

# waterfrontline

The water's edge is the front line.

The flood in slow motion:

Henderson, Sodus, & Ogdensburg, New York; and Montreal, Canada.  
2017, 2019. 2020?

The Great Lakes are getting greater, year after year. Let's start with a high level picture of the way the water drainage system works for Lake Ontario, and then imagine heating up the arctic region. The resulting problem is very straightforward to see; the solutions are not.

To begin, here's Lake Ontario, with Canada on the north and US on the south. At its western end, near Buffalo, water flows into it from Lake Erie. The water flow for this map is left to right, west to east. Water goes over Niagara Falls as it passes from Lake Erie into Lake Ontario, then at its east end the lake goes past Kingston and up the St Lawrence River toward Montreal. Lake Ontario is the last Great Lake the waters of the other Great Lakes pass through on their way to the Atlantic.



Before the flow from Lake Ontario gets to Montreal, it reaches the Saunders Dam at Massena, New York. The Saunders Dam is a hydroelectric dam, but it also provides flood control so that Montreal is not flooded by high levels of water coming from Lake Ontario.

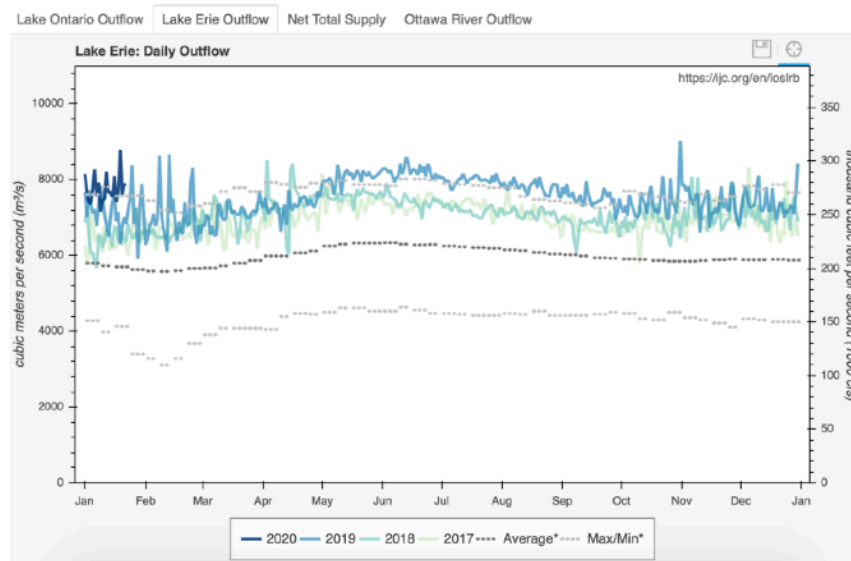
At the same time, water is flowing east from Ottawa along the Ottawa River, running toward Montreal. To protect Montreal from flooding, the Saunders Dam operators have to account for both the Ottawa River volume and the incoming volume from the St Lawrence/Lake Ontario; they can only stem the flow of the St Lawrence. (The Ottawa River only has one dam between Ottawa and Montreal (see <https://www.ottawariverkeeper.ca/map-gallery/>) at Carillon, and it is just a power-generation run-of-the-river dam, not a water retention dam.)

Now, warm the region above Ottawa via climate change. That warming will significantly increase the early flow from the spring thaw into the Ottawa River as ice melts. To protect

Montreal, and since you can't constrict the Ottawa River's flow, you must further dam the flow coming from Lake Ontario via the St Lawrence River; otherwise, Montreal would flood.

So we are starting to deliberately create a backup, holding more water in Lake Ontario so Montreal doesn't flood from the increased flow in the Ottawa River. But this isn't a closed system! That same climate-driven melt that feeds the Ottawa River increases the flow of water into Lake Superior, Lake Erie, and the systems that feed into Lake Ontario. So as you are closing Lake Ontario's relief valve in order to protect Montreal against flooding, the water level in Lake Ontario *has to rise* because it is receiving more water. It's just math and basic physics — we can all agree Lake Ontario's not going to go backwards up Niagara Falls.

The historical values for the flows in these lakes is online at <https://ijc.org/en/loslr/watershed/flows>. From that site, here are the last 3+ years of flows *from* Lake Erie *into* Lake Ontario. Consider this the input into the system, the starting point. The lines get progressively darker; 2017 is the lightest, then 2018, 2019, and finally the first part of 2020. 2018 was not significantly worse than 2017 (a flood year), but 2019 was higher, and 2020 is starting out above the prior years. It's important to start here because this is the primary input into the system of Lake Ontario's water control and distribution. It varies through the year, it is increasing year over year, and in 2019 it was higher than average for every month:

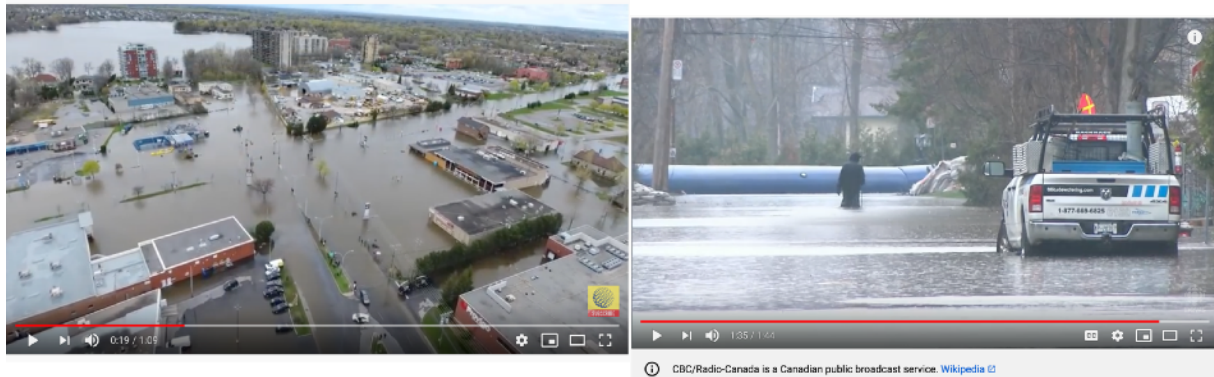


That was the input. How did the system respond? Here are the *outflows* from Lake Ontario to the river. To keep it simple, focus on 2019, the darkest full line. 2017 and 2019 had floods.

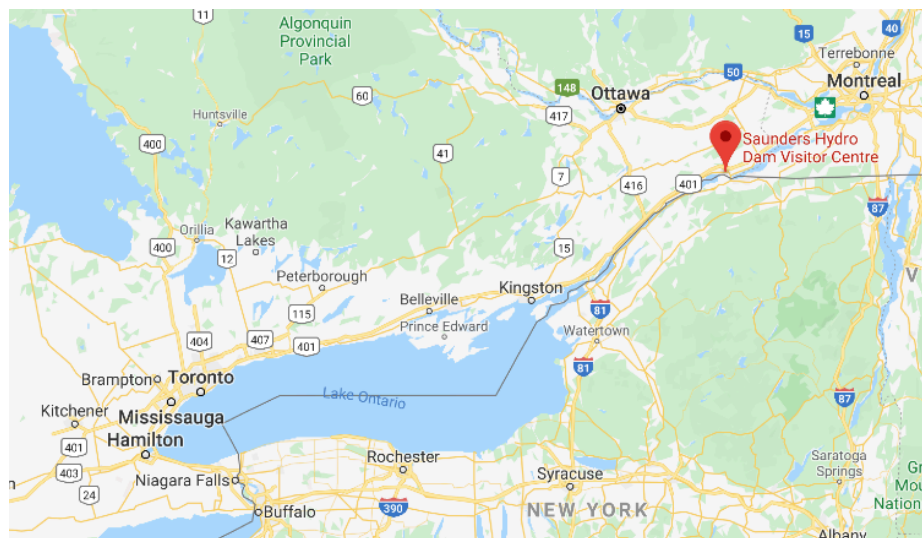


That straight portion of the lines for 2017 and 2019, from June to August, is a sign of an intervention: a solution to one problem but the trigger of others. Lake Ontario was receiving water (from Lake Erie) and discharging water (through the St Lawrence) and then in June the discharge level stopped increasing. We can see from the Lake Erie chart that during that same time period water kept coming in at an increasing flow rate. What happened?

The operators of the Saunders dam, executing a plan called Plan 2014, held up the water in the St Lawrence because the increased flow from Lake Ontario, coupled with the increased flow from the Ottawa River, would have resulted in flooding Montreal. And Montreal was already recovering from floods by direct storms at earlier times in those years (*in both 2017 and 2019*: Screen shots from drone video of Montreal's May 2017 flood : <https://youtu.be/OvnAt6A8Vns> and Montreal's April 2019 flood: <https://youtu.be/EMJXQdjTJ1Y> ).



So we would expect that Lake Ontario would *have* to rise because of its increased volume that is not being released down the river. And the St Lawrence River between Kingston and the dam would rise for the same reason. And these would immediately cause flooding issues in the low-lying areas there, helpfully shown topographically in Google Maps: the green areas along the St Lawrence riverbanks and in the southeast corner of the Lake Ontario shoreline (roughly from Watertown to the Syracuse area) are the lowest land and the most susceptible to floods:





And that is exactly what is happening. The small towns in those areas are getting flooded out, with no way to adequately protect against the rising lake. The lake is spreading to the southeast, into the lowest area it can find, because that is what liquids do. The residents of Henderson, New York have recently met with other community groups in an effort to try to force changes to the way the lake's water levels are managed. (See [https://www.nny360.com/news/jeffersoncounty/group-plans-lawsuit-protest-for-plan-changes/article\\_bf08f1dd-1713-5d69-bcfa-2110bf83b2e2.html](https://www.nny360.com/news/jeffersoncounty/group-plans-lawsuit-protest-for-plan-changes/article_bf08f1dd-1713-5d69-bcfa-2110bf83b2e2.html)) As part of that effort, the groups are calling for a potential blockade of the St Lawrence River if the situation is not fixed.

Henderson and its harbor area were flooded in May 2017:

(see [https://www.syracuse.com/weather/2017/05/check\\_out\\_flooding\\_in\\_from\\_henderson\\_harbor\\_to\\_alexandria\\_bay\\_photos.html](https://www.syracuse.com/weather/2017/05/check_out_flooding_in_from_henderson_harbor_to_alexandria_bay_photos.html) for photos)

and were covered in the local June 2019 newscast about floods impacting the coast:  
<https://youtu.be/XgE5naWrzew>



Rising flood waters doing more damage along Lake Ontario shoreline

The town of Sodus and surrounding areas — including Wolcott as shown in this screenshot — were shown during 2017's flooding: (<https://youtu.be/EZwyZqn5o50>)



Lake Ontario's record-breaking high waters continue to batter businesses along its shore (May 2017)

Along the St Lawrence River, Ogdensburg struggled to complete work on repairs to structures damaged in 2017 — because more flood damage came before the work could be completed.

(<https://northcountrynow.com/news/work-remains-stalled-docks-trail-section-still-closed-ogdensburg-struggles-river-flooding>)

As the city manager noted, these conditions have become the new normal.

## NCNow News

### Work remains stalled on docks, trail section still closed as Ogdensburg struggles with river flooding

Saturday, June 1, 2019 - 8:37 am

By JIMMY LAWTON

North Country This Week

OGDENSBURG — A portion of the Ogdensburg Maple City trail remains closed and work is suspended on the city dock high water levels on the St. Lawrence River continue to plague the city.

"The water levels are still incredibly high making it tough to use our boat launches.," Ogdensburg Parks and Recreation Director Matthew J. Curatolo said.

A small, 40-foot section of the Maple City Trail remains closed.

The flooding comes as the city has been working to repair damage caused by high water levels in 2017.

Meanwhile the traffic circle work has stopped temporarily until the water recedes and parts of the trail near Dobisky are closed for now due to high water.

"Unfortunately this seems to be becoming the new normal," City Manager Sarah Purdy said.

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Even NPR paid a visit in 2019: (<https://www.npr.org/2019/06/15/732992618/high-flooding-on-lake-ontario-and-st-lawrence-river>)

RUSSELL: There's been record snow and rainfall in the Great Lakes Basin this year. That water has to go somewhere, and that somewhere is the St. Lawrence River. IJC spokesman Frank Bevacqua says the commission has done all it can to reduce the impact of flooding.

FRANK BEVACQUA: The obvious cause for the flooding is that there's been too much water coming into the system.

RUSSELL: Bevacqua says they even released more water from a massive dam than they normally would in hopes of bringing levels down on the lake and the river.

BEVACQUA: There's a tremendous amount of public concern, and I think commissioners want to make sure that no stone is left unturned.

RUSSELL: That is welcome news for Kathleen Hilborne. She, like a lot of the shore owners here, still blames the IJC.

HILBORNE: My father was on the river his whole life. This has never happened. My husband's family had a camp on the river. This never happened.

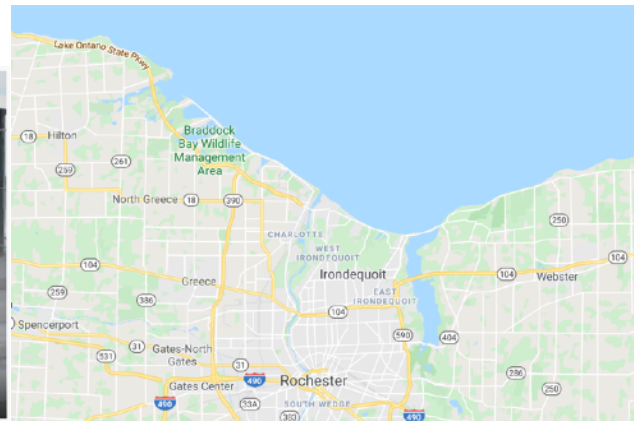
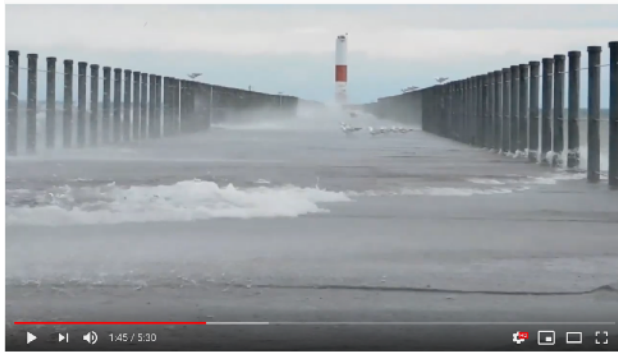
While it's not a comfort, everybody quoted is right. It didn't happen like this before.

The climate was different then. More ice stayed frozen then, so the water levels stayed lower. But you can see things have changed, and we can predict where the damage will first occur.

If we try to solve this by elevating all of those low-lying areas — effectively raising the sides of the basin holding the water of Lake Ontario — that will just make some other spot along the shoreline the lowest. More water would rush down the Genessee (at Rochester) into the Finger Lakes region and will flood central New York state. The wildlife management areas and fishing areas around Crescent Beach would see rising levels of force from the lake. *(NOTE: You could make a case for current flooding events in New York state being a part of this same system, with the New York Finger Lakes region seeing increased floods in towns like Danby and Ithaca.)*

*(A video of the Rochester pier being overwashed in June 2019:*

*<https://youtu.be/OkXgW5qZmCw>:*



## GOING FORWARD

Solving these issues systemically requires looking at the whole system. The solutions so far have focused on solving specific areas — point solutions for point problems. In October, (<https://www.wnytv.com/2019/10/31/jefferson-st-lawrence-counties-get-m-flood-resiliency-economic-development/>), NY Governor Andrew Cuomo visited Clayton, NY, with the news that the state is providing \$60 million to Jefferson and St Lawrence county municipalities to rebuild after their recent floodings:

*“This is literally improving your community, the economic competitiveness of your community, the homes in your community, the facilities in your community. They are going to be better than ever before,” said Cuomo.*

*The money will be used for 38 projects under the Lake Ontario Resiliency and Economic Development Initiative, or REDI.*

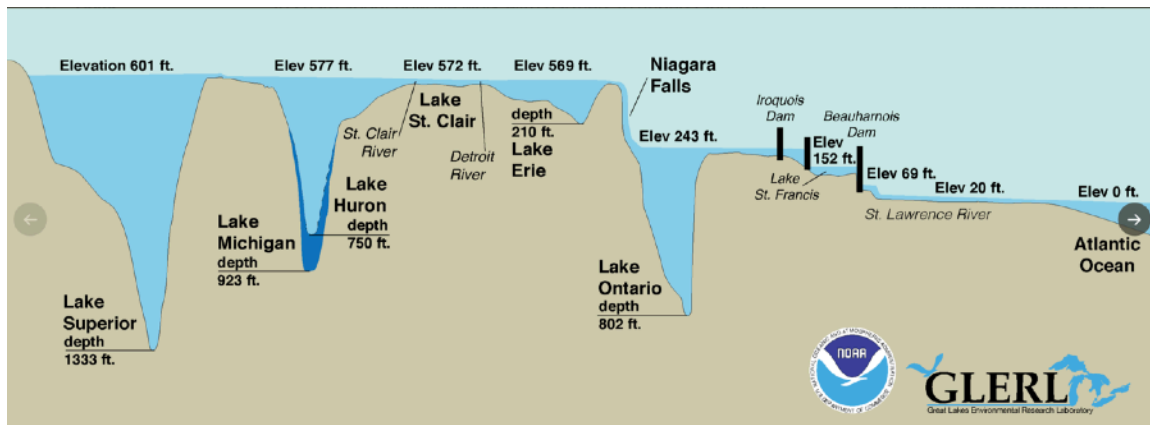
The commission's site (<https://www.governor.ny.gov/programs/lake-ontario-resiliency-and-economic-development-initiative-redi>) provides further details on the plans:

*The REDI Commission allocated \$20 million for homeowner assistance, \$30 million to improve the resiliency of businesses, and \$15 million toward a regional dredging effort that will*

benefit each of the eight counties in the REDI regions. The remaining \$235 million has been allocated towards local and regional projects that advance and exemplify the REDI mission.

When starting projects, care should be taken to be sure they align with strategic solutions to systemic issues. How do they address the climate-driven influx of water into the system, and its handling?

What does the upstream region even look like? As shown by NOAA ([https://twitter.com/NOAA\\_GLERL/status/1103655038352834561?s=20](https://twitter.com/NOAA_GLERL/status/1103655038352834561?s=20)), the lakes are not identical in shape or depth. In the NOAA graphic shown here, Lake Ontario has a standard elevation of 243 feet.



On a weekly basis, the Army Corps of Engineers issues a forecast on the Great Lakes water levels (<http://re-wm.usace.army.mil/ForecastData/weekly.pdf>). For the week of January 24, 2020, Lake Ontario's elevation is 246.33 feet. That's a foot higher than it was on January 1, 2019, prior to that year's flooding, and 3 feet above what's shown on the graphic. And in the middle of January, the lake level *is going up*.

	SUPERIOR	MICH-HURON	ST. CLAIR	ERIE	ONTARIO
Forecasted Water Level for Jan 24, 2020 (feet)	602.72	581.69	576.71	573.56	246.33
Chart Datum (feet)	601.10	577.50	572.30	569.20	243.30
Difference from chart datum (inches)	+19	+50	+53	+52	+36
Difference from average water level for Dec 24, 2019 (inches*)	0	+3	+4	+6	+3
Difference from average water level for Jan 24, 2019 (inches*)	+4	+20	+21	+8	+8
Difference from long-term monthly average of Jan (inches)	+15	+39	+37	+32	+20

If the lake this year follows its behavior in 2017 and 2019, it would be reasonable to assume a 4 ft increase in the elevation of Lake Ontario between January and May — which would result in a water level worse than the 2019 flooding and would put many small towns along the Lake Ontario southern shoreline past flood stage if nothing is done to avoid that water level being reached. In 2018, the rise was closer to 2 feet, which still reaches flood levels if added to the January 2020 starting elevation. From the same report, the upstream lake systems are sending downstream more water than average:

FORECASTED MONTHLY OUTFLOWS/CHANNEL CONDITIONS
Lake Superior's outflow into the St. Marys River is forecasted to be above average. Lake Michigan-Huron's outflow into the St. Clair River and Lake St. Clair's outflow through the Detroit River are predicted to be above average for January. In addition, Lake Erie's outflow into the Niagara River and Lake Ontario's outflow into the St. Lawrence River are projected to be above average for January. Water levels and flows in the connecting channels can be significantly impacted by ice during the winter months.



How should the government funds be directed? The trap to avoid is fixing easy things quickly if they are likely to have no strategic value. For example, fixing a damaged deck on a restaurant may seem as a resilience expenditure, but it does not prevent the larger systemic problem from being worse next year and possibly destroying the entire restaurant building. Those larger, more difficult problems — involving measures like deepening the lakes or channeling the waters around major cities — require significant civil engineering projects that will take vision and years to complete, and while they are underway the annual floods will remain a threat.

Meanwhile, the state's US Senators also stepped in. In December 2019, Senators Schumer and Gillibrand pushed to allocate \$1.5 million from the federal budget for an urgent review of Plan 2014, which governs the release allocation at the Saunders Dam: (<https://www.adirondackdailyenterpriser.com/news/local-news/2019/12/senators-call-for-overhaul-study-of-lake-ontario-flood-control-plan/>)

*“The funding is included in a bipartisan omnibus 2020 spending package that is expected to pass Congress this week. The senators said in their statement that the Canadian government will match the funding. Plan 2014 took 16 years and \$20 million to develop. It replaced Plan 1958-D, which had been in use since 1963. Many shoreline property owners have called for a repeal of Plan 2014 and a return to Plan 1958-D, although the IJC maintains that flooding conditions in 2017 and 2019 would have been similar under either plan.”*

Using either the current or former plan, the heavy additional flow into Lake Ontario will result in flooding somewhere. Without a systemic solution, the parties are arguing about where that flood will be. And they can't make the release volume too great, or it will impact the shipping lanes in Lake Ontario beyond allowable limits; there is no simple solution.

The Lake Ontario residents' plans for changing the dam usage will relieve some flooding for the residents of Lake Ontario and the St Lawrence River, at the expense of releasing more water and potentially increasing the risk of flooding at Montreal. *Once it's in Lake Ontario, the water has to go somewhere.* Importantly, any strategy that is based solely on changing Plan 2014 is usually a discussion based on *past* flow values (as that is the plan's basis), but as already shown above those flow rates change year over year. The replanning needs to start with a realistic assessment of *future* water flows.

Engineering design decisions start by defining the requirements, the constraints, the variables, and the constants — the boundaries within which the system functions.

And it's just math: the input volume of water into Lake Ontario is not a constant value that matches its value from 10 years ago or even 3 years ago (*it was on that first chart; the January 1 incoming rate went from around 6,000 cubic meters per second to 8,000. Even those with no background in fluid dynamics can see that's a 33% increase.*) The incoming flow rate is a variable, and you have to go back to Square One and reset your engineering design approach based on that. This is a design issue; it cannot be solved as an after-the-fact fix.

The entire shoreline is waiting for the strategic fix. Shoreline residents are watching.

Because they are the front line, and they know it.

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For further study:

For the full version of Plan 2014, see [https://ijc.org/sites/default/files/2018-08/Plan2014\\_CompendiumReport\\_1.pdf](https://ijc.org/sites/default/files/2018-08/Plan2014_CompendiumReport_1.pdf)

For a detailed webinar from the community organization along with inundation forecasts, see <https://youtu.be/V6xEivQFGRg>