International Niagara Board of Control

One Hundred Thirty Seventh Semi-Annual Progress Report

to the

International Joint Commission

Covering the Period March 1 through August 31, 2021

Executive Summary

Lake Erie began the reporting period with a March mean level 48 cm (19.0 inches) above its period-of-record (1918-2020) average level for the month. The level of Lake Erie remained above average on a monthly basis throughout this reporting period. During its seasonal rise, Lake Erie's water level rose 13 cm (5.1 inches) from March to June, compared to its average rise of 26 cm (10.2 inches). In July, the lake level further rose 10 cm (3.9 inches) instead of its average decline of 2 cm (0.8 inches) for the month. Lake Erie levels ended the reporting period with an August monthly mean water level of 51 cm (20.2 inches) above average (Section 2).

The level of the Chippawa–Grass Island Pool (CGIP) is regulated under the International Niagara Board of Control's 1993 Directive. The Power Entities (Ontario Power Generation and the New York Power Authority) were able to comply with the International Niagara Board of Control's (the board) directive at all times during the reporting period (Section 3).

All gauges required for the operation of International Niagara Control Works (INCW) were operating normally most of this reporting period to provide flow measurements over Niagara Falls (Section 4).

Flow over Niagara Falls exceeded minimum Treaty requirements at all times during the reporting period with the exception of June 27, 2021 at 21:00 for a rescue mission (Section 5).

During the reporting period the diversion from the Niagara River for the Sir Adam Beck (SAB) I and II plants averaged 1,580 m^3/s (55,800 cfs) and diversion to the Robert Moses Niagara Power Project averaged 2,278 m^3/s (80,450 cfs). The Niagara River flow at Queenston during the period March through August 2021 averaged 6,937 m^3/s (244,980 cfs), which was 963 m^3/s (34,010 cfs) above the 1900-2020 average of 5,974 m^3/s (210,970 cfs) for the period.

Flow measurements are taken on a regular schedule to confirm the accuracy of the gauges used to determine the allocation of water from the Niagara River. No flow measurements were scheduled during this reporting period. The next measurement series in the Welland Canal is planned for the fall of 2021, subject to changing COVID-19 travel restrictions. The regularly scheduled measurement for the Upper Niagara River was postponed due to COVID-19 travel restrictions and is now scheduled for spring 2022 (Section 8).

Ontario Power Generation (OPG) and New York Power Authority (NYPA) continued ongoing upgrades to their generating units for efficient use of water for power generation (Section 9).

The Lake Erie – Niagara River Ice Boom was operated by the Power Entities in accordance with conditions of International Joint Commission Order of Approval. Solid ice formation did not occur during the winter of 2020-2021. A media advisory was issued by the board on March 16, 2021 informing the public that removal operations would begin on March 18. However, due to staff shortages during COVID-19, NYPA began ice boom removal on March 22. All spans were moved to their summer storage facility by April 16, 2021, ending the 2020–2021 ice boom season (Section 10).

Table of Contents

List of Tables

List of Figures

Enclosures

COVER: Photo of the Niagara River's turbulence from Bird Island Park at sunset. (Photo Credit: Lauren Schifferle, USACE).

INTERNET SITES

International Joint Commission
English: https://ijc.org/en
French: https://ijc.org/fr

International Niagara Board of Control
English: https://www.ijc.org/en/nbc
French: https://www.ijc.org/fr/ccrn

Lake Erie-Niagara River Ice Boom
https://iceboom.nypa.gov/

INTERNATIONAL NIAGARA BOARD OF CONTROL

Cincinnati, Ohio
Burlington, Ontario

September 28, 2021

International Joint Commission
Washington, D.C.
Ottawa, Ontario

Commissioners:

1. General

The International Niagara Board of Control (the board) was established by the International Joint Commission (IJC) in 1953. The board provides advice to the IJC on matters related to the IJC's responsibilities for water levels and flows in the Niagara River. The board's main duties are 1) to ensure the operation of the Chippawa-Grass Island Pool (CGIP) upstream of Niagara Falls within the limits of the board's 1993 Directive (revised in 2017), and 2) to oversee the operation of the Lake Erie-Niagara River Ice Boom at the outlet of Lake Erie. The board also collaborates with the International Niagara Committee (INC), a body created by the 1950 Niagara Diversion Treaty to determine the amount of water available for Niagara Falls and hydroelectric power generation.

The Board is required to submit written reports to the IJC at its semi-annual meetings in the spring and fall of each year. In accordance with this requirement, the board herewith submits its One Hundred Thirty Seventh Semi-Annual Progress Report, covering the reporting period March 1, 2021 to August 31, 2021.

All elevations in this report are referenced to the International Great Lakes Datum 1985 (IGLD 1985). Values provided are expressed in metric units, with approximate customary units (in parentheses) for information purposes only. Monthly mean Lake Erie water levels are calculated from four gauges established by the Coordinating Committee on Great Lakes Basic Hydraulic and Hydrologic Data (http://www.greatlakescc.org) to provide a lake-wide average water level.

2. Basin Conditions

The level of Lake Erie was above average throughout the reporting period. It began the reporting period with a high level for March, 48 cm (19.0 inches) above its 1918–2020 average for the month. During its seasonal rise, Lake Erie's water level rose 13 cm (5.1 inches) from March to June, compared to its average rise of 26 cm (10.2 inches). In July, the lake level further rose 10 cm (3.9 inches), instead of its average decline of 2 cm (0.8 inches) for the month. Lake Erie levels ended the reporting period with an August monthly mean water level of 51 cm (20.2 inches) above average. Recorded monthly water levels for the period March 2021 through August 2021 are shown in Table 1 and depicted graphically in Figure 1. The following paragraphs provide more detail on the main factors that led to the water level changes observed on Lake Erie during the reporting period.

Lake Erie receives water from its local drainage basin and from the upstream lakes. The water supplied to a lake from its local drainage basin is referred to as its net basin supply (NBS). A lake's NBS is the sum of the amount of water the lake receives from precipitation falling directly on its surface and runoff (including snow melt) from its surrounding basin watershed, minus the amount of water that evaporates from its surface. The sum of Lake Erie's NBS and the inflow from Lake Michigan–Huron via the St. Clair-Detroit Rivers system is its net total supply (NTS).

Precipitation is a major contributor to NBS, both directly on the lake and through runoff from the lake basin due to rain and snowmelt. Recent precipitation data and departures from the long-term average are shown in Table 2 and depicted graphically in Figure 2. The Lake Erie basin received 47.92 cm (18.86 inches) of precipitation during the period March through August 2021. This is about 3% below the 1900-2017 average for the period. Precipitation was above average for June, July, and August while it was below for March, April, and May during the reporting period.

The monthly Lake Erie NBS for this reporting period are shown in Figure 3. A negative NBS value indicates that more water left the lake during the month through basin evaporation than entered it through precipitation and runoff. On average, this is the case for Lake Erie

from August to November. For the remainder of the year, average precipitation and runoff are typically greater than the water lost to evaporation. During the reporting period, the lake's NBS was below average for March, April, and May while it was above for June, July, and August.

Inflow via the Detroit River is the major portion of Lake Erie's NTS, and is greatly influenced by the level of Lake Michigan–Huron. Continuing the trend of the above average levels seen for the past few years, the level of Lake Michigan-Huron was above average for the entire reporting period (Figure 4). The above average lake level caused the flow in the Detroit river to be above average for the entire reporting period (Figure 5). Lake Erie inflow via the Detroit River was approximately 27% above the long-term average from March through August 2021.

The inflow from Lake Michigan–Huron via the Detroit River combined with Lake Erie's NBS resulted in very wet conditions with a NTS for Lake Erie of approximately 18% above average for the period March through August 2021. The NTS were above-average for all months this reporting period. The NTS to Lake Erie for this reporting period is depicted relative to the long-term average in Figure 6.

Lake Erie discharges water to Lake Ontario through the Niagara River and the Welland Canal. The portion of the Lake Erie outflow that is diverted through the Welland Canal is relatively small, approximately between three and five percent of the total Lake Erie outflow. It is used for navigation purposes through the canal and for the generation of electricity at Ontario Power Generation's (OPG's) DeCew Falls hydroelectric plants. Most of the outflow from Lake Erie occurs through the Niagara River and depends on the level of the lake at its outlet. Generally speaking, above-average lake levels result in above-average outflow, and below-average lake levels lead to below-average outflow. Flow in the river is also influenced by winter ice and summer aquatic plant growth in the river, both of which can decrease the flow. Prevailing winds can also cause variations in the lake outflow. Strong westerly winds raise the lake level at the east end, resulting in increased outflow, while easterly winds have the opposite effect. Throughout the reporting period, the Niagara River monthly average

flows at Buffalo were well above-average ranging from 6,710 m^3/s (236,960 cfs) to 7,130 m^3/s (251,790 cfs) due to above-average levels on Lake Erie (Figure 7).

While it is impossible to accurately predict future supplies to the lakes, it is possible to estimate future lake levels based on historical supplies, past levels (1918-present), and current levels. The six-month water level forecast prepared at the beginning of September by the U.S. Army Corps of Engineers (USACE) and Environment and Climate Change Canada (ECCC) indicates that if average water supply conditions are experienced, the level of Lake Erie would remain above average throughout the fall and early winter.

3. Operation and Maintenance of the International Niagara Control Works

The water level in the Chippawa-Grass Island Pool (CGIP) is regulated in accordance with the Board's 1993 Directive. The Directive requires that the Power Entities – Ontario Power Generation (OPG) and the New York Power Authority (NYPA) – operate the International Niagara Control Works (INCW) to ensure the maintenance of an operational long-term average CGIP level of 171.16 m (561.55 feet) to reduce the adverse effects of high or low water levels in the CGIP. The Directive also establishes tolerances for the CGIP's level as measured at the Material Dock gauge. The Power Entities complied with the Board's Directive at all times during the reporting period.

The accumulated deviation of the CGIP's level from March 1, 1973 through August 31, 2021 was +0.18 meter-months above the long-term operational average elevation. The accumulated deviation was within the maximum permissible accumulated deviation of ±0.91 meter-months for this reporting period.

During the reporting period, tolerances for regulation of the CGIP were suspended due to ice on March 1, 2, 3, 5, 6, 7, 14, and 15. Due to abnormally high flows, tolerances were suspended on March 26 and 27. Due to life saving/emergency operations, tolerances were suspended on May 15, 29, 30, June 20, 27, 28, and August 1, 2.

The locations of the water level gauges on the Niagara River are shown in Enclosure 1. Recorded daily maximum and minimum Material Dock water levels covering the reporting period are shown in Figure 8.

Regular maintenance at the INCW included a trunnion seal replacement on Gate 3, which commenced on June 8, 2021 with a completion date of June 10, 2021. A hydraulic system overhaul on Gate 7 was initiated on March 15, 2021 and was returned to service on September 3, 2021. G12 will only be used, if needed, to loosen the ice shield.

Following a forced station service outage due to switchgear failure, a maintenance program was created for the INCW primary power supply components. Maintenance was carried out July 9, 2021 for the INCW T1 power transformer and 13.8 kv switchgear, and July 29, 2021 for the INCW T2 power transformer and 13.8 kv switchgear.

Several on-going maintenance and capital projects continue at the INCW and although some were suspended due to the COVID-19 pandemic, they are planned for re-start as conditions permit. The public safety enhancement project is ongoing with an estimated completion of Q4 2021. This project will provide for expanded public safety monitoring of the CGIP, including public alert and monitoring at the NYPA intakes. The temporarily suspended, control room reconfiguration project is 90% complete, currently aiming for restart, with targeted completion date of Q4 2021. The Niagara River WLG house replacement project will address the poor condition of the gauge houses and provide upgrades to gauge telemetry/redundancy. This project commenced in the Q2 2021 with an estimated completion date of Q3 2022. The gate hydraulic system pilot project is scheduled to begin execution phase in Q4 2021 with scheduled completion in Q3 2022. This project will verify the new hydraulic system design, providing a robust and reliable hydraulic system for integration into the upcoming gate rehabilitation project. The Septic upgrade project is currently in execution with an estimated completion date of Q4 2021. The existing septic system has failed, the new system will provide a compliant and reliable septic service. The INCW Tower Project will provide an elevator and 4th floor in compliance with the building code / disabilities act. This project has a planned completion of Q4 2022. The ice camera

replacement project had a projected completion of Q4 2021, however will be deferred to 2023 to coincide with the NYPA camera replacement project. Working with NYPA will provide for common equipment and software, and create stronger, more reliable ice monitoring. The NRC domain hardware / software replacement project started in Q3 2021 and is estimated to be complete by Q1 2022. The new system will provide redundancy for improved functionality and reliability. And finally, the Gate Rehabilitation Project will replace all gate components and control. This project is planned to start in Q1 2023 and will run over 10 years until completion.

4. Gauging Stations

The gauges used to determine flows in the Niagara River, monitor the CGIP levels and the flow over Niagara Falls are the Fort Erie, Material Dock and Ashland Avenue gauges as shown in Enclosure 1. The Buffalo, Slater's Point, and U. S. National Oceanic and Atmospheric Administration (NOAA) Ashland Avenue gauges are used as alternatives in the event of primary gauge failure. The Slater's Point and Material Dock gauges are owned and operated by the Power Entities. Both NOAA and the Power Entities own and operate water level gauges at the Ashland Avenue location. All gauges required for the operation of the INCW were in service during this reporting period, except for the following incidents. A Niagara Falls, Ontario Canada, a Bell communication system power failure rendered the following gauges unavailable starting on August 14, 2021 at 23:37 until August 15, 2021 at 11:53 (12 hrs, 16 min): Fort Erie, Frenchman's Creek, Slaters Point, and Material Dock. The Ashland Avenue Gauge was unavailable due to planned maintenance on July 4, 2021 from 06:25 to 09:00.

5. Flow over Niagara Falls

The Niagara Diversion Treaty of 1950 sets minimum limits on the flow of water over Niagara Falls. During the tourist season (April-October) daytime hours, the required minimum Niagara Falls flow is 2,832 cubic metres per second (m^3/s) (100,000 cubic feet per second (cfs)). At night and at all times during the non-tourist season months

(November-March), the required minimum Falls flow is 1,416 m^3/s (50,000 cfs). The appropriate operation of the INCW, in conjunction with power diversion operations, maintains sufficient flow over the Falls to meet the requirements of the 1950 Niagara Diversion Treaty. Falls flow met or exceeded minimum Treaty requirements at all times during the reporting period with the exception of June 27, 2021, as described below. The recorded daily average flow over Niagara Falls, covering the reporting period, is shown in Figure 9.

On June 27, 2021 at 21:00 EST, the flow over Niagara Falls was below the Treaty requirement by 370 m^3/s. This violation was the result of actions undertaken by the New York State Parks Police to rescue a vessel grounded on a shoal in the CGIP. To aid in the rescue, the INCW closed all gates at 20:40 EST to increase water levels in the CGIP.

6. Falls Recession

The board monitors the Horseshoe Falls for changes in its crestline. Crestline changes may result in a broken curtain of water which could change the scenic value of the Falls. Changes in the crestline could also form a notch which could signal a period of rapid Falls recession that has not been seen in more than a century. A review of the Falls crest imagery (most recent image found during this reporting period was taken on August 25, 2021) showed no evidence of notable change in the crestline of the Falls during this reporting period.

7. Diversions and Flow at Queenston

Diversion of water from the Niagara River for power purposes is governed by the terms and conditions of the 1950 Niagara Diversion Treaty. The Treaty prohibits the diversion of Niagara River water that would reduce the flow over Niagara Falls for scenic purposes to below the amounts specified previously in Section 5 of this report.

The hydroelectric power plants, OPG's Sir Adam Beck (SAB) I and II in Canada and NYPA's Robert Moses Niagara Power Project in the United States, withdraw water from the CGIP upstream of Niagara Falls and discharge it into the Lower Niagara River at Queenston, ON and Lewiston, NY, respectively. During the period of March through August 2021, diversion for the SAB I and II plants averaged 1,580 m^3/s (55,800 cfs) and diversion to the Robert Moses Niagara Power Project averaged 2,278 m^3/s (80,450 cfs). Diversion from the Welland Canal to OPG's DeCew Falls Generating Stations averaged 203 m^3/s (7,170 cfs) for the same period. Records of diversions for power generation covering the reporting period are shown in Figure 10.

The monthly average Niagara River flow at Queenston, Ontario, for the period of March through August 2021, and departures from the 1900–2020 long-term average are shown in Table 3. Maximum and minimum monthly average flows for the 1900–2020 period of record are shown in Table 4. During the period March through August 2021, the flow at Queenston averaged 6,937 m^3/s (244,980 cfs), which was 963 m^3/s (34,010 cfs) above the 1900-2020 average of 5,974 m^3/s (210,970 cfs) for the period. The monthly values ranged between 6,814 m^3/s (240,630 cfs) and 7,132 m^3/s (251,860 cfs).

8. Flow Measurements in the Niagara River and Welland Canal

Discharge measurements are regularly scheduled in the Niagara River and Welland Canal as part of a program to verify the gauge ratings used to determine flow in these channels for water management purposes. Measurements are obtained through joint efforts of the USACE and ECCC. Measurement programs require boats, equipment and personnel from both agencies to ensure safety, quality assurance checks between equipment and methods, and bi-national acceptance of the data collected. The USACE and ECCC continue efforts to standardize measurement equipment and techniques. Historically, measurements were made at several locations as described below. Due to COVID-19 restrictions there were no discharge measurements taken in 2020.

Upper Niagara River: Regularly scheduled measurements are taken near the International Railway Bridge, located in the Upper Niagara River, on a 3-year cycle to provide information to evaluate stage-discharge relationships for flow entering the Niagara River from Lake Erie. The regularly scheduled discharge measurements near the International Railway Bridge were taken in May 2018. The regularly scheduled measurement at the International Railway Bridge has been postponed due to COVID-19 travel restrictions and is now scheduled for spring 2022. These measurements may need to be delayed if COVID-19 restrictions prohibit the collection of this data. These measurements support the stage-discharge relationship known as the Buffalo rating equation, due to the use of water level data from the Buffalo NOAA gauge. The Buffalo rating equation is used in the Great Lakes water supply routing models to estimate the flow in the Niagara River.

Lower Niagara River: Discharge measurements are made on a 3-year cycle at the Ashland Avenue Gauge Rating Section, located just upstream of the OPG and NYPA hydroelectric generating stations at Queenston–Lewiston, to verify the 2009 Ashland Avenue gauge rating of the outflow from the Maid-of-the-Mist Pool below the Falls. The Ashland Avenue gauge rating is used to determine the flow over Niagara Falls for purposes of the 1950 Niagara Treaty. Measurements taken in September 2019 have been compiled in a final report currently awaiting review from the INWC. The next measurements at this location are scheduled for September 2022. This set of measurements has been coordinated between ECCC, USACE and the Power Entities.

American Falls Channel: Discharge measurements are made in the American Falls Channel on a 5-year cycle. This is to verify the rating equation used to determine the amount of flow in the American Falls channel and to demonstrate that a dependable and adequate flow of water is maintained over the American Falls and in the vicinity of Three Sisters Islands as required by the IJC directive to the board. Since the American Falls flow is directly related to the operation of the CGIP, the board monitors this relationship. The measurements are made using a section near the upper reach of the American Falls channel close to the American Falls Gauge site. Following the 5-year cycle, the next scheduled measurements at this location are expected to be made in the spring of 2022.

Welland Canal: Discharge measurements are made on a 3-year cycle in the Welland Supply Canal above Weir 8 to verify the index-velocity rating for the permanently installed Acoustic Doppler Velocity Meter (ADVM) which is used in the determination of flow through the Welland Canal. Measurements were made in the Welland Supply Canal in May 2018. These measurements are currently under review. The next measurement series in the Welland Supply Canal is planned for the fall of 2021, subject to changing COVID-19 travel restrictions.

9. Power Plant Upgrades

OPG is continuing a unit rehabilitation program which began in 2007. Currently, the SAB I G10 Gibson Report has been finalized and reviewed by NYPA in summer 2021, and is expected to receive final approval and implementation in September 2021. The SAB I G5 unit overhaul is complete and returning to service in September 2021. An interim rating table is in place and a Gibson Test is expected in early 2022. SAB I G4 & G8 are scheduled for an overhaul in 2025-2026 and G6 in 2026-2027. SAB I units G1 and G2 are undergoing a frequency conversion from 2021-2022 with the installation of new 60 Hz units. G2 is scheduled to be in service in September 2022, and G1 is scheduled to be brought online in May 2022. OPG Performance and Testing is validating manufacturer models to develop interim rating tables for these units. SAB II unit overhauls will begin in May 2024, with G19 & G20 in 2024-2025 and G17 & G18 in 2026-2027.

The DeCew Falls I runner replacement for G8 is scheduled to be complete in September 2021. DeCew Falls II G1 is scheduled for a runner replacement in 2023 and G2 in 2025-2026.

OPG is in the process of replacing the existing Water Record Accounting (WRA) system for the SAB and DeCew GS. The Kisters WISKI product will be used and is expected to go live in early 2022. Through careful planning and understanding of existing processes, the impact to existing regulatory processes is expected to be minimal. The Niagara River

Control Centre has a separate WRA system that will not be replaced by this project.

NYPA continued to improve the Lewiston Pump Generating Plant with further work on PG 2 with PG5 & PG7 remaining. At the Robert Moses Plant planned control upgrades were completed on RM-U12. Initiating work on the control room upgrade. The Robert Moses Unit 1 refurbishment was also ongoing for this reporting period.

10. Ice Conditions and Ice Boom Operation

The 2020-2021 ice season was typically consisted of seasonal and higher than seasonal temperatures. Ice cover over Lake Erie started increasing during the last week of January and peaked at about 83% during the second week of February. It then steadily declined throughout the remainder of the 2020-2021 ice season (Figure 11).

The current Order of Approval governing the operation of the ice boom requires that all floating sections of the boom be opened by the first day of April unless more than 650 km^2 (250 mi^2) of ice remains on eastern Lake Erie. The fixed wing survey flight to estimate Lake Erie ice cover was deferred due to COVID-19 restrictions. Satellite imagery was used to estimate the ice cover on the eastern basin of Lake Erie. Satellite imagery analysis on March 12 showed more than 650 km^2 (250 mi^2) ice cover, which rapidly decreased to 213 km^2 (82 mi^2) on March 14. A meeting was called on March 15 to discuss ice boom removal options; the power entities informed the INWC in the meeting that the ice boom opening could only begin at earliest March 18 because of staff shortages during COVID-19. Subsequently, a media advisory to the public was released on March 16 that opening would start on March 18 should weather and operational safety considerations allow.

The ice boom removal officially began on March 22. All spans were moved from Lake Erie and tied off to the Buffalo breakwall by March 23. The buoy barrels were then taken off their respective anchor cables by March 24. Repair work at the Michigan Avenue Bridge temporarily locked the bridge in the lowered position for a period of time. As such, the spans

remained on the break wall waiting for dry storage until April 14. The 2020-2021 ice boom removal was ultimately completed on April 16, 2021.

11. Other Issues

American Falls Bridges Project: The New York State Office of Parks, Recreation and Historic Preservation (Parks), in conjunction with the New York State Department of Transportation (NYSDOT) and their contractor Greenman-Pedersen, Inc. (GPI), have been developing a plan to reconstruct the American Falls Bridges, which have structural deficiencies. These two bridges cross the American Channel of the Niagara River over extremely turbulent water. Several alternatives are currently being evaluated. One alternative includes a full cofferdam and the complete dewatering of the American Channel, an activity that also occurred in 1969. This alternative would impact the water flow rate and level in the Canadian Channel, and likely affect water levels in some upstream areas.

GPI has submitted a preliminary design report. Parks and NYSDOT have not initiated final design as of August 31, 2021.

12. Meeting with the Public

The board participated in two separate Tri-Board Public Webinars, one in English on August 27, 2021 and the other in French on September 8, 2021. The webinars were conducted in collaboration with the IJC commissioners and communications staff, International Lake Superior Board of Control, International Lake Ontario – St. Lawrence River Board and Great Lakes Adaptive Management Committee. The webinars provided members of the public an overview of the current and forecast conditions of the Great Lakes and discussed water levels throughout the system. A total of 146 members of the public participated in the English session and 84 people attended the French webinar. Following the presentation, many questions were taken from the public during the call. The participants were encouraged to visit the board webpage for additional information and to submit any further questions.

The Niagara Board would support future combined IJC Great Lakes Board events such as the Tri-Board Public Webinar. The event drew interest from many stakeholders and was an efficient means of communicating widely on the board's mandate and role with respect to water management in the Great Lakes Basin.

13. Membership of the Board and the Working Committee

There were no membership changes on the Board or Working Committee during this reporting period.

14. Attendance at Board Meetings

The board met once during this reporting period. The meeting was held on March 26, 2021 through a virtual platform. Mr. Stephen Durrett, U.S. Section Chair, Mr. Aaron Thompson, Canadian Section Chair, board members Mr. David Capka and Ms. Jennifer Keyes, and board secretaries were in attendance.

Original Signed by

Mr. Aaron F. Thompson
Chair, Canadian Section

Original Signed by

Mr. Stephen G. Durrett
Chair, United States Section

Original Signed by

Ms. Jennifer L. Keyes
Member, Canadian Section

Original Signed by

Mr. David Capka
Member, United States Section

Table 1: Monthly average Lake Erie water levels based on a network of four water level gauges and the International Great Lakes Datum (1985).

	Metres			Feet		
Month	Recorded* 2021	Average 1918-2020	Departure	Recorded* 2021	Average 1918-2020	Departure
March	174.58	174.10	0.48	572.77	571.19	1.58
April	174.63	174.24	0.39	572.93	571.65	1.28
May	174.68	174.33	0.35	573.10	571.95	1.15
June	174.71	174.36	0.35	573.20	572.05	1.15
July	174.81	174.34	0.47	573.52	571.98	1.54
August	174.79	174.28	0.51	573.46	571.78	1.68

* Provisional

Table 2: Monthly average precipitation on the Lake Erie basin.

	Centimetres			Inches			
Month	Recorded* 2021	Average 1900-2017	Departure	Recorded* 2021	Average 1900-2017	Departure	Departure (in percent)
March	4.10	7.00	-2.90	1.61	2.76	-1.15	-42
April	5.80	8.10	-2.30	2.28	3.19	-0.91	-28
May	6.20	8.60	-2.40	2.44	3.39	-0.95	-28
June	10.58	8.90	1.68	4.17	3.50	0.67	19
July	12.48	8.60	3.88	4.91	3.39	1.52	45
August	8.76	8.20	0.56	3.45	3.23	0.22	7

* Provisional

Table 3: Monthly Niagara River flows at Queenston.

	Cubic Metres per Second			Cubic Feet per Second		
Month	Recorded 2021	Average 1900-2020	Departure	Recorded 2021	Average 1900-2020	Departure
March	6814	5694	1120	240,630	201,080	39,550
April	6921	5950	971	244,410	210,120	34,290
May	6862	6146	716	242,330	217,040	25,290
June	6835	6121	714	241,380	216,160	25,220
July	7132	6027	1105	251,860	212,840	39,020
August	7057	5905	1152	249,220	208,530	40,690
Average	6937	5974	963	244,980	210,970	34,010

Table 4: Monthly maximum and minimum Niagara River flows at Queenston.

	Maximum Flows			Minimum Flows		
Month	Year	m^3/s	ft^3/s	Year	m^3/s	ft^3/s
March	2020	7757	273,940	1934	4130	145,850
April	2020	8014	283,010	1935	4380	154,680
May	2020	7900	278,990	1934	4530	159,980
June	2019	8059	284,600	1934	4470	157,860
July	2019	7851	277,260	1934	4360	153,970
August	2019	7602	268,460	1934	4370	154,330

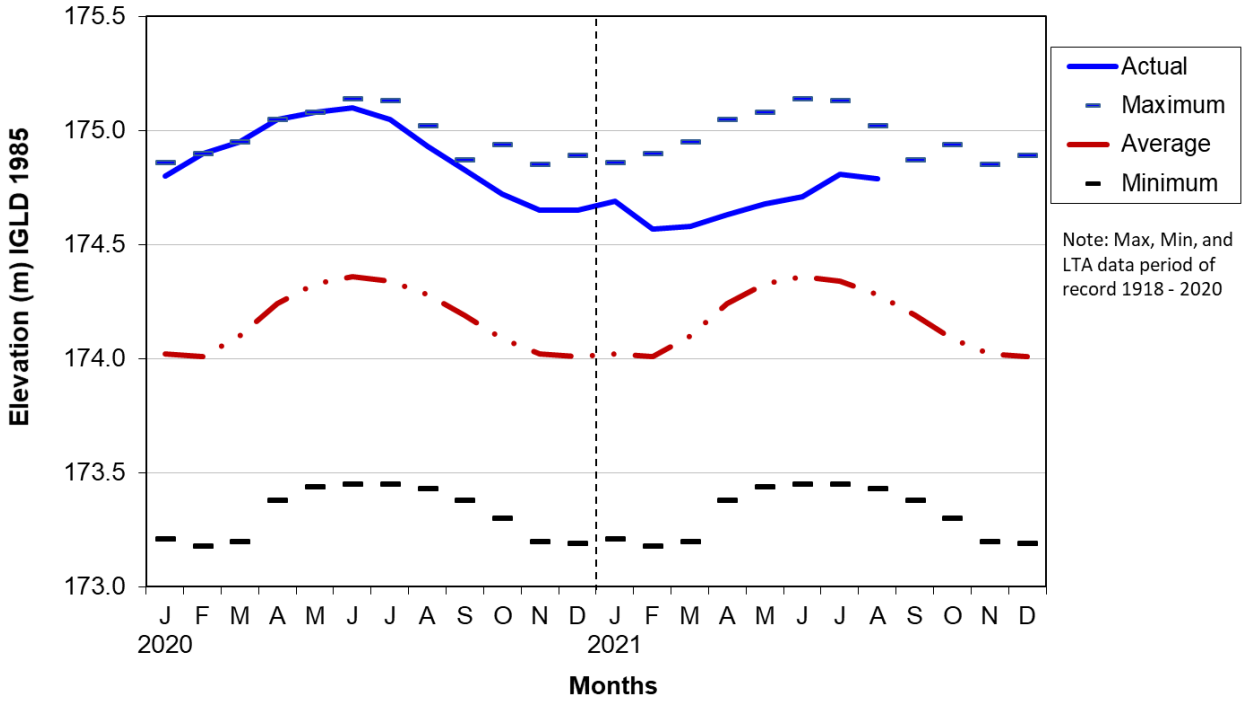


Figure 1: Lake Erie mean monthly and long-term maximum, minimum and average water levels for period-of-record 1918-2020.

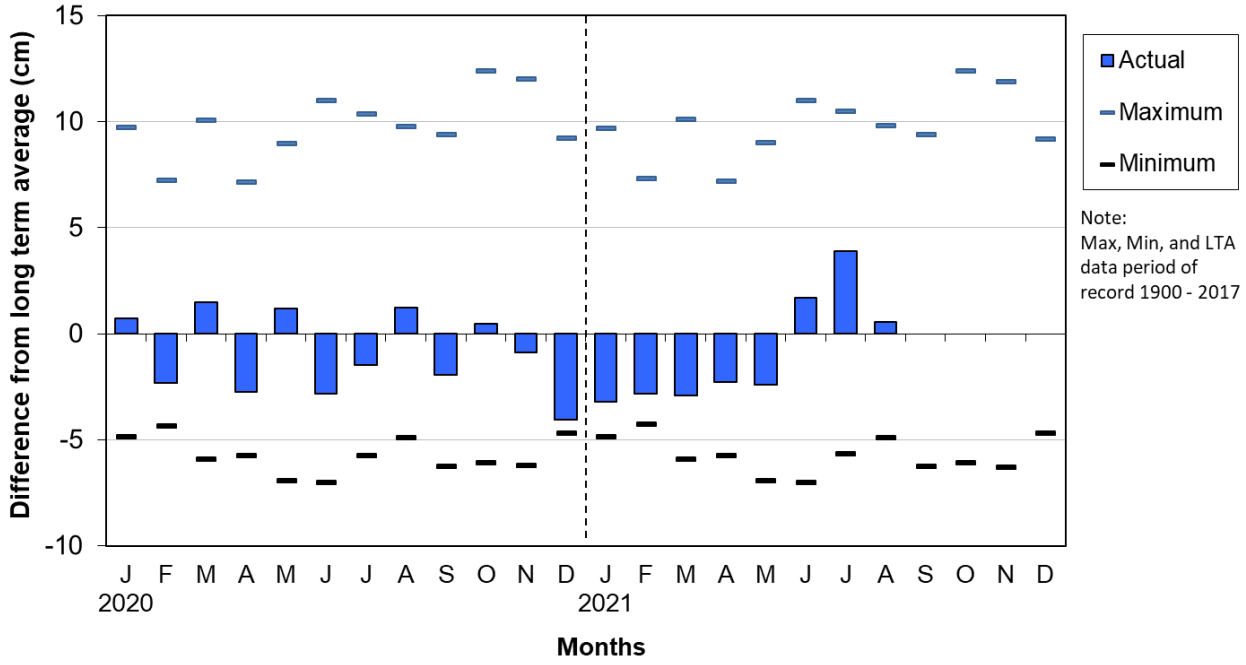


Figure 2: Monthly actual, maximum and minimum precipitation departures from the long-term average on Lake Erie basin.

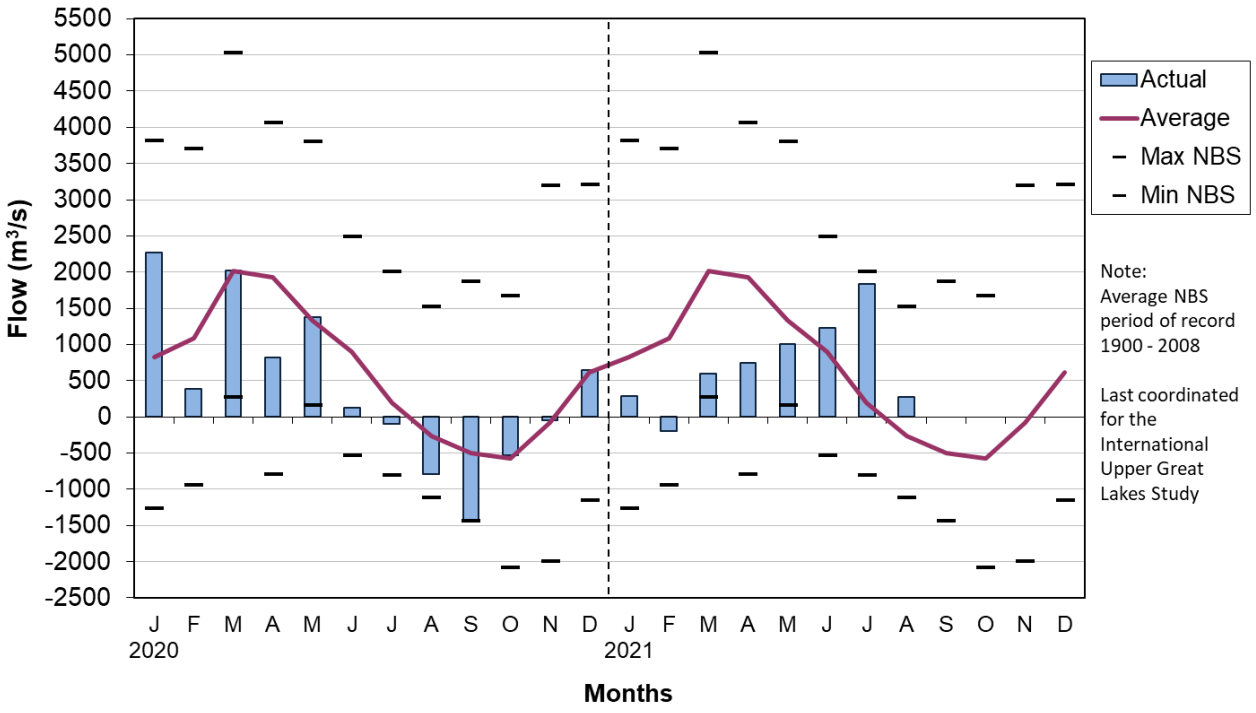


Figure 3: Monthly actual, maximum, minimum and average net basin supplies on Lake Erie basin.

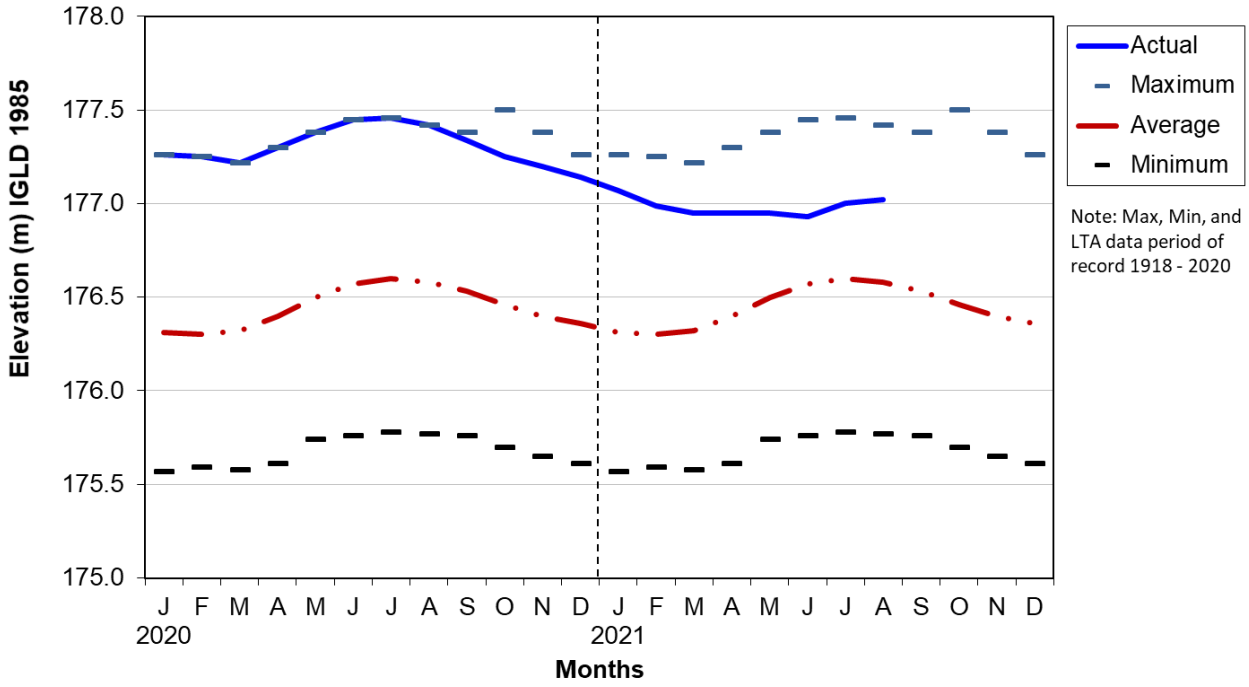


Figure 4: Lake Michigan-Huron mean monthly, maximum, minimum and average water levels for period-of-record 1918-2020.

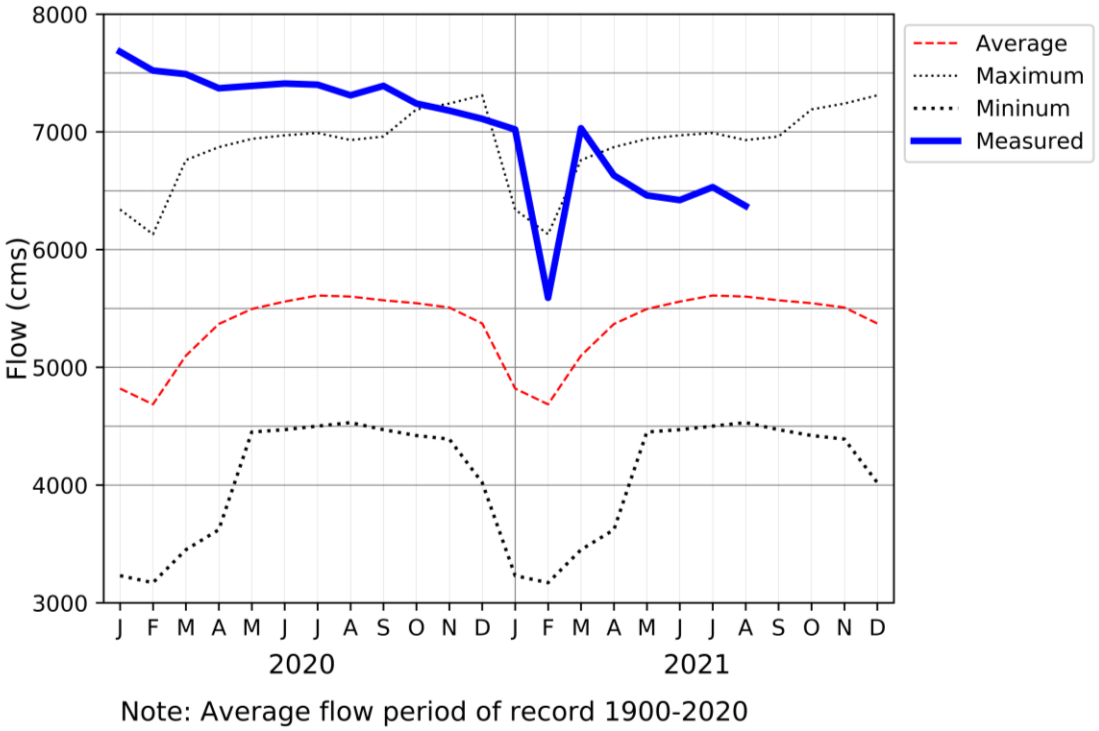


Figure 5: Detroit River mean monthly actual, maximum, minimum and average flows.

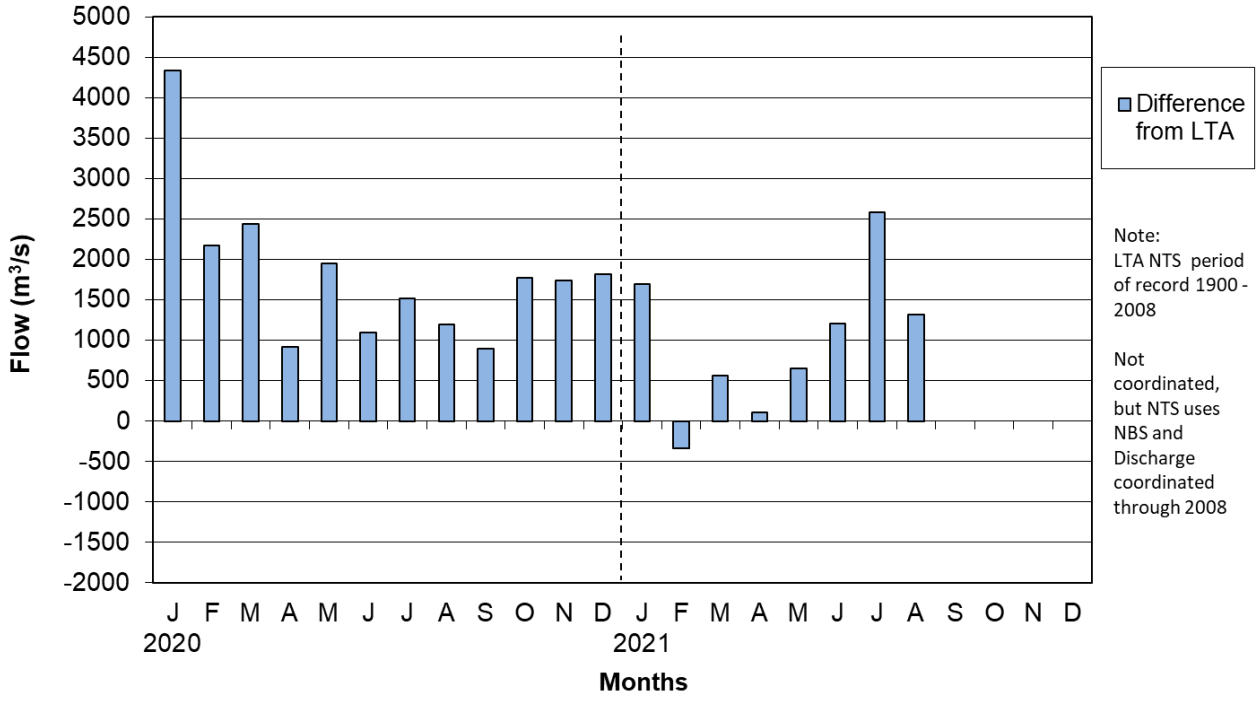


Figure 6: Lake Erie basin monthly net total supplies difference from the long term average.

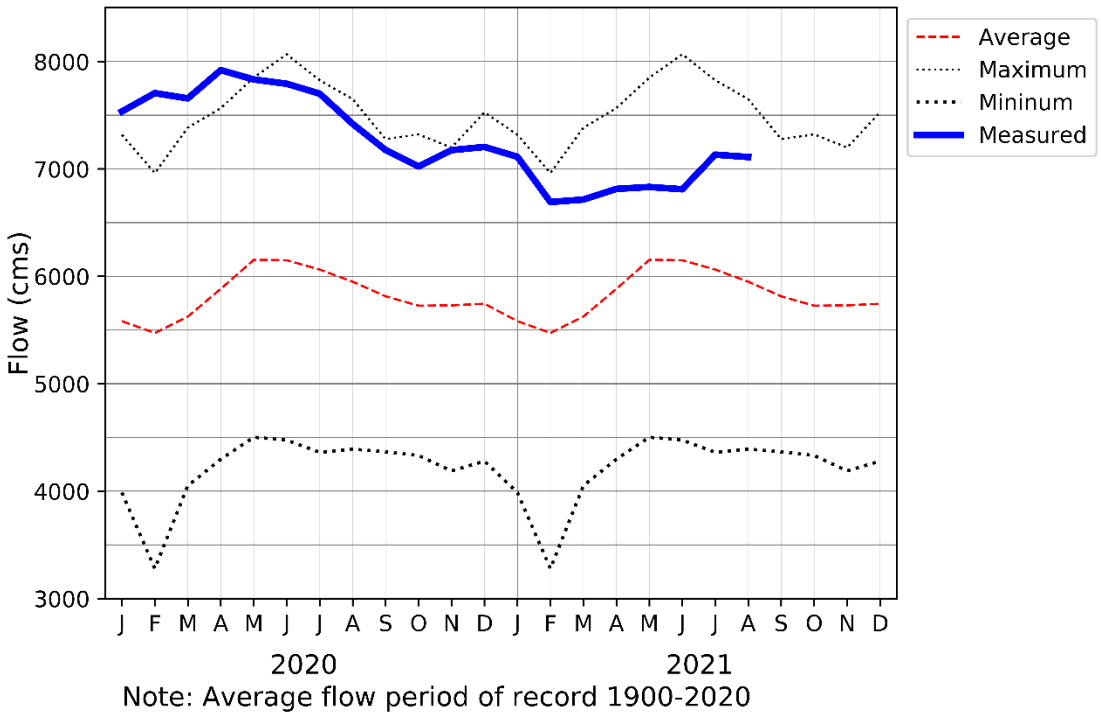


Figure 7: Niagara River mean monthly actual and average flows at Buffalo, New York.

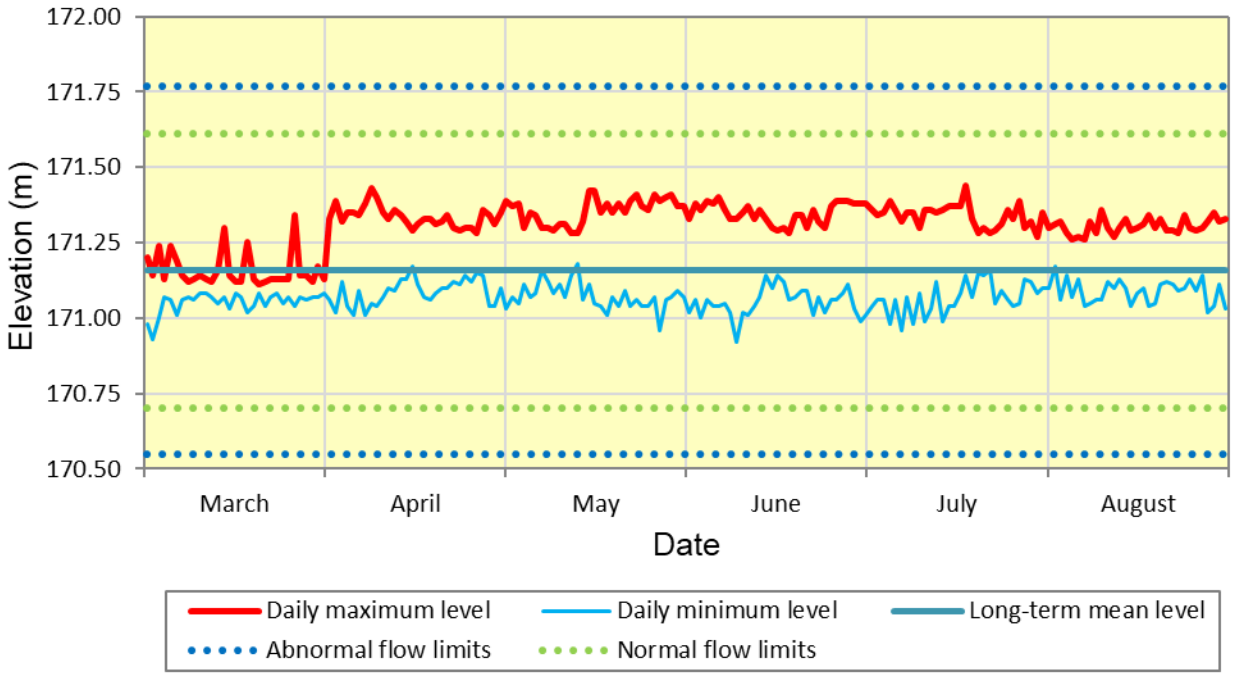
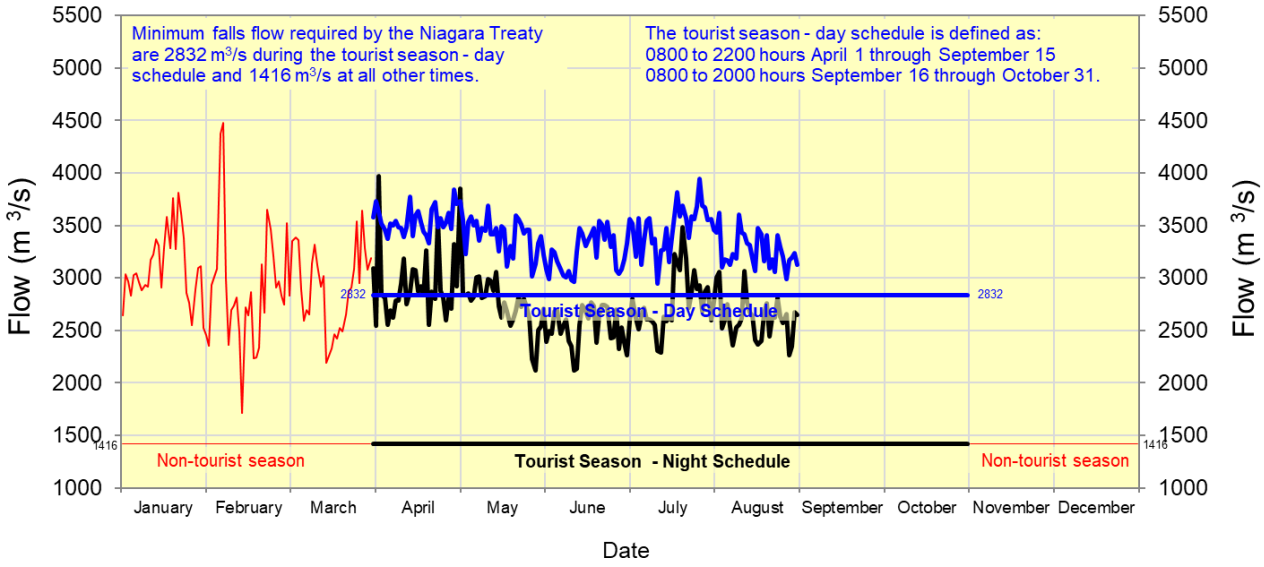
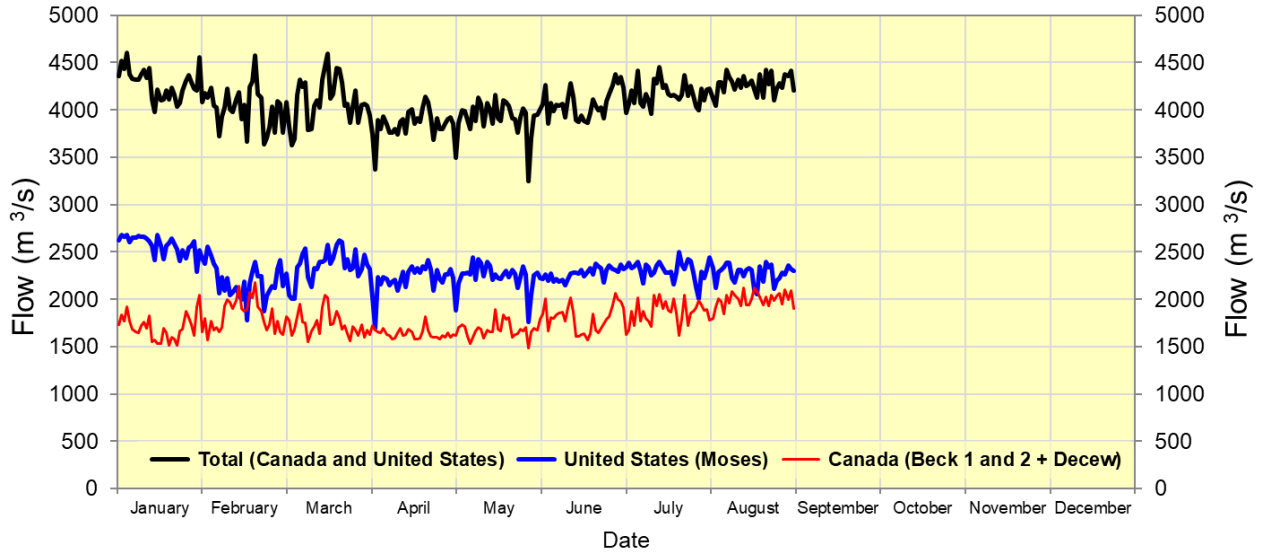


Figure 8: Daily maximum and minimum water levels at Material Dock gauge (March through August 2021).



Note: Flow over Niagara Falls is defined as the flow at Ashland Avenue gauge

Figure 9: Daily flow over Niagara Falls from January through August 2021 (flow at Ashland Avenue in m^3/s).



Note: For purposes of the Niagara Treaty, the Canadian diversion includes water diverted from the Niagara River and water diverted through the Welland ship canal for power purposes

Figure 10: Daily diversion of Niagara River water for power purposes (January through August 2021).

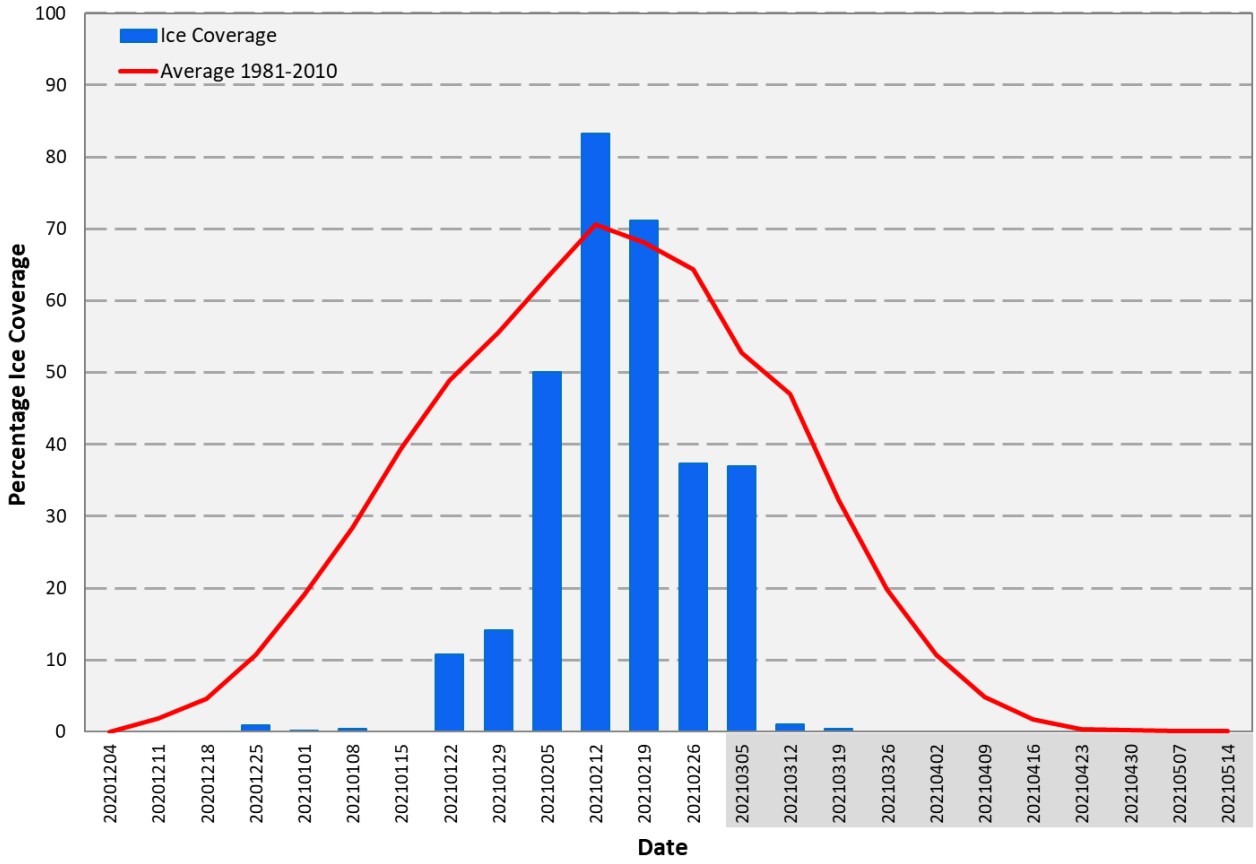


Figure 11: Weekly ice coverage for Lake Erie during the 2020-21 ice season.

Enclosure 1: Map of the Niagara River showing water level gauge locations.