International Niagara Board of Control

One Hundred Twentieth Semi-Annual Progress Report

to the

International Joint Commission

Covering the Period September 21, 2012 through March 20, 2013

EXECUTIVE SUMMARY

The level of Lake Erie was below average throughout the entire reporting period. Lake Erie began the reporting period with a September mean level 21 cm (8.3 inches) below its long-term average level for the month. While the lake's level followed its usual seasonal decline into October, above average rainfall and associated runoff stopped the decline about a month earlier than on average. The lake level remained relatively steady from November to January, as it typically does; however, precipitation, early snowmelt and associated runoff caused the lake to begin its seasonal rise a bit earlier than usual in February. February's mean water level was 12 cm (4.7 inches) below 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).

A Falls flow violation occurred during the morning of February 16, 2012 as a result of control actions taken by the Niagara River Control Centre's on-shift supervisor to reduce additional flow over Niagara Falls. Despite corrective actions take, the flow over Niagara Falls was below the minimum requirement of 1416 m^3/s (50,000 cfs) for 2:00 a.m. and 3:00 a.m. The amount below the minimum requirement was 53 m^3/s (1,872 cfs) and 15 m^3/s (530 cfs), respectively, at these times (Section 5).

The Board is developing techniques utilizing Geographic Information Systems to help geo-reference and assess the extent of recent and future changes in the crest of the Horseshoe Falls at Niagara (Section 6).

OPG has completed construction of the Niagara Tunnel Project, which will provide 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 is scheduled for March 21, 2013 (Section 9).

Installation of the Lake Erie-Niagara River Ice Boom began on December 18 and was completed on December 20, 2012. The Boom remained in place at the end of the reporting period (Section 10).

The Board will hold a meeting with the public in September 2013 in the Niagara Falls, ON area (Section 12).

COVER: View from the control room of the Niagara River Control Centre on March 22, 2013, looking across the International Niagara Control Works. (Photo courtesy of Mr. Peter Kowalski, Ontario Power Generation)

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International Joint Commission
www.ijc.org

International Niagara Board of Control
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Lake Erie-Niagara River Ice Boom
www.iceboom.nypa.gov

INTERNATIONAL NIAGARA BOARD OF CONTROL

Cincinnati, Ohio March 20, 2013
Burlington, Ontario

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

Commissioners:

1. GENERAL

The International Niagara Board of Control (Board) submits its One Hundred Twentieth Semi-Annual Progress Report, covering the reporting period September 21, 2012 through March 20, 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 was below average throughout the entire reporting period. The lake began the reporting period with a September mean level 21 cm (8.3 inches) below its long-term average level for the month. While the lake's level followed its usual seasonal decline into October, above average rainfall and associated runoff stopped the decline about a month earlier than on average. The lake level remained relatively steady from November to January, as it typically does, but began its seasonal rise a bit earlier than usual in February. This was due to precipitation, early snowmelt and associated runoff. Lack of typical ice retardation in February on the St. Clair and Detroit Rivers, which would normally decrease the inflow to Lake Erie, was likely also a factor. The February mean water level was 12 cm (4.7 inches) below the long-term average for the month. Recorded monthly water levels for the period September 2012 through February 2013 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 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. 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.

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 depicted graphically in Figure 2. Precipitation on the Lake Erie basin was above average during the months of September, October, and January, below average during November and December, and average in February. Much of the January and February precipitation would normally be stored on the basin in the form of snow and ice until spring; however, the precipitation that fell late in February came in the form of rain, which caused much of the snow from earlier snowfalls to melt and contribute runoff to the lake. During the period September 2012 through February 2013, the basin received about 43 cm (16.9 inches) of precipitation. This is approximately 5% above average for the period.

The recent NBS to Lake Erie are shown relative to average on a monthly basis in Figure 3. Negative NBS values indicate that more water leaves the lake during the month due to evaporation than enters 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 near-average in September, December and January, above-average in November, and well-above average during October and February. Despite very low precipitation on the lakes basin during November, the lake's November NBS was slightly positive instead of negative as it has been on average. This was likely due to runoff received by the lake from the heavy rainfall experienced near the end of October. The above-average NBS during October and November resulted in an earlier-than-normal stop in the lakes seasonal decline in water levels. While precipitation in February was average, much of it fell in the form of rain instead of snow, which resulted in the lake's high NBS during that month and the early start to its annual seasonal rise.

A major portion of Lake Erie's NTS comes from Lakes Michigan-Huron via the Detroit River. The level of Lakes Michigan-Huron continued to be well below average during the reporting period. As a result, inflows to Lake Erie via the Detroit River were about 9% below the long-term average for the six-month period September 2012 through February 2013. The January and February Detroit River flows are much closer to average than the other months, which is not what would be expected from the low levels on Lakes Michigan-Huron. This is likely due to the warm winter keeping the flow retardation in the river, due to the ice cover that normally forms, very low. 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 lake's inflow from upstream, combined with its NBS, resulted in below-average NTS for the months of September 2012 through January 2013 and above-average NTS during February 2013. Overall, Lake Erie's NTS was 4% below average for September 2012 through February 2013. The recent NTS to Lake Erie are 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 water lake levels result in above-average outflows and below-average lake levels lead to below-average outflows. Flow is also influenced by ice in the river during the winter and aquatic plant growth in the river in the summer that can reduce the flow, and by seasonal trends in prevailing winds that on-average raise levels at the eastern end of the lake relative levels at the western end and the lake's average level. Recent monthly outflows via the Niagara River are graphically depicted in Figure 7. The lake's below-average water level conditions from September 2012 through February 2013 resulted in below-average Niagara River flows during those months. However, it appears that a lack of the significant ice retardation of the flow and a larger-than-average increase in the lake's level at its outlet due to wind effect resulted in flows closer to average during January and February than would normally be expected based on Lake Erie's water level.

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 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 and Environment Canada indicates that the level of Lake Erie is expected to remain below average throughout the spring and summer unless very high 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* 2012-2013	Average 1918-2011	Departure	Recorded* 2012-2013	Average 1918-2011	Departure
September	173.95	174.16	-0.21	570.70	571.39	-0.69
October	173.82	174.06	-0.24	570.28	571.06	-0.78
November	173.85	173.99	-0.14	570.37	570.83	-0.46
December	173.82	173.99	-0.17	570.28	570.83	-0.55
January	173.82	173.99	-0.17	570.28	570.83	-0.55
February	173.86	173.98	-0.12	570.41	570.80	-0.39

* Provisional

TABLE 2 – MONTHLY AVERAGE PRECIPITATION ON THE LAKE ERIE BASIN

	Centimetres			Inches			
Month	Recorded* 2012-2013	Average 1900-2008	Departure	Recorded* 2012-2013	Average 1900-2008	Departure	Departure (in percent)
September	9.63	8.13	1.50	3.79	3.20	0.59	18
October	11.23	7.04	4.19	4.42	2.77	1.65	60
November	2.26	7.28	-5.02	0.89	2.87	-1.98	-69
December	6.73	6.78	-0.05	2.65	2.67	-0.02	-1
January	7.82	6.35	1.47	3.08	2.50	0.58	23
February	5.31	5.31	0	2.09	2.09	0.0	0

* Provisional

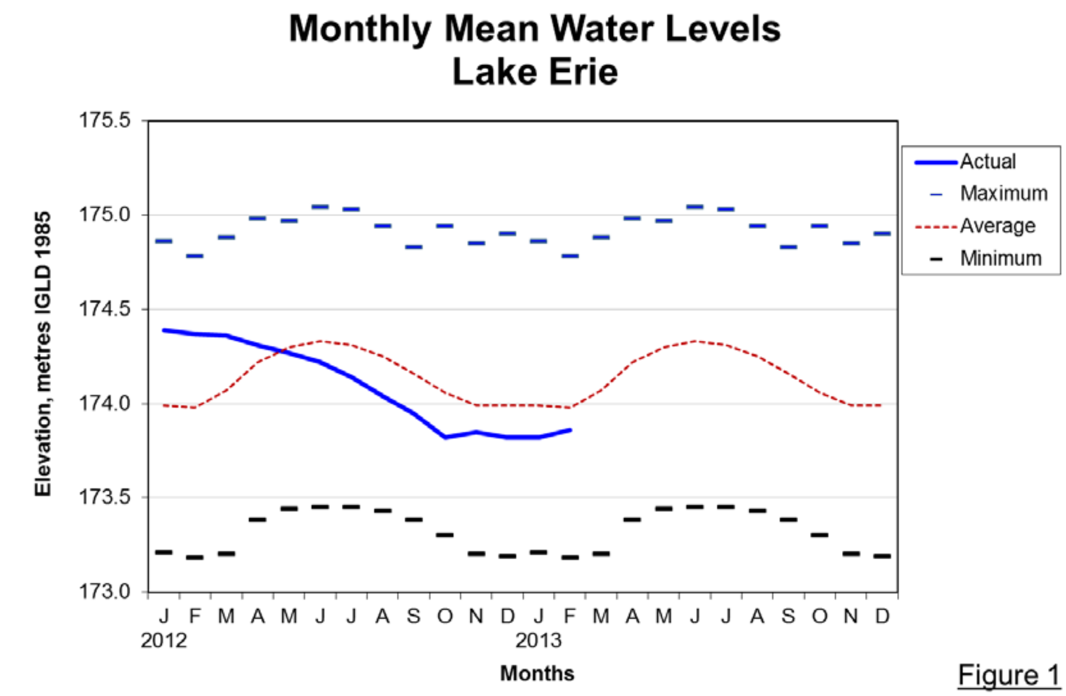


Figure 1

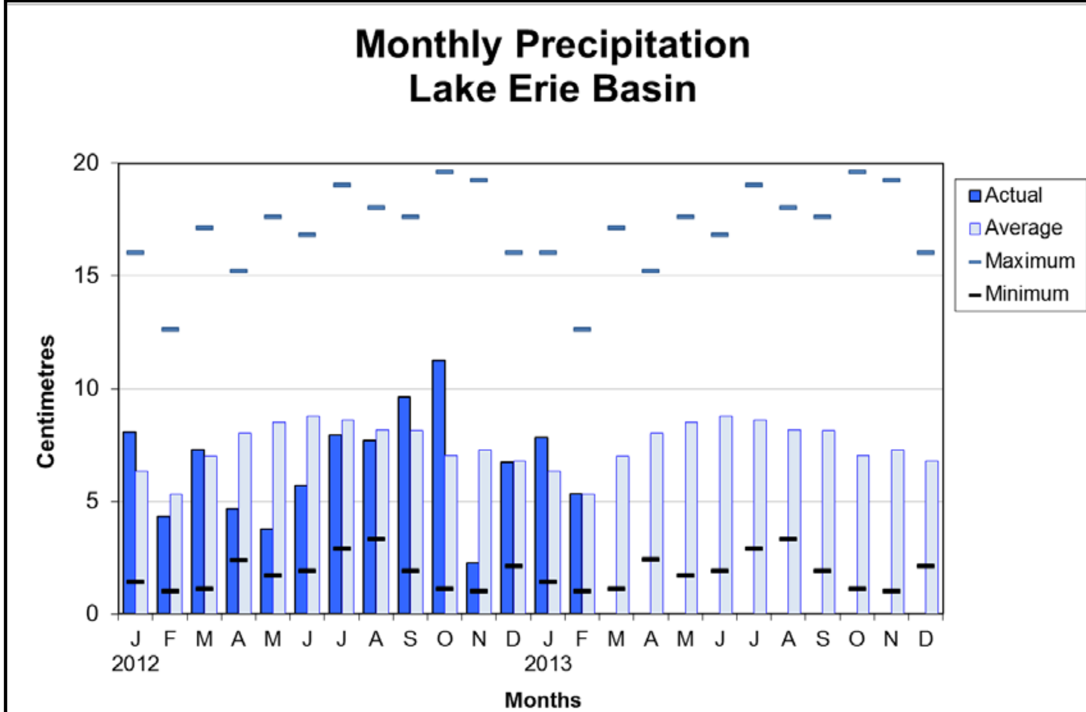
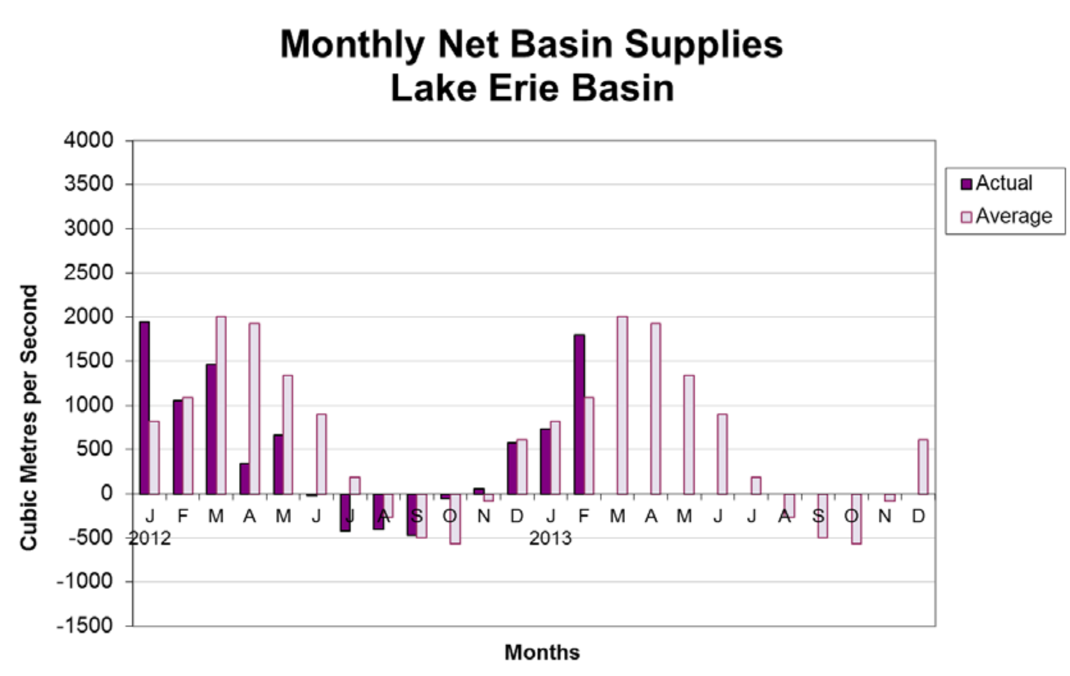


Figure 2



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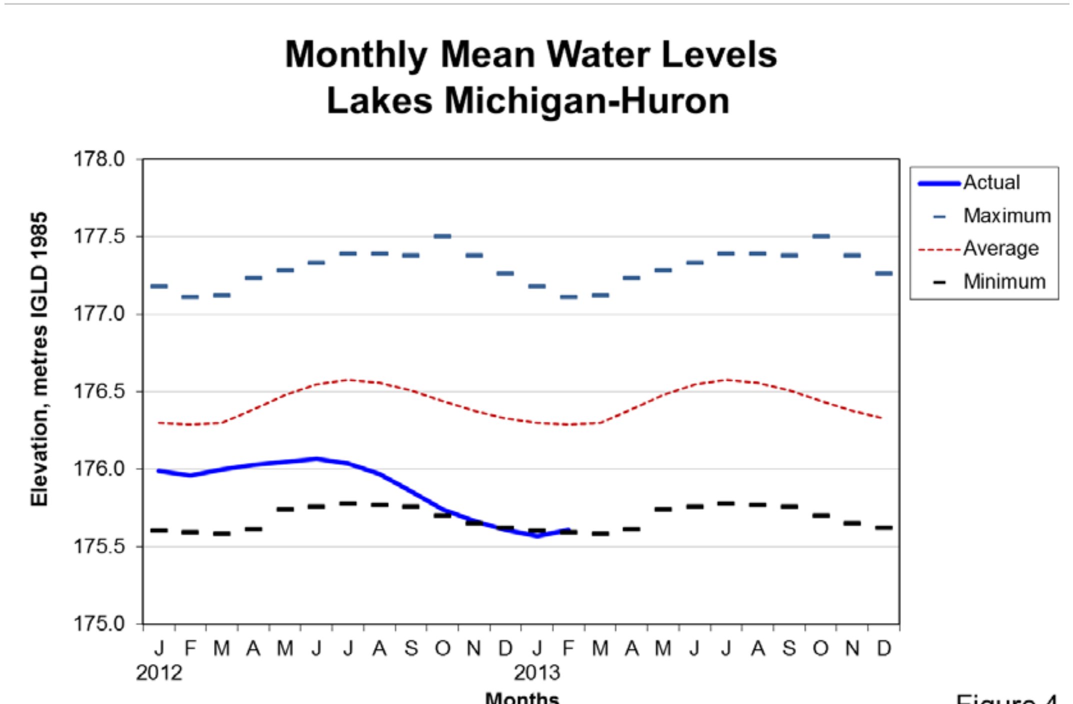

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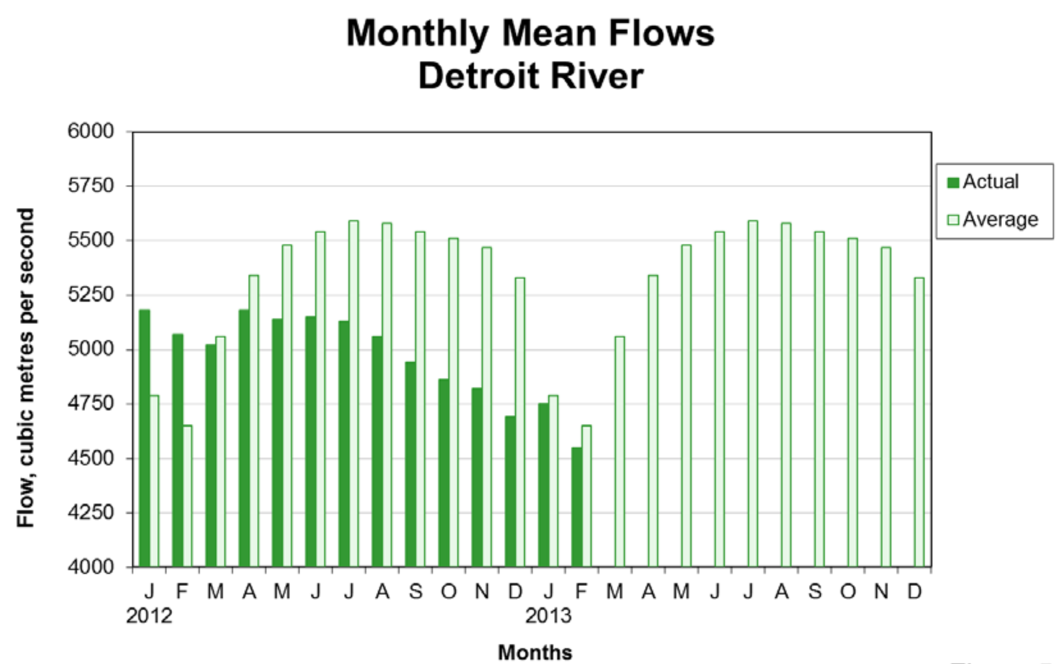

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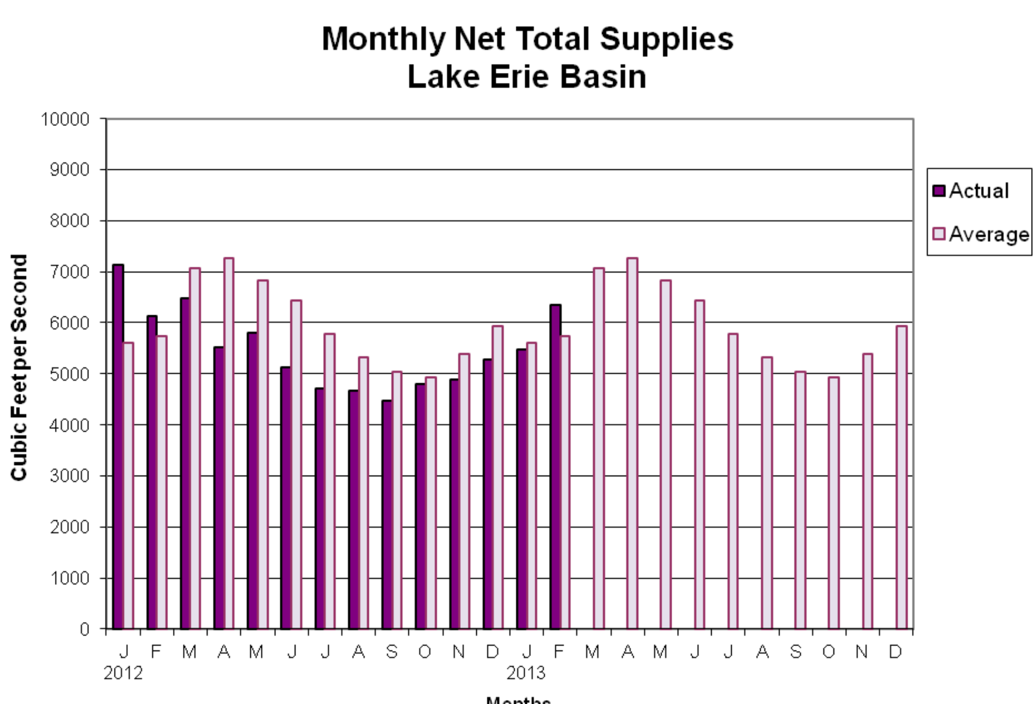


Figure 6

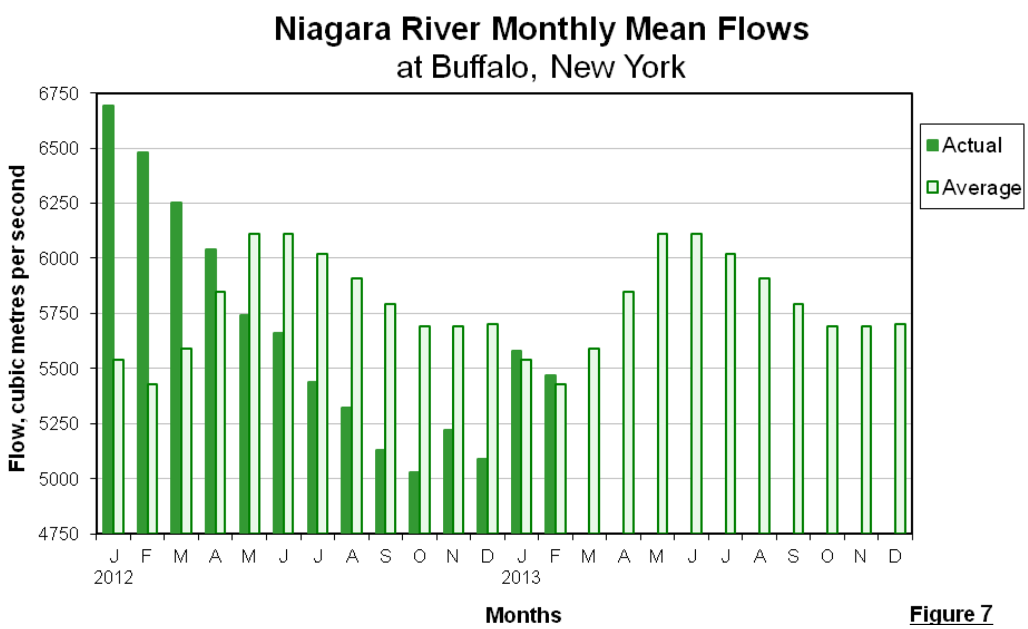


Figure 7

3. OPERATION AND MAINTENANCE OF THE INTERNATIONAL NIAGARA CONTROL WORKS

The water level in the Chippawa-Grass Island Pool (CGIP) is regulated in accordance with the Board's 1993 Directive. The Directive requires that the Power Entities—Ontario Power Generation (OPG) and the New York Power Authority (NYPA)—operate the International Niagara Control Works (INCW) to ensure the maintenance of an operational long-term average CGIP level of 171.16 m (561.55 feet) to 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, 2013 was 0.22 metre-months (0.72 foot-months) above the long-term operational average elevation. The maximum permissible accumulated deviation is ± 0.91 metre-months (± 3.00 foot-months).

Tolerances for regulation of the CGIP level were suspended on December 26 and 27, 2012 due to low flow conditions. Tolerances were also suspended on January 24-26 and 31, and on February 1-5, 7-10, 19-22 and 26, 2013 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 period September 2012 through February 2013 are shown in Enclosure 2.

Gate 1 remains out-of-service for work on the Niagara Tunnel Project.

As a result of inspections performed by OPG in 2008, replacement of oil transfer lines on Gates 1-13 of the INCW commenced in 2010 when work was initially completed on Gate 2. Replacement of the oil transfer lines on Gates 1, 3, 6, 7, 10 and 11 was completed in 2011. Work on Gates 4, 5, 8, 9, and 12 was completed during 2012. Due to the different structural design, oil transfer lines of the newer gates (Gates 14-18) do not need to be replaced. Gate 9 was removed from service in May 2012 for repairs to ice shields, and replacement of the trunion and wiper seals and rollway hinges. It was returned to service in October 2012. Following the failure and subsequent replacement of a flexible hydraulic hose associated with the control system for Gate 13, OPG has initiated a program to replace all similar hydraulic hoses on the INCW. The piping and hose assemblies are being fabricated off site for installation that will begin after April 1, as the work requires each gate to be fully open. The installation of these hoses for all gates should be completed by June 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. A Consulting Engineering firm has been commissioned to provide options for bridge strengthening design. The Consultant’s report was not yet available at the time of this submission.

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 International Niagara Committee (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 periods of time during the reporting period due to various telecommunications problems that occurred in the United States and/or Canada. During these periods, data from the NOAA gauge was used to calculate flow over Niagara Falls. Mitigating actions were taken by telecommunications providers and by the Power Entities that reduced the number and duration of failures. On September 27, a one-hour outage of the Power Entities' gauge was taken to have the gauge adjusted to remove a discovered discrepancy. 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 remainder of the reporting period.

Water levels from the Material Dock gauge were unavailable for 11 hours on December 11, 2012 due to a loss of its AC power supply. During that time, water level readings were obtained from the Slater's Point 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 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. It will be reinstalled in 2013 following the ice season. Once 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 2832 cubic metres per second (m^3/s) (100,000 cubic feet per second (cfs)). At night and during the winter months, the required minimum Falls flow is 1416 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 Niagara Treaty of 1950. Falls flow met or exceeded minimum Treaty requirements at all times during the reporting period with the sole exception on February 16, 2013, as noted below. The recorded daily flow over Niagara Falls, covering the period September 2012 through February 2013, is shown in Enclosure 3.

As a result of control actions to reduce flows over Niagara Falls in excess of the Treaty minimum, the NRCC on-shift supervisor partially closed a gate at 12:38 a.m. during the morning of February 16, 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. In response to the decreasing level, three additional control gates were operated to the full open position in an effort to restore the elevation as quickly as possible. The flow over Niagara Falls was below the minimum requirement of 1416 m^3/s (50,000 cfs) for 2:00 a.m. and 3:00 a.m. The amount below the minimum requirement was 53 m^3/s (1,872 cfs) and 15 m^3/s (530 cfs), respectively, at these times. Further direction has been provided 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.

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 Niagara Treaty of 1950, 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, which could signal a period of rapid Falls recession, unseen in more than a century. No significant changes in the crestline were observed during the reporting period.

In its 119th semi-annual report, the Board reported on two rockfalls that occurred in August 2009 and July 2012. Although visible in satellite images and oblique photographs taken from elevated vantage points, the change resulting from the 2009 and 2012 rockfalls has not resulted in a broken curtain of water over the length of the crestline nor, in the opinion of the Board, negatively affected the scenic beauty of the Falls. The Board is developing techniques utilizing Geographic Information Systems to help geo-reference and assess the extent of these and 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 September 2012 through February 2013, diversion for the SAB I and II plants averaged 1571 m^3/s (55,480 cfs) and diversion to the Robert Moses Niagara Power Project averaged 1750 m^3/s (61,800 cfs).

The average flow from Lake Erie to the Welland Canal for the period September 2012 through February 2013 was 182 m^3/s (6,430 cfs). Diversion from the canal to OPG's DeCew Falls Generating Stations averaged 136 m^3/s (4,800 cfs) for the period September 2012 through February 2013.

Records of diversions for power generation covering the period September 2012 through February 2013 are shown in Enclosure 4.

The monthly average Niagara River flows at Queenston, Ontario, for the period of September through February, and departures from the 1900-2011 long-term average are shown in Table 3. Maximum and minimum monthly average flows, for the period of record 1900-2011, are shown in Table 4. During the period September 2012 through February 2013, the flow at Queenston averaged 5216 m^3/s (184,200 cfs), with the monthly average ranging between 5017 m^3/s (177,170 cfs) and 5457 m^3/s (192,710 cfs). The flow at Queenston for the same period in 2011-12 averaged 6291 m^3/s (222,160 cfs), with the monthly averages ranging between 5805 m^3/s (205,000 cfs) and 6736 m^3/s (237,880 cfs).

TABLE 3 - MONTHLY NIAGARA RIVER FLOWS AT QUEENSTON

	Cubic Metres per Second			Cubic Feet per Second		
Month	Recorded 2012-13	Average 1900-2010	Departure	Recorded 2012-13	Average 1900-2010	Departure
September	5123	5723	-600	180,920	202,110	-21190
October	5017	5640	-623	177,170	199,170	-22000
November	5255	5652	-397	185,580	199,600	-14020
December	5110	5690	-580	180,460	200,940	-20480
January	5457	5538	-81	192,710	195,570	-2860
February	5332	5430	-98	188,300	191,760	-3460
Average	5216	5612	-397	184,200	198,190	-13990

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
September	6880	1986	4340	1934	242,960	153,270
October	7220	1986	4320	1934	254,970	152,560
November	7030	1986	4190	1934	248,260	147,970
December	7410	1985	4270	1964	261,680	150,790
January	7240	1987	3960	1964	255,680	139,850
February	6900	1987	3320	1936	243,670	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 flows 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. Measurements are made at the following locations:

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 and the Fort Erie rating equations and the Buffalo-Material Dock equation. 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 was closer to the 2012 measured flows than any of the older equations, particularly the May 2012 measurements which averaged 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. The Fort Erie equation is used by the Power Entities to estimate available water.

Environment Canada is also making discharge measurements to correlate water levels at the new international water level gauge located near the International Bridge section to flow. Flow measurements will be taken during summer months to observe the impact of aquatic plant growth on flows. They also hope to do flow measurements under ice conditions. The goal is to develop a set of ratings to determine Niagara River flows on a continuous basis based on the water levels at this gauge.

Cableway: 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 the fall of 2013.

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 to ensure 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 Chippawa-Grass Island Pool, 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. On May 8 and 9, 2012, as part of the regular 5-year measurement cycle, discharge measurements were again made at this section, this time using an ADCP mounted on a remote control boat. On average there was no difference between the 2012 measurements and those computed using the present American Falls rating equation. Following a 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. The St. Lawrence Seaway Management Corporation's was unable to provide water level data for the time of these measurements, so the 2010 measurements could not be used to verify the rating. To make up for the lack of results from the 2010 measurements, off-schedule measurements were made in the Welland Supply Canal on May 3, 2012. 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 Acoustic Doppler Velocity Meter (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 Acoustic Doppler Velocity Meter (ADVM) and water level gauging equipment will be installed upstream of the existing ADVM by the Seaway Corporation. When the new equipment becomes operational, discharge measurements will be required in order to develop a Weir 8 rating for this new installation. These measurements may be in addition to the regularly scheduled Welland Canal measurements.

New York State Barge Canal: Measurements were taken in May and November 2012 by the US Army Corps of Engineers in the New York State Barge Canal as part of an effort by the INWC to gain a better understanding of the flows in the canal system and the diversion of water from the Niagara River. Preliminary results of the measurements and related work suggest that the assumed constant flow values of 0 m^3/s and 31.0 m^3/s currently used for computational purposes during the non-navigation and navigation seasons, respectively, are reasonable approximations. The need to update the values used for computational purposes will be discussed by the INC and the INWC following the completion of the review effort.

9. NIAGARA TUNNEL PROJECT AND PLANT UPGRADES

OPG continued with the construction of the Niagara Tunnel Project throughout the reporting period. On November 6, 2012, workers in the tunnel poured the last portion of concrete required to finish the arch (top) concrete lining. The tunnel is now lined with concrete from end-to-end. During December 2012, OPG installed stop logs at the tunnel entrance and began to fill the intake area with water. After the intake area was filled with water, the coffer dam that had been installed upstream of the INCW to permit construction of the intake was removed. On February 12, 2013, OPG removed the natural rock plug separating the open cut at the tunnel outlet and the channel that will carry the water from the tunnel to the Pump Generating Reservoir and/or to the SAB I and II plants. The tunnel was watered up on March 2 and 3 and its official in-service date is scheduled for March 21, 2013, increasing the water diversion capability for OPG's SAB complex. The increased diversion capacity 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, G4, G5, G7, G9 and G10. G1 and G2 (both are 25 Hz units) remain removed from service at this time, and rehabilitation of G6 and G8 will be considered after work is completed on the other units as they were more recently upgraded. The upgrades of Units G7and G9 were completed in March 2009/February 2012 (two parts) and December 2010, respectively. Work to replace the G3 runner and for a generator re-wind began in April 2012 and is expected to be complete by June 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 has since been decided that a full Gibson Test will be done when the vibration issues are resolved. 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. OPG is working to resolve the issues with G7.

10. ICE CONDITIONS AND ICE BOOM OPERATION

In accordance with Condition (d) of the Commission's October 5, 1999 supplementary Order of Approval, installation of the Lake Erie-Niagara River Ice Boom's spans began on December 18. Installation 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. On December 13, the water temperature at Buffalo was 5.6ºC (42ºF). Given the lake's water temperature and that December 16 fell on a Sunday, installation of the ice boom was planned to begin on December 17 or 18, conditions permitting. Weather conditions were favorable on December 17; however, the barge that NYPA uses to install the boom was in use until December 16 to assist OPG with work at the INCW. As a result, installation of the boom started on December 18.

Preparations for installing the ice boom began in late November. Beginning on November 27, the junction plates were raised from the bottom of the lake and floatation barrels attached. This first phase of installation was completed on November 30. The strings of boom pontoons were pulled from their summer storage area and placed inside the Buffalo Harbor breakwall during the period December 4 through 10, completing the second phase. Six spans of the boom were placed starting from the Canadian side on

December 18. Ten spans were installed on December 19 and the final 6 spans were installed on December 20, completing the final phase of installation. The water temperature at Buffalo remained above 4ºC (39ºF) throughout the boom installation period.

On February 12, 2013, a combination of high winds and strong ice pressure contributed to the breaking of span F of the ice boom. Repair of span F was completed the afternoon of February 13. Span D of the boom experienced a break that occurred February 15 and was repaired that very day. Although a natural ice arch did form at the mouth of Lake Erie, the boom remained unstable. Winds and ice forced into the boom by wind tested the strength limits of the boom.

Lake Erie Ice conditions for the 2012-2013 ice seasons have been dictated by rising and falling temperatures for the region. The ice season has been met with 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, a 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. The lack of solid ice formation was also confirmed by MODIS (Moderate Resolution Imaging Spectroradiometer) satellite images available throughout the season.

The helicopter flights scheduled for February 14 and March 12, 2013 to measure ice thickness in the lake's eastern basin were cancelled based on the review of available MODIS imagery and ground-based observations, which indicated that there was open water at four, if not all, of the six standard measurement sites. Although there may have been ice at one or both of the most easterly measurement sites, it was not considered stable enough to land on and take measurements. A fixed-wing flight to determine the extent and condition of ice remaining on the eastern basin of the lakes is scheduled to be conducted on March 22, 2013 by representatives of the Board's Working Committee in preparation for removal of the ice boom. The boom remained in place at the end of the reporting period.

11. DAILY WATER LEVEL FLUCTUATIONS IN THE UPPER NIAGARA RIVER WATERSHED

The Board was contacted late in this reporting period by scientists from the Ontario Ministry of Natural Resources working on the Niagara River Remedial Action Plan (RAP). The scientists raised concerns that daily water level fluctuations in the Niagara River resulting from the operation of the INCW are causing degradation to the fisheries of the Upper Niagara River and its tributaries. The scientists have suggested the IJC consider conducting a formal bi-national study to look at the problem. The Board will endeavour to look into this issue in more detail during the next reporting period and will discuss this issue at the fall Board meeting and subsequently report to the IJC.

12. MEETING WITH THE PUBLIC

In accordance with the Commission's requirements, the Board will hold an annual meeting with the public in September 2013. The meeting will be in the Niagara Falls, ON area, with the meeting location and date to be determined. Information on items including current and projected Great Lakes levels, the operation of the Lake Erie-Niagara River Ice Boom, and OPG's Niagara Tunnel Project will be presented at the meeting. The Board's 2012 meeting was held in Niagara Falls, NY on September 12.

13. MEMBERSHIP OF THE BOARD AND ITS WORKING COMMITEE

The membership of the Board and its 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 March 20, 2013, in Chicago, IL. BG Burcham, U.S. Section Chair, Mr. Thompson, Canadian Section Chair, and Mr. Allerton, U.S. Member, were in attendance. Ms. Keyes, Canadian Member was unable to attend.

Respectfully Submitted,

Original Signed by

BG MARGARET W. BURCHAM
Chair, United States Section

Original Signed by

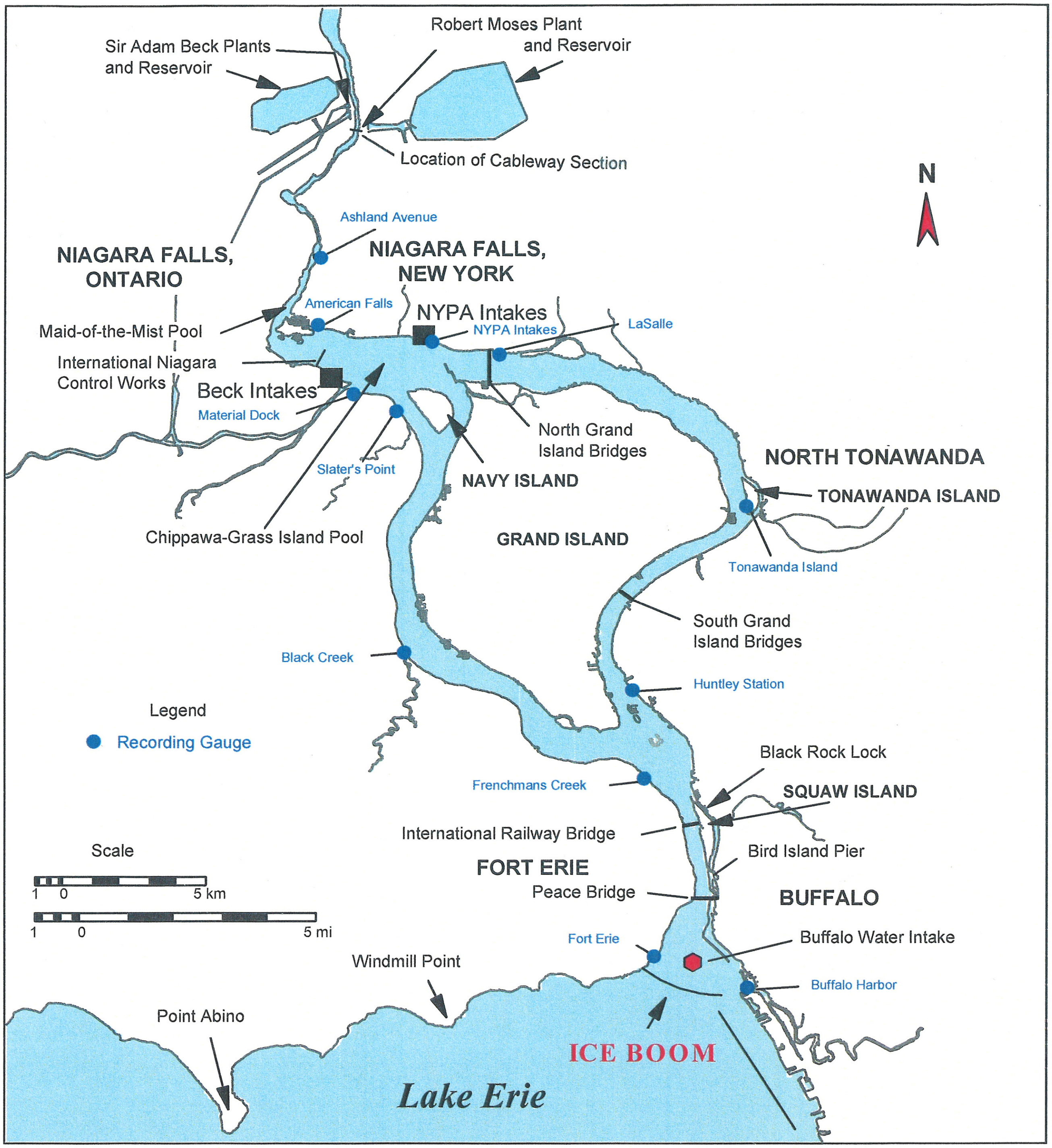
Mr. AARON F. THOMPSON
Chair, Canadian Section

Original Signed by

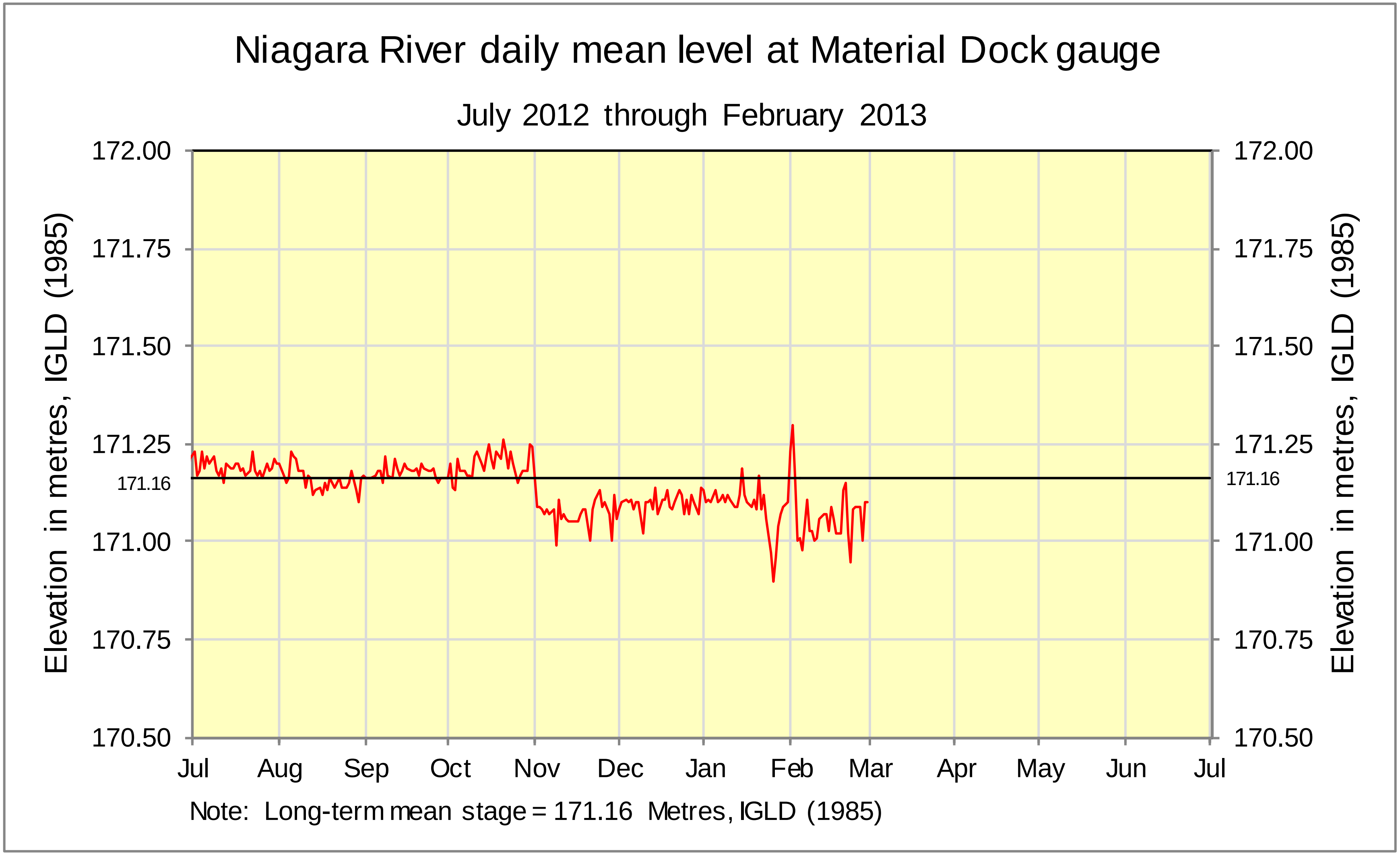
Mr. WILLIAM H. ALLERTON
Member, United States Section

Original Signed by

Ms. JENNIFER L. KEYES
Member, Canadian Section

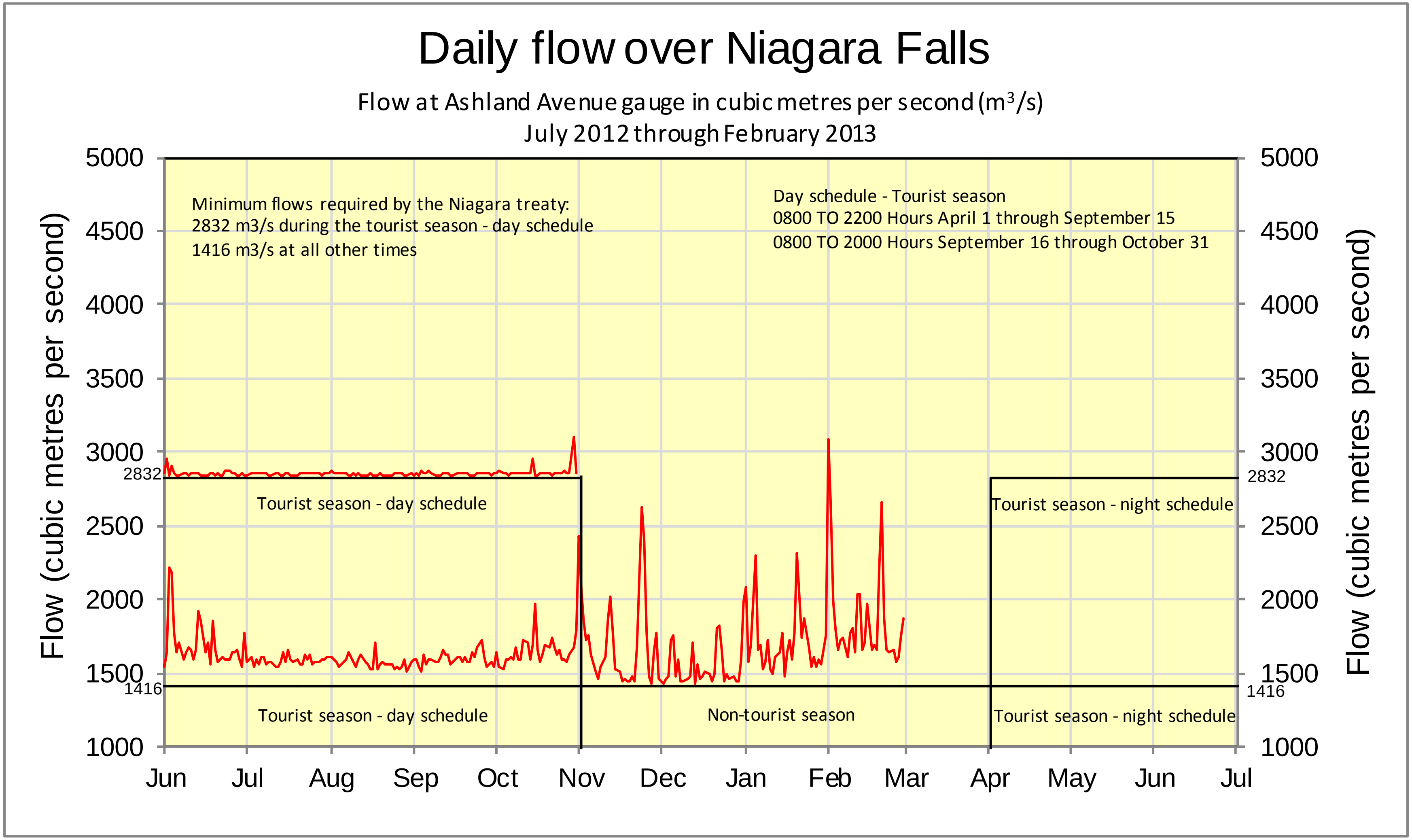

Sir Adam Beck Plants
and Reservoir
Robert Moses Plant
and Reservoir
Location of Cableway Section
N
Ashland Avenue
NIAGARA FALLS,
ONTARIO
NIAGARA FALLS,
NEW YORK
American Falls
NYPA Intakes
NYPA Intakes
LaSalle
Maid-of-the-Mist Pool
International Niagara
Control Works
Beck Intakes
Material Dock
North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

ENCLOSURE 1

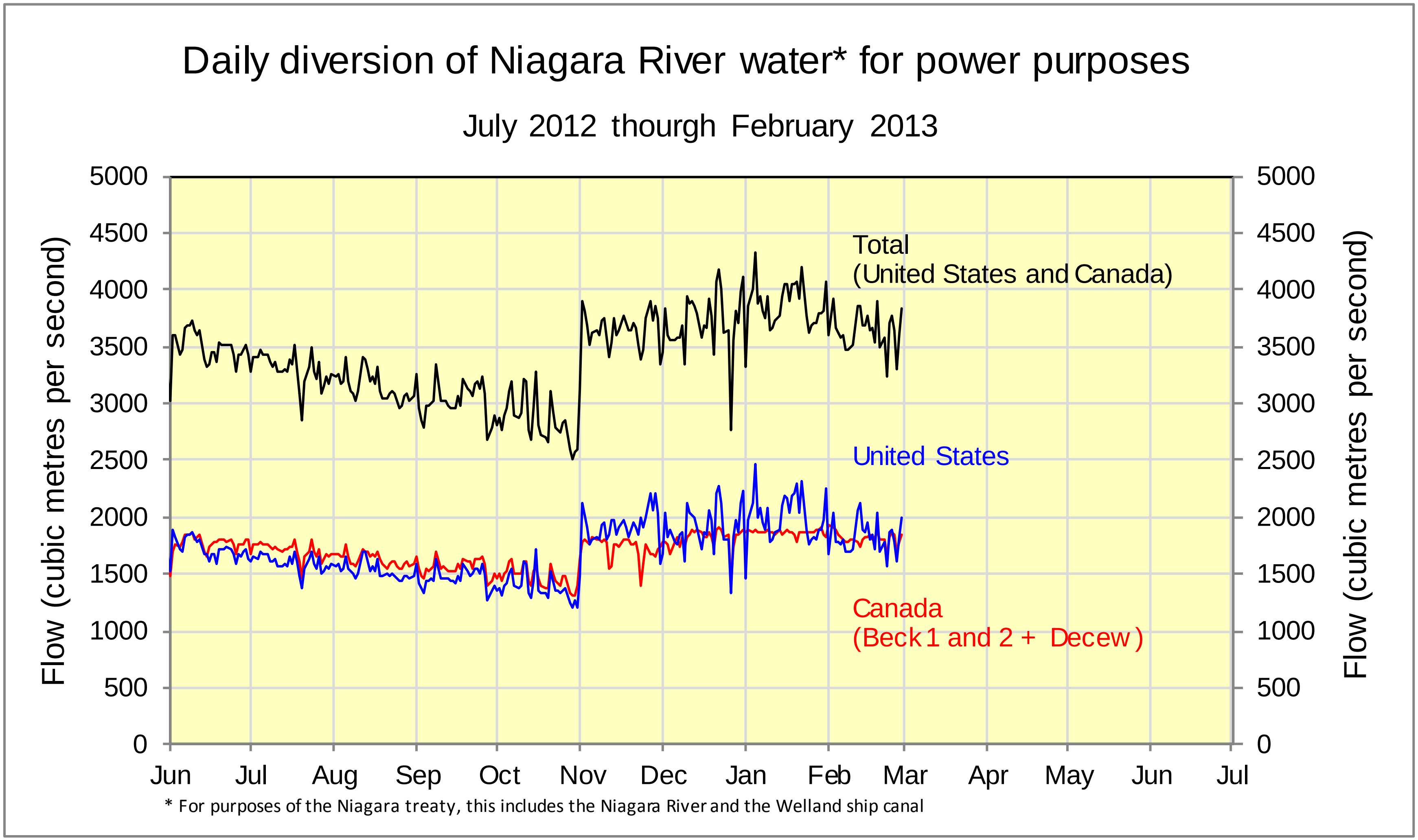


Niagara River daily mean level at Material Dock gauge
July 2012 through February 2013
Elevation in metres, IGLD (1985)
172.00
171.75
171.50
171.25
171.16
171.00
170.75
170.50
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Note: Long-term mean stage = 171.16 Metres, IGLD (1985)

ENCLOSURE 2


Daily flow over Niagara Falls
Flow at Ashland Avenue gauge in cubic metres per second (m^3/s)
July 2012 through February 2013
Minimum flows required by the Niagara treaty:
2832 m3/s during the tourist season - day schedule
1416 m3/s at all other times
Day schedule - Tourist season
0800 TO 2200 Hours April 1 through September 15
0800 TO 2000 Hours September 16 through October 31
Tourist season - day schedule
Tourist season - night schedule
Tourist season - day schedule
Non-tourist season
Tourist season - night schedule
2832
1416
5000
4500
4000
3500
3000
2500
2000
1500
1000
Flow (cubic metres per second)
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul

ENCLOSURE 3


Daily diversion of Niagara River water* for power purposes
July 2012 thourgh February 2013
Flow (cubic metres per second)
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
Total
(United States and Canada)
United States
Canada
(Beck 1 and 2 + Decew)
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
* For purposes of the Niagara treaty, this includes the Niagara River and the Welland ship canal

ENCLOSURE 4