International Niagara Board of Control

One Hundred Twenty Fifth Semi-Annual Progress Report

to the

International Joint Commission

Covering the Period March 6, 2015 through September 24, 2015

Executive Summary

The level of Lake Erie began the reporting period with a March mean level at 8 cm (3.1 inches) below its 1918–2014 period-of-record, long-term average level for the month. Between March and July, the lake level rose 75 cm (29.5 inches), which is triple the average 24 cm (9.4 inches) rise for that period. The August mean water level was 37 cm (14.6 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 (OPG) and the New York Power Authority (NYPA)—were able to comply with the Board's Directive at all times during the reporting period (Section 3).

Work continues on the International Control Dam (ICD) Bridge Repair Project with the first set of support brackets installed on March 5, 2015. This work is being undertaken to address a problem with suspect corbel ledge supports and the identified failure mechanism. The project will include every pier/span of the International Niagara Control Works (INCW) and is expected to continue until December 2016. As of August 27, 2015 brackets have been installed on 7 of the 18 spans of the INCW and work is progressing well. (Section 4).

Falls flow violations were reported on April 22 and July 12, 2015. Both were the result of requests from emergency services to reduce flow for rescue operations. In both cases, the flow dipped below the treaty requirement for a single hour before being restored (Section 5).

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 in the Upper Niagara River were taken in May 2015 with the preliminary results showing good comparison to the

2012 Buffalo rating equation. Also during this reporting period, measurements were made in the Welland Supply Canal, the results of which are still under review. The next measurements at the Ashland Avenue Gauge Rating (formerly the Cableway) section are planned for May 24-27, 2016, while the next measurement series in the American Falls Channel are scheduled for the Spring of 2017 (Section 8).

Western New York experienced below average temperatures from November 2014 through April 2015, making the winter of 2014–2015 one of the coldest in the region's recorded history. Fixed-wing ice observation flights, satellite images and ice thickness measurements were used to monitor ice cover over the eastern part of Lake Erie for operation of the Lake Erie Ice Boom. An ice observation flight performed on April 19, 2014 revealed that only 218 km^2 (84 square mile) of eastern lake ice remained. Removal of the Lake Erie Ice Boom began on April 20, 2015 with the final spans of the ice boom removed from Lake Erie and tied off to the Buffalo break wall on April 25, 2015. The final spans of the ice boom were then pulled onto shore on May 6, 2015 ending the 2014–15 ice boom season. (Section 10).

The Board held its annual meeting with the public on September 10, 2015 in Niagara-on-the-Lake with 5 members of public attending either in person or remotely (Section 12).

The membership of both the Board and the Working Committee is unchanged from the last report. (Section 13).

COVER: View of Beck and Robert Moses power plants at Queenston-Lewiston.. (Photo by Dr. Frank Seglenieks, EC)

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1 Map of the upper Niagara River

INTERNET SITES

International Joint Commission
www.ijc.org

International Niagara Board of Control
English: ijc.org/en_/inbc
French: ijc.org/fr_/inbc

Lake Erie-Niagara River Ice Boom
www.iceboom.nypa.gov

INTERNATIONAL NIAGARA BOARD OF CONTROL

Cincinnati, Ohio
Burlington, Ontario

September 24, 2015

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

Commissioners:

1. General

The International Niagara Board of Control (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, 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 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 April and October of each year. In accordance with this requirement, the Board herewith submits its One Hundred Twenty Fifth Semi-Annual Progress Report, covering the reporting period March 6, 2015 to September 24, 2015.

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 Lake Erie water levels are based on a network of four gauges to better represent the average level of the lake.

2. Basin Conditions

The level of Lake Erie began the reporting period with a March mean level at 8 cm (3.1 inches) below its 1918–2014 period-of-record, long-term average level for the month. Between March and July, the lake level rose 75 cm (29.5 inches), which is triple the average 24 cm (9.4 inches) rise for that period. The August average water level dropped 12 cm (4.7 inches) from the July average during a month when the level typically drops by 6 cm (2.4 inches). The August mean water level was 37 cm (14.6 inches) above average. The lake's water level is forecasted to continue its seasonal decline during September. Recorded monthly water levels for the period March 2015 through August 2015 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.

Table 1: Monthly average Lake Erie water levels based on a network of 4 water level gauges and the International Great Lakes Datum (1985).

	Metres			Feet		
Month	Recorded* 2015	Average 1918-2014	Departure	Recorded* 2015	Average 1918-2014	Departure
March	173.99	174.07	-0.08	570.83	571.10	-0.27
April	174.22	174.22	0.00	571.59	571.59	0.00
May	174.31	174.30	+0.01	571.88	571.85	+0.03
June	174.53	174.33	+0.20	572.60	571.95	+0.65
July	174.74	174.31	+0.43	573.30	571.88	+1.42
August	174.62	174.25	+0.37	572.90	571.69	+1.21

* Provisional

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 land area, 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).

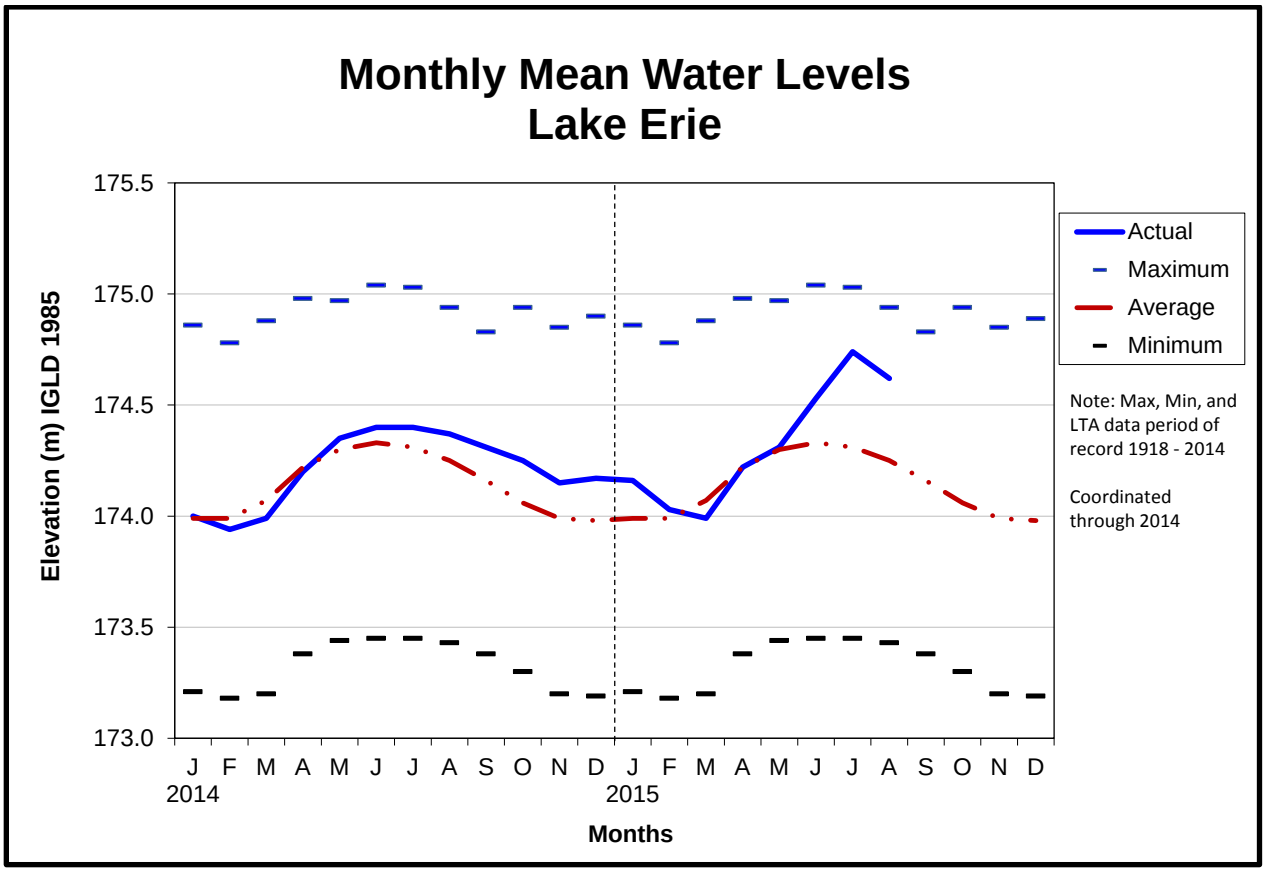


Figure 1: Lake Erie mean monthly water levels.

Precipitation is a major contributor to NBS, both directly on the lake and through runoff 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 low precipitation during March and April was more than compensated for during an extremely wet June. The 17.1 cm (6.7 inches) of precipitation in June was 8.3 cm (3.3 inches) above the average and a record amount for the month for the period of record (1900-2015). During the period March 2015 through August 2015, the basin received 51.9 cm (20.4 inches) of precipitation. This is approximately 5.2% above average for the period.

The recent NBS to Lake Erie is shown relative to average on a monthly basis in Figure 3. A negative NBS value indicates that more water left the lake during the month due to evaporation than entered it through precipitation and runoff. On Lake Erie, this typically happens from August through November. For the remainder of the year, combined precipitation and runoff are usually greater than the water lost to evaporation. The lake's NBS was below average for March and August and above average for the rest of the reporting period. As a result of the record precipitation in June, the NBS for that month was also a record high for the period of record.

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

	Centimetres			Inches			
Month	Recorded* 2015	Average 1900-2011	Departure	Recorded* 2014-2015	Average 1900-2011	Departure	Departure (in percent)
March	2.67	7.03	-4.36	1.05	2.77	-1.72	-62
April	7.09	8.11	-1.02	2.79	3.19	-0.40	-13
May	9.78	8.62	1.16	3.85	3.39	0.46	14
June	17.12	8.79	8.33	6.74	3.46	3.28	95
July	8.23	8.61	-0.38	3.24	3.39	-0.15	-4
August	7.04	8.19	-1.15	2.77	3.23	-0.46	-14

* Provisional

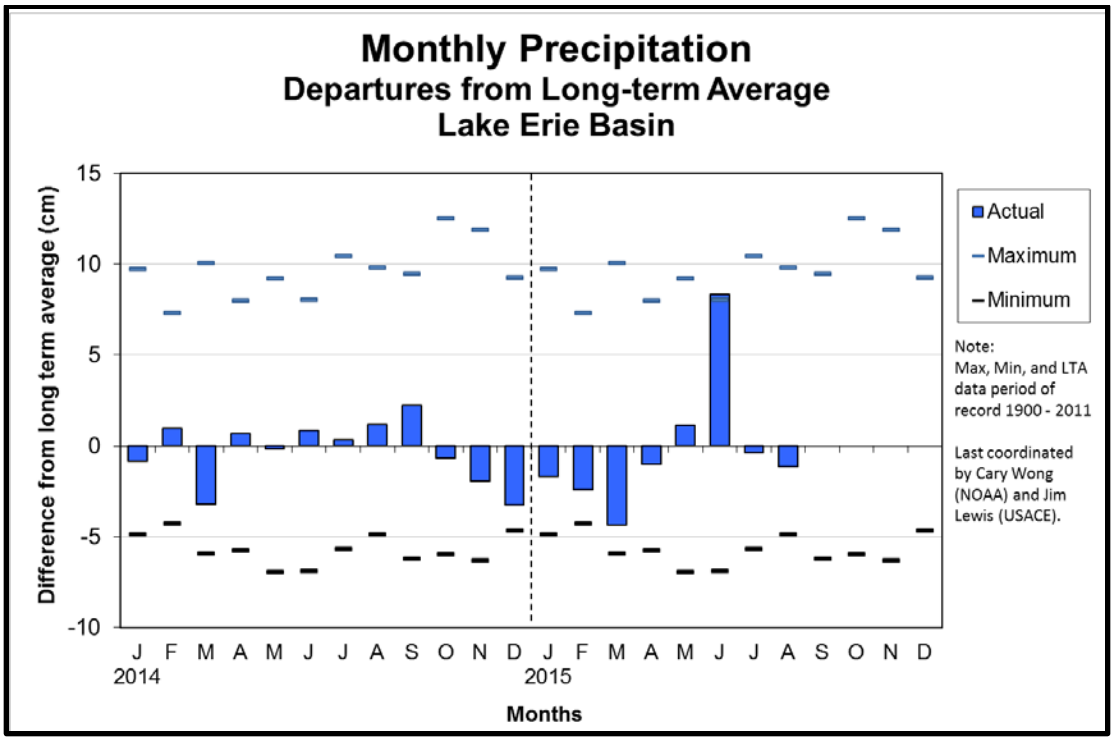


Figure 2: Monthly precipitation departures from long-term average on Lake Erie basin.

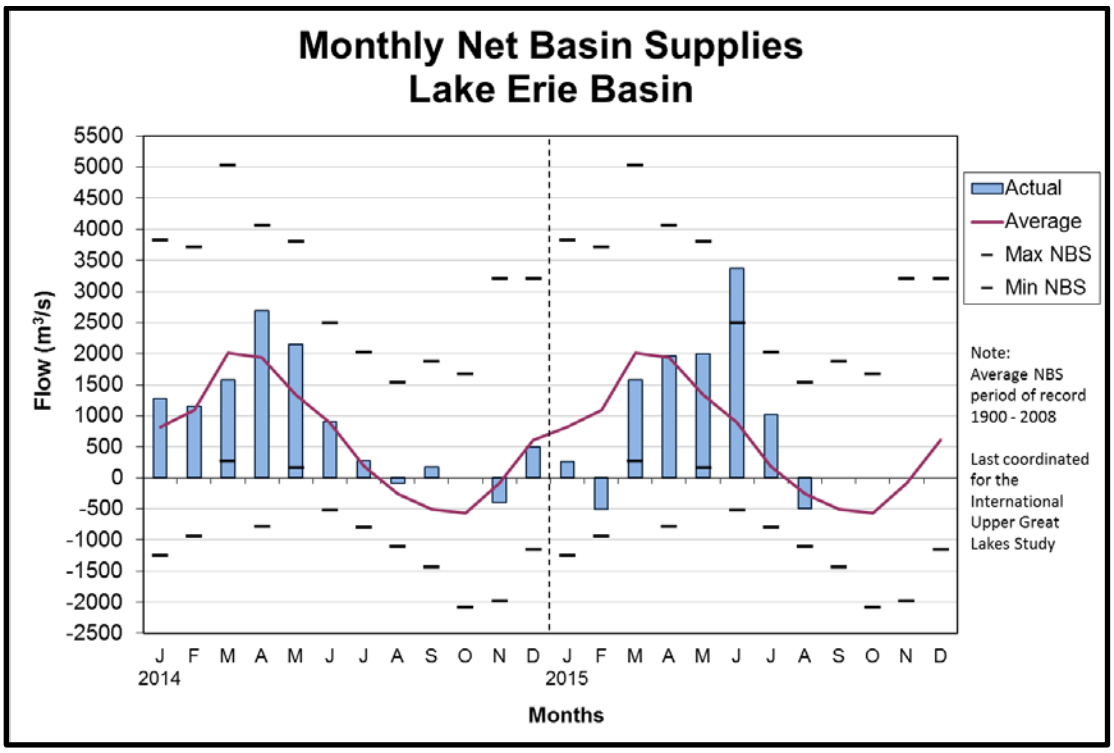


Figure 3: Monthly net basin supplies on Lake Erie basin.

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 past year, the level of Lake Michigan-Huron was above average for the entire reporting period (Figure 4). This high lake level caused the flow in the Detroit River to be above average for the entire reporting period (Figure 5). Inflow to Lake Erie via the Detroit River was about 8.0% above the long-term average for the six-month period March 2015 through August 2015.

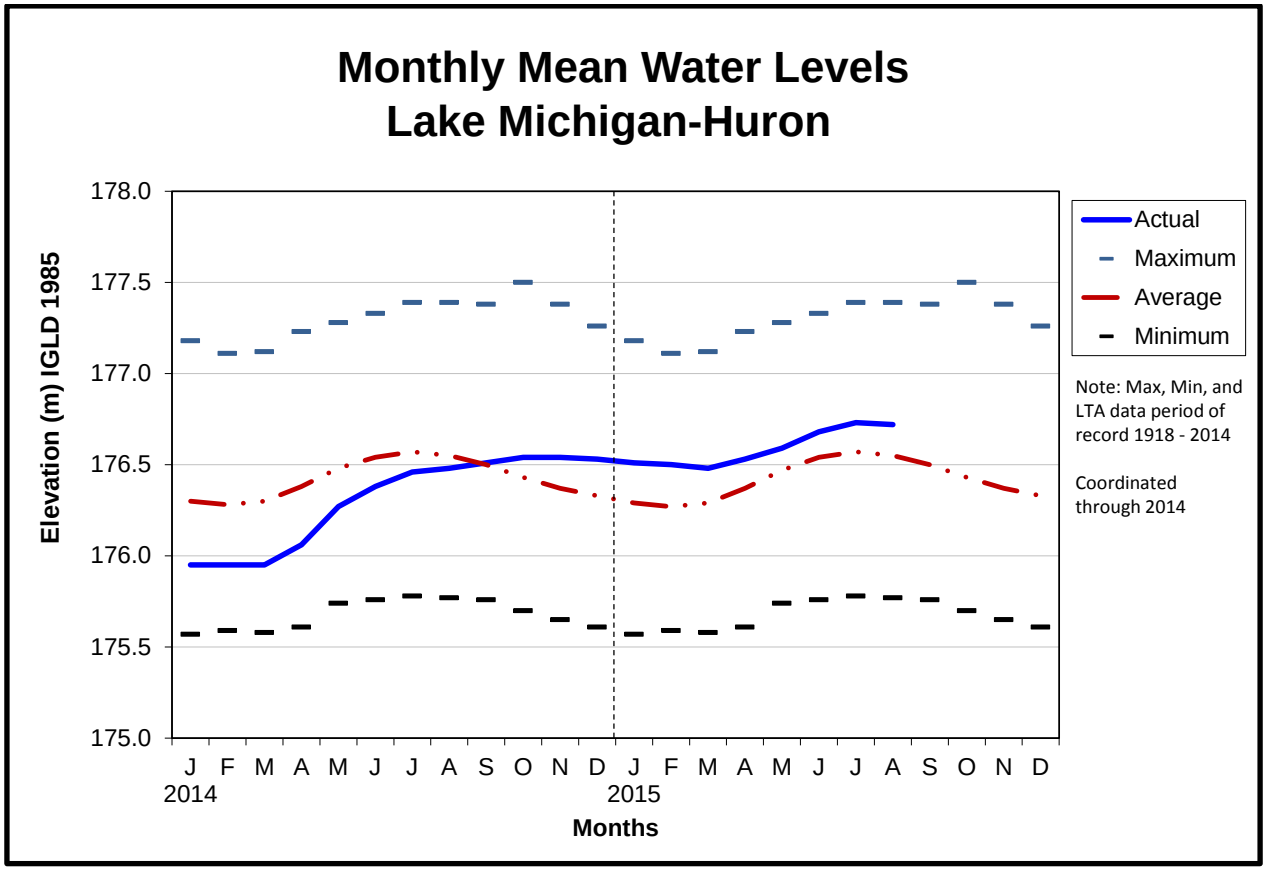


Figure 4: Lake Michigan-Huron mean monthly water levels.

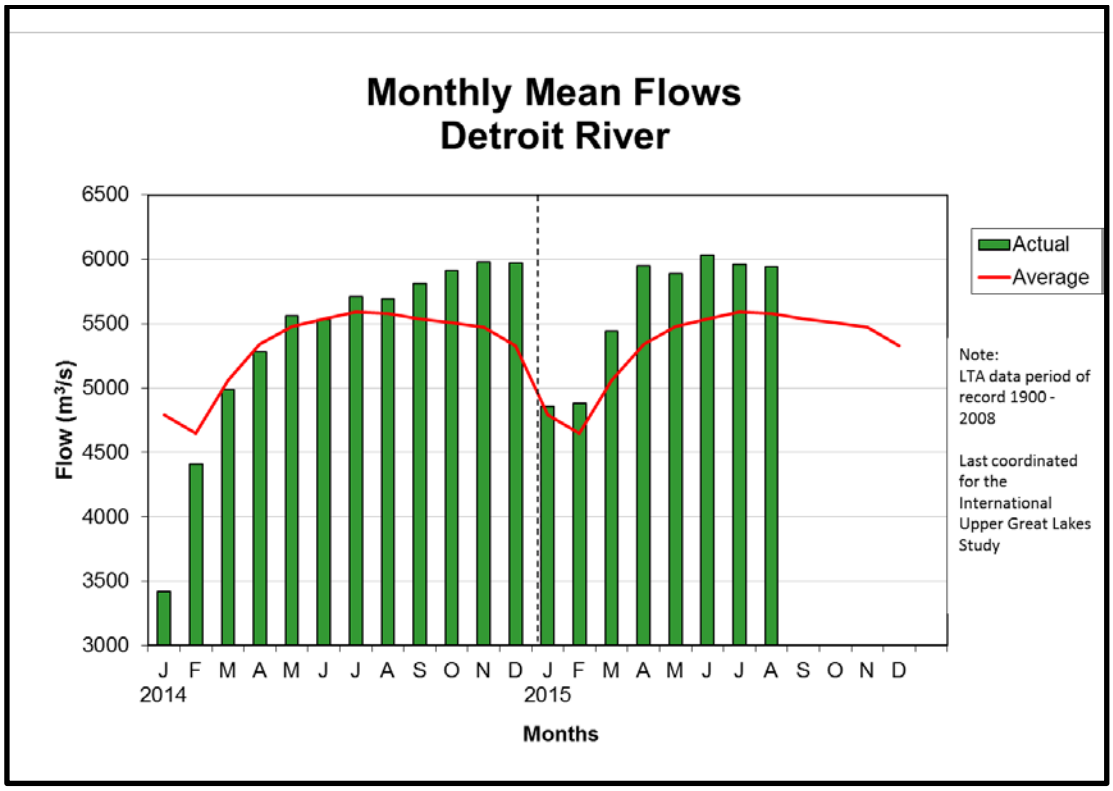


Figure 5: Detroit River mean monthly flows.

The inflow from Lake Michigan–Huron via the Detroit River combined with Lake Erie's NBS resulted in a NTS for Lake Erie about 15.3% above average for the period March through August 2015 (Figure 6). The March NTS was just slightly below-average and NTS was above-average from April to August. The NTS for June was significantly above average, also mainly due to the high precipitation seen in the month.

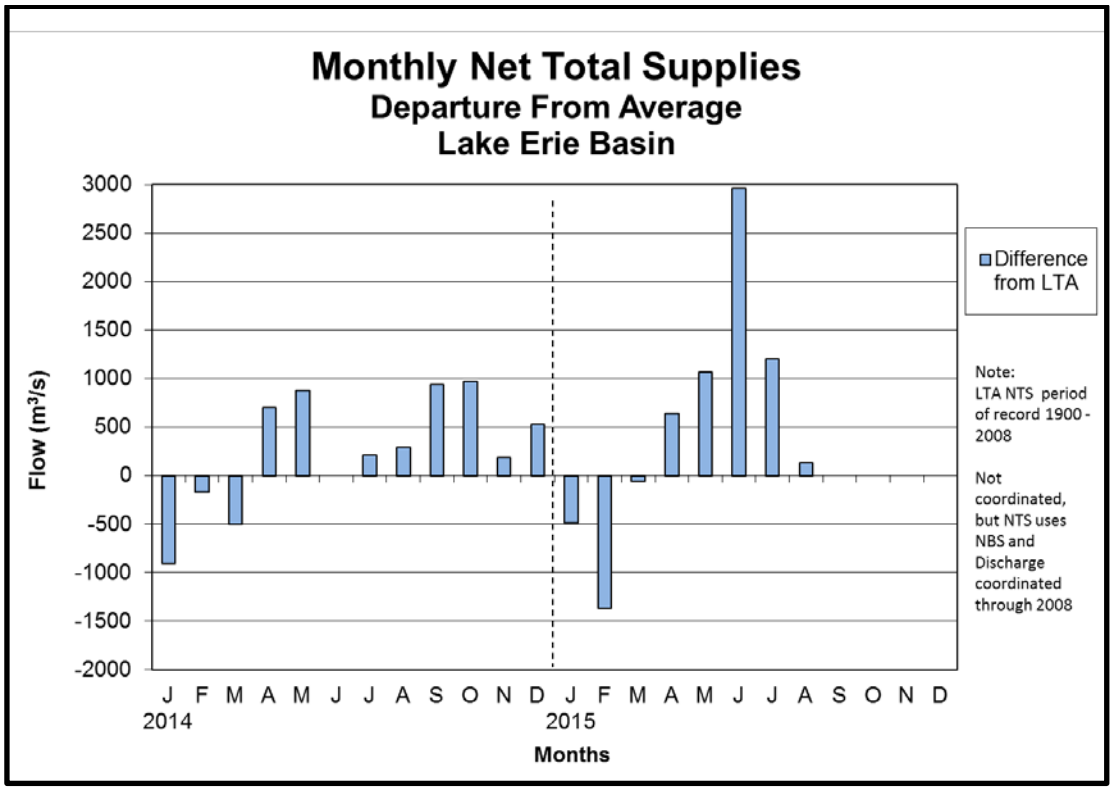


Figure 6: Lake Erie basin monthly net total supplies difference from the long term average (1900-2008).

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–about 4 to 5% of the total Lake Erie outflow–and 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. The major portion 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. However, outflow is also influenced by winter ice and summer aquatic plant growth in the river, both of which tend to reduce the flow. Prevailing winds can also cause variations in lake outflow, with strong westerly winds raising the level of the lake at the east end resulting in increased outflow and easterly winds having the opposite effect. Niagara River outflow (Figure 7) was close to or even a bit below average from March to May; however the higher lake levels seen from June to the end of the reporting period resulted in much higher than average flows for

the rest of the report period, particularly in July. While the August flow dropped from July, it was still well above average.

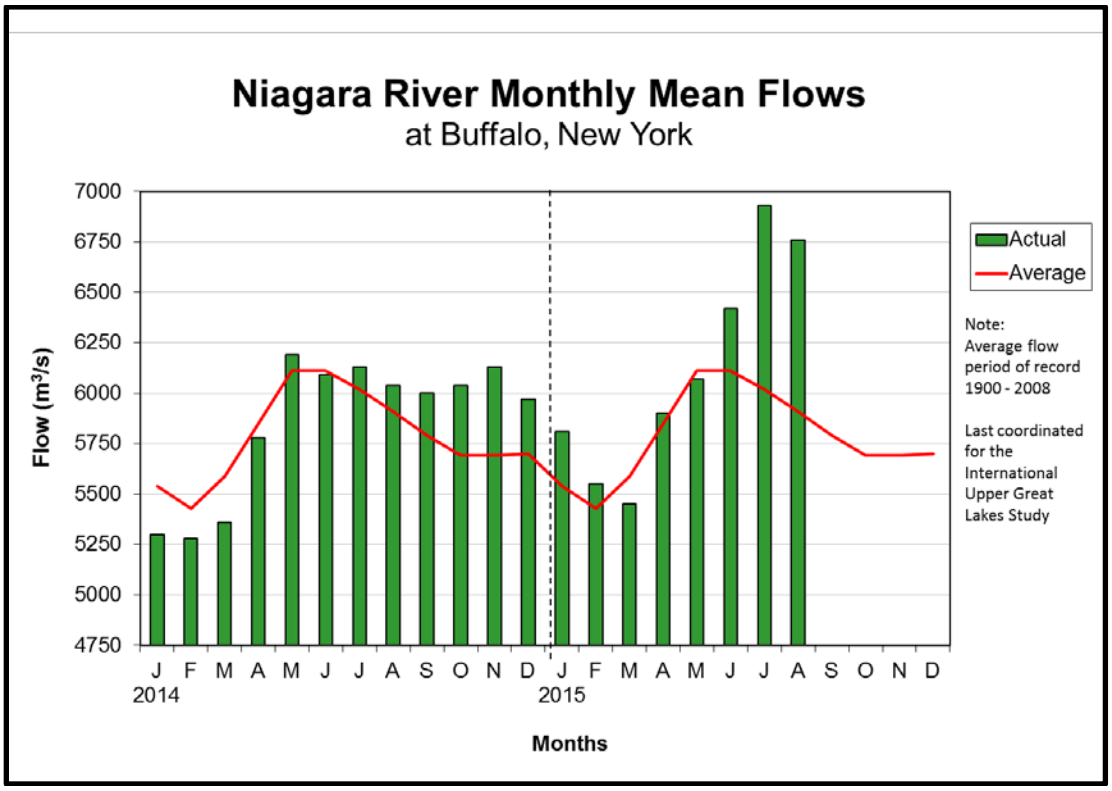


Figure 7: Niagara River mean monthly flows at Buffalo, New York.

While it is not possible to predict with accuracy the supplies to the lakes for the coming months, using historical supplies and the current levels of the lakes, it is possible to make some estimate of water levels for a few months out. The six-month water level forecast prepared at the beginning of September by the U.S. Army Corps of Engineers (USACE) and Environment Canada (EC) indicates that if average water supply conditions are experienced, the level of Lake Erie would remain above average throughout the fall and the beginning of winter.

3. Operation and Maintenance of the International Niagara Control Works

The water level in the CGIP is regulated in accordance with the Board's 1993 Directive. The Directive requires that the Power Entities– 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 ameliorate adverse 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, 2015 was 0.53 metre-months (1.7 foot-months) above the long-term operational average elevation. The maximum permissible accumulated deviation is ±0.91 metre-months (±3.0 foot-months).

Tolerances for regulation of the CGIP were suspended on the following occasions during the reporting period: March 26, 2015 due to ice conditions and both April 22 and 23, 2015 as well as July 12, 2015 for life-saving/emergency operations.

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.

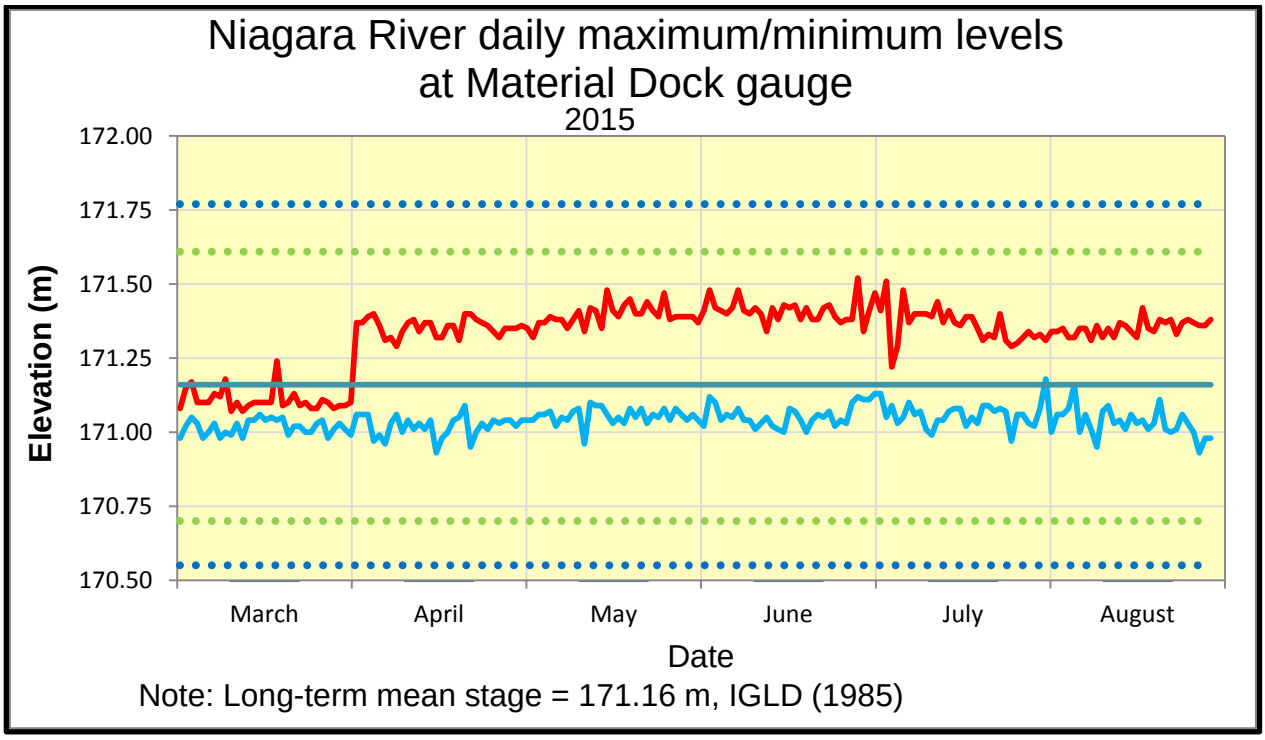


Figure 8: Niagara River daily maximum and minimum water levels at Material Dock gauge. Green dotted line indicates the normal limits in the directive, while the blue dotted lines indicate the limits during abnormal flow or ice conditions.

Gates 1 and 3 of the INCW were removed from service on a planned basis from May 26 to June 7, 2015 to facilitate installation of the dewatering structure in Gate 2.

Gate 2 of the INCW was removed from service on April 30, 2015 for execution of a major overhaul on gate components. Work continues and is expected to be completed by early November 2015.

Gate 4 and 5 of the INCW were removed from service on July 13, 2015 for execution of the ICD Pier 5 Ventilation Project, a project to address infiltration of water and mould into the pier interior. These gates are expected to be returned to service by mid-September 2015.

Gates 9 to 13 and 15 to 18 of the INCW were removed from service on a planned basis, daily on February 9 and 10, to undertake ice clearing immediately upstream of Gates 14 and 16.

Gates 11 to 18 of the INCW were removed from service on a planned basis daily from May 11 to 13 to facilitate use of a large barge and tug to remove the dewatering structure from the downstream side of Gate 16 following a major overhaul.

Gate 14 of the INCW was returned to service on April 10, 2015 following a major outage, remediation, and testing of the overpressure system.

Gate 16 of the INCW was removed from service on May 14, 2014 to complete major maintenance work on the gate's hydraulic and mechanical components. The gate was returned to service on June 29, 2015

Work continues on the ICD Bridge Repair Project with the first set of support brackets installed on March 5, 2015. Scaffold and work platforms are being constructed in order to install steel brackets beneath each span to provide added support to the corbel ledge of each pier. This work is being undertaken to address a problem with suspect corbel ledge supports and the identified failure mechanism. The project will include every pier/span of the INCW and is expected to continue until December 2016. A new process has been undertaken whereby the control gates are not deemed unavailable and workers execute the project activities using fall arrest equipment. As of August 27, 2015, brackets have been installed on 7 of the 18 spans of the INCW and work is progressing well. During the interim until project completion, the temporary vehicle load restriction that was placed on the structure remains in effect on the non-remediated portions of the dam. The remediated portion of the structure from Span 1 to 7 has a load rating of 24/45/62.5 tonnes and complies with the Canadian Highway Traffic Bridge Standard.

4. Gauging Stations

The Niagara River gauges used to monitor the CGIP levels and the flow over Niagara Falls are the Slater's Point, Material Dock, American Falls, and Ashland Avenue gauges (see Enclosure 1). The Slater's Point and Material Dock gauges are owned and operated by the Power Entities. The American Falls gauge is owned and operated by the U. S. National Oceanic and Atmospheric Administration (NOAA). Both NOAA and the Power Entities own and operate water level gauges at the Ashland Avenue location.

Subject to on-going comparison checks of the water level data from the Power Entities' and NOAA's Ashland Avenue gauges by the INC, the Power Entities' gauge is used for officially recording water levels and determining the flow over Niagara Falls. The Power Entities' gauge at Ashland Avenue was not reporting water level data from February 9 to February 11, 2015 due to loss of gauge calibration following a power outage. In addition, the Ashland Avenue gauge was not reporting data during periods on May 26 to May 27, 2015 and August 11 to August 12, 2015, all due to communications failures. During the aforementioned failures, data was obtained from the NOAA gauge located at the Ashland Avenue site.

An initiative to reduce failures from the Ashland Avenue gauge was undertaken in July 2014. It included the replacement of sensors and transmitters used by the Power Entities' gauge, along with installation of a redundant wireless transmission system. Work was completed on August 27, 2015. The new data path employs a T1 communications circuit from the gauge to the NYPA Switchyard and is then routed to Niagara River Control Centre (NRCC) via NYPA x NRCC private microwave channel.

Remediation work at Ashland Avenue that took place in November 2014 has been augmented in August 2015 by way of a diving inspection of the river inlet and completion of a bathymetric survey of the area in the vicinity of the water level gauge. Based on further assessment of the data, and subject to regulatory and environmental approvals, flattening out the bank slope may be undertaken in 2016-2017.

Water levels from the Fort Erie gauge, used by the NRCC to determine the upper Niagara River flow for INCW operational purposes, were unavailable from July 12 to July 17, 2015 due to communications failure. In addition, water levels from the Fort Erie gauge were also unavailable for a short period of time on February 24, 2015 due to a power outage. During this time, the Buffalo water level gauge was used to provide an estimated elevation at the Fort Erie gauge.

All gauges required for the operation of the INCW were in operation during the remainder of the reporting period.

A temporary water level datalogger was initially installed at the Maid of the Mist Steamship Company (now Hornblower Niagara) dock by OPG on August 8, 2012. The datalogger was in place on a trial basis and recorded water levels during the latter portion of the ice-free season of 2012. It was reinstalled in April 2013, again in April 2014 and in May 2015 to record water levels during the ice-free seasons. This gauge is being considered as an alternate to the Ontario Power Generating Station Tailwater Gauge. Preliminary assessment of the collected data has started. However, it is inconclusive so far with respect to developing a relationship with the Ashland gauge. Additional data from 2015 will be the last data collected.

5. Flow over Niagara Falls

The International Niagara Treaty of 1950 sets minimum limits on the flow of water over Niagara Falls. During the tourist season (April-October) day time 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 Treaty. Falls flow met or exceeded minimum Treaty requirements at all times during the

reporting period with the exception of April 22 and July 12, 2015, as described below. The recorded daily average flow over Niagara Falls, covering the period March 2015 through August 2015, is shown in Figure 9.

On April 22, 2015, the flow over Niagara Falls was below the treaty requirement at 1:00 p.m. by an amount of 126 cms (4,450 cfs). This was the result of a request by the Niagara Parks Police for an immediate reduction in flow over Niagara Falls at 11:40 a.m. to facilitate the rescue of two persons stranded on rocks in the lower Niagara River near the Niagara Glen. The rescue efforts were completed at 12:18 p.m. and operations to increase the flow over Niagara Falls were commenced. Flows were restored to normal levels by 2:00 p.m.

The flow over Niagara Falls was also below the treaty requirement at 8:00 a.m. on July 12, 2015, by an amount of 378 cms (13,349 cfs). This was the result of a request by the New York State Parks Police for an immediate hold in flow over Niagara Falls at 6:30 am to facilitate the search and rescue of an individual that had fallen into the lower Niagara River between Devil's Hole and the Whirlpool. The search and rescue efforts were concluded at 8:10 am and operations to increase the flow over Niagara Falls were commenced. Flows were restored to normal levels by 9:00 a.m.

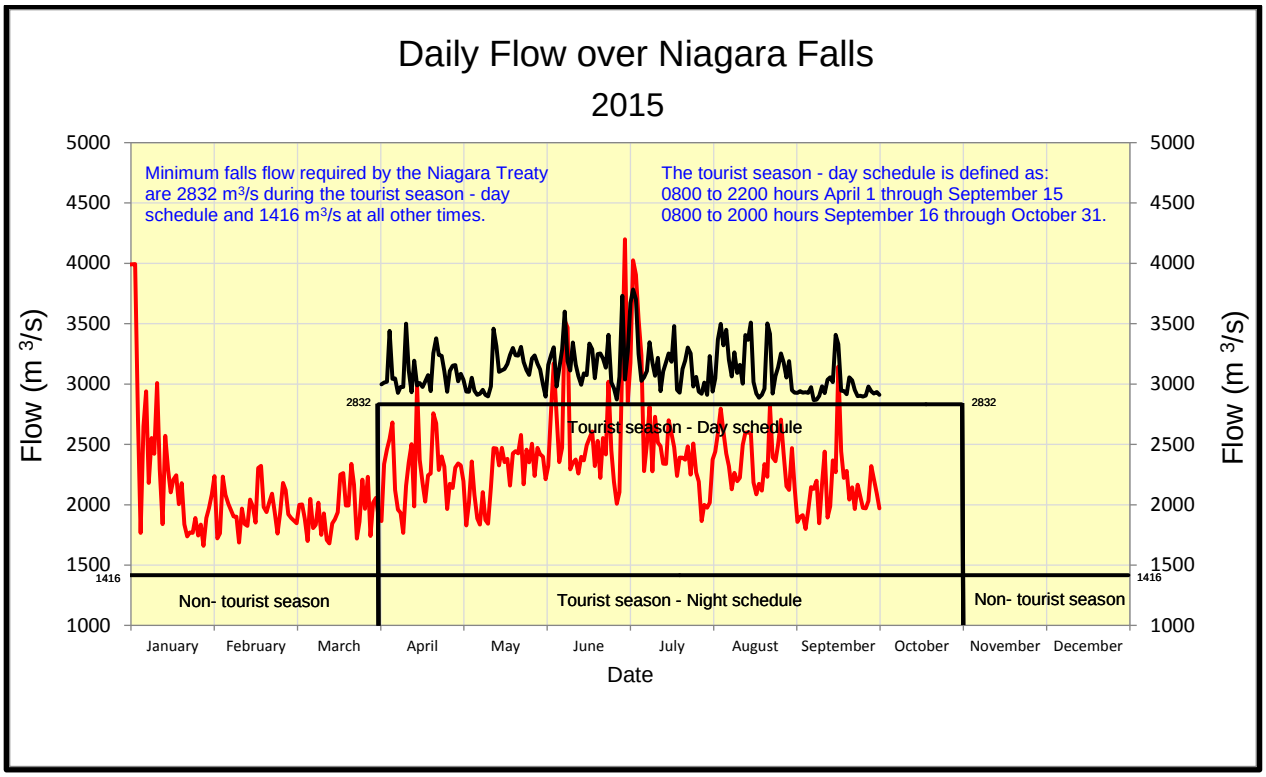


Figure 9: Daily flow over Niagara Falls.

6. Falls Recession

As part of its activities, the Board monitors the Horseshoe Falls for changes in its crestline that might result in a broken curtain of water along its crestline or suggest the formation of a notch in the crestline. The formation of a notch could signal a period of rapid Falls recession that has not been seen in more than a century. The review of recently available imagery suggests that no notable changes in the crestline of the Falls occurred during the 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 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 2015 through August 2015, diversion for the SAB I and II plants averaged 1,576 m^3/s (55,660 cfs) and diversion to the Robert Moses Niagara Power Project averaged 2,027 m^3/s (71,580 cfs).

The average flow from Lake Erie to the Welland Canal for the period March 2015 through August 2015 was 245.8 m^3/s (8,690 cfs). Diversion from the canal to OPG's DeCew Falls Generating Stations averaged 196 m^3/s (6,920 cfs) for the same period of time.

Records of diversions for power generation covering the period March 2015 through August 2015 are shown in Figure 10.

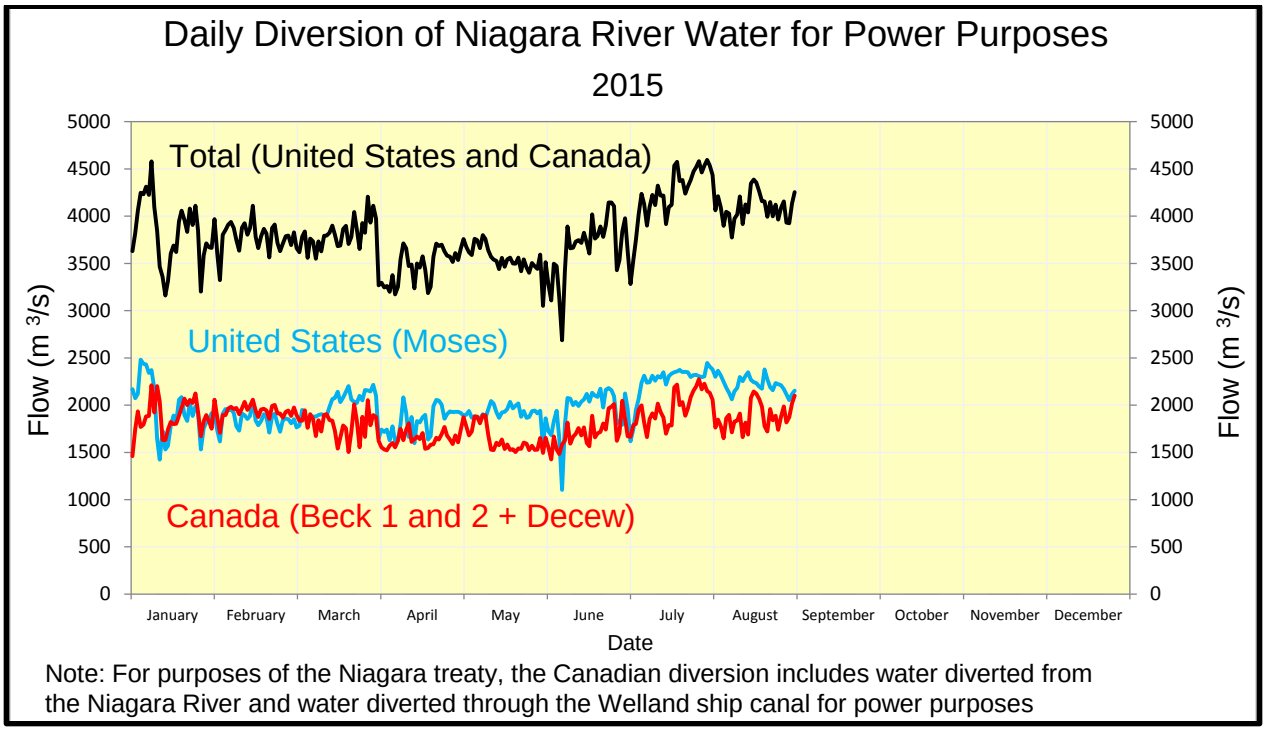


Figure 10: Daily diversion of Niagara River water for power purposes.

The monthly average Niagara River flows at Queenston, Ontario, for the period of March 2015 through August 2015, and departures from the 1900–2014 long-term average are shown in Table 3. Maximum and minimum monthly average flows for the 1900–2014 period of record are shown in Table 4. During the period March 2015 through August 2015, the flow at Queenston averaged 6,295 m^3/s (222,310 cfs), which was above the 1900-2014 average of 5,916 m^3/s (208,920 cfs) for the period. The monthly values ranged between 5,548 m^3/s (195,930 cfs) and 6,940 m^3/s (245,080 cfs).

Table 3: Monthly Niagara River flows at Queenston.

	Cubic Metres per Second			Cubic Feet per Second		
Month	Recorded 2015	Average 1900-2014	Departure	Recorded 2015	Average 1900-2015	Departure
March	5548	5641	-93	195,930	199,210	-3,280
April	6022	5892	130	212,660	208,070	4,590
May	6097	6088	9	215,310	215,000	310
June	6411	6064	347	226,400	214,150	12,250
July	6940	5966	974	245,080	210,690	34,390
August	6750	5849	901	238,370	206,560	31,810
Average	6295	5917	378	222,310	208,960	13,350

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	1974	7320	258,500	1934	4130	145,850
April	1974	7550	266,630	1935	4380	154,680
May	1974	7560	266,980	1934	4530	159,980
June	1986	7610	268,740	1934	4470	157,860
July	1986	7510	265,210	1934	4360	153,970
August	1986	7190	253,910	1934	4370	154,330

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 EC. 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 EC continue efforts to standardize measurement equipment and techniques. Historically, measurements were made at several locations as described below. During the current reporting period, measurements were taken at the International Railway Bridge section located in the upper Niagara River as well as at the Welland Canal. These measurements are documented below.

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 for evaluating 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 2015. The next measurements are scheduled for 2018. Preliminary results from the 2015 measurements show good comparison to the 2012 Buffalo rating equation. The final report is expected for the Spring 2016 semi-annual report.

EC is also taking continuous measurements of water levels at a new International Gauging Station (proposed) located near the International Railway Bridge section. Flow measurements were taken throughout 2013 and 2014 to observe the seasonal impact of aquatic plant growth on flow. EC will use continuous Acoustic Velocity measurement data to assist with assessing flow conditions under ice during the winter and during periods affected by aquatic plant growth. Continuous daily discharge data during non-ice affected periods is being reviewed by both EC and USGS, and is expected to be published.

Lower Niagara River: Discharge measurements are made on a 3-year cycle at the Ashland Avenue Gauge Rating (AAGR) section (formerly known as the Cableway 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. In the Spring of 2007, Acoustic Doppler Current Profiler (ADCP) technology replaced the use of conventional current meter measurements at the AAGR section. In accordance with the 3-year measurement cycle at the AAGR section, a suite of discharge measurements at Falls flows close to the 1,416 and 2,832 m3/s (50,000 and 100,000 cfs) are planned for 2016. These discharges represent the minimums specified in the 1950 Niagara Treaty. The October 30 to November 1 dates have been selected in recent years for efficiency of the measurement session to coincide with the change from 1950 Niagara Treaty day-time summer tourist season to daytime non-tourist season minimum Falls flow requirements. The most recent set of discharges measured at the AAGR section during the 2013 and 2014 field season continued to support the 2009 Ashland Avenue rating equation. The results of the discharge measurements were analyzed and documented in a report prepared by Great Lakes Hydraulics and Hydrology Office, U.S. Army Corps of Engineers, Detroit District and Meteorological Service of Canada, Ontario Region, Environment Canada entitled "Discharge Measurements on the Niagara River Near the Cableway Section, 2013/2014: For Verification of the Ashland Avenue Gauge Rating For the Maid-of-the-Mist Pool Outflow, August 2015". The report has been reviewed by the Hydraulics Subcommittee of the Coordinating Committee on Great Lakes Basic Hydraulic and Hydrological Data, and the INWC. Formal approval of this report will be discussed by the INWC and Board in the spring meetings. Preliminary dates for the next measurement series are May 24-27 of 2016

In addition to the measurements at the AAGR section, measurements are periodically made downstream of the OPG and NYPA hydroelectric generating stations at Queenston–Lewiston during run-of-river conditions, in order to measure the total flow in the lower Niagara River. This section is located approximately 1.6 kilometers (1 mile) upstream of

the Stella Niagara section where conventional measurements were once made. Each total flow measured is finalized and compared to the sum of the outflow from the Maid-of-the-Mist Pool (flow over Niagara Falls) and the discharges from the hydroelectric generating stations. Ultimately, the results should provide greater insight into the turbine ratings and the summation of flow calculations. Brief summaries of these measurements are included in "Discharge Measurements on the Niagara River Near the Cableway Section, 2013/2014: For Verification of the Ashland Avenue Gauge Rating For the Maid-of-the-Mist Pool Outflow, August 2015".

American Falls Channel: Discharge measurements are made in the American Falls Channel on a 5-year cycle 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 American Falls flow is directly related to the operation of the CGIP, the Board monitors this relationship. Since May 2007, measurements are made using a section near the upper reach of the American Falls channel near the American Falls Gauge site. In May 2012, measurements confirmed that there was no difference between measured flows and flows computed using the present American Falls rating equation. Following the 5-year cycle, the next scheduled measurements at this location are expected to be made in the Spring of 2017.

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 ADVM, which are used in the determination of flow through the Welland Canal. Measurements were made in the Welland Supply Canal in May 2012 to re-set the measurement interval. Off-schedule measurements and field work in 2013 provided baseline validation data for a second, redundant, ADVM system, together with confirming the validity of the 2007-2012 index velocity rating at the original site. In this reporting period, a series of measurements were obtained in the Welland Supply Canal to verify the Discharge equations for both ADVM systems. Results from this measurement series are still under review. The next measurement series will take place in 2018.

9. Power Plant Upgrades

OPG began a unit rehabilitation program in 2007 for a number of its Beck I units—Units G3, G7, G9 and G10. The upgrades of G3, G7, and G9 have been completed, while G10 went out of service on September 13, 2015 for rehabilitation (new runner and generator rewind) and will not return to service until September 2016. A new rating table for G9 has been put into service. A testing report has been completed for G3 and the new rating table is circulating for sign-off by the INC members. The test report and draft rating table are being prepared for G7.

No upgrades are planned at any other OPG or NYPA facilities.

10. Ice Conditions and Ice Boom Operation

Western New York experienced below average temperatures from November 2014 through April 2015, making the winter of 2014–2015 one of the coldest in the region's recorded history for the second year in a row, with February being the coldest month on record for the City of Buffalo. The Canadian Ice Service reported that very thick ice covered Lake Erie for a majority of the 2014–15 ice season. The ice covered over 90% of Lake Erie's surface for eight (8) weeks in the 2014-15 ice season, with a maximum coverage of 98% in the first week of March (Figure 11).

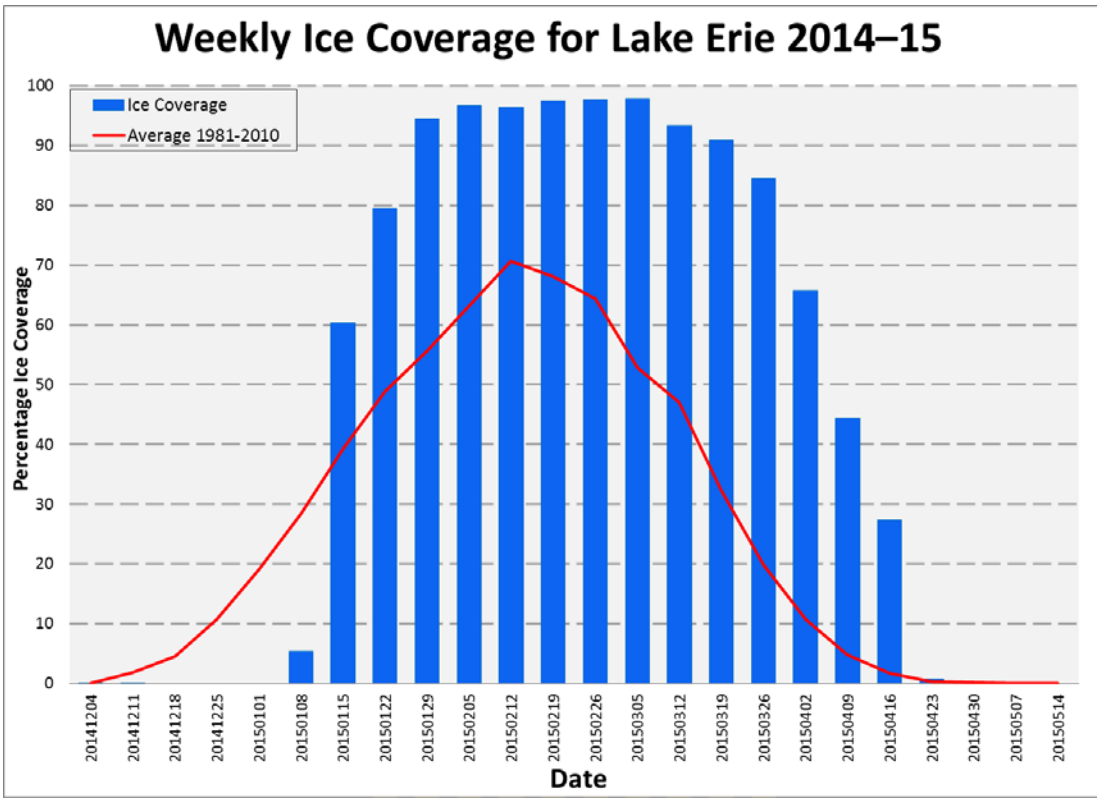


Figure 11: Weeky ice coverage for Lake Erie during the 2014-15 ice season.

As detailed in the previous semi-annual report, a helicopter flight to measure ice thickness at the six standard ice-thickness measurement sites on the eastern end of Lake Erie was conducted on February 13, 2015. The second helicopter flight of the ice season was conducted on March 13, 2015. The ice thickness at the measurement sites ranged from 40 to 58 cm (15.7 to 22.8 inches) averaging 47.5 cm (18.7 inches).

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 square kilometres (250 square miles) of ice remain on eastern Lake Erie. Other factors such as the quality of ice, ice build-up in the river above/below the Falls or in the lower Niagara River, or prediction of unfavourable weather are also considered.

Satellite imagery for March 24, 2015 showed that the eastern basin of Lake Erie, the portion of the lake east of a line between Long Point, Ontario and Erie, Pennsylvania,

was 95 percent ice covered, an area of about 4,860 km^2 (1,875 square miles). Considering the quantity of ice remaining on Lake Erie, the Board informed the Commission by letter dated March 25, 2014 that the ice boom's opening would be delayed beyond April 1. A media advisory regarding the delay in ice boom opening was also issued by the Board at that time.

Further, based on the areal extent and thickness of the lake's ice cover, representatives of Power Entities and the Board's Working Committee decided to postpone the use of fixed-wing ice observation flights to determine the extent and condition of ice remaining on the eastern basin in preparation for removal of the ice boom until after available satellite imagery showed that the extent of ice cover in lake's eastern basin was less than 75%.

A fixed-wing ice observation flight to determine the extent of ice cover over the eastern part of Lake Erie was performed on April 15, 2015. The flight showed 2,176 km^2 (840 square miles) of ice coverage on the eastern end of the lake. A second fixed-wing ice observation flight occurred April 19, 2014. This flight revealed that only 218 km^2 (84 square miles) of eastern lake ice remained.

Removal of the Lake Erie Ice Boom began on April 20, 2015, the day after INWC members conducted the final fixed-wing ice flight of the season. The final spans of the ice boom were removed from Lake Erie and tied off to the Buffalo break wall on April 25, 2015. They were then pulled onto shore on May 6, 2015, ending the 2014–15 ice boom season.

In response to public concern on the timing of ice boom removal and INWC efforts to monitor Lake Erie ice cover, regular updates were provided on the Board's website at ijc.org/en_/inbc/ice_boom.

Guidelines on the annual operation of the ice boom (this includes its installation, maintenance, and removal) are contained in the document titled - "Procedural Guide

for the Operation of the Lake Erie-Niagara River Ice Boom". The last Board approved update to this document occurred in October 1984. As there have been many technological advances since then, particularly in the remote determination of lake ice extent. Document review and update is in progress.

11. Other Issues

American Falls Bridges Project: With the continual deterioration of two of the pedestrian bridges spanning the American Falls Channel over the last several years, New York State Parks (NYSP) has worked with consultants to evaluate the existing structure conditions and possible rehabilitation and replacement alternatives. The two pedestrian bridges in question are the ones crossing the American Falls Channel from Prospect Park to Green Island and from Green Island to Goat Island. NYSP has requested that the New York State Department of Transportation (NYSDOT) assist them through project scoping, design and construction to either rehabilitate the structures to a like-new condition or replace them. Phase 1, the planning and scoping phase, was completed in the Fall of 2013, while the second phase, preliminary design phase, was completed in the Fall of 2014. The third phase, final design, is to be completed in mid to late 2015, while the final phase, construction, is scheduled for the Spring of 2017.

The IJC and the Board may be asked to review the project's plans, which could include rehabilitating the existing bridges, relocating the bridges with portions of the old bridge structure removed or left in place, and the need to cofferdam each bridge pier and/or the entire river channel during construction. The options considered will be modelled with a 1-dimensional hydraulic model to see if they could have a temporary or permanent impact on flow in the American Falls Channel.

There have been no further updates since the November 6, 2014 meeting with the NYSDOT and their contractor, Greenman–Pedersen, Inc.

12. Meeting with the Public

In accordance with the Commission's requirements, the Board held their annual meeting with the public on September 10, 2015 at the Niagara-on-the-Lake Community Centre in Niagara-on-the-Lake. There were 5 people at the meeting, with 4 members of the public attending in person and 1 person participating on-line via webinar/teleconference. Information on items including current and projected Great Lakes levels, the operation of the Lake Erie–Niagara River Ice Boom, and the recession of Niagara Falls were presented by Canadian Board Chair Aaron Thompson at the meeting.

13. Membership of the Board and the Working Committee

The membership of both the Board and the Working Committee is unchanged from the last report. Mr. Arun K. Heer acted as the US Secretary to the Board for this review period.

14. Attendance at Board Meetings

The Board met once during this reporting period. The meeting was held on September 24, 2015, in Montreal, QC. Mr. Stephen Durrett, U.S. Section Alternate Chair, and Mr. Aaron Thompson, Canadian Section Chair were in attendance.

Original Signed by

Mr. AARON F. THOMPSON
Chair, Canadian Section

Original Signed by

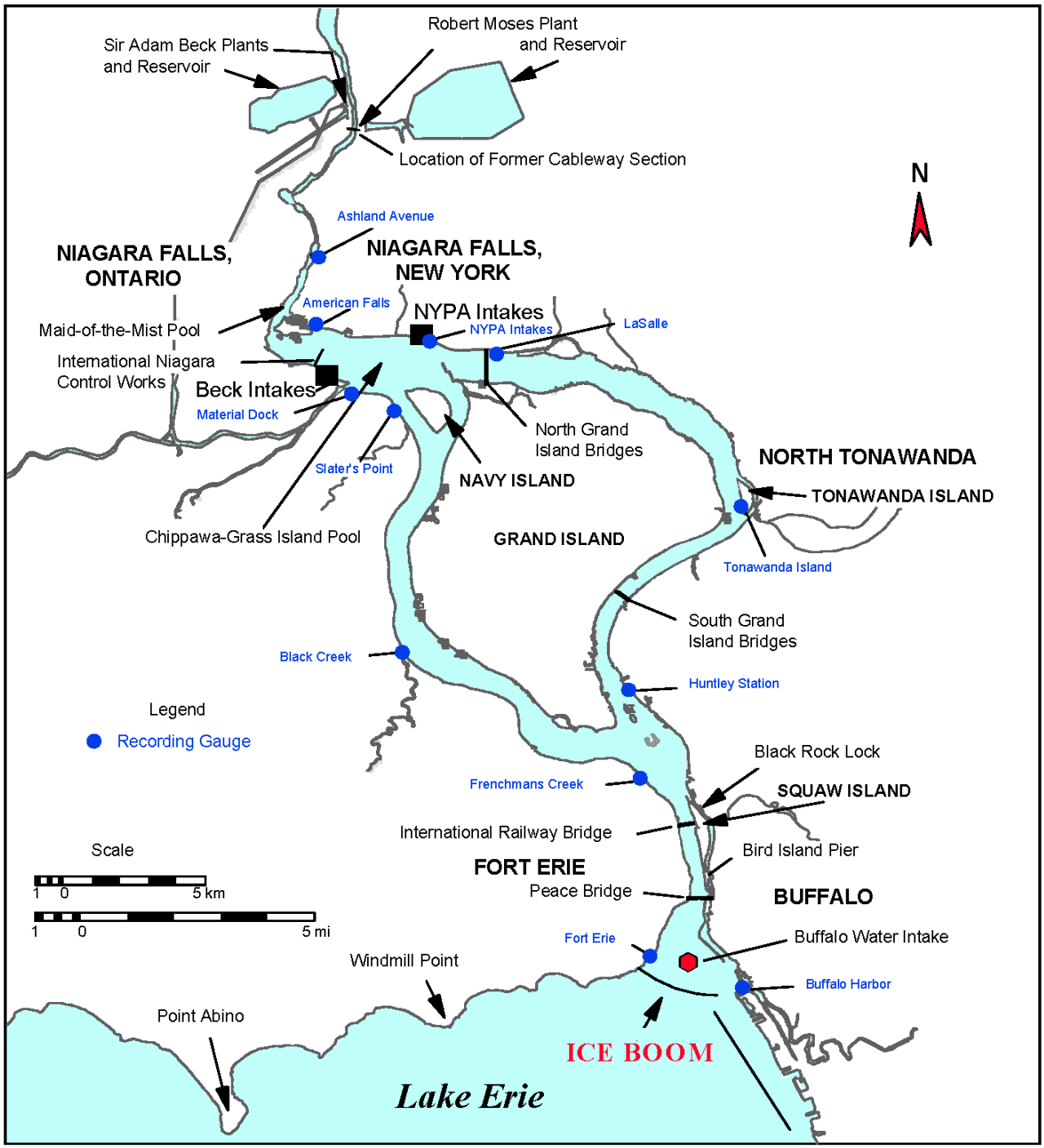
BG RICHARD G. KAISER
Chair, United States Section

Original Signed by

Ms. JENNIFER L. KEYES
Member, Canadian Section

Original Signed by

Mr. WILLIAM H. ALLERTON
Member, United States Section


Sir Adam Beck Plants
and Reservoir
Robert Moses Plant
and Reservoir
Location of Former Cableway Section
N
Ashland Avenue
NIAGARA FALLS,
ONTARIO
NIAGARA FALLS,
NEW YORK
American Falls
NYPA Intakes
NYPA Intakes
LaSalle
Maid-of-the-Mist Pool
International Niagara
Control Works
Beck Intakes
Material Dock
North Grand
Island Bridges
NORTH TONAWANDA
TONAWANDA ISLAND
Slater's Point
NAVY ISLAND
Chippawa-Grass Island Pool
GRAND ISLAND
Tonawanda Island
South Grand
Island Bridges
Black Creek
Huntley Station
Legend
Recording Gauge
Black Rock Lock
Frenchmans Creek
SQUAW ISLAND
International Railway Bridge
Bird Island Pier
Scale
FORT ERIE
Peace Bridge
BUFFALO
1 0 5 km
1 0 5 mi
Fort Erie
Buffalo Water Intake
Windmill Point
Buffalo Harbor
Point Abino
ICE BOOM
Lake Erie

ENCLOSURE 1