



LAKE ONTARIO

LAKEWIDE ACTION AND MANAGEMENT PLAN



2022
ANNUAL
REPORT

Sandbanks Dunes Beach in Sandbanks Provincial Park on Lake Ontario, Canada. Source: Getty – <https://www.gettyimages.ca/detail/photo/sandbanks-provincial-parks-sandbanks-dunes-beach-royalty-free-image/622161930?adppopup=true>.

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What is the Lake Ontario LAMP?

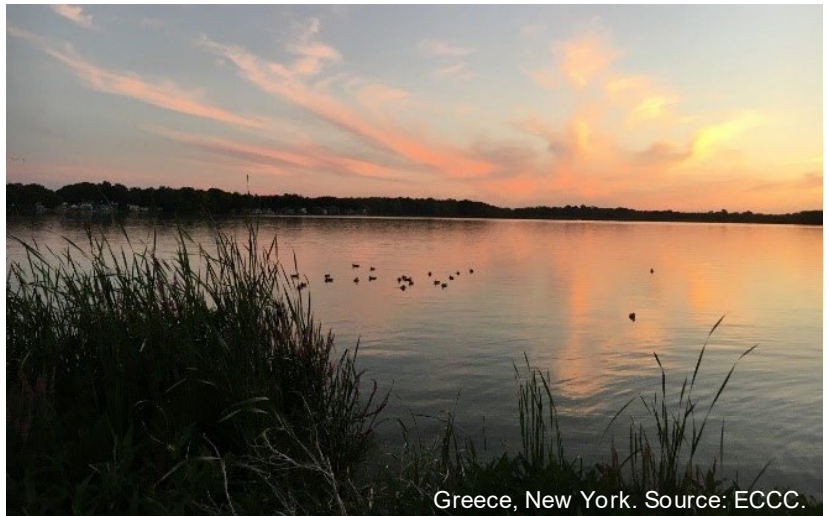
Under the [2012 Great Lakes Water Quality Agreement \(GLWQA\)](#), the governments of Canada and the United States committed to restore and maintain the physical, biological and chemical integrity of the waters of the Great Lakes.

The [2018-2022 Lake Ontario Lakewide Action and Management Plan \(LAMP\)](#) is an ecosystem-based strategy for protecting and restoring the water quality of Lake Ontario, including the connecting Niagara River and St. Lawrence River to the international boundary. The Lake Ontario Partnership, led by the U.S. Environmental Protection Agency (U.S. EPA) and Environment and Climate Change Canada (ECCC), develops, and implements the LAMP. The partnership also facilitates information sharing, priority setting and coordination of multinational protection and restoration activities.

OVERVIEW

Lake Ontario shows improvements with fewer beach closings due to bacterial contamination and declines in contaminant concentrations in fish, based on the assessments of the nine State of the Great Lakes indicators. Overall, the status of the Lake Ontario basin ecosystem is fair and the trend is unchanging to improving, however, nutrient issues remain a challenge, and land-based stressors continue to affect the Lake, including rapid population growth in the western basin.

Lakewide management is guided by a shared vision of a healthy, prosperous and sustainable Lake Ontario in which the waters are used and enjoyed by present and future generations. Although much effort has gone into the protection and restoration of the lake, some stressors persist, limiting the health, productivity, and use of Lake Ontario and its connecting river systems. Over the past year, the Lake Ontario Partnership agencies have continued to take action to meet the priorities set in the 2018-2022 Lake Ontario LAMP.



Greece, New York. Source: ECCC.

The Partnership is also looking to the future as it develops the next 2023 – 2027 Lake Ontario LAMP, which is scheduled for publication and implementation in 2023. In 2022, the Partnership worked with members of the research community to plan and develop projects for the binational 2023 Cooperative Science and Monitoring Initiative (CSMI) field year.

In the following sections of this annual report, the Lake Ontario Partnership provides updates on our activities to reduce chemical contamination, manage nutrients and algae, prevent and control invasive species, restore and protect habitat and species, and conduct outreach and engagement.

REDUCING CHEMICAL CONTAMINATION

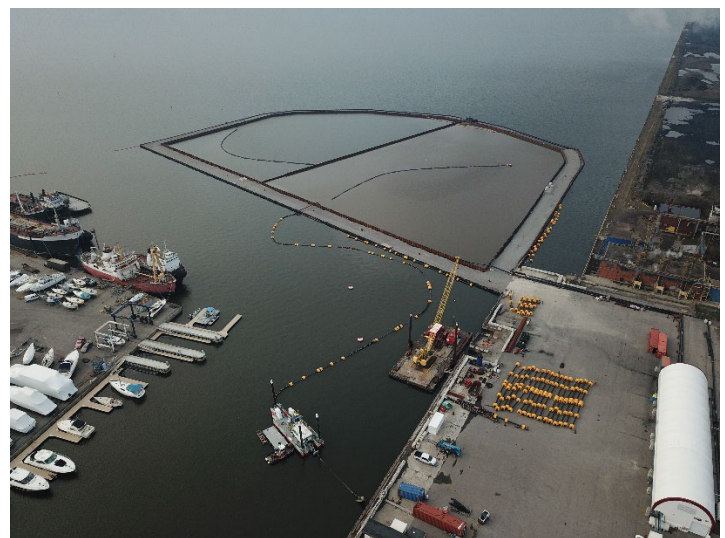
Under Annex 3 of the GLWQA, the U.S. and Canada have identified eight [Chemicals of Mutual Concern](#) (CMCs). Levels of toxic chemicals monitored in Lake Ontario have declined, including declines in contaminant concentrations in fish filets. Lake Ontario's fish continue to be a nutritious food source. While consumption advisories for certain species of fish remain in effect, some have recently become less restrictive due to clean-up efforts. Significant work continues in Lake Ontario Areas of Concern (AOCs) to reduce legacy chemicals and remove Beneficial Use Impairments (BUIs) tied to chemical contamination. The Lake Ontario Partnership is working on the following activities to reduce and monitor chemical contamination.

Randle Reef Sediment Remediation Project, Hamilton Ontario

The [Randle Reef](#) Sediment Remediation Project is an ongoing effort to clean-up the most contaminated sediment site on the Canadian side of the Great Lakes. Randle Reef is located in Hamilton Harbour on Lake Ontario. Hamilton Harbour is a designated Area of Concern under the Great Lakes Water Quality Agreement. The land adjacent to Randle Reef has a long history of industrial

use dating back to the late 1800s, leaving a legacy of extensive contamination. Characterization of the contamination determined polycyclic aromatic hydrocarbons (PAHs) to be the most significant contaminant at the site (with other lesser co-located contaminants). This 10-year, multi-stage project will manage 615,000 m³ (804,390 cubic yards) of contaminated sediment.

Stage 1, completed in 2017, involved constructing an Engineered Containment Facility (ECF) by installing two parallel sheet pile walls into clay to create an impermeable perimeter. In Stage 2, the remaining contaminated sediment at the site was hydraulically dredged and pumped into the ECF and dewatered. The excess water was pumped out, treated by an on-site water treatment plant, and then discharged back to the harbour. A smaller portion of the site was covered with sand (with an augmented organic content), reactive core membrane sheets, and armour stone in order to isolate the contamination and create a protective layer on top of it known as a cap. The completion of Stage 2 in 2021 achieved the effective isolation of all the targeted sediment contamination from the harbour ecosystem. ECF cap construction (Stage 3) is expected to begin in 2023. Stage 3 includes the placement of a flexible membrane liner that will serve as the upper environmental seal.



Aerial photo of contaminated sediment being hydraulically dredged and pumped into the Environmental Containment Facility (ECF). Source: ECCC.

NOAA's Mussel Watch Program

Mussels are widely used to monitor chemical pollution in our lakes and oceans. Because they are filter feeders and stay in one place, they bioaccumulate contaminants and provide information about chemical contamination in the surrounding environment. The National Oceanographic and Atmospheric Administration (NOAA's) Mussel Watch Program (MWP) has been operating a nationwide, coastal contaminant monitoring program since 1986. In 1992, the MWP expanded to include the Great Lakes following the invasion and proliferation of zebra and quagga mussels (collectively referred to as dreissenid mussels). Chemical analyses of the contaminants in dreissenid mussel tissue provides a wealth of data that can be used to track the status and trends of over 150 chemical contaminants in the Great Lakes. This includes indications of the effectiveness of pollution prevention legislation and remediation programs, such as those related to the GLWQA, which address the remediation and protection of our Great Lakes. The Mussel Watch Program has been operating in Lake Ontario since its beginning in the region and including long-term monitoring sites located at Oswego, Olcott, and Cape Vincent, and in the vicinity of the four named Areas of Concern (AOCs), namely the St Lawrence River at Massena/Akwesasne, Oswego River (delisted), Eighteenmile Creek, and the Rochester Embayment.

The most recent MWP data from Lake Ontario is from 2018. This includes a suite of contaminants of emerging concern (CECs). Trends suggest overall lower levels of contaminants in several areas of Lake Ontario relative to the Great Lakes basin. Analysis of Lake Ontario data from 1992 to 2010 indicates that concentrations of most metals and organic compounds were relatively low with concentrations of the legacy pesticide, Mirex, the exception, and found at a higher level at Olcott and Cape Vincent. Subsequent analyses of Mirex in mussels collected from these sites in 2012 and 2018 suggested

declining levels. The comparison of PAH concentrations in Lake Ontario mussels with basin-wide data found that most samples were in a grouping for the lowest levels of contamination (Kimbrough et al., 2021). Similarly, a comparison of Lake Ontario sediment PAH levels with nationwide data by Freitag et al., (2021) found that most samples were in an intermediate level group, with no samples belonging to the highest group. Taken together, these findings *suggest overall lower levels of contaminants* in several areas of Lake Ontario relative to basin-wide Great Lakes concentrations. This provides important information for prioritizing future research.

MWP monitoring planned for late-summer 2022 will provide further information on a suite of Chemicals of Mutual Concern (CMCs) detrimental to human and animal health including short-chain chlorinated paraffins (SCCPs) and perfluorinated compounds (PFOAs, PFCAs, and PCOS) both found in dreissenid mussels and sediments at several locations in Lake Ontario.



NOAA's Mussel Watch Team surveying in the Great Lakes. Source: NOAA.

MANAGING NUTRIENTS AND ALGAE

Lake Ontario's beaches and nearshore waters provide good opportunities for swimming and other recreational uses. Excessive growth of the nuisance algae *Cladophora* is problematic in some nearshore areas due in part to nutrient loading and increased water clarity caused by the

filtering effects of invasive mussels. Harmful algal blooms occur in some embayments of the lake. In contrast, offshore phosphorus concentrations are below objectives which may limit lake productivity. The Lake Ontario Partnership is working on the following activities to monitor nutrients and address excessive nutrient loading.

Woodward Wastewater Treatment Plant Upgrades, Hamilton Ontario

Wastewater can be a source of excess nutrients to the lakes and is one of the contributing factors leading to the “Eutrophication or Undesirable Algae” Beneficial Use Impairment in the Hamilton Harbour Area of Concern. Upgrading infrastructure at wastewater treatment plants can reduce the negative impacts by improving effluent quality. The City of Hamilton is currently undertaking a wastewater treatment plant upgrade under its Clean Harbour Program, an ambitious goal with support from the Government of Ontario and the Government of Canada to enhance water quality in Hamilton Harbour. This includes upgrading the Woodward Avenue Wastewater Treatment Plant, the largest single capital investment in Hamilton’s history. The upgrade project is a multi-phase, multi-year process that began in 2017 and is scheduled for completion in 2022. The main objective of the project is to meet effluent targets defined by the Hamilton Harbour Remedial Action Plan for phosphorus, ammonia and suspended solids. The upgrades will implement proven tertiary wastewater treatment technology to Hamilton’s highest-volume wastewater treatment plant. For more information visit: [Woodward Wastewater Treatment Plant Upgrades | City of Hamilton](#)



The Tertiary Treatment Building undergoing upgrades. Source: City of Hamilton.

American Farmland Trust Demonstration Farm Network in the Genesee River Valley

Second only to the Niagara River, the Genesee River contributes significant phosphorus and other contaminant loads to Lake Ontario. In 2018 the American Farmland Trust (AFT) partnering with the Natural Resources Conservation Service (NRCS) in New York, the New York Farm Viability Institute, and the Great Lakes Restoration Initiative launched the [Genesee River Demonstration Farms Network](#). The goals of the Network are to demonstrate conservation systems that support and enhance farm viability, build soil health, and benefit the environment and water quality. Additional goals were to quantify the economic and environmental benefits of soil health management systems; share technology, information, and lessons learned with farmers, agribusiness, conservation agencies, landowners, and the public; create on-farm research opportunities to evaluate and demonstrate conservation practices; and to facilitate farmer-to-farmer discussions and learning opportunities.



Genesee River Demonstration Farms Network Signage at a participating farm. Source: John Larson, AFT.

The early commitment of the first two demonstration farms—Gary Swede Farm LLC and HaR-Go Farms—helped American Farmland Trust leverage USDA NRCS support to secure additional funding from EPA’s Great Lakes Restoration Initiative and the New York Farm Viability Institute to grow the Network to 12 farms in 2022. In 2019 Jay Swede of [Gary Swede Farm LLC](#) improved his bottom line by US\$55/acre (Cdn\$72/0.405 hectare) and his

total net income by US\$82,257 (Cdn\$107,317) on the 1500 acres (607 hectares) in the study area by adopting no till, strip till, cover crops, and nutrient management practices. This led to an estimated reduction in nitrogen (N), phosphorus (P), and sediment losses by 40%, 92%, and 96%, respectively. In 2020 Jay Gould of [HaR-Go Farms](#) was able to improve his bottom line by adopting no till, use of cover crops, and nutrient management practices which resulted in an annual increase in total net income of US\$4,780 (Cnd\$6236), an annual increase in per acre (0.405 hectare) net income of US\$11 (Cnd\$14) for an overall return on investment of 18%. These practices led to an estimated reduction in N, P, and sediment losses by 41%, 39%, and 29%, respectively.

By building and supporting partnerships, engaging farmers, and deepening AFT's database to facilitate broader adoption of conservation practices, the opportunities for producers and landowners to share outcomes and experiences have multiplied sustainable and economic benefits throughout the region.



American Farmland Trust conducted a Demonstration Farm Tour on August 24, 2022, in Pavilion, New York to showcase the work Genessee River Valley farmers are doing to address soil health through practices such as no till farming, use of cover crops and crop rotations. Source: John Larson, AFT.

PREVENTING AND CONTROLLING INVASIVE SPECIES

Invasive species, including the Sea Lamprey, invasive mussels, and Phragmites have significantly altered habitat and the food web in Lake Ontario. Specific habitats such as coastal wetlands have been affected by several invasive species such as Phragmites or Common Reed. However, even with the changes brought on by invasive species, coastal wetland amphibians and birds show improving trends. Lake Trout populations are also improving, due in part to successful Sea Lamprey control. The Lake Ontario Partnership is working on the following activities to prevent and control invasive species.

Boat Cleaning Programs Help Stop the Spread of Invasive Species

One of the main pathways for transfer of aquatic invasive species (AIS) between waterbodies is recreational water vehicles (e.g., motor boats, canoes, kayaks, jet skis). As a result, the province of Ontario and New York State are taking significant steps to engage the Lake Ontario community to do its part in minimizing this risk to the ecosystem. This includes programs to educate anglers about their role in controlling the spread of invasive species and the importance of using boat cleaning stations.

In New York State, a top priority of the statewide [AIS management plan](#) is to expand the coverage of boat stewardship programs across the state, particularly in popular, high-use areas. In-person interactions with boaters, anglers, and other recreational water users raises awareness about aquatic invasive species and practices that reduce the chance of spreading aquatic invaders, such as cleaning, draining, and drying boats and gear. Read more about [the practices required to prevent the spread of AIS \(PDF\)](#). In 2022 and 2023 the New York State Office of Parks, Recreation, and Historic Preservation (NYS ORPHP) will work with the State University of New York College of Environmental Science and Forestry to implement the NYS ORPHP Boat Stewardship Program at 25 ORPHP boat launches within the St. Lawrence, Lake Ontario,



ISAP Volunteers encourage recreationalist to “Clean, Drain, Dry” their watercrafts each time they leave the launch. Source: OFAH.

Niagara River and eastern Lake Erie basins. Boat stewards will operate boat washing stations throughout the peak recreational boating season from Memorial Day to Labor Day. Stewards throughout the state provide information about aquatic invasive species and associated New York State regulations, and remove any aquatic invasive species found on watercraft and trailers via inspection and decontamination. The New York State Department of Environmental Conservation (NYSDEC), the Partnerships for Regional Invasive Species Management (PRISM) for Western New York, the Finger Lakes, and the St. Lawrence and Eastern Lake Ontario, New York Sea Grant (NYSG), and several other partners have teamed up to provide support for invasive species detection and control, and watercraft inspection steward programs. This team of agencies is making every effort to standardize the training, messaging, and

information that is collected and distributed throughout the state.

Ontario continues to take strong action to reduce the threat of invasive species and coordinate efforts to prevent, detect, respond to, and manage their impacts. This includes reducing the risk of introducing and spreading invasive species through the recreational boating pathway. As of January 1st, 2022, Ontario strengthened actions to address the risk of this pathway by regulating watercraft (e.g., boats, canoes, kayaks) as a carrier of invasive species under the Invasive Species Act, 2015. The new regulation requires watercraft users to open drain plugs to allow water to drain from their boat and boat equipment, as well as take reasonable precautions to remove all aquatic plants (weeds), animals and algae from any boat, boat equipment, vehicle or trailer before transporting it overland. The regulation also requires watercraft and watercraft equipment to be free of

any aquatic organisms prior to arriving at a launch site or placing a watercraft into any body of water. To support watercraft users in compliance with the new regulations and outline additional preventive measures which can be taken, Ontario developed the [Best Management Practice Guidelines for Preventing the Spread of AIS](#).

These actions build upon almost 30 years of targeted communications and outreach promoting best practices to prevent AIS introduction and spread via the boating pathway. In 1992, Ontario partnered with the Ontario Federation of Anglers and Hunters to establish the Invading Species Awareness Program (ISAP). The ISAP continues to implement programming to educate watercraft users about regulations they must follow and voluntary preventative actions which can be taken. In 2022, the ISAP spearheaded a social media campaign dedicated to Clean, Drain, Dry and the new regulations alongside like-minded organizations that reached over 335,000 people and achieved over 18,000 engagements. This effort supported a successful Great Lakes AIS Landing Blitz (for more information, visit www.glc.org/work/blitz), where ISAP staff and volunteers, through their Water Steward Program, coordinated 10 separate events, reached 331 boaters, educated over 100 summer camp children, and installed over 50 Clean, Drain, Dry signs on 28 different lakes, including some on Lake Ontario.

For more information about aquatic invasive species in Lake Ontario and boat stewardship programs, please see:

[Aquatic Invasive Species Boat Stewards - NYS Dept. of Environmental Conservation](#); [Ontario's Invading Species Awareness Program](#); and [Home - Stop Aquatic Hitchhikers](#)



ISAP Volunteers install "Clean, Drain, Dry" signs. Source: OFAH.

PROTECTING AND RESTORING HABITAT AND NATIVE SPECIES

Coastal wetlands have been impacted by development, past water level regulation, and invasive species such as Phragmites and Hybrid Cattail. The status of habitat connectivity between tributaries and the lake is fair but is improving. Diporeia, a shrimp-like zooplankton that is an important food source for many prey fish species, is now rarely found in the lake. Some native prey fish, such as Deepwater Sculpin, are recovering naturally and restoration



Volunteer helps boater inspect their boat. Source: NYSDEC.

efforts for populations of other native prey fish are proving successful. Lake Sturgeon populations are showing some signs of recovery with spawning taking place in a few tributaries. The Lake Ontario Partnership is working on the following activities to protect and restore habitat and species.

Canada's Lake Ontario Coastal Baseline Habitat Survey

The GLWQA Habitat and Species Annex includes a commitment to conduct a baseline survey of existing habitat, against which to establish a Great Lakes basin target of net habitat gain, and measure future progress. ECCC led a baseline coastal habitat survey of the Canadian side of Lake Ontario in 2021, from the Niagara River to the St. Lawrence River at the Quebec boarder, beginning at the shoreline to approximately 2 kilometres (1.24 miles) inland. The survey assessed four ecologically significant habitat categories (wetlands, uplands, tributaries, and inland lakes and ponds), and analyzed across six components of net habitat gain (extent, biodiversity, condition, function, protection,

restoration) (Figure 1). Developing and applying consistent methods to assess and report on coastal ecosystems will help resource managers identify habitats in need of conservation action. It also facilitates developing goals, objectives, and targets, and enables reassessments to measure change and progress. The spatial data results are published on the [Government of Canada Open Data Portal](#).

NYSDEC Announces New Flood Mapping Tool to Benefit Lake Ontario Region

The NYSDEC announced in the spring of 2022 the release of a new flood inundation mapping tool for Lake Ontario, developed in collaboration with the U.S. Geological Survey (USGS), to assist flood prone communities along the lake. The Flood Inundation Mapper includes 321 miles (517 km) of New York shoreline and depicts estimates of inundation areas and shoreline flooding water depth by using data collected from eight new USGS lake gauges. The eight new USGS lake gauges supplement the existing four NOAA elevation gauges and provide information on wave dynamics not captured by existing gauges. Flood inundations layers were

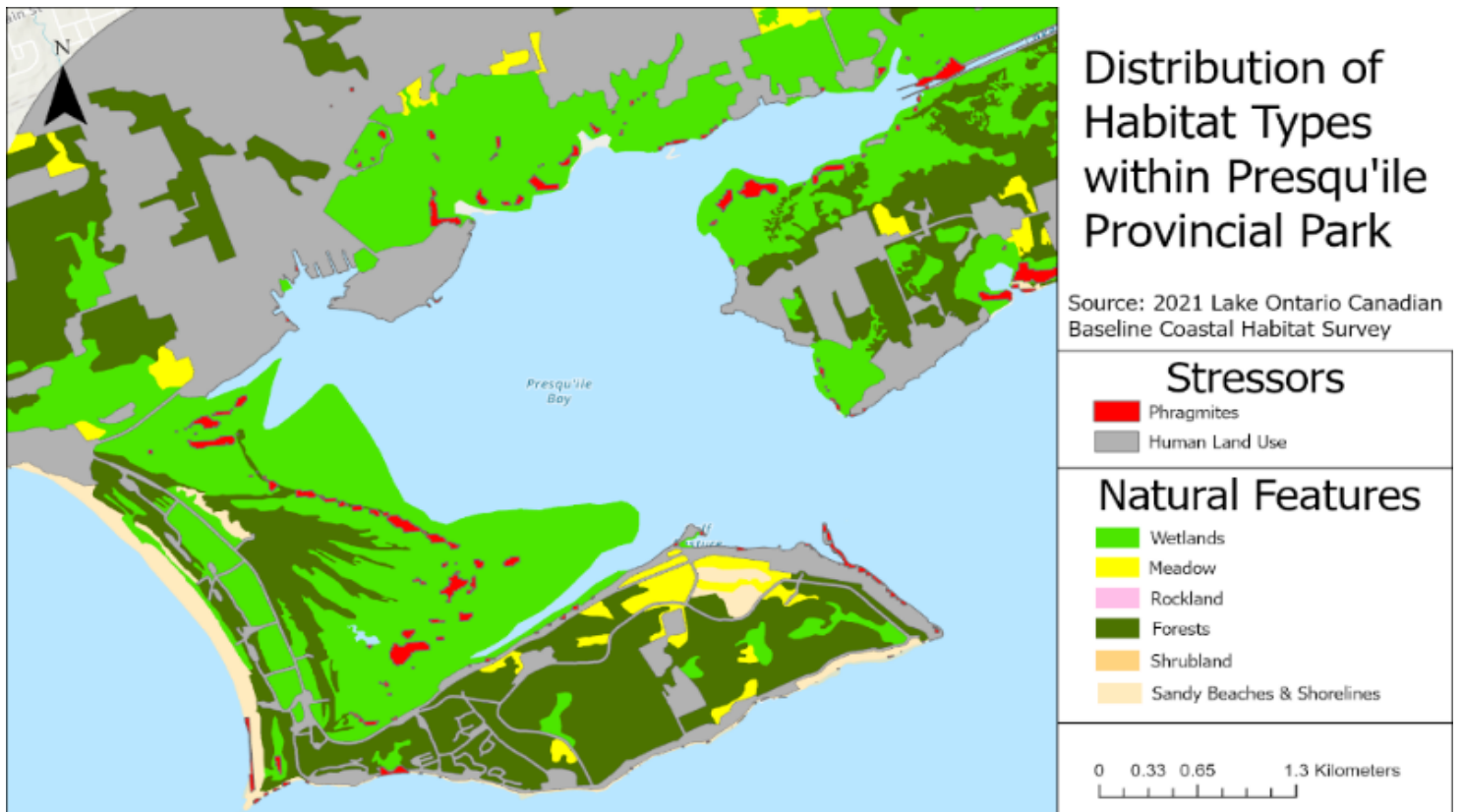
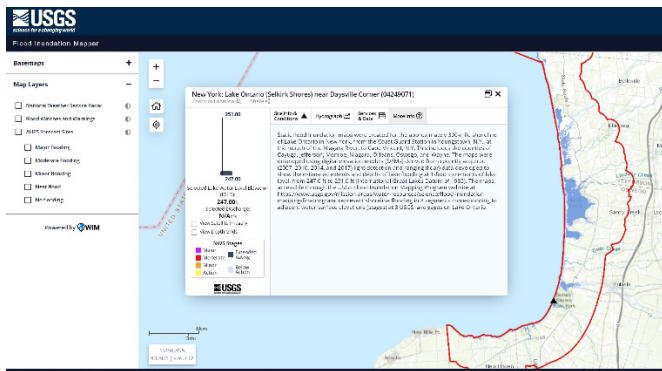


Figure 1: distribution of habitat types within Presqu'île Provincial Park.

developed incorporating recently acquired light detection and ranging (lidar) data.

DEC supported the initiative through the State's Environmental Protection Fund. In addition to building community resilience to flooding under increasingly variable water levels and extreme storms, the Flood Inundation Mapper and associated gauges will assist researchers, wetland scientists, and natural resource managers with protection and restoration of wetland and shoreline habitat. For example, data from the strategically located lake gauges have already been used to inform designs for several nature-based shoreline projects under New York's Resiliency and Economic Development Initiative (REDI), have aided research scientists as they evaluate wetland response to varying water levels, and assisted the United States Army Corps of Engineers (USACE) as they monitor performance of a restoration project at Braddock Bay.

The flood inundation tool along with links to the eight new USGS gauges is available online to the public at <https://fim.wim.usgs.gov/fim/>.



Screen shot of the USGS flood inundation tool.

OUTREACH AND ENGAGEMENT

Great Lakes Summer Teacher Workshops Held Throughout NY's Great Lakes in 2021 and 2022

In the summer of 2021 and 2022, NYS Department of Environmental Conservation's Great Lakes Program and New York Sea Grant partnered with NYS Office of Parks, Recreation, and Historic Preservation and

other local [Great Lakes Ecosystem Education Exchange](#) (GLEEE) partners to inspire 79 teachers and educators throughout NY's Great Lakes basin to impart a deeper understanding and appreciation for NY's Great Lakes within their classrooms and programs. A series of 8 workshops were held throughout NY's Great Lakes. In 2021, workshops were held at Evangola, Hamlin, Fair Haven, and Southwick Beach State Parks and in 2022 workshops were held in or near Environmental Justice areas, including Buffalo, Rochester, Oswego, and Massena. Teachers learned about the watershed and had the opportunity to interact with experts on water quality, fisheries management, and invasive species. Teachers were given free resources to take back to their classrooms, where they reach an estimated 5,575 students. These professional development workshops were held as part of the long-term NY GLEEE and [Center for Great Lakes Literacy](#) programming. Contact greatlakes@dec.ny.gov for more information.



Teachers learn about GLEEE resources at Evangola workshop. Source: NYSDEC and NY Sea Grant.

Canadian Great Lakes Nearshore Webinar Series

The "nearshore waters" are where the land meets the water and where most people interact directly with the Great Lakes. However, the water quality and ecosystem health of the nearshore are being impacted by nuisance and harmful algae, harmful chemicals, bacterial contamination of beaches, and impediments to coastal processes. In fall of 2021 and winter of 2022 Environment and Climate Change Canada invited the Great Lakes community to participate

in a series of webinars to explore and discuss the findings of the first cumulative assessment of Canadian Great Lakes nearshore waters. Each session consisted of a presentation from ECCC on the results as well as guest speakers with expertise in the key issues impacting the nearshore. The four themes included: Contaminants in Water, Sediment, and Fish; Coastal Processes; Nuisance & Harmful Algae; and Areas of High Ecological Value. Approximately 125 people participated in each session consisting of a mix of the public, academia, environmental non-government representatives, government staff, and Indigenous communities. The recordings of the sessions can be viewed at [Great Lakes Nearshore Webinar Series \(greatlakeswebinarseries.com\)](https://greatlakeswebinarseries.com).



A screen shot of Julia Hatcher (ECCC) facilitating a panel discussion on the impact of chemical and bacterial contamination on the nearshore with Satyendra Bhavsar (MECP), Gregory Ford (SDF Canada) and Tom Edge (McMaster University).

GLWQA Engagement Opportunities

The Lake Ontario Partnership held two *Let's Talk Lake Ontario* public webinars in 2022 to discuss the topics of invasive species and chemical contaminants and actions taken to address these issues. You can keep up to date on GLWQA engagement opportunities in the Engagement section of Binational.net. Information on many of our partner organizations' upcoming outreach and engagement opportunities can also be found at the Great Lakes Commission's "[Great Lakes Calendar](#)".

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