International Niagara Board of Control

One Hundred Twenty Sixth Semi-Annual Progress Report

to the

International Joint Commission

Covering the Period September 25, 2015 through March 31, 2016

Executive Summary

The level of Lake Erie began the reporting period with a September mean level of 34 cm (13.4 inches) above its 1918–2014 period-of-record, long-term average level for the month. The level of Lake Erie remained above average on a monthly basis throughout the remainder of the reporting period. The February mean water level was 28 cm (11.0 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).

Preparation work for the remediation of the Ashland Avenue gauge station conducted during the reporting period included: a topographic survey of the river bank and slope, diving inspections of the river inlet pipe, and a bathymetric survey. Discussions between NOAA and the Power Entities about potential short- and long-term solutions to the problem took place and a remediation plan was developed. Based on a further assessment of the data obtained and subject to regulatory and environmental approvals, a consultant's review of the survey and design of any underwater improvements will be completed in 2016. Remedial construction work is estimated for 2017 (Section 4).

No Falls flow violations were reported during this reporting period (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. The regularly scheduled discharge measurements near the International Railway Bridge for the Upper Niagara River were taken in April 2015; draft results and the report for these measurements are expected to be released in the spring of 2016. The next measurements in the Lower Niagara River (at Ashland Avenue gauge) are scheduled for May 24-27, 2016 (Section 8).

Installation of the Lake Erie-Niagara River Ice Boom for the 2015-2016 ice season was completed on December 28, 2015. Generally warmer than average temperatures in 2015-2016 prevented formation of solid ice cover across Lake Erie, however the ice boom controlled ice formed on the lake in the short cold periods experienced in the later winter. Opening of the boom began on March 8, 2016, with the boom spans removed from the navigation channels of the lake by March 14, and all components in storage by April 1 (Section 10).

New York State Parks is in the preliminary design phase of rehabilitation/reconstruction of the two pedestrian bridges spanning the American Falls Channel. Preliminary plans have been reviewed by members of the INWC. Additional information has been requested to assess the impacts of the project. The board will continue to review the plans and advise the IJC of the potential for impact on the operation of the CGIP in accordance with the board's 1993 directive (Section 11).

The board will hold its annual meeting with the public in the fall of 2016 in the Niagara Falls, NY area (Section 12).

Ms. Jeanette Fooks, Environment and Climate Change Canada, replaced Mr. Herman Goertz to join the Canadian Section of the Working Committee; Mr. John Spain, U.S. Federal Energy Regulatory Commission, replaced Mr. Gerald L. Cross to join the U.S. Section of the Working Committee; and Mr. Michael Asklar, from the New York Power Authority was also appointed as a member of the U.S. Section of the Working Committee, replacing Ms. Lori Gale (Section 13).

COVER: View of the Horseshoe Falls and the International Niagara Control Works (Photo Sandrina Rodrigues, Environment and Climate Change Canada)

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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 March 31, 2016
Burlington, Ontario

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 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 provide oversight of 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 the spring and fall of each year. In accordance with this requirement, the board herewith submits its One Hundred Twenty Sixth Semi-Annual Progress Report, covering the reporting period September 25, 2015 to March 31, 2016.

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 was above average throughout the reporting period. It began the reporting period with a September mean level at 34 cm (13.4 inches) above its 1918–2014 period-of-record long-term average level for the month. Between September and January, the monthly mean lake level declined 27 cm (10.6 inches), which is 10 cm (4.0 inches) more than the average 17 cm (7.0 inches) decline for that period. Lake Erie's water level began its seasonal rise a month earlier than normal with its monthly average water level rising 4 cm (1.8 inches) from January to February, when typically the level remains steady. Lake Erie levels ended the reporting period with February mean water level 28 cm (11.0 inches) above average, with its level continuing to rise through the remainder of March. Recorded monthly water levels for the period September 2015 through February 2016 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 four water level gauges and the International Great Lakes Datum (1985).

	Meters			Feet		
Month	Recorded* 2015-2016	Average 1918-2014	Departure	Recorded* 2015-2016	Average 1918-2014	Departure
September	174.50	174.16	0.34	572.51	571.39	1.12
October	174.34	174.06	0.28	571.98	571.06	0.92
November	174.22	173.99	0.23	571.59	570.83	0.76
December	174.17	173.99	0.18	571.42	570.83	0.59
January	174.23	173.99	0.24	571.62	570.83	0.79
February	174.27	173.99	0.28	571.74	570.83	0.91

* Provisional

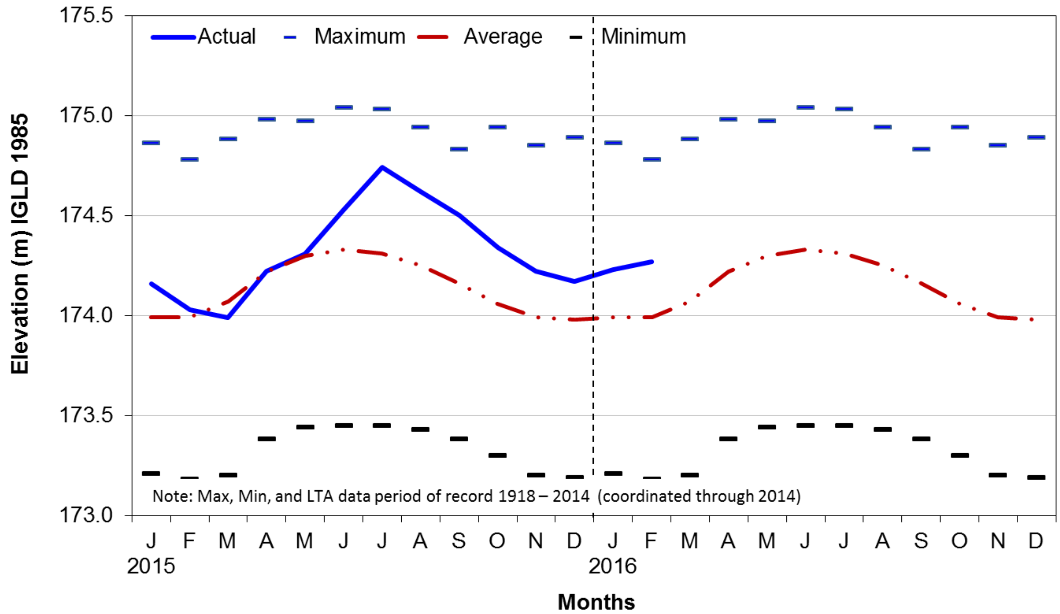


Figure 1: Lake Erie mean monthly and, long-term maximum, minimum and average water levels.

Lake Erie receives water from its local drainage basin and from 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).

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. Overall, precipitation on the Lake Erie basin was below average for the reporting period, with the basin receiving 36.5 cm (14.4 inches) of precipitation from September 2015 to February 2016, which is approximately 11.3 percent below average for the period. However, the first three months of the period were well below average while the last three months were at or slightly above average.

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

	Centimeters			Inches			
Month	Recorded* 2015-2016	Average 1900-2012	Departure	Recorded* 2015-2016	Average 1900-2012	Departure	Departure (in percent)
September	6.45	8.20	-1.75	2.54	3.23	-0.69	-21
October	6.48	7.20	-0.72	2.55	2.83	-0.28	-10
November	4.62	7.30	-2.68	1.82	2.87	-1.05	-37
December	7.29	6.80	0.49	2.87	2.68	0.19	7
January	6.30	6.30	0.00	2.48	2.48	0.00	0
February	5.31	5.30	0.01	2.09	2.09	0.00	0

* Provisional

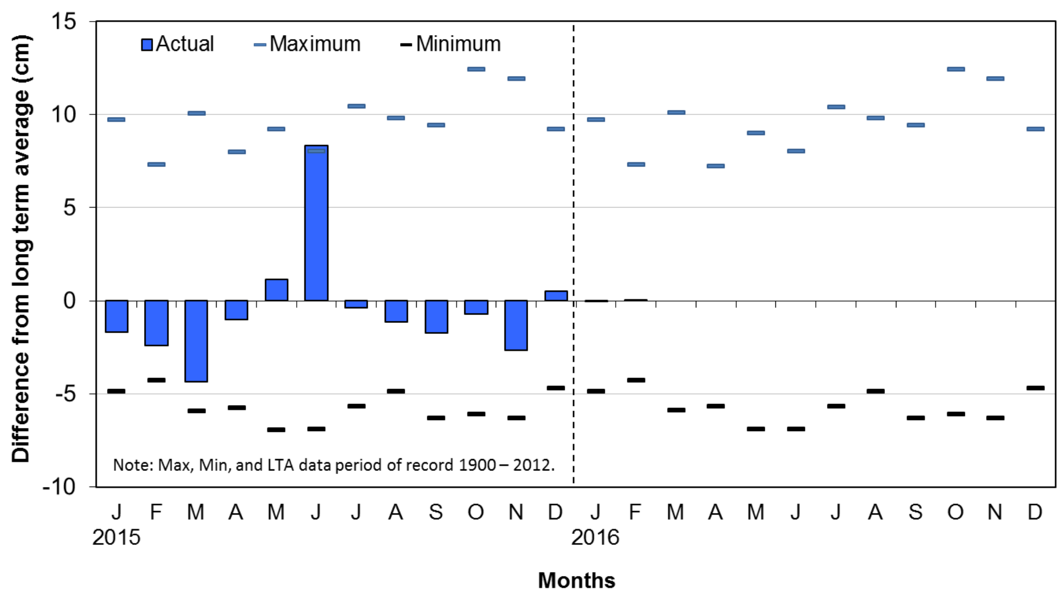


Figure 2: Monthly actual, maximum and minimum precipitation departures from the long-term average on Lake Erie basin.

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. During the reporting period, the lake's NBS was above average for September and February, below average for October, and close to average for the rest of the reporting period (November, December and January).

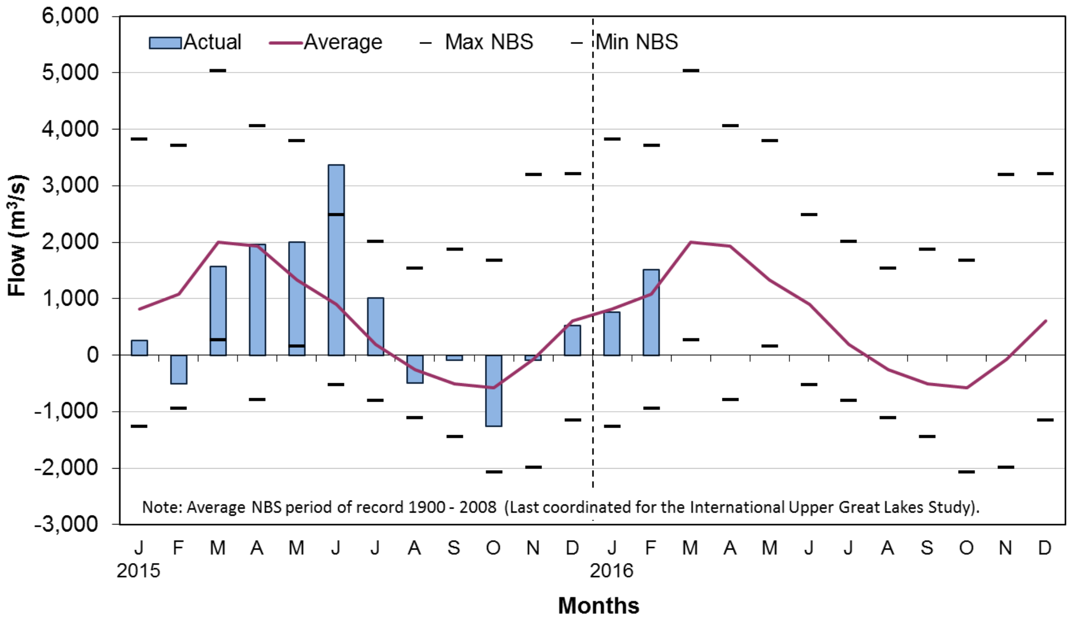


Figure 3: Mean monthly and long-term maximum, minimum and average net basin supplies on Lake Erie basin.

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. Similar to the last reporting period, the level of Lake Michigan–Huron was above average throughout the current reporting period. This above average lake level also resulted in above average flows into the Detroit River for the entire reporting period. As a result, inflow to Lake Erie via the Detroit River was about 13 percent above the long-term average for the six-month period from September 2015 through February 2016. The monthly mean water level on Lake Michigan–Huron and the monthly mean flow in the Detroit River are provided in Figures 4 and 5, respectively.

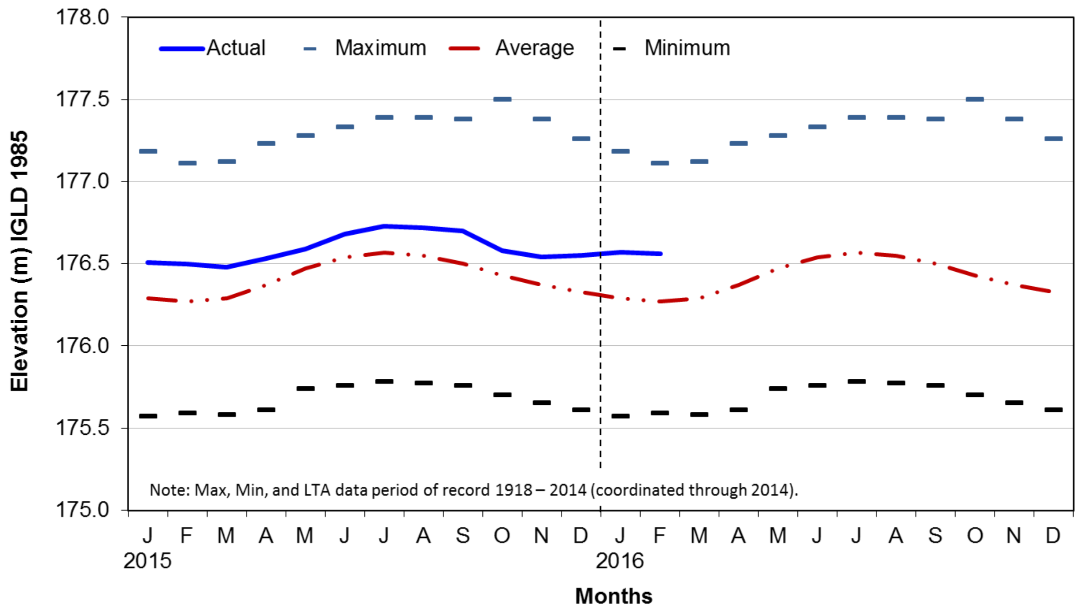


Figure 4: Lake Michigan-Huron mean monthly, and long-term maximum, minimum and average water levels.

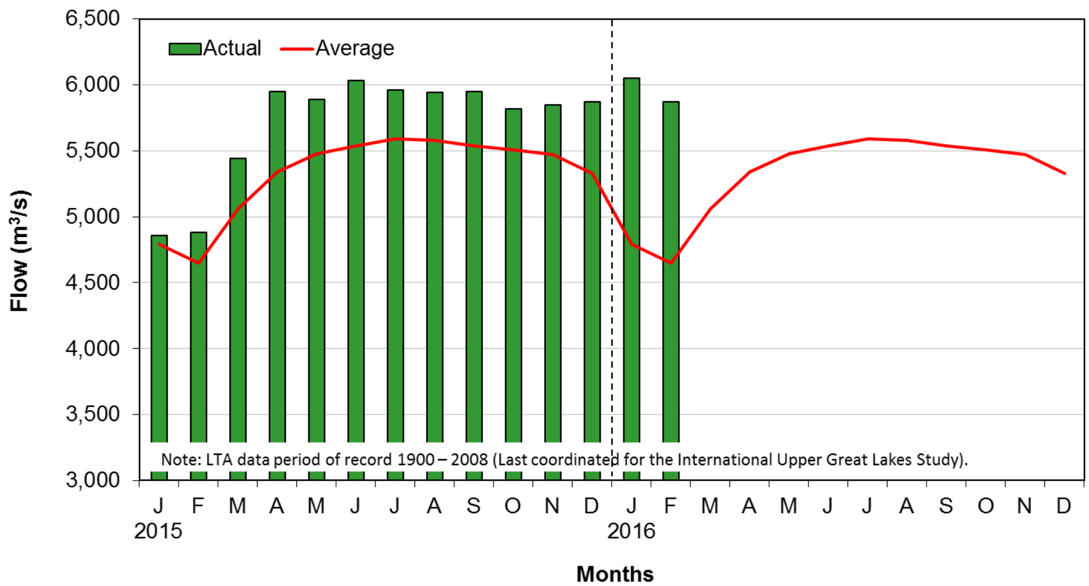


Figure 5: Detroit River mean monthly and long-term average flows.

The inflow from Lake Michigan–Huron via the Detroit River combined with Lake Erie's NBS, resulted in above-average NTS throughout the reporting period except for the month of October. Overall, Lake Erie's NTS was about 13 percent above average for the period September 2015 through February 2016. The recent NTS to Lake Erie is depicted relative to average in Figure 6.

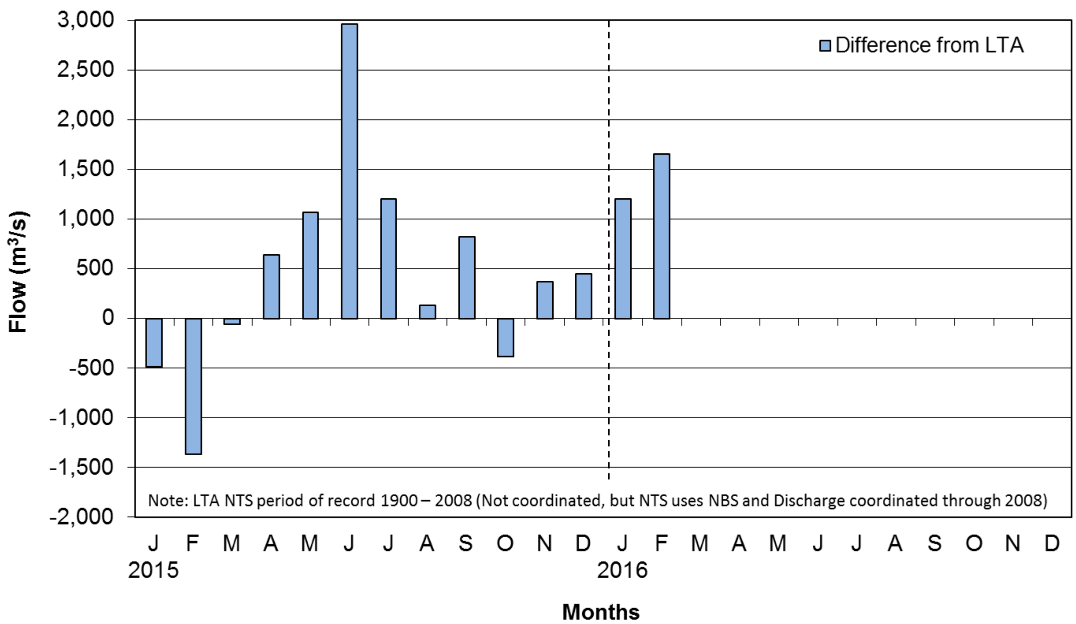


Figure 6: Lake Erie basin monthly net total supplies difference from the long-term average.

Lake Erie discharges water to Lake Ontario through the Niagara River and the Welland Canal. The portion of 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 generation of electricity at Ontario Power Generation's (OPG's) DeCew 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 ice during the winter and aquatic plant growth during the summer, both of which can reduce the flow. Additionally, seasonal trends in prevailing winds typically raise levels at the eastern end of Lake Erie relative to levels at the western end and the lake's average level. Recent monthly outflow via the Niagara River is graphically depicted in Figure 7. The lake's above average water level conditions from September 2015 through February 2016 resulted in Niagara River flow also being above average during those months.

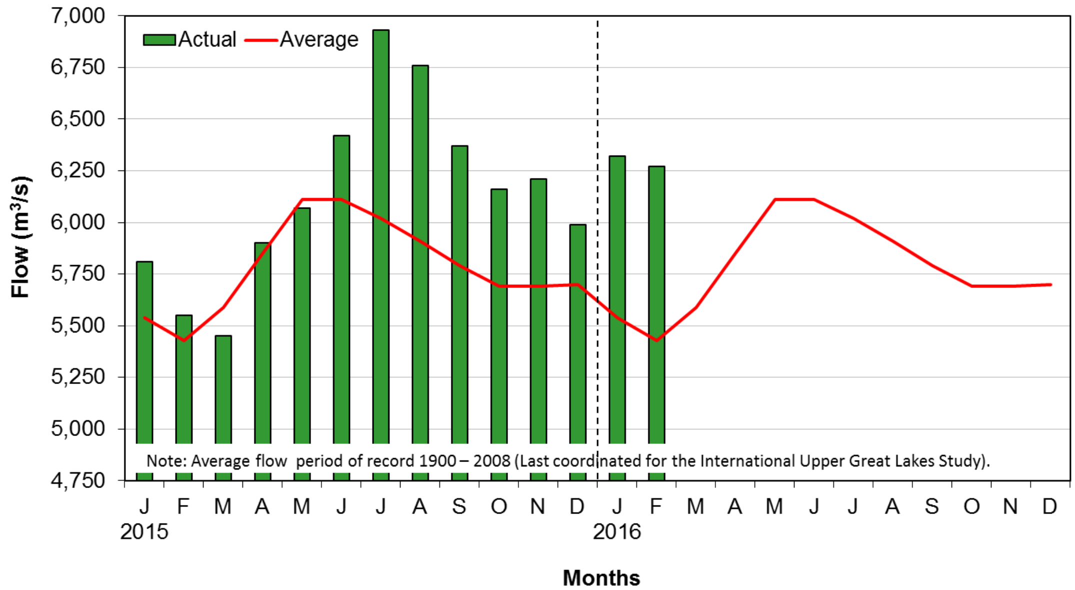


Figure 7: Niagara River mean monthly and long-term average flows at Buffalo, New York.

The six-month water level forecast prepared at the beginning of March by the U.S. Army Corps of Engineers (USACE) and Environment and Climate Change Canada (ECCC) indicates that Lake Erie water levels will likely remain above average throughout the spring and summer. This forecast is made using historical water supplies and current lake levels, and it should be noted that the accuracy of this prediction is limited and actual conditions could vary from the prediction.

3. Operation and Maintenance of the International Niagara Control Works

Water levels in the CGIP are 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 February 29, 2016 was +0.22 metre-months (+0.72 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 a number of occasions during the reporting period, as follows: October 29, 2015, November 12-13, 2015 and January 10-11, 2016 on account of abnormally high flow conditions and on February 13-19, and 27-28, 2016 due to ice conditions.

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

Work undertaken on the multi-year International Control Dam Bridge Repair Project continued in 2016 with the initial phase to install structural steel supports being completed on February 11, 2016. Completion of this portion of the work has allowed restoration to full loading of the spans up to the Canadian Highway Bridge Traffic Standard of 25/45/62.5 tonnes. The next phases involve replacement of the expansion joints on each span, replacement of cylinder access hatch covers, scarifying the entire concrete underlay, installing new curbing and re-pouring a suitable crowned concrete underlay followed by application of asphalt top coat paving to the entire dam. All remaining work is expected to be completed by November 30, 2016.

Gates 1 and 3 of the INCW were removed from service on a planned basis from November 6 to 10, 2015 to facilitate removal of the dewatering structure from the upstream and downstream sides of Gate 3 on the completion of major overhaul. Gate 2 was unavailable from April 30, 2015 to November 12, 2015 for major overhaul and to facilitate repairs to the damaged rollway components.

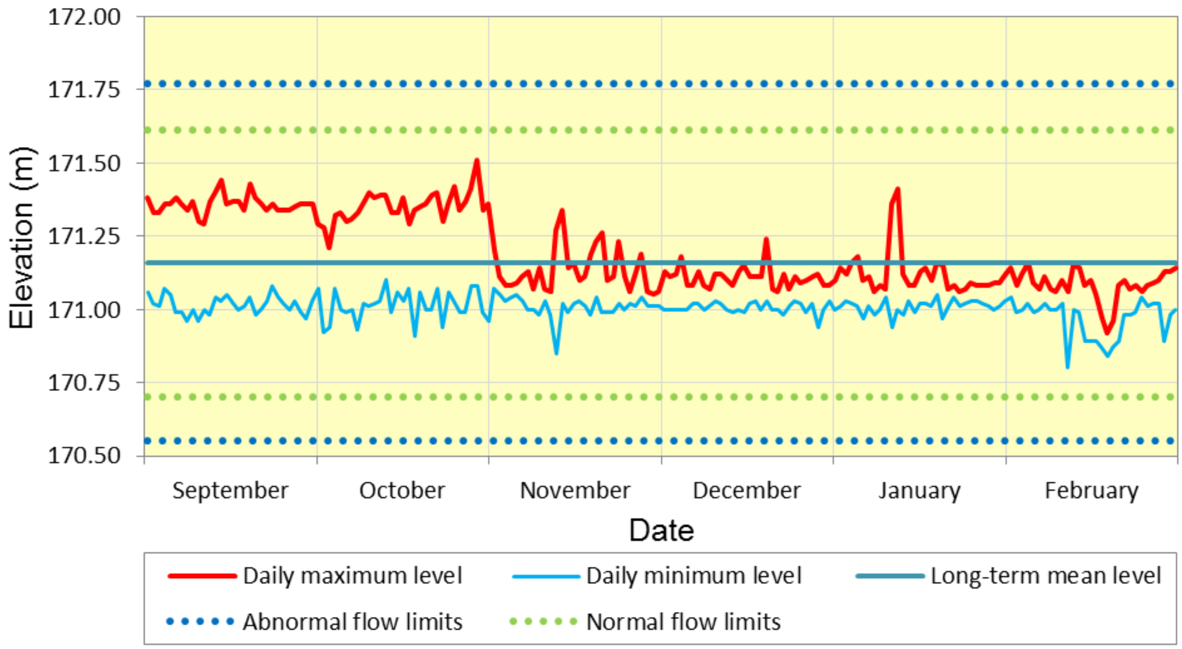


Figure 8: Niagara River daily maximum and minimum water levels at Material Dock gauge.

Gates 1, 4 and 5 were also unavailable, on December 21 and 22 for clearance to install icebreaker approach warning markers about 61 m (200 ft) upstream of the INCW. Gates 1 and 2 were also unavailable on January 11, 2016 to facilitate installation of a new net solar radiometer on Pier 2 of the INCW. Gates 3 and 4 were removed from service from November 30 to December 3, 2015 in an attempt to reduce excessive leakage through the 3A trunnion seal.

Gates 4 and 5 were unavailable from July 13 to October 23 for clearance to undertake work associated with INCW Pier 5 Ventilation Project. This project involved installation of a prototype of an improved air management system to reduce moisture and resultant mould growth in INCW piers.

Gates 9, 10, 11, 12, 13, 16, 17 and 18 of the INCW were unavailable on February 17 to 19, 2016 during installation of a new diesel backup generator onto the station service system at the INCW. During the outage, ten portable generators were brought on site to meet the existing station load and to operate some of the gates. Since some of the gates mentioned above were unavailable for operation, the required size of the portable generators was reduced.

Gate 15 was unavailable from February 2 to 11, 2016 to facilitate change out of severely leaking trunnion service seals. The attempt to complete the work was unsuccessful because the leakage at the 15A seal was too high to allow change out at this time without dewatering the gate.

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. Although the Ontario Power Generating Station Tailwater gauge has been approved as a ‘limited’ alternate to the Ashland Avenue gauge, the reliability of this gauge has come into question. As such and to the extent required, the NOAA gauge at Ashland Avenue was used as an alternate during the outages identified below. The existing gauges functioned adequately to monitor the CGIP levels and the flow over Niagara Falls for this reporting period.

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 for short periods of time on September 24, 2015 as a result of planned communications circuit cutover from a temporary to permanent installation.

The Power Entities' gauge at Ashland Avenue was not reporting water level data for a period on October 5, 2015 due to a defective power supply at the gauge house. The Power Entities' gauge at Ashland Avenue was also not reporting water level data during the periods from November 16 - 17, 2015 and on November 19, 2015 due to failures experienced with communications and modem equipment. The failing components were subsequently replaced to address the problem.

Remediation work at the Ashland Avenue gauge site during the reporting period included a topographic survey of the river bank and slope in the vicinity of the water level gauge, diving inspections of the river inlet pipe and a bathymetric survey of the area in the vicinity of the water level gauge. Discussions between NOAA and the Power Entities about potential short- and long-term solutions to the problem have taken place and a remediation plan has been developed. Based on a further assessment of the data obtained and subject to regulatory and environmental approvals, a consultant review of the survey and design of any underwater improvements will be completed in 2016. Remedial construction work is planned for 2017, as deemed necessary.

The Material Dock gauge serves as the approved official measuring point for the water surface elevation of the Chippawa-Grass Island Pool and associated storage volume. Water levels from the Material Dock gauge were unavailable for a short period on December 16, 2015 due to communications failures.

The Slater’s Point gauge serves as an approved alternate to the Material Dock gauge used for monitoring the level of the Chippawa-Grass Island Pool. Water levels from the Slater’s Point gauge were unavailable for a short period on December 16, 2015 due to communications failures.

Water levels from the Fort Erie gauge are used by the Niagara River Control Centre (NRCC) to determine the upper Niagara River flow for operation of the INCW. Water levels from the Fort Erie gauge were unavailable for a short period on November 19 and December 16, 2015 due to communications failures. Water levels from the Fort Erie gauge were also unavailable for short periods on November 24 and 25, 2015 caused by sinking and sticking of the level sensor float. During all failures, 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.

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). 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. The recorded daily flow over Niagara Falls, covering the period September 2015 through February 2016, is shown in Figure 9.

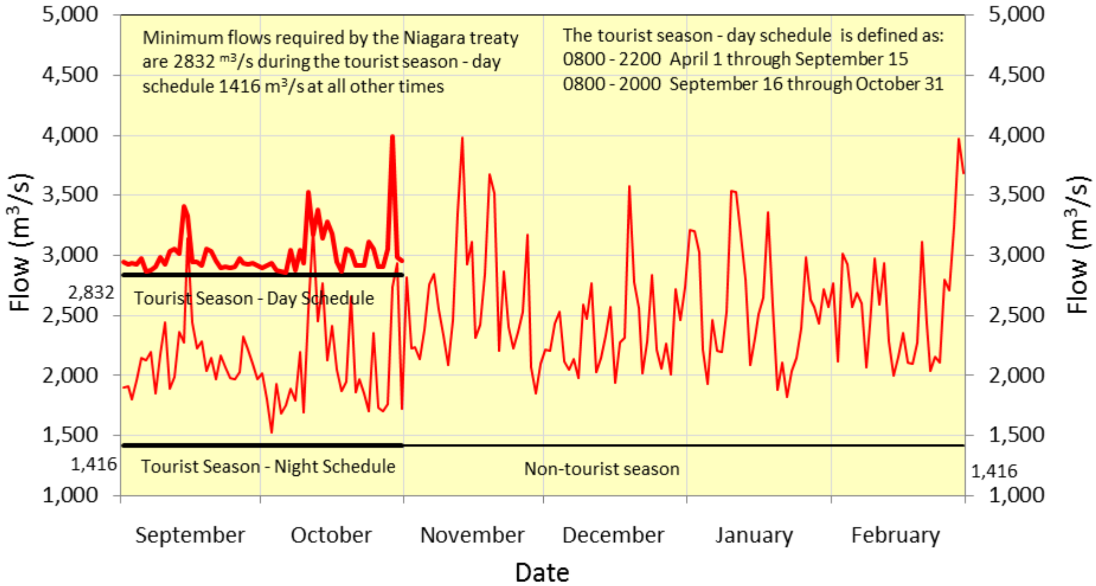


Figure 9: Daily flow over Niagara Falls (flow at Ashland Avenue in m^3/s from September 2015 through February 2016).

6. Falls Recession

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 September 2015 through February 2016, diversion to the SAB I and II plants averaged 1,537 m^3/s (54,280 cfs) and diversion to the Robert Moses Niagara Power Project averaged 2,154 m^3/s (76,070 cfs).

The average flow from Lake Erie to the Welland Canal for the period September 2015 through February 2016 was 231 m^3/s (8,160 cfs). Diversion from the canal to OPG's DeCew Falls Generating Stations averaged 186 m^3/s (6,570 cfs) for the same period of time.

Records of diversions for power generation covering the period September 2015 through February 2016 are shown in Figure 10.

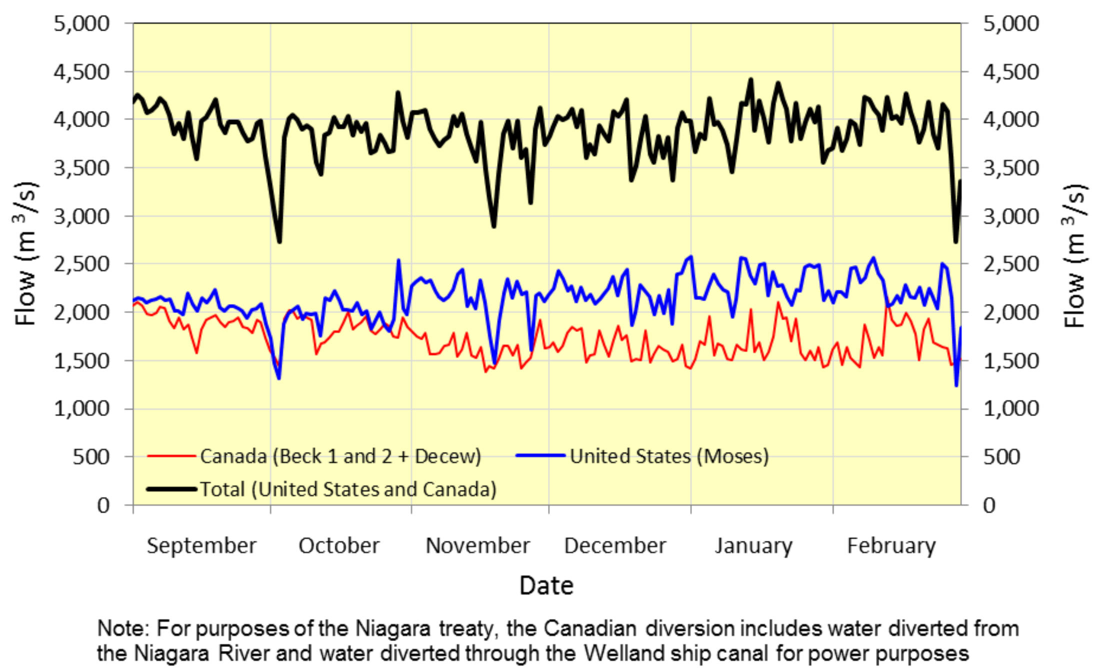


Figure 10: Daily diversion of Niagara River water for power purposes.

The monthly average Niagara River flows at Queenston, Ontario, for the period September 2015 through February 2016, 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 September 2015 through February 2016, the flow at Queenston averaged 6,240 m^3/s (220,360 cfs) with the monthly values ranging between 6,027 m^3/s (212,840 cfs) and 6,363 m^3/s (224,710 cfs). The flow at Queenston for the same period in 2014–15 averaged 5,944 m^3/s (209,910 cfs) with the monthly values ranging between 5,601 m^3/s (197,800 cfs) and 6,125 m^3/s (216,300 cfs).

Table 3: Monthly Niagara River flows at Queenston.

	Cubic Metres per Second			Cubic Feet per Second		
Month	Recorded 2015-2016	Average 1900-2014	Departure	Recorded 2015-2016	Average 1900-2014	Departure
September	6337	5719	618	223,790	201,960	21,830
October	6141	5642	499	216,870	199,250	17,620
November	6232	5657	575	220,080	199,780	20,300
December	6027	5695	332	212,840	201,120	11,720
January	6363	5541	822	224,710	195,680	29,030
February	6337	5433	904	223,790	191,860	31,930
Average	6240	5615	625	220,360	198,290	22,070

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
September	1986	6880	242,960	1934	4340	153,270
October	1986	7220	254,970	1934	4320	152,560
November	1986	7030	248,260	1934	4190	147,970
December	1985	7410	261,680	1964	4270	150,790
January	1987	7240	255,680	1964	3960	139,850
February	1987	6900	243,670	1936	3320	117,240

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. During the 2015 field season, measurements were taken at the International Railway Bridge Section located in the upper Niagara River and the Welland canal. The 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 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 April 2015. Draft results and the report for these measurements are under review and expected to be released in the spring of 2016. The next measurements at the International Railway Bridge are scheduled for spring 2018. 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.

ECCC is also taking continuous measurements of water levels at a new International Gauging Station (proposed) [Niagara River at Fort Erie, 02HA013] located near the International Railway Bridge section. ECCC plans to use continuous Acoustic Velocity measurement data to assist with assessing flow conditions under ice-affected and weed-affected periods. Continuous daily discharge data during non-ice affected periods is currently reviewed by both ECCC and USGS, and published on a bi-annual basis. The calibration of the acoustic instrument is ongoing, based on the discharge measurements completed since its installation.

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. The next measurements at this location are scheduled for May 24-27, 2016. 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 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 near 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 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 Acoustic Doppler Velocity Meter (ADVM), which are used in the determination of flow through the Welland Canal. Measurements were made in the Welland Supply Canal in April 2015. Preliminary results from these measurements confirmed the rating of both the newer ADVM installation and the 2007-2012 index velocity rating at the original ADVM installation site. Results will be finalized and reported during the next reporting period. The next measurement series in the Welland Supply Canal will take place in the spring of 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 upgrade work on G3 has been completed and the test report and new unit rating table are in the review process. The rehabilitation of G7 is now complete as the new unit rating table created after its upgrades was put into service on January 27, 2016. The rehabilitation of G9 was completed during previous reporting periods. G10 has been out of service since September 2015 for its rehabilitation (new runner and generator rewind).

The G2 unit at DeCew Falls II is expected to be removed for service from November 2016 to February 2017.

10. Ice Conditions and Ice Boom Operation

Preparations for installing the Lake Erie–Niagara River ice boom began in late November. From November 30 to December 1, 2015, the junction plates were raised from the bottom of the lake, and floatation barrels were attached. The strings of boom pontoons were pulled from their summer storage area and placed inside the Buffalo Harbor breakwall from December 3-10, 2015.

In accordance with Condition (d) of the Commission's October 5, 1999 supplementary Order of Approval, installation of the ice boom may begin when the Lake Erie water temperature, as measured at the Buffalo Water Intake, reaches 4ºC (39ºF) or on December 16, whichever occurs first. Given the stated conditions, installation of the twenty-two ice boom spans began on December 16, placing six spans of the boom starting from the Canadian side. High winds and waves slowed the progress of installation with the remaining 16 spans being put into place over the next 12 days, as weather permitted. The final spans were installed on December 28, completing the ice boom's installation for the 2015–16 ice season.

A practice drill for NYPA's Flood Warning Notification Plan in the Event of Ice-Affected Flooding on the Upper Niagara River was undertaken on December 9, 2015. This year's drill simulated a flood event along the U.S. shore of the Niagara River. It was triggered by an ice jam between the NYPA Intakes and the Buckhorn Dykes, causing rising water levels at LaSalle Yacht Club and beneath the North Grand Island Bridge.

Weekly reports on the ice conditions for Lake Erie and the Niagara River were prepared and submitted to the board by the Power Entities beginning on December 17, 2015. Data jointly compiled by the Canadian Ice Centre and the U.S. National Ice Center of weekly ice coverage for Lake Erie is shown in Figure 11.

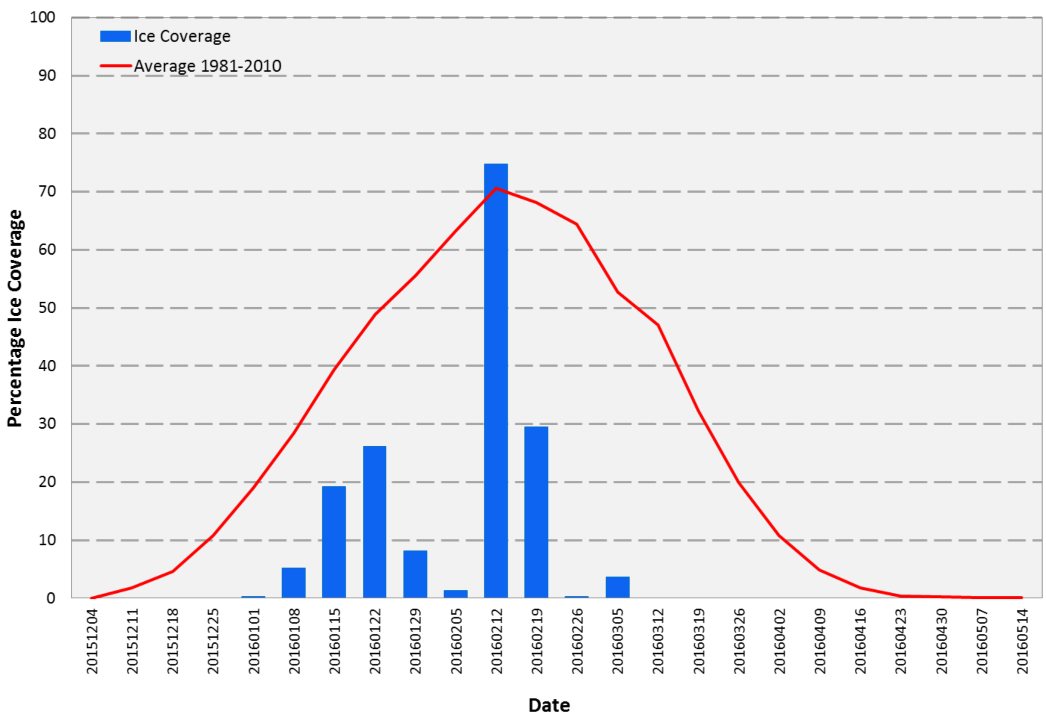


Figure 11: Weeky ice coverage for Lake Erie during the 2015-16 ice season up to March 31, 2016.

The spare ice boom spans that had previously been secured to the breakwall came loose and were reported to be free-floating on January 12, 2016. These were subsequently secured later that same day.

Lake Erie ice conditions for the 2015-2016 ice season was light due to only a few short cold spells followed by unseasonably warm temperatures. Unseasonably warm weather in January delayed the start of ice formation on Lake Erie until the second week in January. Ice continued to form in the western basin of the lake and inside Long Point Bay, peaking at 26.2% coverage by the fourth week in January, before beginning to dissipate and falling to about 1.4% coverage in the week of February 5. Periods of heavy snow and cold weather caused the ice coverage to increase to 74.7% in the week of February 12, which quickly declined to 29.5% for the following week. Fluctuating temperatures throughout the ice season did not allow a solid ice formation to occur on Lake Erie, with the majority of ice defined as medium or skim ice. The lack of solid ice formation was also confirmed by MODIS (Moderate Resolution Imaging Spectroradiometer) satellite images available throughout the reporting period. With the return of milder temperatures, the ice cover fell to just under one percent in the week of February 26. Another round of snow slightly increased the lake ice coverage to about four percent for the week of March 5, however, that quickly disappeared in subsequent days. The eastern basin of Lake Erie remained virtually ice-free throughout the reporting period, with only a small amount of ice showing in Long Point Bay on the ice coverage chart for the week of February 17.

Strong winds and open water conditions over most of the Eastern part of Lake Erie resulted in some damage to the ice boom. A report was received on February 11, 2016 of a break in the ice boom at Span D. A second report on February 19, 2016 identified a second break at Span F. Repairs were undertaken on February 23 to both Span D and F, and two trailing pontoons at Span I were also removed from the string. It was noted during an inspection that one small buoy barrel on the Canadian side of Span F was also missing. No further breaks in the ice boom were reported.

No solid ice formed on Lake Erie in the vicinity of the ice boom at any time during the 2015-16 ice season. In contrast, during the 2014-15 ice season, the ice coverage on Lake Erie had grown to 95% at the end of January, and held steady at around 97% for the rest of the 2014-15 reporting period.

Considering the lack of ice on the lake, the absence of ice buildup in the Maid-of-the-Mist Pool below Niagara Falls and the risk of continuing damage to the ice boom due to open water conditions, the board issued a media advisory on March 8 and boom opening operations started on the same day. Eight spans were removed on March 8, two on March 10, an additional eight on March 11, and the last four spans of the boom were removed on March 14. Last year, boom removal began on April 20 and was completed on April 25.

Given the lack of ice, the two helicopter flights typically carried out in February and March to measure ice thickness on the eastern part of Lake Erie were cancelled. Review of available MODIS imagery and ground-based observations indicated that there was open water at all of the six standard measurement sites. Similarly, the fixed-wing flights normally scheduled in early March to determine the extent and condition of the ice cover in order to decide when the ice boom can be removed were not needed this year.

Details of the annual operation of the ice boom (including the 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 update to this document that was approved by the board was in October 1984. As there have been many technological advances since then, particularly in the remote determination of lake ice extent, the document is under a review process and is in the process of being updated.

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 condition of the structures 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. The second phase, preliminary design phase, is scheduled to be completed in the summer of 2016, once comments from a public meeting held on 27 January 2016 are addressed. The third phase (final design) and fourth phase (construction) have currently been postponed indefinitely until further funding can be secured.

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 considered options for the permanent bridge structures have been 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. The Working Committee received a copy of the model in November 2015 and has provided some preliminary feedback to the NYSDOT's consultant, Greenman-Pederson, Inc., regarding model development.

The IJC has also asked the board to consider the impacts of the construction phase on the CGIP and impacts that it may have on the ability to maintain levels with the 1993 directive limits. The USACE has reviewed a preliminary 1-dimensional hydraulic model of the Niagara River developed by Greenman-Pederson Inc., and has provided recommendations for improving the model. NYSDOT is planning to continue to work with

Greenman-Pederson to improve the accuracy of the model to a level that could then be used to estimate potential impacts on the CGIP before temporarily stopping work on the project pending further funding. It is expected that further assessment of the potential for impacts on the operation of the CGIP will be required when work on this project resumes and the board, through the INWC, will continue to review the estimated impacts of the construction and advise the IJC.

12. Meeting with the Public

In accordance with the Commission's requirements, the board will hold its annual meeting with the public in August or September 2016. The meeting will be in the Niagara Falls, NY area, with the meeting location and date to be determined. A location will be chosen that will allow for members of the public to attend the meeting remotely.

13. Membership of the Board and the Working Committee

The membership of the board remains unchanged from the last report. Changes to the board's Working Committee during the reporting period are:

Ms. Jeanette Fooks, Environment and Climate Change Canada replaced Mr. Herman Goertz on the Canadian Section of the Working Committee on November 4, 2015.

Mr. Gerald L. Cross of the U.S. Federal Energy Regulatory Commission (FERC) retired on December 31, 2015 and has vacated his position on the U.S. Section of the Working Committee. Mr. John Spain from the FERC replaced Mr. Cross as of February 7, 2016.

Mr. Michael Asklar, from the New York Power Authority, was appointed as a member of the U.S. Section of the Working Committee on January 1, 2016. Mr. Asklar replaced Ms. Lori Gale, who changed assignments.

14. Attendance at Board Meetings

The board met once during this reporting period. The meeting was held on March 31, 2016 at Detroit District office of the US Army Corps of Engineers, Detroit, Michigan. BG Richard Kaiser U.S. Section Chair, Mr. Aaron Thompson, Canadian Section Chair and Mr. William Allerton, US board member, were in attendance.

Original Signed By

Mr. AARON F. THOMPSON
Chair, Canadian Section

Original Signed By

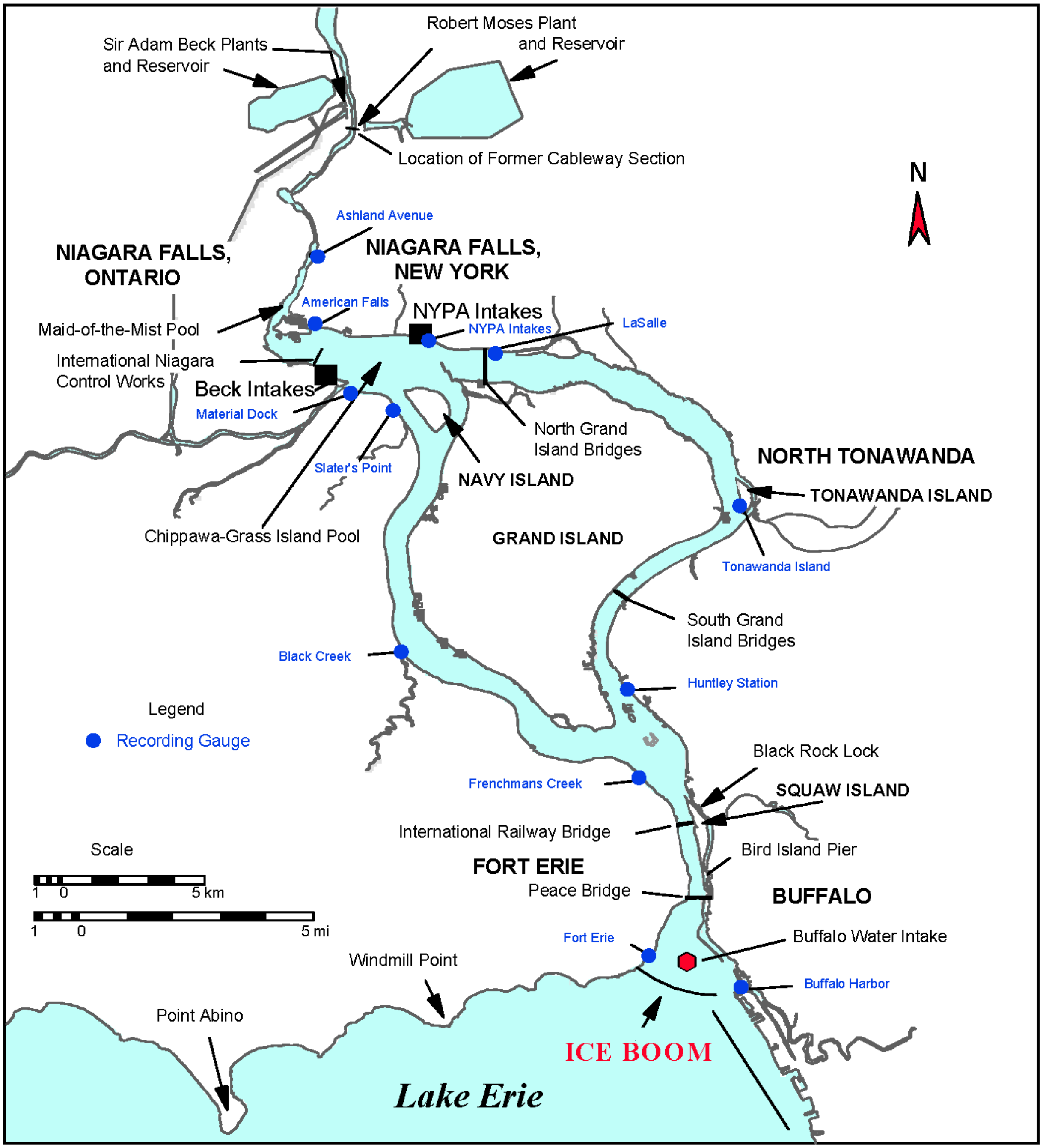
BG RICHARD G. KAISER
Chair, United States Section

Original Signed By

Ms. JENNIFER L. KEYES
Member, Canadian Section

Original Signed By

Mr. WILLIAM H. ALLERTON
Member, United States Section



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