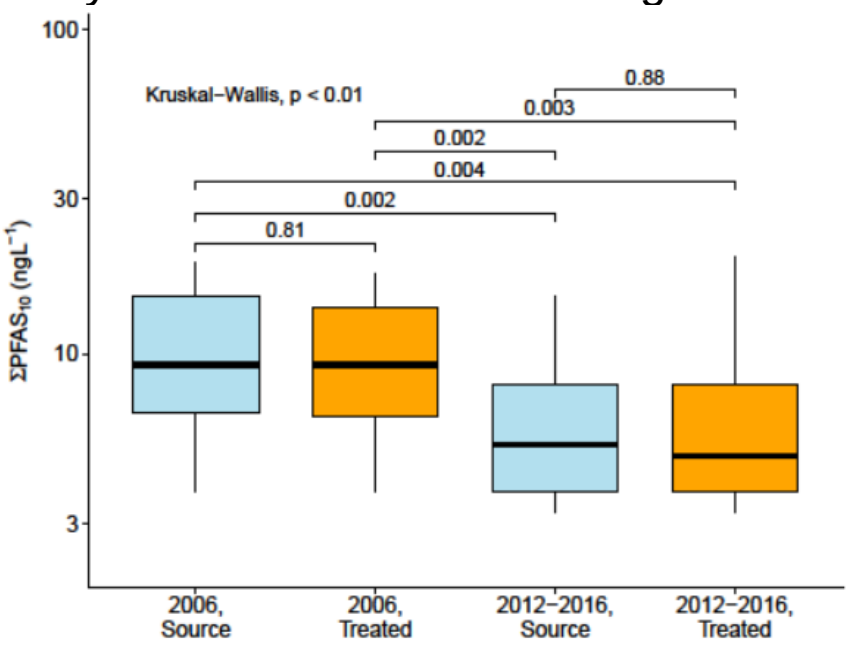
- MECP initiated regular monitoring of forage and large fish in the late 2000s, focusing on potentially impacted sites.
- First fish consumption advisories due to elevated PFOS levels were published in 2011 in the Guide to Eating Ontario Fish.
- In January 2021, the State of Wisconsin updated its rainbow smelt fish consumption advisory in Lake Superior as a result of elevated PFAS levels.
  - MECP is working with the Ministry of Natural Resources and Forestry to collect smelt and further expand the information for this type of fish.





Municipal Drinking Water in Ontario

- Ministry study compared 10 PFAS (*$\sum PFAS_{10}$) at 25 Drinking Water Systems in 2006 and 2012-2016.
- All samples had detectable levels of PFAS.
- Significant decrease in PFAS concentrations can be attributed to implementation of RMM nationally and internationally
- PFOS + PFOA represented 9-66% of the ∑PFAS in drinking water.
- Median PFOS and PFOA concentrations in drinking water post RMM were 0.98 ng/L and 1.5 ng/L respectively.
- Median ∑PFAS10 = 5.82 ng/L.
- No samples exceeded any jurisdictional advisory levels of PFAS in drinking water.
- **Study concluded that PFAS in municipal drinking water unlikely to be a concern in Ontario unless due to a spill or intentional release (published 2020).**



$\sum PFAS_{10}$ = PFHpA + PFHxS+ PFOS + PFOSA + PFOA + PFDS + PFDA + PFDoDA + + PFNA + + PFUnA.

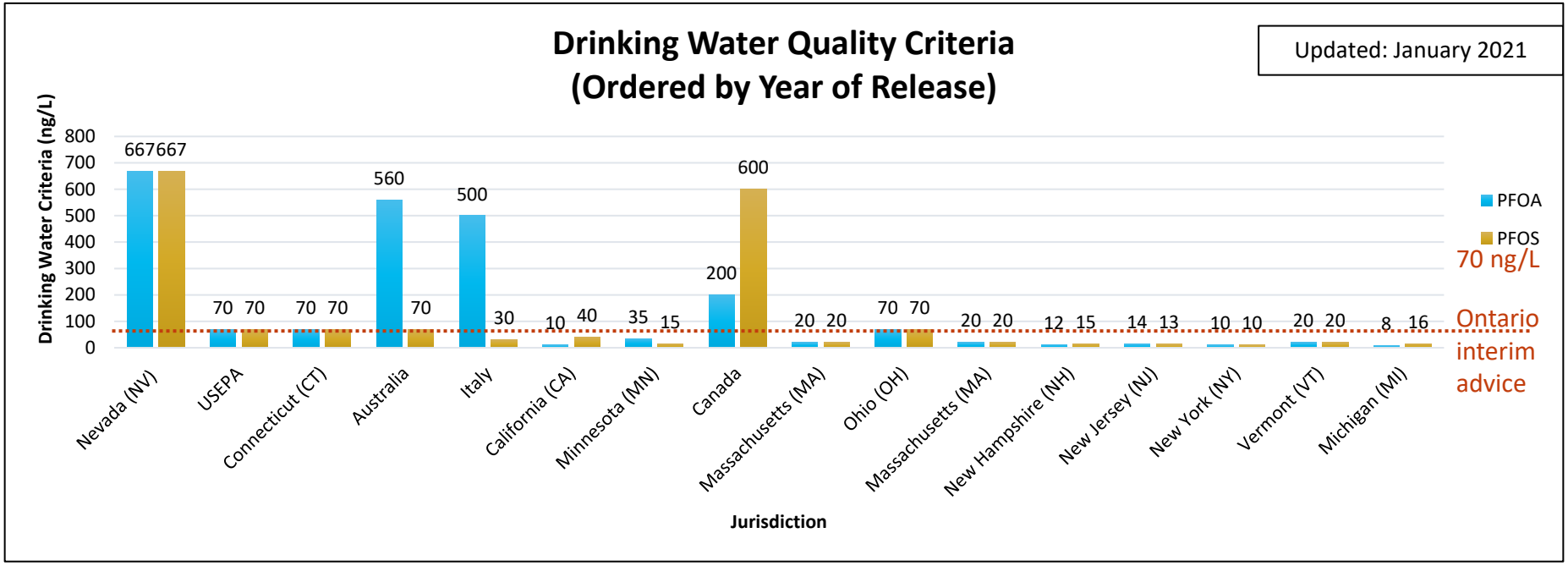
Summary of Monitoring Results

- Since PFAS were never manufactured in Ontario, ambient concentrations are significantly lower than those in other parts of the world (especially the US).
- Generally, ambient water monitoring indicates PFAS levels are not of concern in Ontario;
    - Concentrations < current guidelines and standards (where available)
    - Detections and concentrations of PFOS/PFOA decreasing after implementation of RMM
    - Need to track replacement PFAS and trends moving forward – analytical and monitoring resources
- Past uses of PFOS-based firefighting foam has resulted in high soil and groundwater PFOS concentrations at some Ontario locations.
- Limited information suggests there are still sources of PFAS to municipal sewer systems.
- Due to the persistence of these “forever chemicals” select PFAS continue to be cycled through the environment.

Ontario's Drinking Water Advice

- Health Canada published guidelines for two PFAS in 2018: PFOS (600 ng/L) and PFOA (200 ng/L). However, these guidelines are less stringent than those set by other leading jurisdictions.
- The ministry carried out a review of current science and other jurisdictional values to inform the development of interim advice for drinking water systems. This advice is more stringent than Health Canada's guidelines.
  - Ministry's interim advice ($\sum PFAS_{11} < 70$ ng/L) is more in line with other jurisdictions. It reflects the achievability of certified treatment technology.
- Note: Jurisdictions may refer to their drinking water quality criteria as standards (regulatory or non-regulatory), Maximum Concentration Limits, action levels, etc.

∑PFAS 10	∑PFAS11 DW advice
PFHpA	Y
PFHxS	Y
	PFHxA
PFOS	Y
PFOSA	Y
PFOA	Y
PFDS	Y
PFDA	Y
PFDoDA	Y
PFNA	Y
PFUnA	Y



Ontario's Drinking Water Advice cont'd

- Ministry's interim advice ($\sum PFAS_{11}$ < 70 ng/L) is consistent with the current federal "health advisory" used in the United States; however, some states have recently set more stringent drinking water quality criteria.
  - The ministry's rationale document describes the approach in detail and was shared with Ontario Drinking Water Advisory Coucil in January 2020 and Health Canada on December 11, 2020.
  - The ministry is revising the rationale document in light of Health Canada's comments, and new science that has since developed.
- On April 24, 2021, the federal government posted a notice of intent in the Canada Gazette, Part I to move forward with activities to address the broad class of PFAS, recognizing that the large number of PFAS makes a chemical by chemical approach impractical as well as concerns about newer replacement PFAS. This approach is intended to consider cumulative effects, and to prevent regrettable substitution.
- The federal government also noted an intent to move forward with drinking water guidelines for PFAS as a group. This will likely result in a future replacement of the current guidelines for PFOS and PFOA. The ministry and Health Canada have already discussed opportunities to work together on new guidelines for PFAS as a group.

Ongoing Ministry engagement in working groups

Drinking Water

- Ministry scientists participate in the federal/provincial/territorial processes to develop Canadian Drinking Water Quality Guidelines and will work with Health Canada in the development of new/revised Guidelines, that will focus on PFAS as a group.

Soil and Ground Water

- Canadian Council of Ministers of the Environment (CCME) are in the process of finalizing guidelines for PFOS. Guidelines are voluntary and jurisdictions make their own decisions about whether to adopt or not.

Great Lakes National and Binational Agreements

- PFOS, PFOA and Long-Chain Perfluorinated carboxylic acids are designated Chemicals of Mutual Concern (CMC) under the Great Lakes Water Quality Agreement (Canada & USA).
    - CMCs have strategies developed to reduce exposure.
- These chemicals are Chemicals of Concern under Canada-Ontario Agreement on Great Lakes Water Quality and Ecosystem Health (COA).
    - Annex 2 (Harmful Pollutants) commits the Provincial government to: Identifying and assessing the occurrences, sources, loadings, transport and impacts of Chemicals of Concern.
- The Great Lakes St Lawrence Governors and Premiers have formed a Great Lakes PFAS Task Force to discuss PFAS issues and push for further federal action (US focus).

Summary

- Generally, ambient water monitoring indicates PFAS levels are not of concern in Ontario.
- Past uses of PFOS-based firefighting foam has resulted in high soil and groundwater PFOS concentrations at some Ontario locations.
    - Continued efforts needed to find and address historically contaminated areas.
- Science continues to evolve on effects of PFAS;
    - Efforts needed to track science and consider needs for provincial standards and guidelines;
    - Need to track replacement PFAS and trends moving forward and,
    - Continue identifying and addressing localized PFAS contamination through risk assessment and remediation, if required.