International Niagara Board of Control

One Hundred Twenty Fourth Semi-Annual Progress Report

to the

International Joint Commission

Covering the Period September 25, 2014 through March 5, 2015

EXECUTIVE SUMMARY

The level of Lake Erie began the reporting period with a September mean level 15 cm (5.9 inches) above its 1918–2013 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 4 cm (1.6 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).

Remediation work on the Ashland Avenue gauge, conducted between November 4 and November 6, included: removal of sediment from the gauge well, test operation of the gauge well valve and clean out of the gauge inlet pipe in its entirety from the well to the river. This work was the first stage in long-term remediation plan developed by the National Oceanic and Atmospheric Administration (NOAA) and Power Entities to address an on-going issue at the Ashland Avenue gauge (Section 4).

There were no Falls flow violations reported during the 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 next measurements in the Upper Niagara River are scheduled for April 27 through May 1, 2015, while the next measurement series in the Welland Supply Canal will take place during the week of April 27, 2015 (Section 8).

Installation of the Lake Erie-Niagara River Ice Boom began on December 15 and was completed on December 16, 2014. A small amount of ice began to form on Lake Erie

around mid-December, however it wasn't until mid-January that over half of the lake was covered in ice. By the end of January, the ice coverage had grown to almost 95%, much above the average of 56% for that time of year. The ice coverage held steady at around 97% for the rest of the reporting period. The boom remained in place at the end of the reporting period as the areal extent of ice was well above the 650 square kilometres (250 square miles) and was of significant thickness. (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. Construction is scheduled to begin in the Spring of 2017 (Section 11).

The Board will hold its annual meeting with the public in the fall of 2015 in the Niagara Falls, ON area (Section 12).

The membership of the Board has had one change with Stephen G. Durrett being named as the Alternate U.S. Section Chair, replacing Deborah H. Lee. (Section 13).

COVER: View of the American Falls. (Photo by Mr. James Scungio, USACE)

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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
Burlington, Ontario

March 5, 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 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 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 April and October of each year. In accordance with this requirement, the Board herewith submits its One Hundred Twenty Fourth Semi-Annual Progress Report, covering the reporting period September 25, 2014 to March 5, 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 was above average throughout the reporting period. It began the reporting period with a September mean level at 15 cm (5.9 inches) above its 1918–2013 period-of-record, long-term average level for the month. Between September and January, the lake level declined 15 cm (5.9 inches), which is close to the average 17 cm (7.0 inches) decline for that period. The February average water level dropped 13 cm (5.1 inches) from the January average during a month when the level typically remains steady. The February mean water level was 4 cm (1.6 inches) above average. The lake's water level is forecasted to begin its seasonal rise during March. Recorded monthly water levels for the period September 2014 through February 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.

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).

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. Precipitation on the Lake Erie basin started the reporting period above average during the month of September, but then remained below average for the rest of the reporting period. During the period September 2014 through February 2015, the basin received 33.3 cm (13.1 inches) of precipitation. This is approximately 18.9% below 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. During the reporting period, the lake's NBS was above average for September, October and December and below average for November, January, and February.

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. For the first time in many years, the level of Lake Michigan–Huron was above average during the entire reporting period. This high lake level also resulted in higher than average flow in the Detroit River for the entire reporting period. The lake's outflow was significantly reduced during January and February due to the impact of ice in the St. Clair and Detroit rivers but was still above average. As a result, inflow to Lake Erie via the Detroit River was about 6.7% above the long-term average for the six-month period September 2014 through February 2015. 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.

The inflow from Lake Michigan–Huron via the Detroit River combined with Lake Erie's NBS, resulted in above-average NTS from September to December and below-average NTS for the months of January and February. Overall, Lake Erie's NTS was about 3% above average for September 2014 through February 2015. The recent NTS to Lake Erie is depicted relative to 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–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. Flow is also influenced by ice in the river during the winter and aquatic plant growth in the river in 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 2014 through February 2015 resulted in Niagara River flow also being above average during those months.

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 a few months out. The six-month water level forecast prepared at the beginning of March 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 spring and summer. However, low water supply conditions would result in below average Lake levels.

TABLE 1 – MONTHLY AVERAGE LAKE ERIE WATER LEVELS

(Based on a network of 4 water level gauges)
International Great Lakes Datum (1985)

	Metres			Feet		
Month	Recorded* 2014-2015	Average 1918-2013	Departure	Recorded* 2014-2015	Average 1918-2013	Departure
September	174.31	174.16	+0.15	571.88	571.39	+0.49
October	174.25	174.06	+0.19	571.69	571.06	+0.63
November	174.15	173.99	+0.16	571.36	570.83	+0.53
December	174.17	173.98	+0.19	571.43	570.80	+0.63
January	174.16	173.99	+0.17	571.38	570.83	+0.55
February	174.03	173.99	+0.04	570.96	570.83	+0.13

* Provisional

TABLE 2 – MONTHLY AVERAGE PRECIPITATION ON THE LAKE ERIE BASIN

	Centimetres			Inches			
Month	Recorded* 2014-2015	Average 1900-2011	Departure	Recorded* 2014-2015	Average 1900-2011	Departure	Departure (in percent)
September	10.41	8.16	2.25	4.10	3.21	0.89	28
October	6.43	7.12	-0.69	2.53	2.80	-0.27	-10
November	5.38	7.32	-1.94	2.12	2.88	-0.76	-26
December	3.56	6.80	-3.24	1.40	2.68	-1.28	-48
January	4.62	6.32	-1.70	1.82	2.49	-0.67	-27
February	2.92	5.35	-2.43	1.15	2.11	-0.96	-45

* Provisional

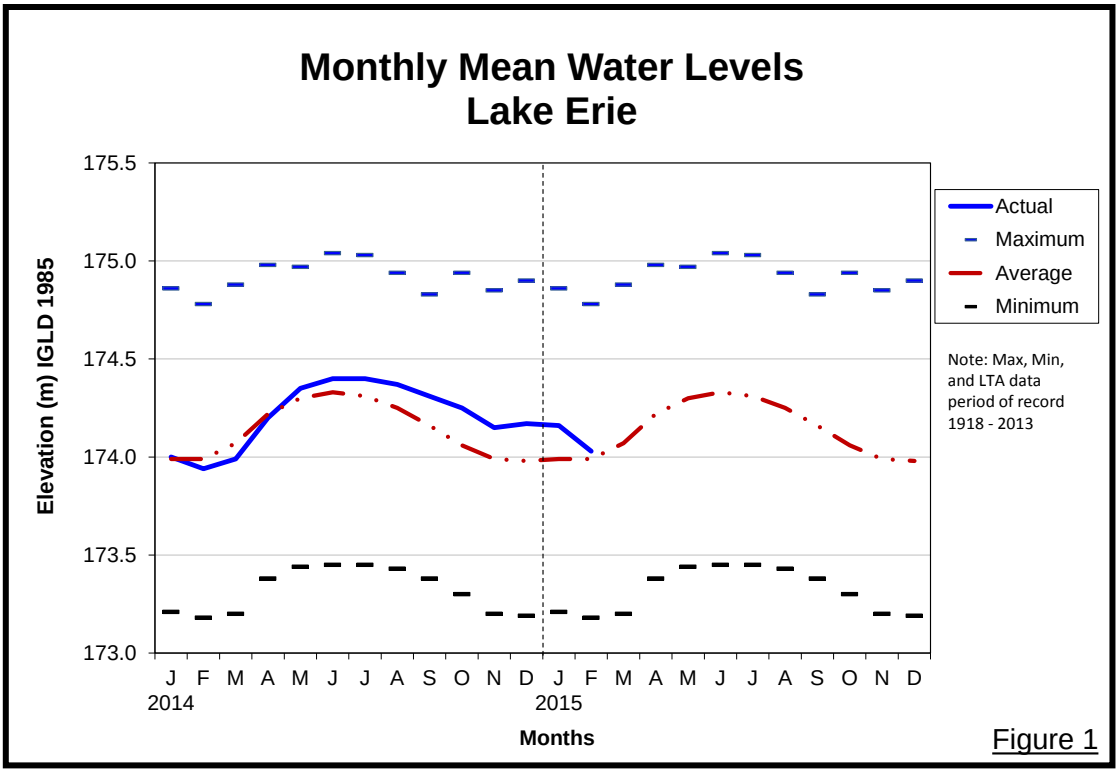
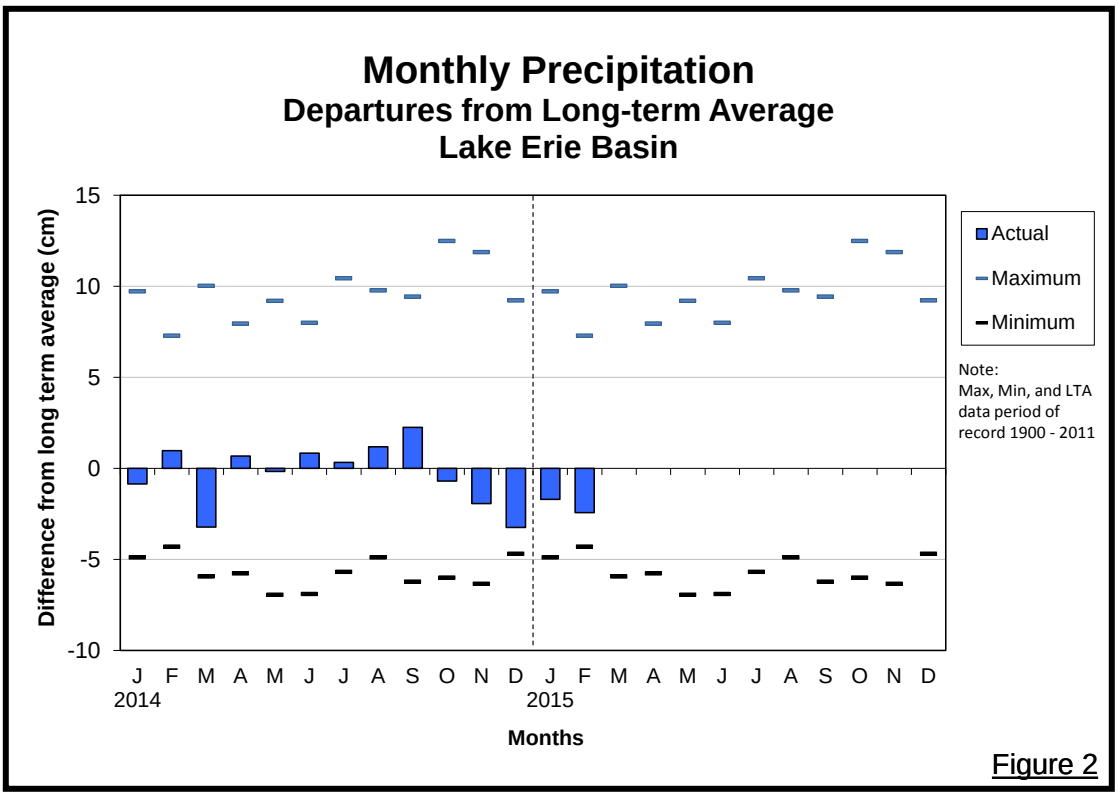


Figure 1



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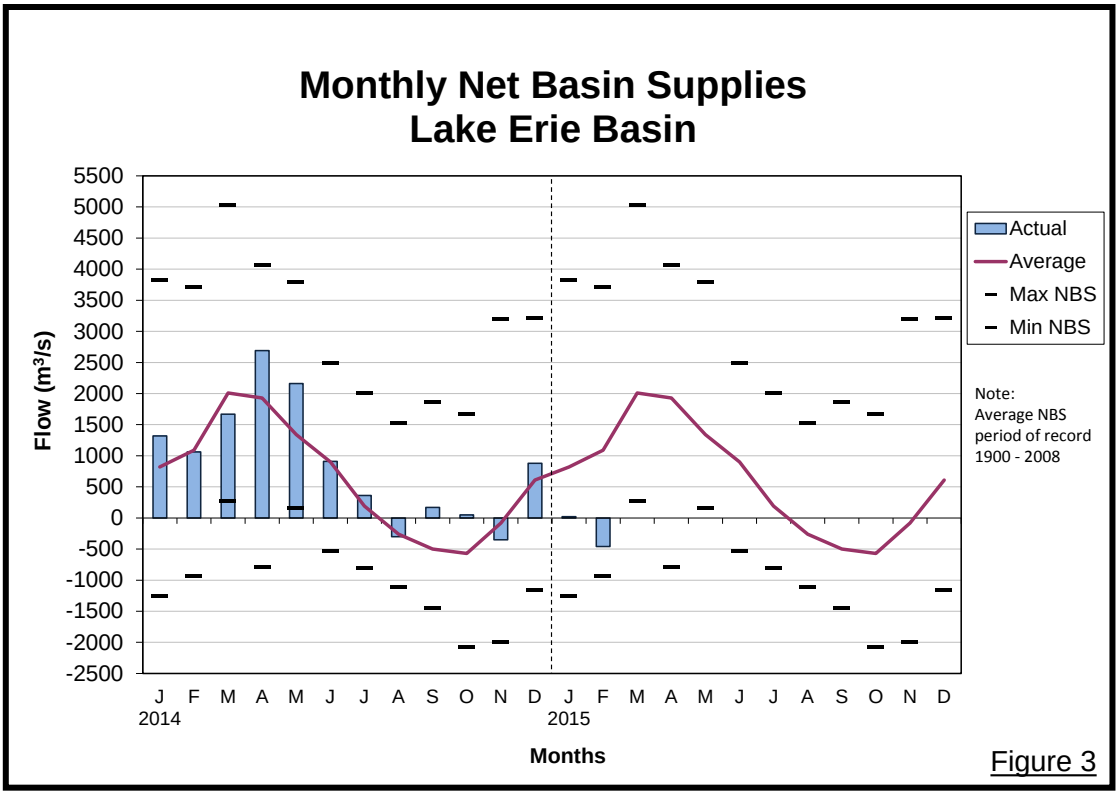

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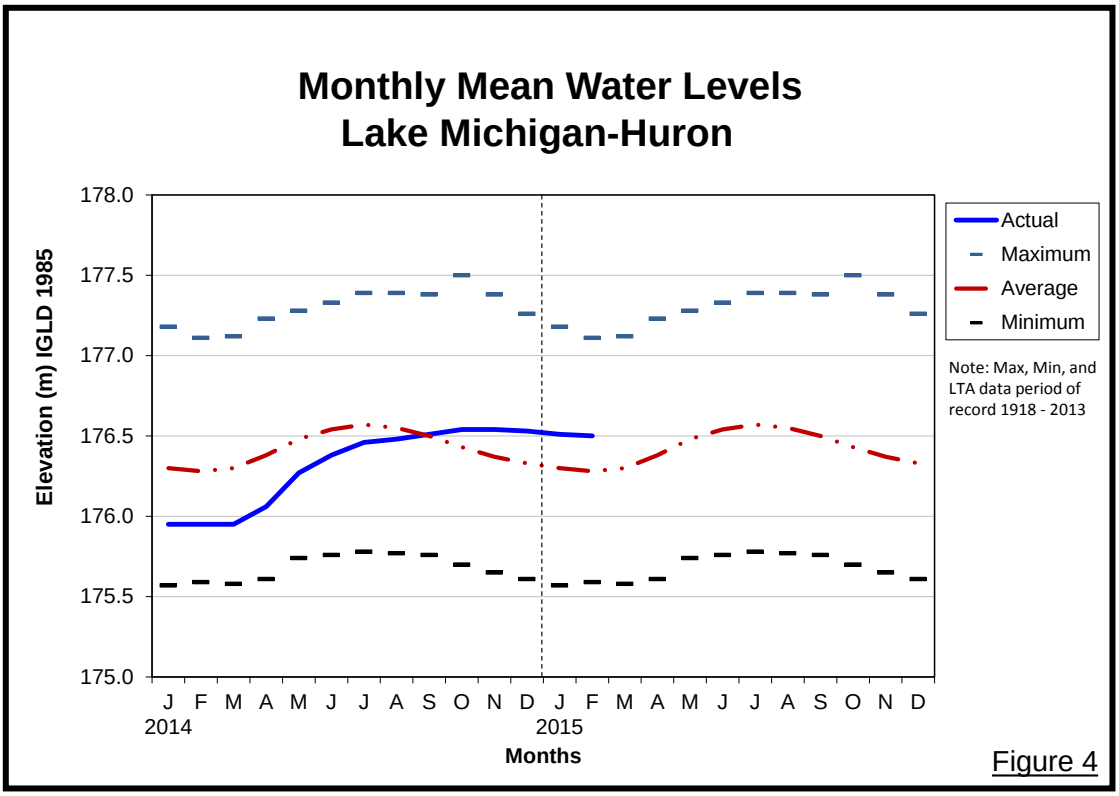


Figure 4

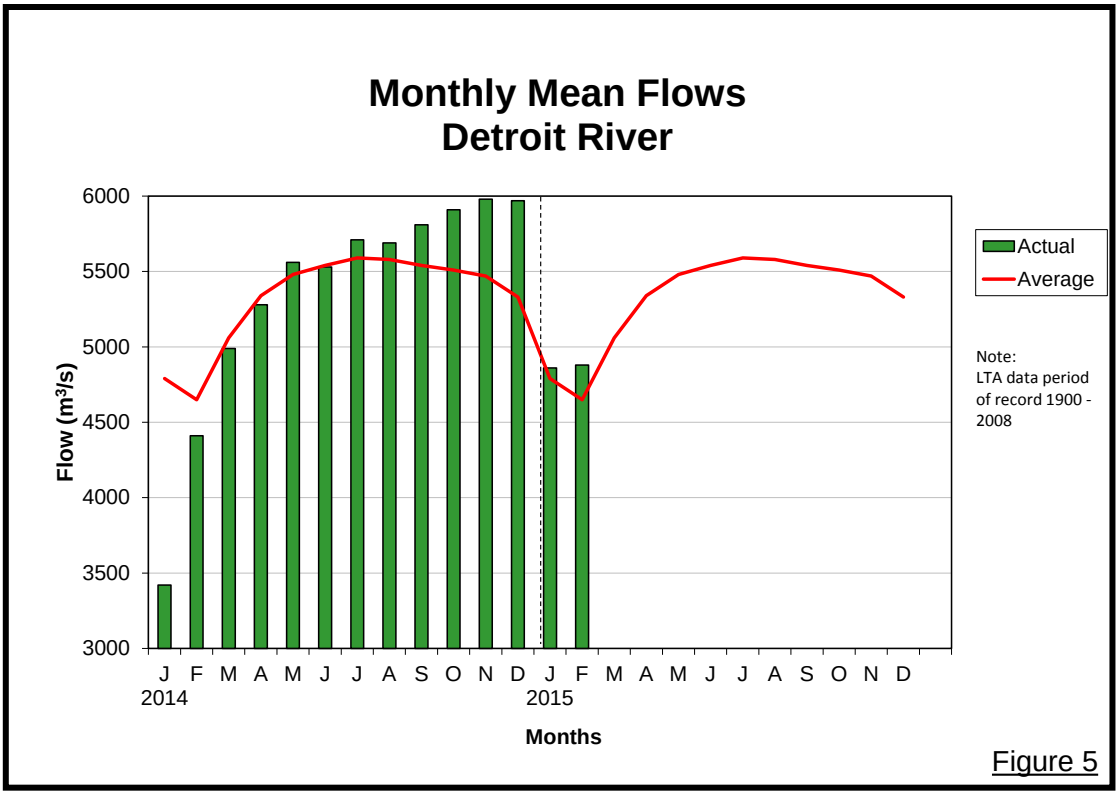


Figure 5

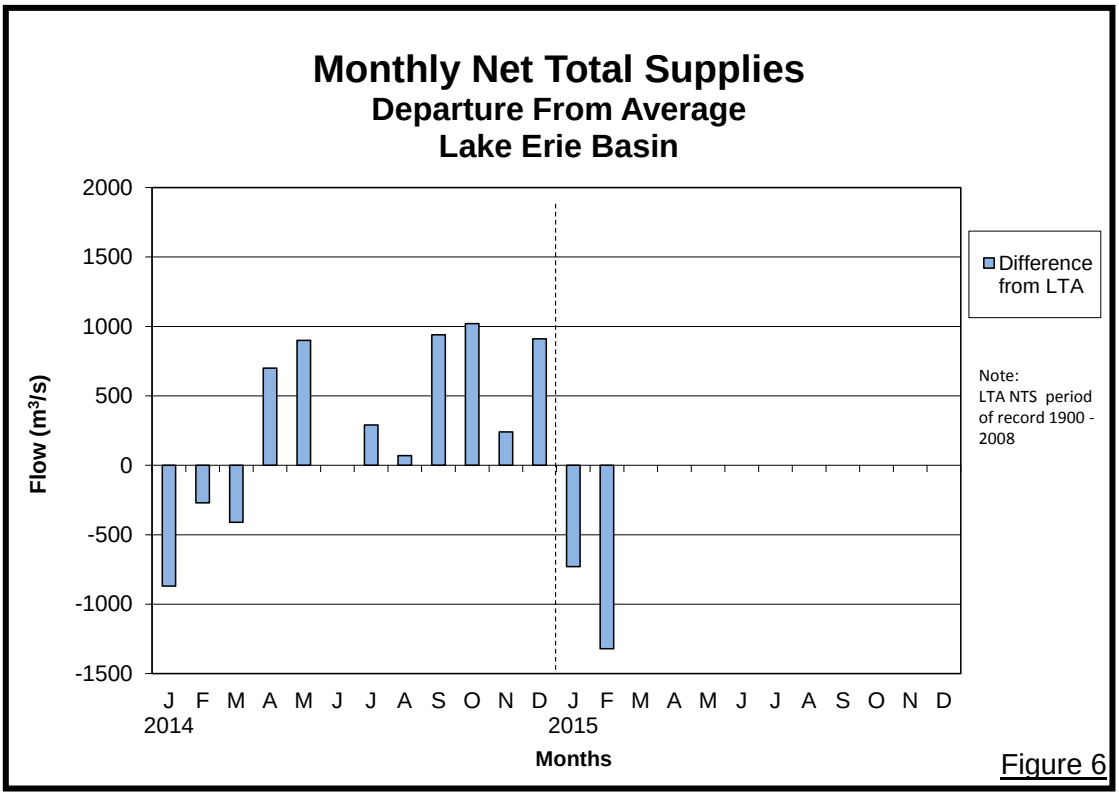


Figure 6

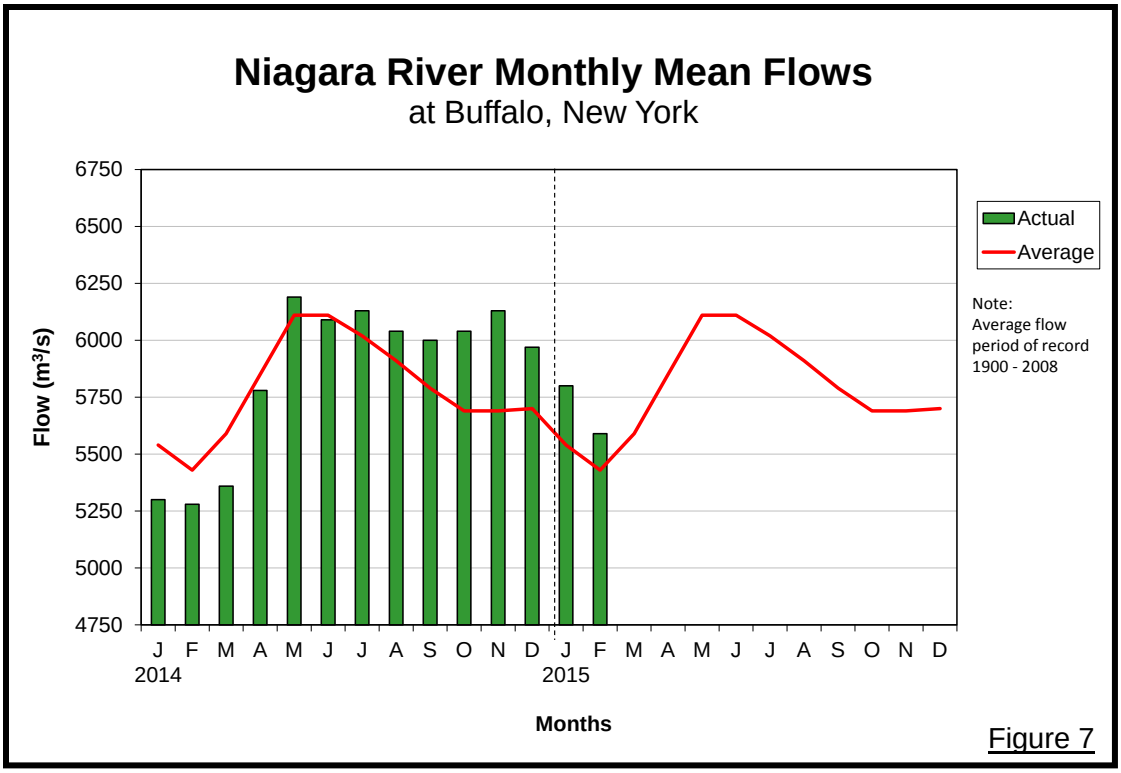


Figure 7

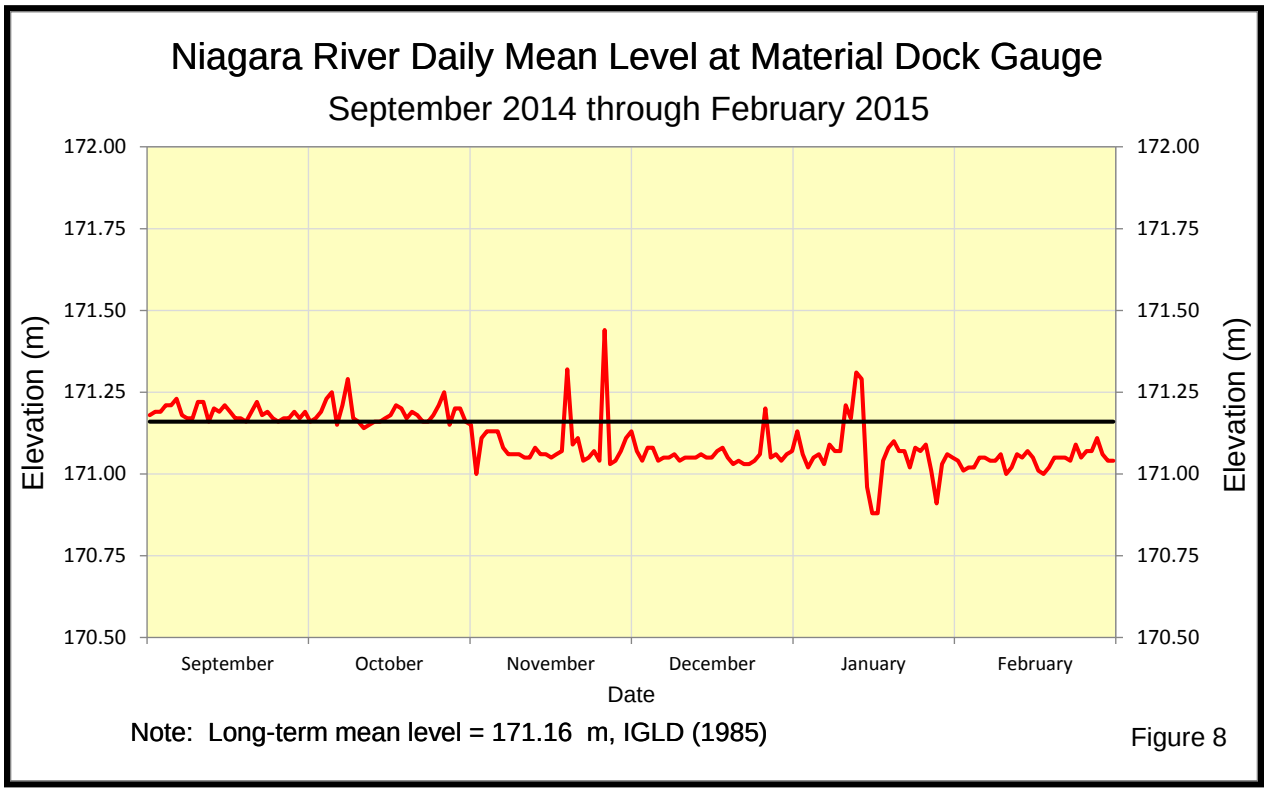
3. OPERATION AND MAINTENANCE OF THE INTERNATIONAL NIAGARA CONTROL WORKS

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 February 28, 2015 was +0.37 metre-months (+1.2 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. They were suspended on November 24-25, 2014, December 25, 2014 and January 9, 2015 on account of abnormally high flow conditions and on January 10-17, 25-27, 29-30, 2015 and February 1-2, 8, 14-16, 19-20, and 24-25, 2015 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.



Note: Long-term mean level = 171.16 m, IGLD (1985)

Figure 8

Gates 1 to 4 of the INCW were removed from service on a planned basis on September 2, 3 and 9, 2014 to facilitate water rescue practice by City of Niagara Falls firefighters.

Gates 1 and 2 of the INCW were removed from service on a planned basis, daily from October 14 to December 18, 2014 to facilitate installation of under-deck scaffold and

associated work platforms. Gate 3 was unavailable from December 1 to December 10, 2014 for similar work. The 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. 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.

Gates 11, 12 and 13 of the INCW were removed from service on a planned basis from November 29 to November 30, 2014 to facilitate removal of the work stairwell, allow flooding of the inter-space and removal of the upstream dewatering structure from Gate 16.

Gate 14 of the INCW continues on outage to remediate and test the overpressure system. This work is expected to be complete by the end of February 2015, at which time the gate will be returned to full service.

Gates 15, 17 and 18 of the INCW were removed from service from October 7 to October 8, 2014, from November 3 to November 4, 2014 and from November 26 to December 1, 2014 for clearance to remove and re-install Gate 16 cylinder barrels and rods, and to facilitate removal of the work stairwell, allow flooding of the inter-space and removal of the upstream dewatering structure from Gate 16.

Gate 16 of the INCW was removed from service on May 14, 2014 and has not yet been returned to service in order to complete major maintenance work on the gate’s hydraulic and mechanical components.

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. The Ontario Power Generating Station Tailwater gauge served as an approved 'limited' alternate to the Ashland Avenue gauge 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 11 and 12, 2014 and November 11, 2014 due to calibration issues with new transmitting devices installed at the gauging station. An initiative to reduce failures from the Ashland Avenue gauge was undertaken in July 2014 including the replacement of sensors and transmitters used by the Power Entities gauge along with installation of a redundant wireless transmission system.

The Power Entities' gauge and the NOAA gauge at Ashland Avenue were not reporting water level data during the daytime period from November 4 to November 6, 2014 due to planned remediation work being undertaken at the gauge site. During this time, water levels from the Ontario Power Generating Station Tailwater gauge were used to determine the flow over Niagara Falls. This remediation work was completed in consultation with the Board and INC representatives.

The remediation work at Ashland Avenue included: removal of sediment from the gauge well, testing operation of the gauge well valve, and cleaning out of the gauge inlet pipe in its entirety from the well to the river. A video inspection of the inlet pipe was also executed.

This work was undertaken as a result of information provided by NOAA to the Board and to the Power Entities of an on-going issue at the Ashland Avenue water level gauging station. The end of the station's intake pipe has repeatedly been covered by rocks pushed by ice and erosion of the river bank in the vicinity of the gauge. Divers have been forced to excavate the station's intake on an annual basis using hydraulic jetting and manually moving rocks, some quite large, to ensure the gauge remained operable. 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. The aforementioned work represented the first stage in that plan. Additional work is being planned for 2015 which will include diving inspections of the river inlet and completing a bathymetric survey of the area in the vicinity of the water level. Based on a further assessment of the data and subject to regulatory and environmental approvals, flattening out the bank slope may be undertaken in 2016-2017.

The Power Entities' gauge at Ashland Avenue was not reporting water level data during a short period on January 20, 2015 due to communications issues. The NOAA gauge at Ashland Avenue was used as an alternate during this outage. A comparison of water level readings from the Power Entities' and NOAA's Ashland Avenue gauges showed that they were within the acceptable INC tolerances of $\pm$2 cm ($\pm$0.8 in) on a daily basis for all other days during the reporting period.

Water levels from the Slater's Point gauge were unavailable from January 3, 2015 to January 8, 2015 due to communications issues. 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 Fort Erie gauge, used by the Niagara River Control Centre (NRCC) located at the INCW to determine the upper Niagara River flow for operational purposes, were unavailable for a short period of time on September 13, 2014 due to undetermined causes. 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 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 and again in April 2014 to record water levels during the 2013 and 2014 ice-free seasons. Hornblower Niagara took over operation of the dock in 2014. They have indicated that they would be supportive of the installation of a permanent gauge at their site. This gauge is being considered as a permanent replacement of the Ontario Power Generating Station Tailwater gauge as backup for the Ashland Avenue 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, and additional data will be 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. The recorded daily flow over Niagara Falls, covering the period September 2014 through February 2015, is shown in Figure 9.

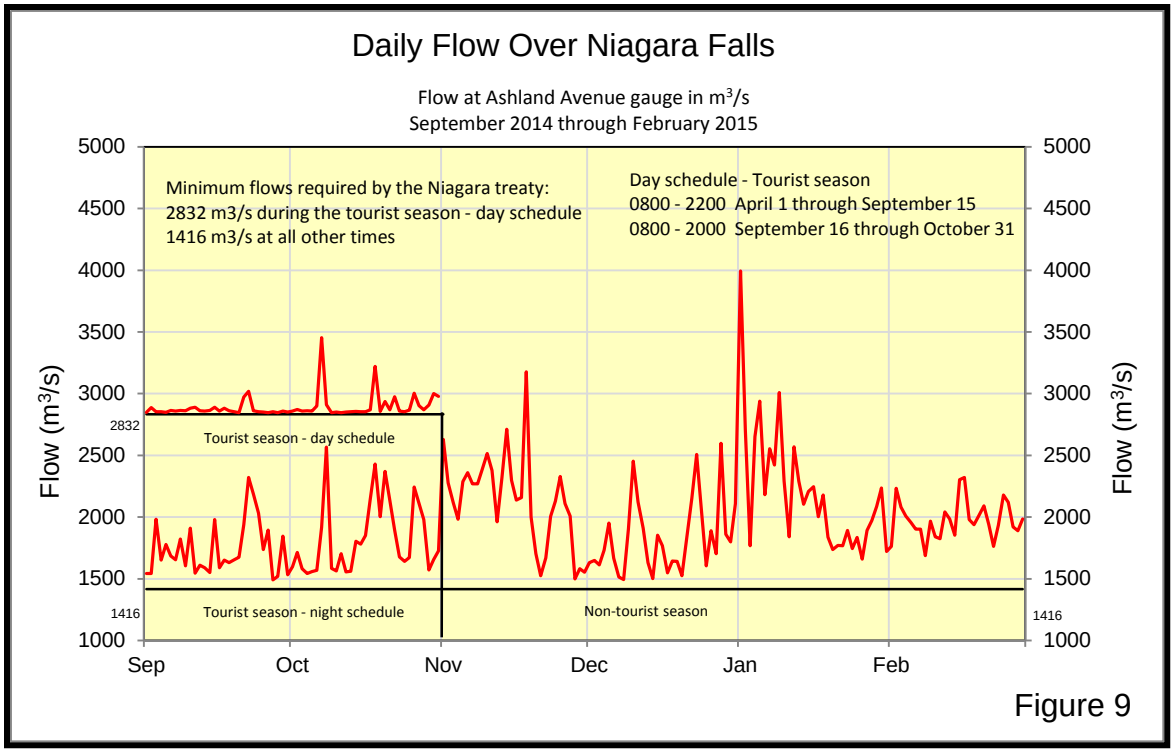


Figure 9

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 September 2014 through February 2015, diversion for the SAB I and II plants averaged 1,558 m^3/s (55,020 cfs) and diversion to the Robert Moses Niagara Power Project averaged 1,993 m^3/s (70,380 cfs).

The average flow from Lake Erie to the Welland Canal for the period September 2014 through February 2015 was 234 m^3/s (8,260 cfs). Diversion from the canal to OPG's DeCew Falls Generating Stations averaged 188 m^3/s (6,640 cfs) for the same period of time.

Records of diversions for power generation covering the period September 2014 through February 2015 are shown in Figure 10.

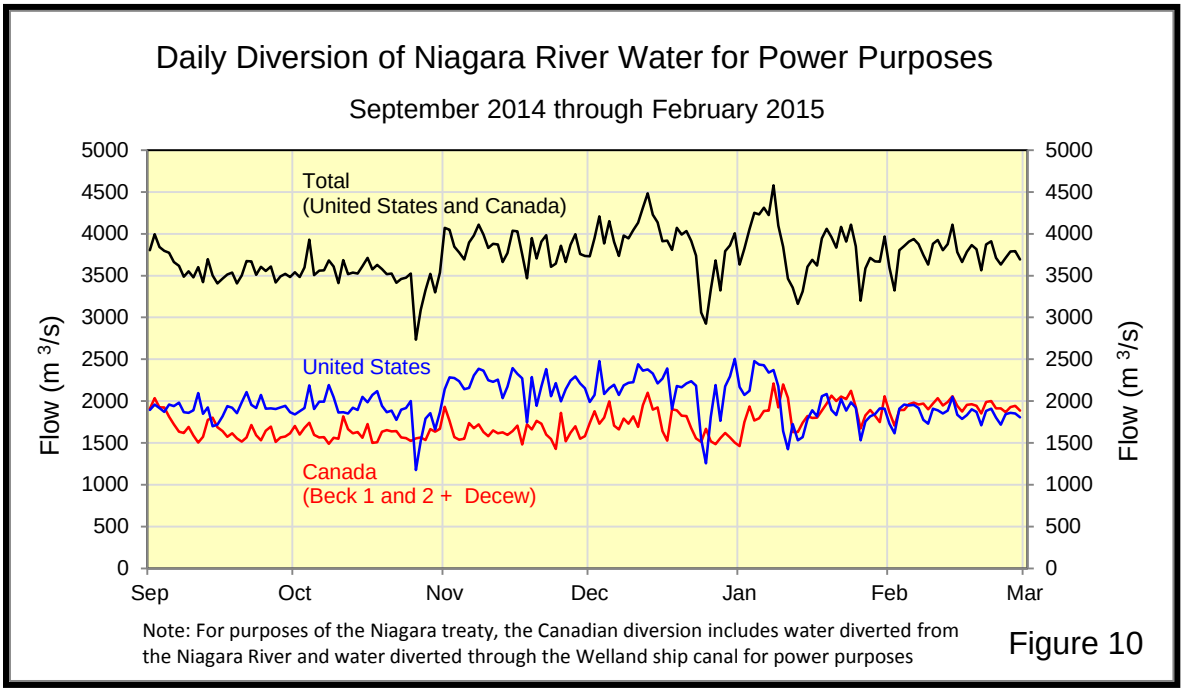


Figure 10

The monthly average Niagara River flows at Queenston, Ontario, for the period of September 2014 through February 2015, and departures from the 1900–2013 long-term average are shown in Table 3. Maximum and minimum monthly average flows for the 1900–2013 period of record are shown in Table 4. During the period September 2014 through February 2015, the flow at Queenston 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). The flow at Queenston for the same period in 2013–14 averaged 5,575 m^3/s (196,880 cfs), with the monthly values ranging between 5,343 m^3/s (188,690 cfs) and 5,763 m^3/s (203,520 cfs).

TABLE 3 – MONTHLY NIAGARA RIVER FLOWS AT QUEENSTON

	Cubic Metres per Second			Cubic Feet per Second		
Month	Recorded 2014-2015	Average 1918-2013	Departure	Recorded 2014-2015	Average 1918-2013	Departure
September	6000	5719	281	211,890	201,960	9,930
October	6041	5642	399	213,340	199,250	14,090
November	6125	5657	468	216,300	199,780	16,520
December	6019	5695	324	212,560	201,120	11,440
January	5875	5541	334	207,470	195,680	11,790
February	5601	5433	168	197,800	191,860	5,940
Average	5944	5615	329	209,910	198,290	11,620

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 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 2014 field season, measurements were taken at the Cableway Section located in the lower Niagara River. The measurements captured minimum discharges associated with non-tourist hours and 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 most recent regularly scheduled discharge measurements near the

International Railway Bridge were taken in May 2012. The next measurements are scheduled for April 27 through May 1, 2015.

As a result of gathering and reviewing low flow measurements from 2012, together with previous discharge measurements made near the International Railway Bridge, a revision of the 2001 Buffalo rating equation was proposed by the Board's Working Committee and accepted by the Board. The newly accepted 2012 Buffalo equation better represents measurement data collected using the latest ADCP technologies and collection procedures. The Buffalo rating equation is used in Great Lakes water supply routing models to estimate the flow in the Niagara River.

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 plans to use continuous Acoustic Velocity measurement data to assist with assessing flow conditions under ice during the winter. Continuous daily discharge data during non-ice affected periods is being reviewed by both EC and USGS, and published. 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 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 Cableway section. In accordance with the 3-year measurement cycle at the Cableway section, a suite of discharge measurements at Falls flows close to the 1,416 and 2,832 m^3/s (50,000 and 100,000 cfs) were planned for October 30 through November 1, 2013. 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. However, weather prevented the low end of the target flows from being acquired on November 1, 2013 and the measurements were rescheduled for August 12-15, 2014. The August 13 and 14 discharge measurements were made at flows near 1,416 m^3/s (50,000 cfs) and on August 12 and 15 measurements were collected near 1,600 m^3/s (56,500 cfs). Measurements were completed in the early morning prior to 8:00 AM local time when the mandatory minimum Falls discharge of 2,832 m^3/s (100,000 cfs) is required. The discharges measured at the Cableway continued to support the 2009 Ashland Avenue rating equation. The results of the discharge measurements were analyzed and documented in a report to the Board, which is currently under review. Preliminary dates for the next measurement series include both summer and/or fall of 2016. Board Secretaries are currently preparing the notices to the Power Entities which must be submitted one year in advance of the measurements.

In addition to the measurements at the Cableway section, measurements were made downstream of the OPG and NYPA hydroelectric generating stations at Queenston–Lewiston during run-of-river conditions on 12 -13 Aug 2014, 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 will be finalized and then 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. The results may provide greater insight into the turbine ratings and the summation of flow calculations. A brief summary of these measurements is included in the report on the Ashland Avenue rating to the Board.

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. Off-schedule measurements were made in the Welland Supply Canal in May 2012 to address the lack of results from the 2010 measurement series, and re-set the measurement interval dates. Additional off-schedule measurements and field work in 2013 provided baseline validation data for a second completely redundant ADVM system, together with confirming the validity of the 2007-2012 index velocity rating at the original site first. The next measurement series in the Welland Supply Canal will take place the week of April 27, 2015.

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. G1 and G2, which are 25 Hz units, remain removed from service at this time, and rehabilitation of G4, G5, G6 and G8 will be considered after work is completed on the other units as they were more recently upgraded.

A new rating table for G9 was put into service on November 6, 2014. Gibson testing of G3 took place in November 2014, with INC and NYPA representations present to witness the testing on November 9th. Testing reports and draft rating tables are being prepared for both G7 and G3. G10 is expected to go out of service in August 2015 for rehabilitation (new runner and generator rewind).

10. ICE CONDITIONS AND ICE BOOM OPERATION

Preparations for installing the Lake Erie–Niagara River ice boom began in late November. From December 4 to December 5, 2014, 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 during the period December 7 through 13.

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. The Lake Erie water temperature first dropped to 4ºC (39ºF) on Sunday, November 23. This early temperature drop was in part a result of a lake effect snow event on eastern Lake Erie that resulted in a significant amount of snow falling south of Buffalo. As the water temperature rose again quickly, it was decided that the start of formation of lake ice was not imminent and thus the ice boom did not need to be installed immediately.

Installation of the boom spans began on December 15 and the final spans were installed on December 16, completing the ice boom's installation for the 2014–15 ice season.

Weekly reports on the ice conditions for Lake Erie and the Niagara River were prepared and submitted to the Board by the Power Entities starting on December 10, 2014. 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. The figure shows that a small amount of ice began to form on Lake Erie around mid-December. However, it wasn't until mid-January that over half of the lake was covered in ice. By the end of January, the ice coverage had grown to almost 95%, much above the average of 56% for that time of year. The ice coverage held steady at around 97% for the rest of the reporting period.

A helicopter flight was conducted on February 13, 2015 to measure ice thickness at the six standard ice-thickness measurement sites on the eastern end of Lake Erie. The ice thickness at the measurement sites ranged from 11.5 to 42 cm (4.5 to 16.5 inches) averaging 25.7 cm (10.1 inches). Another helicopter flight is scheduled for March 13, 2015.

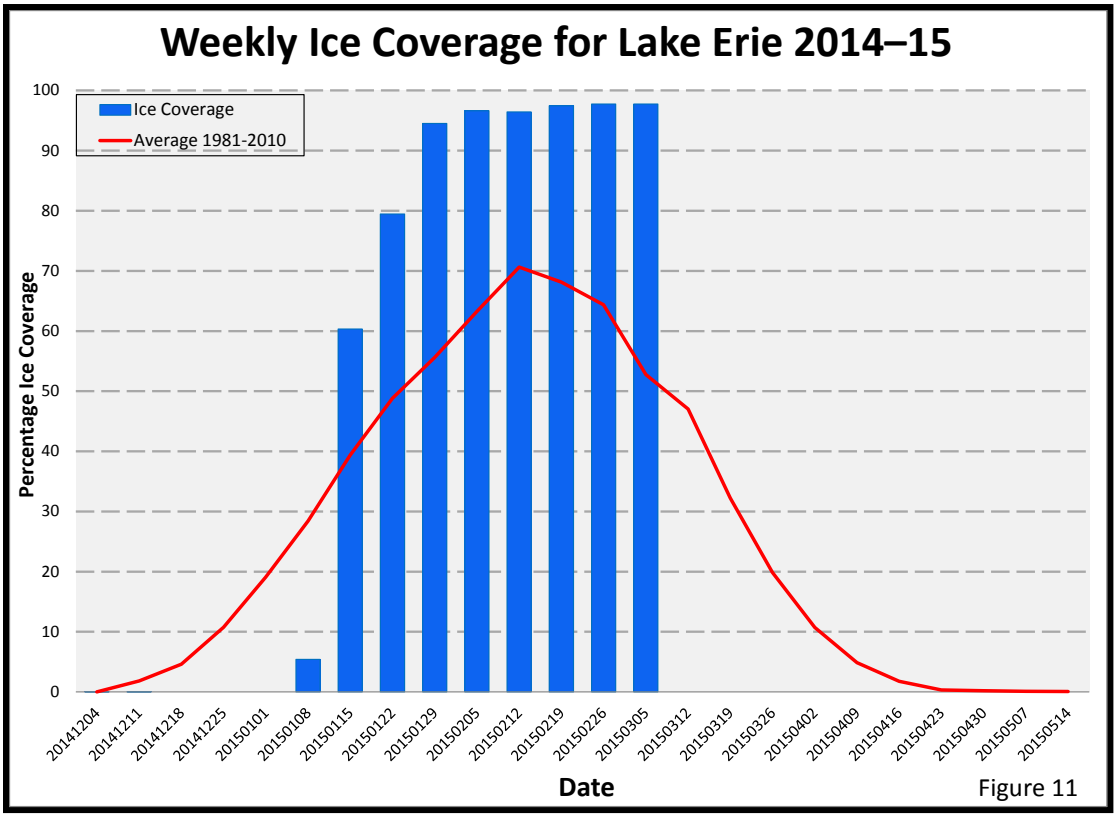


Figure 11

Ice first appeared in the CGIP on January 6. Ice management measures were undertaken in the CGIP, including extensive ice breaker activity, during much of January. In particular, from January 9-12, ice stoppages occurred at the NYPA intakes, resulting in reduced diversions and the use of ice breakers.

On January 9, a report was received that there were possible breaks in the ice boom. An inspection on January 12 confirmed that Spans D, E, J, K, and M were either trailing or broken. From January 14-16, the B-1 ice breaker attempted to clear ice from the leading edge of the ice boom to expose buoy barrels of the broken spans and repairs

began. The ice was a challenge for the B-1 ice breaker which suffered a loss of a rudder shaft main bearing. On January 17, both the B-1 and Latham ice breaker managed to clear enough ice to reconnect Spans J, K, and M. The repairs were completed on January 18 when Spans D and E were spliced. No further breaks in the ice boom have been reported.

The Maid-of-the-Mist Pool had solid ice along its edges and a broken ice cover in its main channel by January 9. The Pool was completely ice covered with thick ice by January 14. A large portion of the Pool remained ice covered at the end of the reporting period.

The NYPA's *Flood Warning Notification Plan in the Event of Ice-Affected Flooding on the Upper Niagara River* was tested on December 3, 2014. A drill was conducted that simulated a flood event along the U.S. shore triggered by an ice jam between the NYPA Intakes and the Buckhorn Dykes downstream of the North Grand Island Bridge.

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 there is more than 650 square kilometres (250 square miles) of ice remaining 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.

From satellite images, ice thickness measurements, and air temperature records it was determined that the areal extent of ice was well above the 650 square kilometres (250 square miles) and was of significant thickness so the boom remained in place at the end of the reporting period.

In response to various inquiries about the date of the removal of the ice boom during the 2013-2014 ice season, regular updates will be posted to the Niagara Board website

during this ice season. The goal of this initiative is to make available more timely information about the removal of the ice boom to the public.

The details on the annual operation of the ice boom (this includes the installation, maintenance, and removal) are contained in the document titled - “Procedural Guide for the Operation of the Lake Erie-Niagara River Ice Boom”. However, the last update to this document that was approved by the Board was back in October 1984. As there have been many technological advances since then, particularly in the remote determination of lake ice extent, the document will be reviewed and updated during this ice season. It is expected that a new version of the procedural guide will be available for the fall board meeting.

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 their 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 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.

U.S. Representatives of the Board attended a NYSDOT Stakeholder meeting at their downtown office in Buffalo, NY on August 6, 2013 in which NYSDOT presented the three alternatives being considered. Procedures for submitting their project application were discussed with the U.S. Representatives. On January 17, 2014, NYSDOT and their contractor, Greenman–Pedersen, Inc., met with the U.S. Representatives at the USACE, Buffalo District Office, to discuss modelling efforts, available data (e.g. levels, flows and bathymetric), the 1969 American Falls project and the Niagara River Treaty of 1950. On November 6, 2014, NYSDOT and their contractor, Greenman–Pedersen, Inc., met with the U.S. Representatives at the USACE, Buffalo District Office, to discuss hydraulic modelling, cofferdams, and construction scenarios, the potential locations and impacts of the proposed cofferdams. After the meeting, the U.S. Representatives recommended to NYSDOT that they meet with the Canadian Representatives of the Board and NRCC personnel to discuss project activities and issues.

12. MEETING WITH THE PUBLIC

In accordance with the Commission's requirements, the Board will hold their annual meeting with the public in August or September 2015. The meeting will be in the Niagara Falls, ON 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 ITS WORKING COMMITEE

The membership of the Board has had one change with Stephen G. Durrett being named as the Alternate U.S. Section Chair replacing Deborah H. Lee. The membership of the Working Committee is unchanged from the last report.

14. ATTENDANCE AT BOARD MEETINGS

The Board met once during this reporting period. The meeting was held on March 5, 2015, in Buffalo, NY. BG Richard Kaiser, U.S. Section Chair, Mr. Aaron Thompson, Canadian Section Chair, Mr. William Allerton, U.S. Member, and Ms. Jennifer Keyes, Canadian Member were in attendance.

Original Signed by

Mr. AARON F. THOMPSON
Chair, Canadian Section

Original Signed by

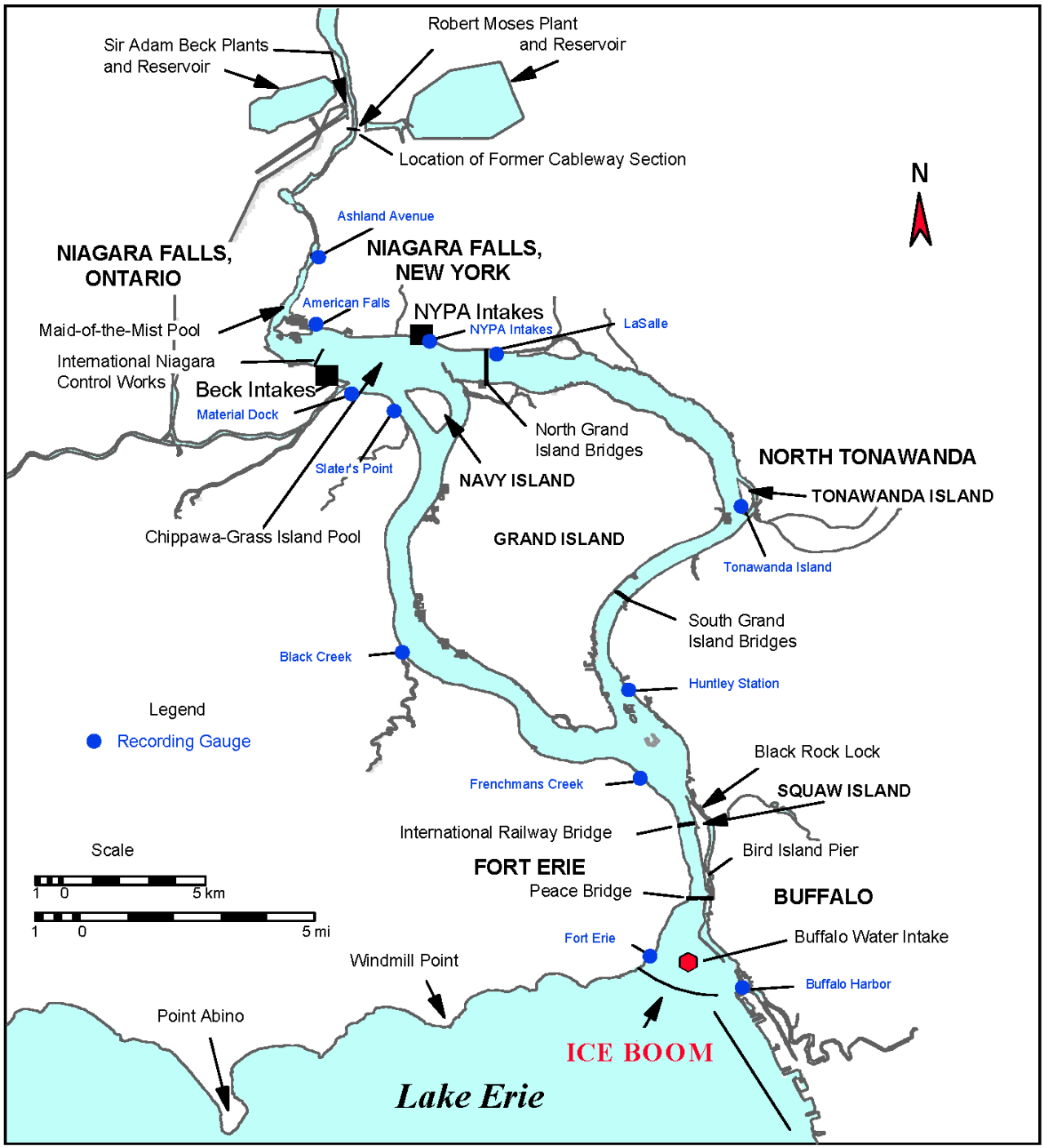
BG RICHARD G. KAISER
Chair, United States Section

Original Signed by

Ms. JENNIFER L. KEYES
Member, Canadian Section

Original Signed by

Mr. WILLIAM H. ALLERTON
Member, United States Section


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