International Niagara Board of Control

One Hundred Twenty First Semi-Annual Progress Report

to the

International Joint Commission

Covering the Period March 21 through September 19, 2013

EXECUTIVE SUMMARY

Lake Erie began the reporting period with a March mean level 15 cm (5.9 inches) below its long-term average level for the month. While the lake's level followed its usual seasonal rise into June, above average rainfall and associated runoff caused the lake to continue to rise into July, to such an extent that the mean level in July was 4 cm (1.6 inches) above the monthly average. In August, the lake level was into its annual seasonal decline and the August mean water level was 3 cm (1.2 inches) above the long-term average. Inflow to Lake Erie from upstream, via the Detroit River, remained below average throughout the reporting period (Section 2).

The level of the Chippawa-Grass Island Pool 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).

Three Falls flow violations occurred during the reporting period. The first two, on March 21 and April 17, 2013, were the result of control actions taken by the Niagara River Control Centre's operator on duty, under ice or changing river flow conditions, that resulted in below Treaty requirement flows over Niagara Falls on these dates. The flow over Niagara Falls was 44 m3/s (1,553 cfs) below the Treaty requirement for the hour of 4:00 a.m. on March 21, 2013, and 54 m3/s (1,907 cfs) below the Treaty requirement for the hour of 8:00 a.m. on April 17, 2013, respectively. The third violation, on July 28, 2013, was the result of a Niagara Parks Police request that the morning transition from nighttime to tourist season daytime Treaty flows be delayed in order to execute the recovery of a body that was found in the lower Niagara River. The flow over Niagara Falls was 275 m3/s (9,711 cfs) below the Treaty requirement of 2,832 m3/s (100,000 cfs) for 8:00 a.m. (Section 5).

The Board has developed techniques utilizing a Geographic Information System to help geo-reference and assess the extent of recent and future changes in the crest of the Horseshoe Falls at Niagara. Based on the most recently available imagery, no significant changes in the crestline were observed during the reporting period. (Section 6).

OPG has completed construction of the Niagara Tunnel Project, which provides increased water diversion capability for OPG's Sir Adam Beck Complex. The tunnel was watered up on March 2 and 3, 2013 and its official in-service date was March 9, 2013 (Section 9).

Removal of the Lake Erie – Niagara River Ice Boom began during the afternoon on March 25, 2013 following a fixed-wing ice observation flight earlier that day. April 17, 2013 marked the end of the 2012-13 ice-boom season when the final spans of the ice boom were pulled to and onto its Katherine Street, Buffalo, NY storage site (Section 10).

The Board held its annual public meeting on September 19, 2013 in Niagara-on-the-Lake, ON. People were able to participate in person, by telephone or on-line by webinar. This was the first time that the Board has offered the telephone or webinar options as an extension of the face-to-face meeting. There were about 25 people at the meeting, with nine members of the public attending in person and two people participating on-line via webinar/teleconference. (Section 11).

Dr. Frank Seglenieks, Environment Canada, was appointed by Mr. Thompson to the position of Canadian Co-Chair of the Board's Working Committee on August 21, 2013, replacing Mr. Jacob Bruxer in that role (Section 12).

COVER: View of a rainbow over Niagara Falls with the International Niagara Control Works in the background (Photo courtesy of Dr. Frank Seglenieks, Environment Canada)

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INTERNET SITES

International Joint Commission
www.ijc.org/language/

International Niagara Board of Control
www.ijc.org/en_/inbc
www.ijc.org/fr_/inbc

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

INTERNATIONAL NIAGARA BOARD OF CONTROL

Burlington, Ontario
Cincinnati, Ohio

September 19, 2013

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

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 oversee the operation of the International Niagara Control Works (INCW) located at the outlet of the Chippawa-Grass Island Pool (CGIP) upstream of Niagara Falls and the installation 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 submits its One Hundred Twenty First Semi-Annual Progress Report, covering the reporting period March 21 through September 19, 2013.

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. The 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 15 cm (5.9 inches) below its long-term average level for the month. The lake level was continuing its usual seasonal rise, but initially at a rate slightly less than average. Above-average rainfall and associated runoff in April, June and July caused the lake's level to continue to rise into July, and subsequently the July mean level was 4 cm (1.6 inches) above the July long-term average level. The lake began its seasonal decline on a daily basis in late July and the lake fell by an average amount on a monthly basis from July to August. The August mean water level was 3 cm (1.2 inches) above the long-term average for the month. Recorded monthly water levels for the period March through August 2013 are shown in Table 1 and are 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 both 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.

Precipitation is a major contributor to NBS, both directly on the lake and through runoff. Recent precipitation data and departures from the long-term averages are shown in Table 2 and are depicted graphically in Figure 2. Precipitation on the Lake Erie basin was above average during the months of April, June and July, and below average during March, May and August. During the period March through August 2013, the basin received about 53.8 cm (21.2 inches) of precipitation. This is approximately 10% 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 about 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 in April, June, July and August and below average in March and May. The above-average NBS in June and July contributed to the continued rise in the lake level that resulted in the lake rising to above its long-term average level in July. The August NBS was slightly above average, even though precipitation that month was below average. This is likely due to below-average evaporation from the lake in August and or continued above-average runoff due to the heavy rainfall in June and July.

The sum of Lake Erie's NBS and its inflow from Lakes Michigan–Huron via the St. Clair–Detroit Rivers system is its net total supply, or NTS. Inflow via the Detroit River is the major portion of Lake Erie's NTS, and is greatly influenced by the level of Lakes Michigan–Huron. The level of Lakes Michigan–Huron continued to be well below average during the reporting period, as did inflows to Lake Erie via the Detroit River. Detroit River flows were about 7% below the long-term average for the six-month period March through August 2013. The monthly mean water level on Lakes Michigan–Huron and the monthly mean flow in the Detroit River are provided in Figures 4 and 5, respectively. The inflow from upstream combined with Lake Erie's NBS, resulted in below-average NTS for the months of March, May and August, and above average NTS during April, June and July 2013. Overall, Lake Erie's NTS was about 1% below average for March through August 2013. 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 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 outflows and below-average lake levels lead to below-average outflows. However, the lake's outflow through the Niagara River is affected 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. Seasonal trends in prevailing winds over Lake Erie that on average raise levels at the eastern end of the lake relative to levels at the western end and relative to the lake's average level also influence the lake's outflow through the Niagara River. Recent monthly outflows via the Niagara River are graphically depicted in Figure 7. Below-average water level conditions on Lake Erie from March through June 2013 resulted in below-average Niagara River flow during those months. Because Erie's level continued to rise in July, instead of falling as it has on average over the 1918–2012 period of record, the Niagara River flow also continued to increase in July, although below its long-term average for that month. In August, the Niagara River flow decreased, as the level of Lake Erie declined and, as in July, remained below the average.

The combination of Lake Erie's NTS and outflow resulted in the water level changes experienced on the lake over the reporting period. While it is not possible to predict with accuracy the water supplies to the lakes for the coming months, using historical supplies and the current levels of each of the Great 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 and Environment Canada indicates that the level of Lake Erie is expected to fall back below average by October unless well-above average water supply conditions are experienced.

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* 2013	Average+ 1918–2012	Departure	Recorded* 2013	Average+ 1918–2012	Departure
March	173.92	174.07	-0.15	570.60	571.10	-0.50
April	174.02	174.22	-0.20	570.93	571.59	-0.66
May	174.10	174.30	-0.20	571.19	571.85	-0.66
June	174.23	174.33	-0.10	571.62	571.95	-0.33
July	174.35	174.31	0.04	572.01	571.88	0.13
August	174.28	174.25	0.03	571.78	571.69	0.09

* Provisional + Period of record is 1918–2012

TABLE 2 – MONTHLY AVERAGE PRECEPITATION ON THE LAKE ERIE BASIN

	Centimetres			Inches			
Month	Recorded* 2013	Average+ 1900–2010	Departure	Recorded* 2013	Average+ 1900–2010	Departure	Departure (in percent)
March	3.00	7.00	-4.00	1.18	2.76	-1.58	-57
April	11.96	8.04	3.92	4.71	3.17	1.54	49
May	6.53	8.53	-2.00	2.57	3.36	-0.79	-23
June	12.67	8.81	3.86	4.99	3.47	1.52	44
July	12.80	8.61	4.19	5.04	3.39	1.65	49
August	6.89	8.15	-1.26	2.71	3.21	-0.50	-15

* Provisional + Most recent period of record is 1900–2010

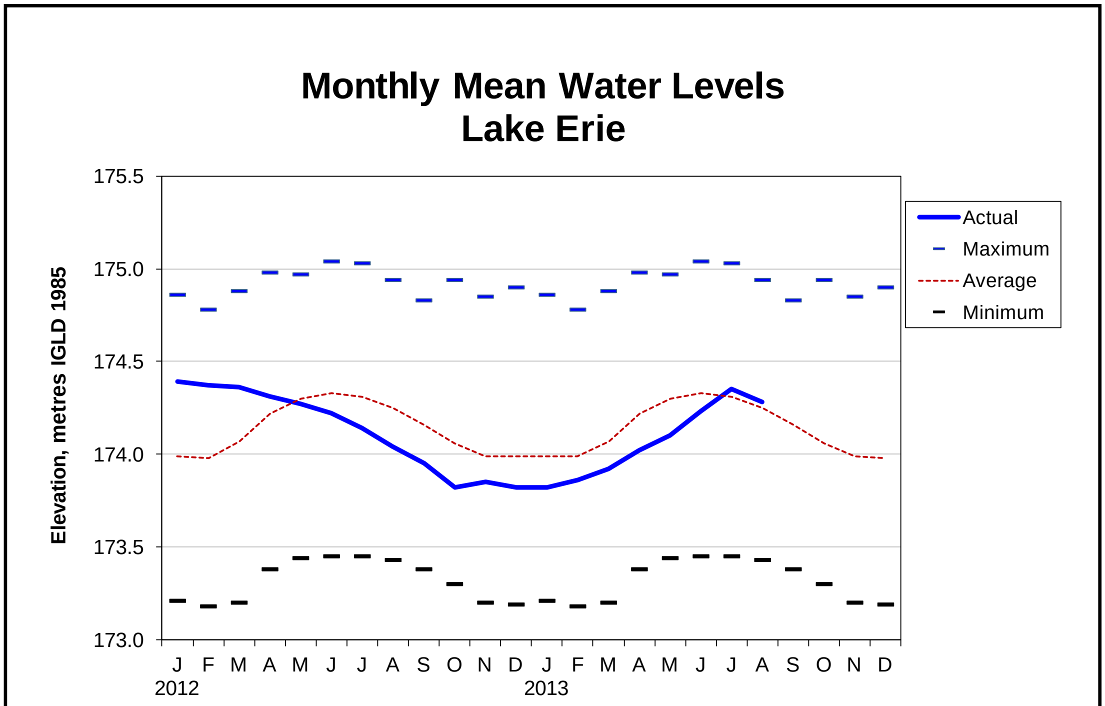
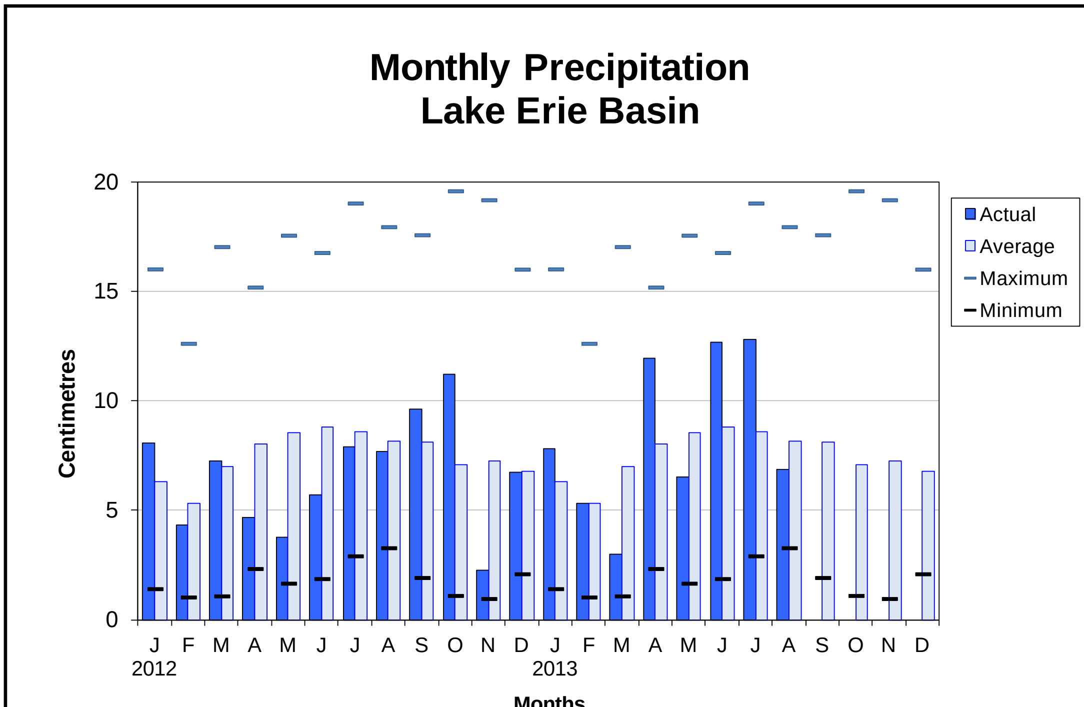


Figure 1



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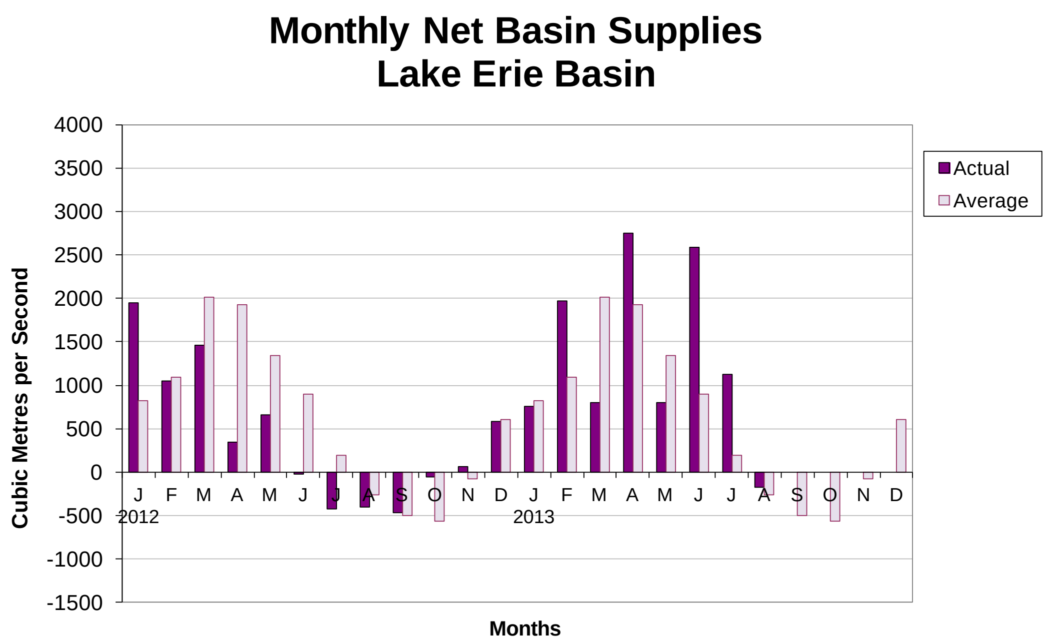

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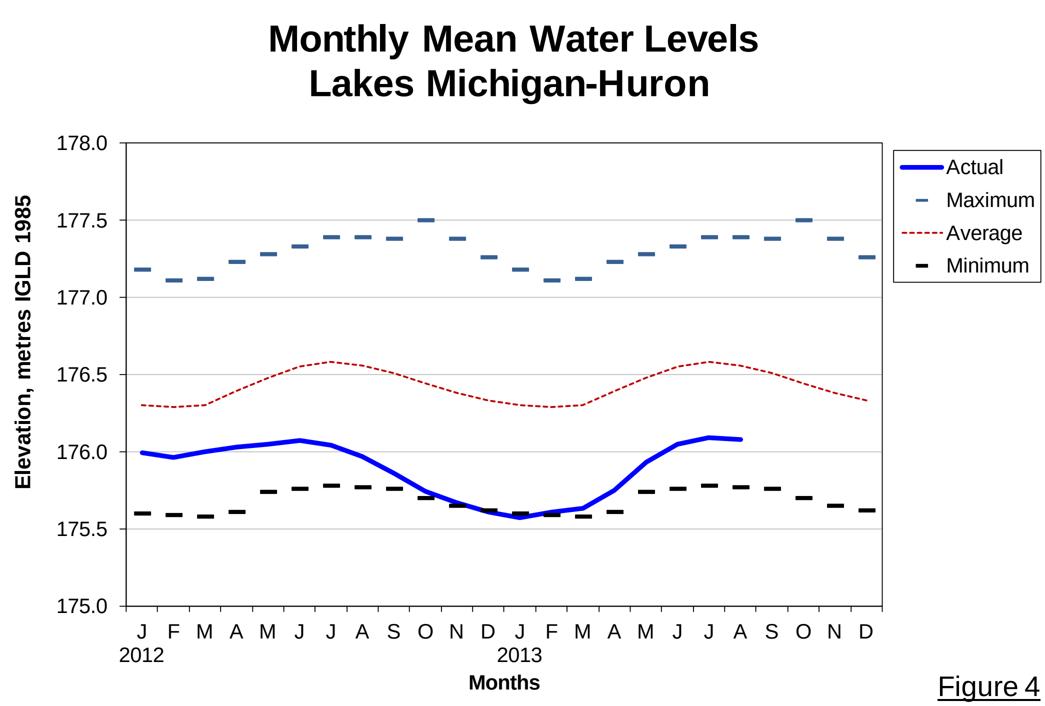

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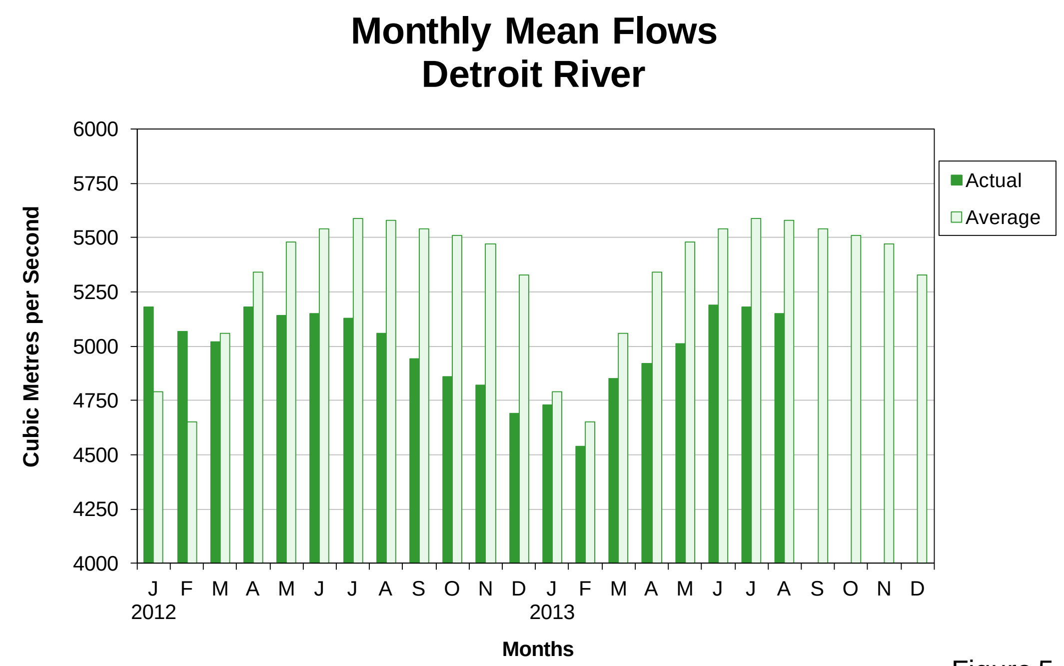

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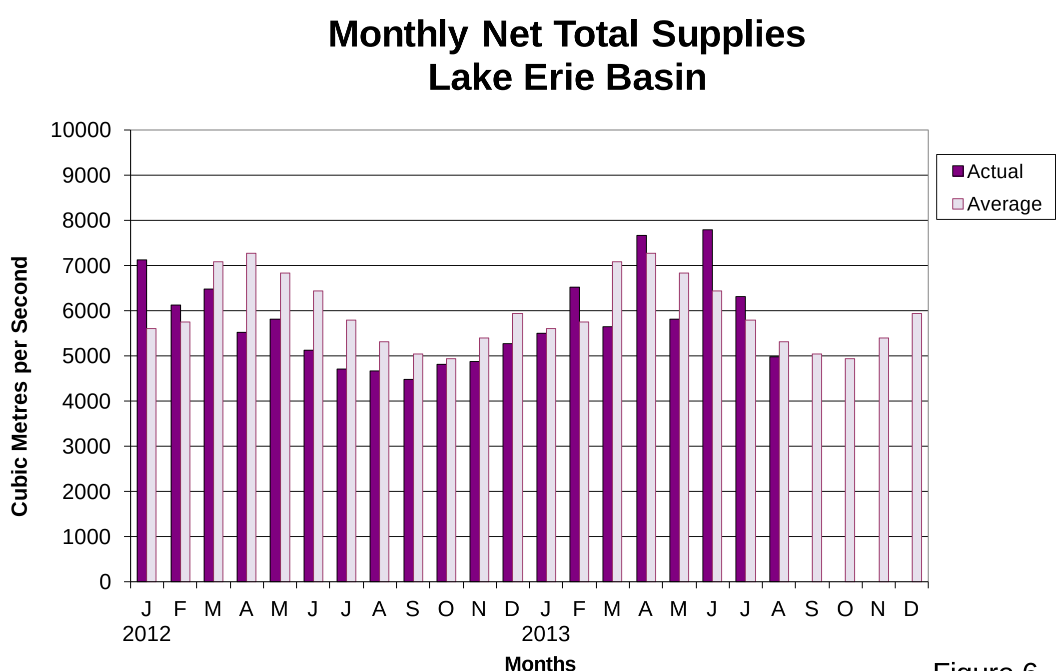

Figure 6

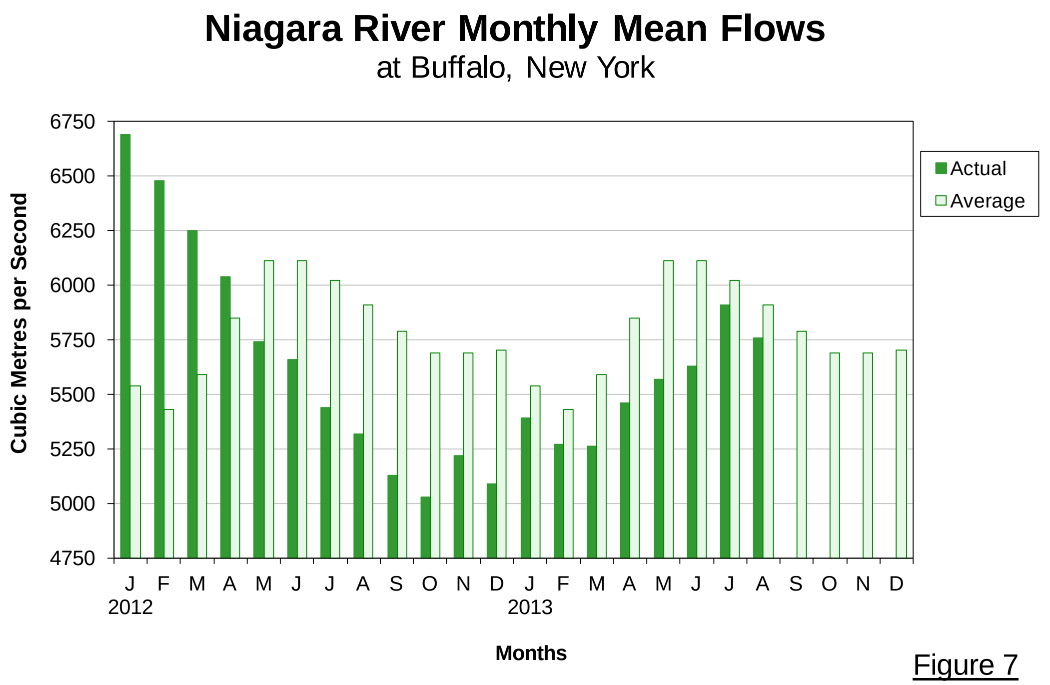

Figure 7

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—Ontario Power Generation (OPG) and the New York Power Authority (NYPA)—operate the 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, 2013 was 0.50 metre-months (1.64 foot-months) above the long-term operational average elevation. The maximum permissible accumulated deviation is ± 0.91 metre-months (± 3.00 foot-months).

Tolerances for regulation of the CGIP level were suspended on March 21, 30, 31 and April 1 to 3, 2013 due to ice conditions. Tolerances were also suspended on July 28, 2013 due to emergency conditions associated with a police action for the recovery of a body from the lower Niagara River.

The locations of the water level gauges on the Niagara River are shown in Enclosure 1. Recorded daily Material Dock water levels covering the period January through August 2013 are shown in Enclosure 2.

Gate 1 of the INCW remains out-of-service in anticipation of rehabilitation work following the completion of the Niagara Tunnel Project. Work to repair hinges and replace seals will be undertaken in the fall of 2013.

Following the failure and subsequent replacement of a flexible hydraulic hose associated with the control system for Gate 13, OPG initiated a program to replace all similar hydraulic hoses on the INCW. The piping and hose assemblies needed were fabricated off site and their installation for all gates was completed between April 1 and May 17, 2013.

During a structural inspection of the INCW, carried out in November 2012, OPG identified a potential issue with the concrete stability of its bridge supports. A load restriction has been put into place for vehicles operating on the structure. Consulting engineering firms have been commissioned to provide options for bridge strengthening. No final report is available at the time of submission. Work to determine the most appropriate repair and method of execution are on-going.

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 both the Power Entities' and NOAA's Ashland Avenue gauges by the INC, the Power Entities' gauge is used for officially recording water levels used to determine the flows over Niagara Falls. The Power Entities' gauge at Ashland Avenue was not reporting water level data for short periods of time during April 11 and May 2, 2013 due to calibration and adjustment work on the gauge. These outages were timed to not interfere with operations, which are based on water level readings taken on the hour. 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 ± 2 cm (± 0.8 in) on a daily basis during the reporting period.

Water levels from the Material Dock gauge were unavailable for short periods of time on May 30 and July 15, 2013 due to a gauge transmitter failure and for calibration, respectively.

Water levels from the Fort Erie gauge were unavailable for short periods of time on May 11, 2013 due to weather-related issues. Data was unavailable on August 8, 14, and 15, 2013 due to the failure of the gauge transmitter. During these times, use of the Buffalo telemark 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.

Gates 2, 3 and 4 of the INCW were required to be out of service periodically from February 23 to March 8, 2013 during the removal of the cofferdam associated with OPG's Niagara Tunnel Project. When the gates were in-service and conditions were deemed safe, work to remove the cofferdam was undertaken. Gate 16 was unavailable from May 3 to 29 and on July 17, 2013 due to oil seepage from the over pressure relief system. Air was subsequently drained from the pressure system to alleviate the problem. No oil was lost to the environment during this time.

A temporary water level datalogger was 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 ice-free season of 2012. The datalogger was reinstalled in April 19, 2013 following the ice season. Once sufficient data is acquired and assessed, the case for installing a permanent water level gauge in the vicinity of this location, to act as an alternative for the Ontario Power Generating Station tailwater gauge and backup for the Ashland Avenue gauge, will be further investigated.

5. FLOWS OVER NIAGARA FALLS

The International Niagara Treaty of 1950 sets minimum limits on the flow of water over Niagara Falls. During the tourist season 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 winter months, the required minimum Falls flow is 1,416 m^3/s (50,000 cfs). The operation of the INCW, in conjunction with power diversion operations, ensures 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 three exceptions--on March 21, April 17 and July 28, 2013--as described below. The recorded daily flow over Niagara Falls, covering the period January through August 2013, is shown in Enclosure 3.

As a result of control actions to reduce the flow over Niagara Falls in excess of Treaty minimum, the NRCC shift supervisor initiated small gate changes at 2:30 a.m. and 2:44 a.m. on March 21, 2013. Due to the presence of heavy lake ice in the Maid-of-the-Mist Pool, combined with a pre-existing ice bridge, the elevation reflected at the Ashland Avenue gauge fell below the minimum required prior to 4:00 am. In response to the falling level, three control gates were fully opened to restore the elevation as quickly as possible. However, the flow over Niagara Falls was 44 m^3/s (1,554 cfs) below the Treaty requirement for the hour of 4:00 a.m. on March 21, 2013. In response to the resulting Treaty violation, Mr. Peter Kowalski, First Line Manager–Operations NRCC, provided additional direction to NRCC Operating staff on the requirements for forecasting the impact of control gate operations when ice is present in the Maid-of-the-Mist Pool.

On April 17, 2013, while transitioning between the minimum Treaty flow requirement of 1,416 m^3/s (50,000 cfs) and 2,832 m^3/s (100,000 cfs), the NRCC shift operator failed to take into consideration a declining Lake Erie level and did not account for changes in river flow correction. Consequently, control gate openings were inadequate to meet the minimum Treaty requirement. Corrective actions were undertaken, but with inadequate time for them to be effective the flow over Niagara Falls was 54 m^3/s (1907 cfs) below the Treaty requirement for the hour of 8:00 a.m.

Given the circumstances and close timing of the March 21 and April 17, 2013 Treaty violations, and in light of the similar Treaty violation on February 16, 2013, previously reported in the Board's 120th semi-annual report, the INC's On-Site Representatives requested that Mr. Kowalski organize and hold a formal Treaty compliance training session for NRCC staff. In addition, the On-Site Representatives asked that members and associates of the INC and the Board be able to attend to highlight the importance of complying with the Treaty and to gain a fuller understanding of NRCC operations. In response, Mr. Kowalski organized and held a training session on May 9, 2013. During the session, which was attended by NRCC staff and six associates of the INC and the

Board, including Mr. Thompson the Canadian INC Member and Board Co-Chair, Mr. Kowalski provided a detailed forensic analysis of each of the three recent violations, provided direction on how to prevent similar situations in the future, and clearly explained the importance of meeting the Treaty requirements at all times.

On July 28, 2013, the Niagara Parks Police requested that the morning transition from nighttime to tourist-season daytime Treaty flow be delayed in order to execute the recovery of a body that was found in the lower Niagara River. Recovery operations were completed at 7:25 a.m. and actions to increase the flow over Niagara Falls were commenced. However, the flow over Niagara Falls was 275 m^3/s (9,711 cfs) below the Treaty requirement of 2,832 m^3/s (100,000 cfs) for 8:00 a.m. Flow was restored to normal for 9:00 a.m.

6. FALLS RECESSION

Clause 2 of the IJC's August 19, 1953 Directive constituting the International Niagara Board of Control called for the Board to review, approve and oversee the construction of the remedial works recommended in the Commission's 1953 report to the Governments of Canada and the United States on the preservation and enhancement of Niagara Falls. The remedial works included excavation and fills on both the US and Canadian flanks of the Cascades immediately upstream of the Horseshoe Falls and the construction of the INCW. With the construction of the remedial works, the Board is required to exercise control over the maintenance and operation of the remedial works in a manner to meet the scenic-beauty requirements of Article IV of the 1950 Niagara Treaty, with the objective of ensuring a dependable and adequate flow over the Horseshoe Falls to provide an unbroken crestline. Therefore, 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.

Based on the most recently available imagery, no significant changes in the crestline were observed during the reporting period.

The Board has now geo-referenced both orthographic and oblique air photos utilizing a Geographic Information System. This system will help to detect and evaluate any future changes in the crestline.

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 hydro power plants, OPG's Sir Adam Beck (SAB) I and II in Canada and NYPA's Niagara Power Project in the United States, withdraw water from the CGIP above Niagara Falls and discharge it into the lower Niagara River at Queenston, ON and Lewiston, NY, respectively.

During the period of March through August 2013, diversion for the SAB I and II plants averaged 1,634 m^3/s (57,700 cfs) and diversion to the Robert Moses Niagara Power Project averaged 1,731 m^3/s (61,130 cfs).

The average flow from Lake Erie to the Welland Canal for the period March through August 2013 was 196 m^3/s (6,920 cfs). Diversion from the canal to OPG's DeCew Falls Generating Stations averaged 139 m^3/s (4,910 cfs) for the period March through August 2013.

Records of diversions for power generation covering the period March through August 2013 are shown in Enclosure 4.

The monthly average Niagara River flows at Queenston, Ontario, for the period of March through August 2013, and departures from the 1900–2012 long-term average are shown in Table 3. Maximum and minimum monthly average flows for the 1900–2012 period of record are shown in Table 4. During the period March through August 2013, the flow at Queenston averaged 5,653 m^3/s (199,630 cfs), with the monthly values ranging between 5,350 m^3/s (188,920 cfs) and 5,923 m^3/s (209,180 cfs). The flow at Queenston for the same period in 2012 averaged 5,777 m^3/s (204,600 cfs), with the monthly values ranging between 5,315 m^3/s (187,700 cfs) and 6,360 m^3/s (224,600 cfs).

TABLE 3 - MONTHLY NIAGARA RIVER FLOWS AT QUEENSTON

	Cubic Metres per Second			Cubic Feet per Second		
Month	Recorded 2013	Average 1900-2012	Departure	Recorded 2013	Average 1900-2012	Departure
March	5350	5648	-298	188,930	199,460	-10,530
April	5567	5901	-334	196,600	208,390	-11,790
May	5612	6099	-487	198,190	215,380	-17,190
June	5620	6077	-457	198,470	214,610	-16,140
July	5923	5976	-53	209,170	211,040	-1,870
August	5847	5860	-13	206,480	206,940	-460
Average	5653	5927	-274	199,630	209,310	-9,680

TABLE 4 - MONTHLY MAXIMUM AND MINIMUM NIAGARA RIVER FLOWS AT QUEENSTON

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

8. FLOW MEASUREMENTS IN THE NIAGARA RIVER AND THE 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 United States Army Corps of Engineers (USACE) and Environment Canada. 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 Environment Canada continue efforts to standardize measurement equipment and techniques. Historically, measurements are made at several locations as described below. No regularly scheduled measurements were made during the reporting period; however additional discharge measurements were conducted in the Welland Supply Canal during the first week in September 2013 and regularly scheduled measurements are planned in the lower Niagara River (near the old Cableway section) in the fall of 2013.

International Railway Bridge: Regularly scheduled measurements are taken near the International Railway Bridge 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. Low Lake Erie water levels in the fall provided an opportunity to obtain measurements at lower flows, so an additional set of measurements were made in November 2012. All of the 2012 measured flows were higher than those computed using both the 2001 Buffalo stage-discharge and the Buffalo–Material Dock stage-fall-discharge rating equations. As a result of reviewing previous discharge measurements made near the International Railway Bridge, a revision of the 2001 Buffalo rating equation is being proposed and is under review by the International Niagara Board of Control's Working Committee. The proposed Buffalo equation is closer to the 2012 measured flows than either of the two older equations, particularly the May 2012 measurements which averaged to be nearly the same as the proposed equation. The Buffalo rating equation is used in Great Lakes water supply routing models to estimate the flow in the Niagara River and to verify other Niagara River flow estimates.

Environment Canada is also taking continuous measurements of water levels at a new International Gauging Station (water levels and flow monitoring) located near the International Bridge section. Flow measurements were taken during the summer to observe the impact of aquatic plant growth on flows, and Environment Canada hopes to use acoustic velocity measurement data to assist with assessing flow conditions under ice this winter. Continuous daily discharge data is targeted to be published at this location, with the recent installation of an Acoustic Doppler Velocity Meter (ADVM) device providing assistance during backwater conditions due to ice and aquatic vegetation.

<u>Cableway Section</u>: 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. Measurements have been made using only ADCP technology since that time. Discharge measurements were last conducted near the Cableway section in October 2010 and,

following the regular measurement schedule for this site, are planned again for October 29 through November 1, 2013. During this measurement session, additional measurements will be made downstream of the OPG and NYPA hydroelectric generating stations at Queenston–Lewiston during run-of-river conditions to measure the total flow in the lower Niagara River. The total flows measured will be 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.

American Falls: 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. Since American Falls flow is directly related to the operation of the CGIP, the Board monitors this relationship. Historically, measurements were made from the pedestrian bridges between Goat Island, Green Island and the U.S. mainland, using conventional measurement methods. In May 2007, measurements were successfully made using an ADCP mounted on a tethered boat at a new section located near the American Falls Gauge site. The measurements made at this section matched the rating equation very well. In May 2012, as part of the regular 5-year measurement cycle, discharge measurements were again made at this section using an ADCP mounted on a remote control boat. On average, there was no difference between the 2012 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 Weir 8 rating, which is used in the determination of flow through the Welland Canal. Regularly scheduled measurements were last made in the Welland Supply Canal in May 2010. However, due to the St. Lawrence Seaway Management Corporation's inability to provide water level data for the time of the 2010 measurements, these measurements could not be used to verify the rating. Therefore, off-schedule measurements were made in the Welland Supply Canal in May 2012 to address the lack of results from the 2010 measurements. The preliminary analysis of the data from the 2012 measurements indicates that the measurements fit the current rating, which is based on the 2007 and 2009 measurement series. It is anticipated that the next regularly scheduled measurements in the Welland Supply Canal will take place in 2015.

The rated Weir 8 discharge is currently based on data provided by an ADVM and water level gauging equipment installed by the St. Lawrence Seaway Management Corporation. In order to provide redundancy for this installation, a second set of ADVM and water level gauging equipment has been installed upstream of the existing ADVM by the Seaway Corporation. Discharge measurements at the Weir 8 site were conducted during the first week in September 2013 to develop a Weir 8 rating for the new installation. These measurements were in addition to the regularly scheduled measurements in the Welland Supply Canal.

9. NIAGARA TUNNEL PROJECT AND PLANT UPGRADES

OPG completed construction of the Niagara Tunnel Project prior to the beginning of the reporting period. The tunnel was watered up on March 2 and 3, 2013 and was officially declared to be in-service on March 9, 2013. Testing of the new tunnel's performance relative to its design capacity was carried out by OPG on July 23 and 24, 2013 and confirmed the total tunnel capacity to be 500 m^3/s (17,660 cfs) $\pm$2%. The increased diversion capacity provided by the new tunnel will enable OPG's SAB plants to more fully utilize Canada's diversion entitlement for power production. Increased diversion will not affect the regulation of the CGIP, which is governed by the Board's 1993 Directive.

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. The upgrades of Units G7 and G9 were completed in March 2009/February 2012 (in two parts) and December 2010, respectively. Work to replace the G3 runner and for a generator re-wind began in April 2012 and was completed in July 2013. G10 is expected to go out of service in June 2015 for rehabilitation.

The Beck I units were originally built with Johnson Valves at the bottom of the penstocks that could be activated to stop water from entering the units. These valves are being removed and their function replaced with headgates that can prevent water from entering the penstocks. As the units are upgraded, sleeves will be installed where the Johnson Valves were removed to improve flow through that portion of the penstock. A sleeve was not installed when G7 was initially upgraded in 2009. The unit was taken out of service again, from early March 2011 until late February 2012, to complete this work. Although an Index Test for G7 was scheduled for May 2012, it was postponed because of vibration problems with the unit. It was decided that a full Gibson Test would be done when the vibration issues are resolved, and this test is now scheduled for some time in November or December 2013. It is recognized that the rating tables currently being used for G7 do not reflect the improvements in performance of the unit expected with the installation of the Johnson Valve sleeve because the table was based on earlier model tests, and that they may result in a slight over-reporting of the water used by the unit. Similarly, G3 is being operated on an interim rating table until a Gibson test takes place. The date of this test has not yet been confirmed.

10. ICE CONDITIONS AND ICE BOOM OPERATIONS

Lake Erie Ice conditions for the 2012–13 ice seasons were dictated by rising and falling temperatures for the region. The ice season saw short, cold spells followed by unseasonably warm temperatures. Ice cover maps produced jointly by the Canadian Ice Service and the US National Ice Center based on RADARSAT (Radar Satellite) information indicated a high percentage of ice cover on Lake Erie throughout the ice season; however, the majority of this ice was defined as medium or skim ice. Although a stable ice cover did form for a large area immediately behind the boom, inconsistent weather did not allow a solid ice formation to occur on Lake Erie.

Towards the end of the 2012–13 ice season, members of the International Niagara Working Committee agreed that the ice formed in the eastern basin of Lake Erie was very thin and, therefore, unsafe for landing a helicopter on. As a result, the Working Committee cancelled both helicopter flights that are typically carried out during the season to measure ice thickness. A fixed-wing aircraft flight was performed over Lake Erie during the morning of March 25, 2013 to determine the extent and condition of the ice cover. The ice observation flight revealed less than 230 square kilometres (89 square miles) of ice remained on the eastern part of Lake Erie, and a limited amount of ice buildup in the Maid-of-the-Mist Pool below Niagara Falls. Given the limited ice cover, and the limited potential for significant new ice to form in either location, preparations for the removal of the ice boom began immediately after the fixed wing flight, and removal began during the afternoon of March 25, 2013.

Six spans were removed from the Canadian side and tied against the Buffalo break wall on March 25, 2013. The ice boom crew continued Phase 1 of the removal process on March 26, and removed 4 spans from between the break walls along the American side, 2 spans from the Canadian side, and opened 1 additional span leaving it trailing. During the night of March 26, two pontoons were stripped off the trailing span during ice flow past the boom. NYPA recovered one pontoon the following day; however, the second pontoon has not been recovered. Only two spans were removed on March 27 and one was left trailing, due to difficulties encountered with the ice field exerting tension on the spans. The final 6 spans were removed and tied off to the break wall on March 28, completing Phase 1 of the removal process.

Weather was not favourable for the ice boom crew to safely retrieve buoy barrels at the beginning of Phase 2 of the removal process. For many days, high west winds and continual ice accumulation persisted at the east section of the Buffalo harbour. Finally, with favourable weather conditions, 12 out of 23 buoy barrels were removed from the Canadian side on April 8. Phase 2 of the ice boom removal process was completed on April 9, 2013 when the remaining 11 junction plate buoy barrels were removed.

Phase 3, the final phase, of the ice boom removal process began on April 10 when ice boom crews began towing the 152-metre (500-foot) long ice boom spans to the boom's Katherine Street, Buffalo, NY storage site where they were pulled onto shore. Four spans were towed and pulled onto shore on April 10 and 11. Three spans were towed from the inner break to the ice boom storage facility on April 12. Another 5 spans were pulled to shore on April 15. April 17, 2013 marked the end of another ice-boom season when the final 3 spans were brought to and pulled onto the storage site.

The ice boom performed as designed during the 2012–13 ice season. The boom experienced two span breaks during the 2012–13 ice season as a result of high winds and strong ice pressure.

11. MEETING WITH THE PUBLIC

In accordance with the Commission's requirements, the Board held its annual meeting with the public during the evening of September 19, 2013 at the Niagara-on-the-Lake Community Centre in Niagara-on-the-Lake, ON. Information on items including current and projected Great Lakes levels, the operation of the Lake Erie–Niagara River Ice Boom, OPG's Niagara Tunnel Project, and the recession of Niagara Falls was presented at the meeting. There were about 25 people at the meeting, with nine members of the public attending in person and two people participating on-line via webinar/teleconference. The 2013 annual meeting was the first time the Board has offered telephone and on-line options as an extension of its face-to-face meeting.

12. MEMBERSHIP OF THE BOARD AND ITS WORKING COMMITEE

The membership of the Board is unchanged from the last report.

Dr. Frank Seglenieks, Environment Canada, was appointed by Mr. Thompson to the position of Canadian Co-Chair of the Board's Working Committee on August 21, 2013.

Dr. Seglenieks replaced Mr. Jacob Bruxer who, having accepted a new position within Environment Canada's Great Lakes–St. Lawrence Regulation Office in Cornwall, ON, is no longer able to dedicate time to matters related to the Niagara Board and its Working Committee.

13. ATTENDANCE AT BOARD MEETINGS

The Board met once during this reporting period. The meeting was held September 19, 2013, in Burlington, ON. Mr. Thompson, Canadian Section Chair, Colonel Peterson, Alternate U.S. Section Chair, Ms. Keyes, Canadian Member, and Mr. Allerton, U.S. Member, were in attendance.

Original Signed by	*Original Signed by*
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Mr. AARON F. THOMPSON Chair, Canadian Section	BG MARGARET W. BURCHAM Chair, United States Section
Original Signed by	*Original Signed by*
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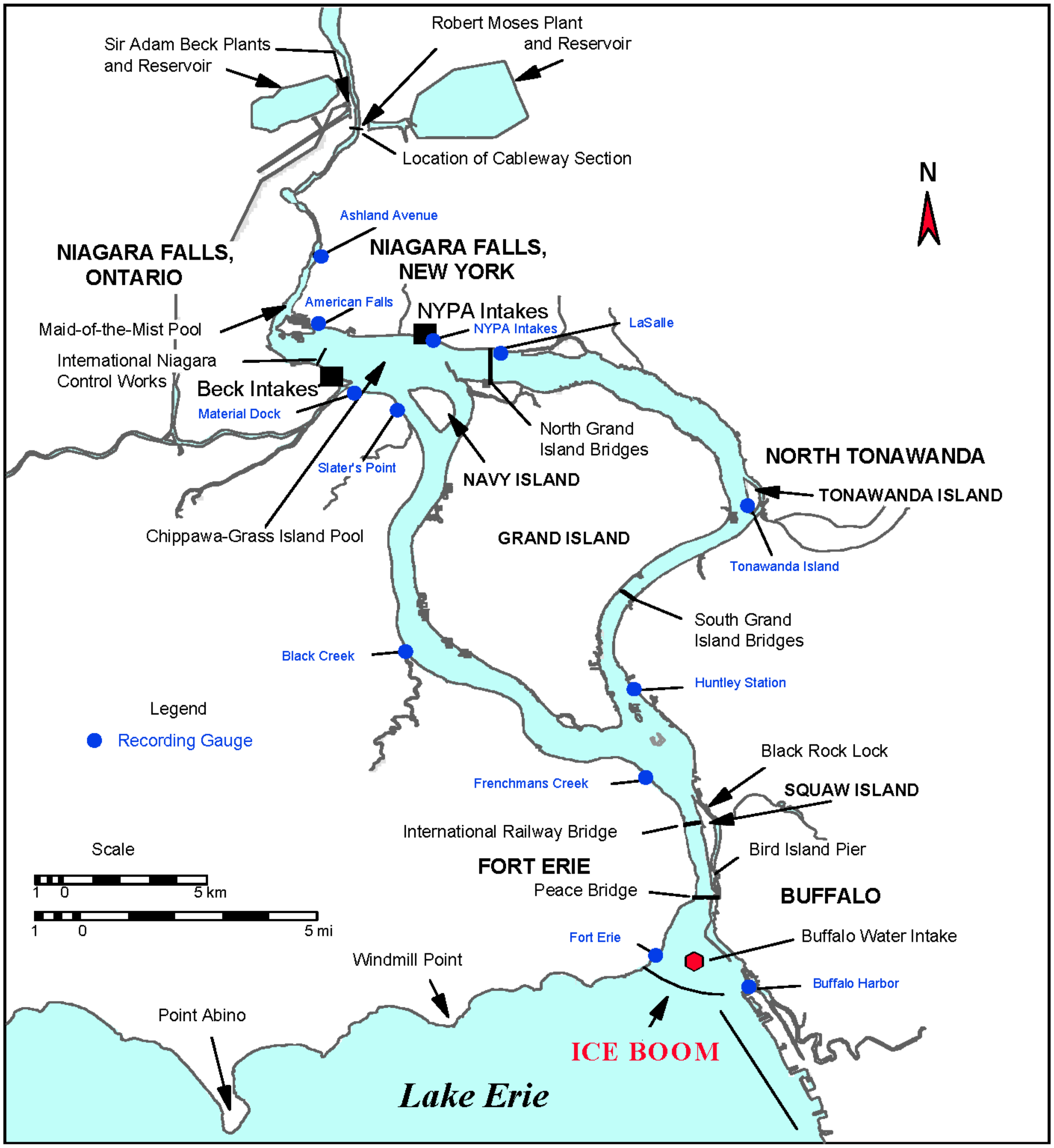
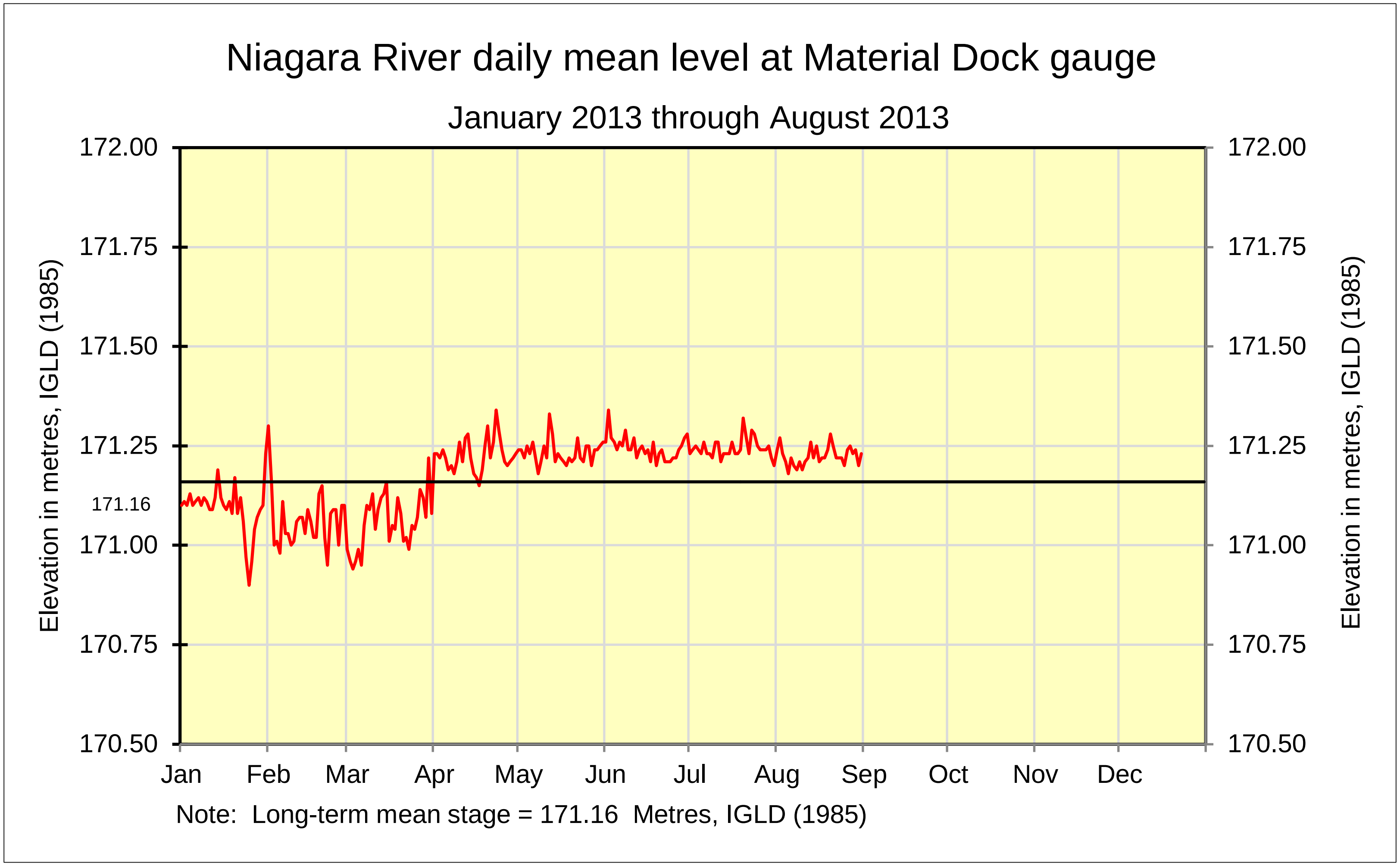
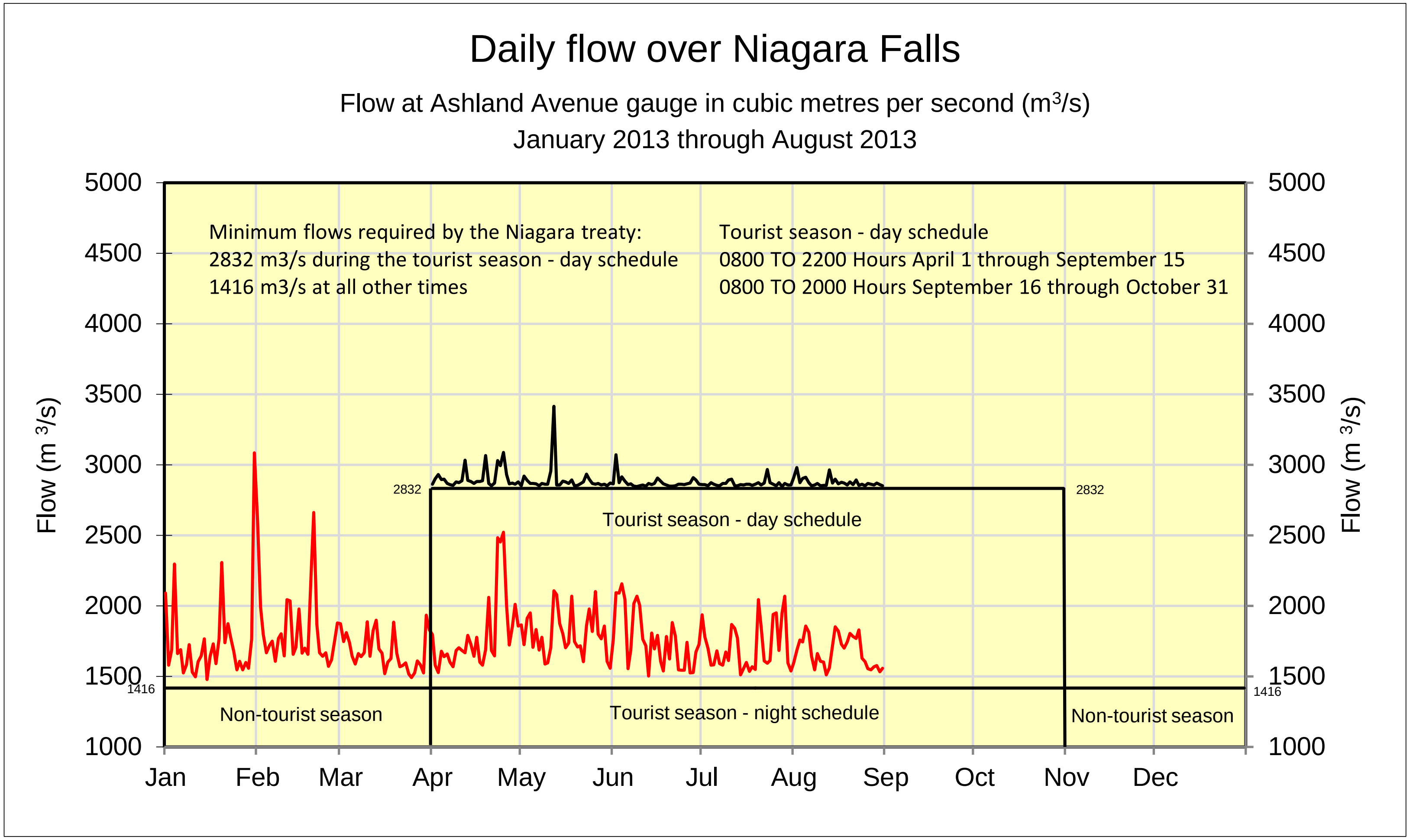
Ms. JENNIFER L. KEYES Member, Canadian Section	Mr. WILLIAM H. ALLERTON Member, United States Section

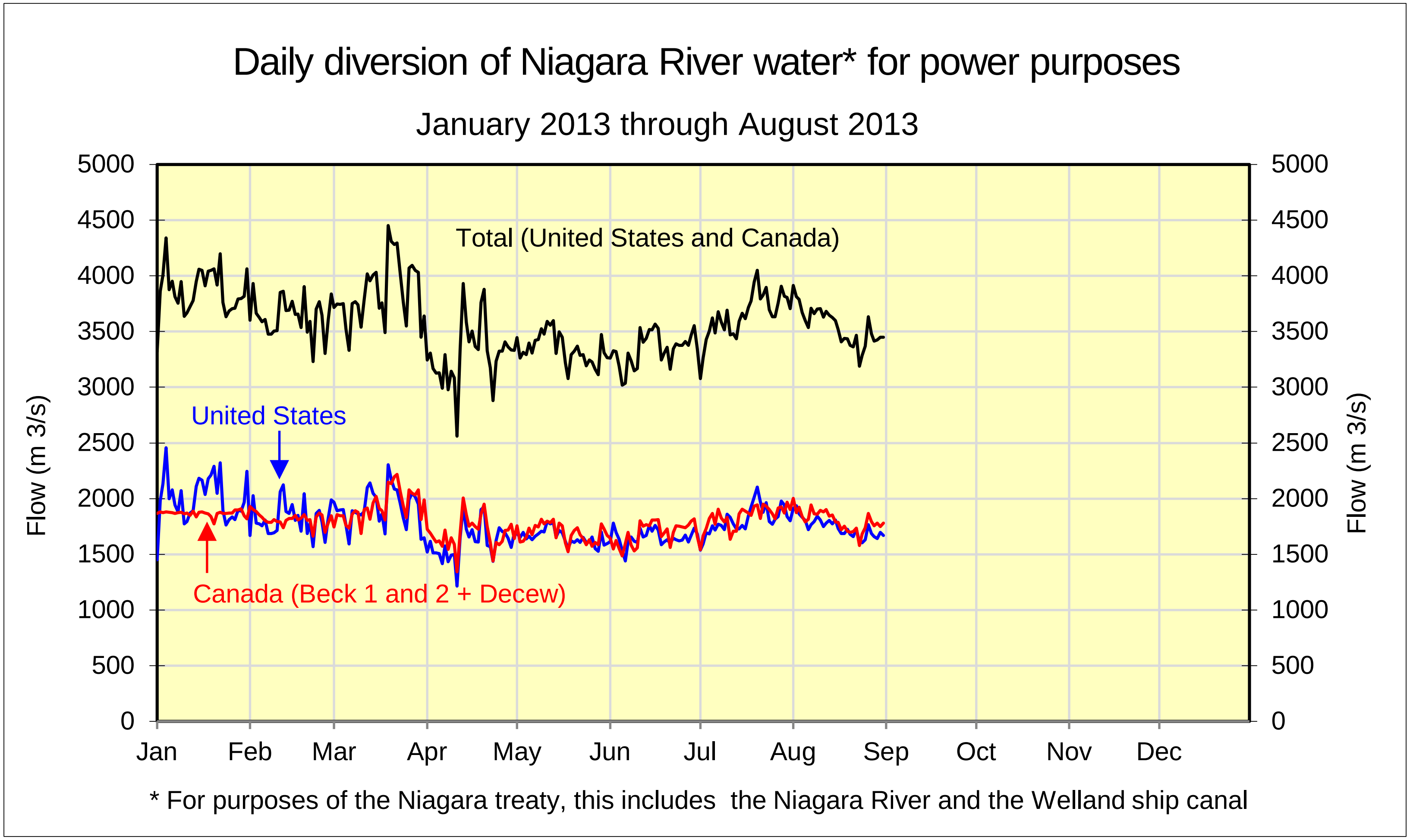

Sir Adam Beck Plants and Reservoir
Robert Moses Plant and Reservoir
Location of Cableway Section
N
Ashland Avenue
NIAGARA FALLS, ONTARIO
NIAGARA FALLS, NEW YORK
American Falls
NYPA Intakes
NYPA Intakes
LaSalle
Maid-of-the-Mist Pool
International Niagara Control Works
Beck Intakes
Material Dock
Slater's Point
North Grand Island Bridges
NAVY ISLAND
NORTH TONAWANDA
TONAWANDA 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


Niagara River daily mean level at Material Dock gauge
January 2013 through August 2013
172.00
171.75
171.50
171.25
171.16
171.00
170.75
170.50
Elevation in metres, IGLD (1985)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Note: Long-term mean stage = 171.16 Metres, IGLD (1985)

Enclosure 2


Daily flow over Niagara Falls
Flow at Ashland Avenue gauge in cubic metres per second (m3/s)
January 2013 through August 2013
Minimum flows required by the Niagara treaty:
2832 m3/s during the tourist season - day schedule
1416 m3/s at all other times
Tourist season - day schedule
0800 TO 2200 Hours April 1 through September 15
0800 TO 2000 Hours September 16 through October 31
Tourist season - day schedule
Non-tourist season
Tourist season - night schedule
Non-tourist season
2832
2832
1416
1416
Flow (m 3/s)
Flow (m 3/s)
5000
4500
4000
3500
3000
2500
2000
1500
1000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

Enclosure 3


Daily diversion of Niagara River water* for power purposes
January 2013 through August 2013
Total (United States and Canada)
United States
Canada (Beck 1 and 2 + Decew)
Flow (m 3/s)
Flow (m 3/s)
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
* For purposes of the Niagara treaty, this includes the Niagara River and the Welland ship canal

Enclosure 4