*An Assessment of the Effects of the*

# Ontario Hydro Redevelopment Project

*A report by the International Joint Commission*

International Joint Commission
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# An Assessment of the Effects of the Ontario Hydro Redevelopment Project: A Report by the International Joint Commission

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## Executive Summary

On December 21, 1998, the Governments of Canada and the United States asked the International Joint Commission to review available information regarding the proposed redevelopment and expansion of Ontario Hydro's[1] water diversion facilities in the Niagara River, consider all effects that Ontario Hydro's proposed project may have on the functioning of the remedial works, and, where the Commission considers it helpful or necessary to its work, to consider other transboundary effects of the Project, including environmental effects. The Governments requested the Commission's response within four months.

The 1950 *Niagara River Diversion Treaty* provided, among other things, for minimum flows over the Niagara Falls; for the waters made available for power purposes by the Treaty to be divided equally between Canada and the United States, provided that either party may use any portion of the other party's share which the other party does not have the capacity to use; and for the completion of certain remedial works (including the Chippawa-Grass Island Pool control structure) necessary to enhance the beauty of the Niagara Falls. Pursuant to the 1950 Treaty, the Governments asked the International Joint Commission to make recommendations as to the nature and design of the remedial works and to supervise their construction. The Governments have requested the Commission to review various modifications to the Chippawa-Grass Island Pool control structure, including the current proposed redevelopment project.

The proposed redevelopment project would include water intake facilities at the Chippawa-Grass Island Pool control structure, two underground tunnels to divert water, a three-unit underground generating station, penstock tunnels, a tailrace discharging to the lower Niagara River, new transmission facilities, and underground cables. The project will be completed in phases: first, the construction of one diversion tunnel, and second, the construction of the second tunnel and underground powerhouse. The tunnels would be excavated by a tunnel boring machine, which would start at the downstream outlet and surface at the Chippawa-Grass Island Pool control structure. The first phase of construction is proposed to

[1]Ontario Power Generation Inc. has now replaced Ontario Hydro as the proponent of the project.

begin in July 1999 and be completed in the summer of 2003. Scheduling for the second phase of construction is less defined but would take place over a period of about six and half years. Any new information that may become available before construction of the second phase of the project, including monitoring data from the first phase, should be considered in undertaking the recommended review of the second phase.

The International Joint Commission asked its International Niagara Board of Control to assist it in reviewing the proposed redevelopment project and responding to the Governments. The Board of Control provided a written report to the Commission on January 21, 1999, assessing the full project (two tunnels and a new generating station). The report assessed hydraulic and environmental considerations and provided conclusions. The hydraulic assessment considered both physical and computer models and included consideration of compliance of the operation of the Chippawa-Grass Island Pool control structure with the Board's 1993 Directive and the 1950 *Niagara River Diversion Treaty*; ice entrainment, cofferdam construction, and effects on the Niagara River and Lake Erie. The environmental assessment considered work that has been done for environmental assessment processes and agency approvals. The Board considered the potential cumulative impact on the Niagara River and Lake Erie of the proposed redevelopment project with the Buffalo and Fort Erie Public Bridge Authority's proposed twinning of the Peace Bridge over the Niagara River. The Board also obtained comments on the proposed redevelopment project from the U.S. Environmental Protection Agency and the U.S. Fish and Wildlife Service and provided these comments to the Commission.

The Board, the U.S. Environmental Protection Agency and the U.S. Fish and Wildlife Service did not identify any reasons why the project as a whole should not proceed.

The Commission held two public hearings in Niagara Falls, Ontario, and Amherst, New York, to provide convenient opportunity for all those interested in the proposed project to present their views. The Commission also accepted written submissions prior to and following the hearings.

While the proposed redevelopment project (two tunnels and a new generating station) may change the pattern of daily fluctuations of the Chippawa-Grass Island Pool, the levels in the Chippawa-Grass Island Pool would be maintained within the levels prescribed in the International Niagara Board of Control Directive of 1993

both during and after construction. Water levels upstream in the Niagara River and Lake Erie would be unaffected. Minimum flows over the Niagara Falls, as required by the 1950 *Niagara River Diversion Treaty*, would be maintained. After construction of the proposed additional generating station, under certain high river flow conditions there would be an instantaneous increase in water levels in the Niagara River at the proposed tailrace outlet of up to 21 centimetres (0.7 foot). This change would be negligible within approximately 100 metres (328 feet) downstream of the Queenston plant site. Based on available information, no significant transboundary impacts were identified regarding sediment suspension, water quality, groundwater movement or contamination, blasting, or air emissions.

The Commission concluded that the construction and subsequent operation of the full proposed project (two tunnels and an additional generating station) would not hinder operation of the Chippawa-Grass Island Pool control structure in accordance with the 1993 Directive. The Commission also considered potential transboundary effects overall. Based on the information provided, and with the understanding that Canadian domestic agencies will be reviewing project specifics as the design progresses, the Commission concluded that there is no reason for Ontario Hydro not to proceed with construction and operation of the first tunnel. The Commission reached no conclusion with respect to the second tunnel and additional generating station, particularly in the absence of a construction schedule. While the information provided on the second tunnel raises no substantive transboundary issues, the uncertain schedule for its construction and the potential for further information to become available lead the Commission to recommend that Governments review the situation in the future prior to its intended construction. For the proposed generating station, the uncertain schedule for its construction and prudence regarding potential transboundary effects of the additional discharge location into the Niagara River lead the Commission to recommend that Governments review the situation in the future prior to its intended construction. Any new information that may become available before construction of the second phase of the project, including monitoring data from the first phase, should be considered in undertaking the recommended binational review of the second phase. The Commission considers that, in general, binational reviews are a good practice for any project with potential transboundary impacts.

The Commission notes that the domestic permits obtained contain significant conditions, and emphasizes to Governments the need for appropriate review of project specifics, with consideration given to their potential transboundary impacts,

as further consideration of the proposed redevelopment project progresses. The Commission notes that many of the environmental studies were completed many years ago, that many years may elapse before the second phase of construction might be undertaken, and thus suggests that further review of environmental effects should be carried out immediately prior to proposed construction of a second tunnel and additional generating station. The Commission notes concerns raised regarding the current operation of the Chippawa-Grass Island Pool control structure and discussions to address these concerns; it supports information sharing and consideration at the local level of alternatives addressing diverse objectives and suggests to Governments that it may be appropriate, depending on the outcome of the discussions, for the Commission and its International Niagara Board of Control to review the 1993 Directive to determine whether any changes are warranted. The Commission notes concerns raised during the public hearings regarding potential scouring and effects on fish of the discharge from the proposed additional generating station and suggests to Governments that mitigation might be required to offset these potential effects. The Commission also considers that appropriate monitoring is required to determine that effects during and after construction are as anticipated when the project was planned, and suggests to Governments that independent monitoring should occur.

The Commission recommends the following to Governments:

1. Construction. Governments should not interpose any objections regarding construction of the first tunnel. The Commission identified no significant transboundary effects or effects on the operation of the Chippawa Grass Island Pool for this tunnel.

2. Further Reviews. Governments should ensure that as the further Canadian reviews of project specifics proceed, including those addressing current permit conditions, potential transboundary impacts are considered. Governments should also require further binational review of potential transboundary impacts immediately prior to proposed construction of later phases of the proposed redevelopment project (i.e., the second tunnel and additional generating station), including effects resulting from the flow vector of the discharge from the proposed generating station, in order to take into account new information or address new issues that may arise during that interval. This binational review could be conducted either under the direction of the Commission or Governments themselves.

3. Monitoring. Governments should ensure appropriate monitoring by Ontario Hydro of the effects of the project on water levels, flows, and the environment. The Commission and its International Niagara Board of Control are willing to assist governments in the monitoring of water levels and flows. For this purpose, it would suggest the Governments require, or authorize the Commission to require, that Ontario Hydro continue to maintain the Material Dock and Slater's Point gages; that following consultation with Canadian agencies it install and maintain a permanent gage below the proposed generating station tailrace at least one year in advance of construction associated with the tailrace; and that it make data from these gages available to agencies in both countries in a format that facilitates real-time access, ready distribution, quality control, and archiving by those agencies. Monitoring for potential transboundary effects should be overseen by an entity independent from Ontario Hydro.

4. Mitigation. Should any adverse transboundary effects occur during or after construction, Governments should ensure that Ontario Hydro undertake timely and appropriate mitigation measures.

## I. Introduction

As requested by the Governments of Canada and the United States, the International Joint Commission has reviewed available information regarding the proposed redevelopment and expansion of Ontario Hydro's[2] water diversion facilities in the Niagara River.

The Commission concluded that the construction and subsequent operation of the full proposed project (two tunnels and an additional generating station) would not hinder operation of the Chippawa-Grass Island Pool Control Structure in accorandance with the 1993 Directive. Regarding potential transboundary effects overall, the Commission noted the project entails two phases of construction: the first tunnel; and the second tunnel and additional generating station. Based on the information provided, and with the understanding that Canadian domestic agencies will be reviewing project specifics as its design progresses, the Commission concluded that there is no reason for Ontario Hydro not to proceed with construction and operation of the first tunnel. The Commission has reached no conclusion with respect to the second tunnel and additional generating station, particularly in the absence of a construction schedule. While the information provided on the second tunnel raises no substantive transboundary issues at this time, the uncertain schedule for its construction and the potential for further information to become available lead the Commission to recommend that Governments review the situation in the future prior to its intended construction. For the proposed generating station, the uncertain schedule for its construction and prudence regarding potential transboundary effects of the additional discharge location into the Niagara River lead the Commission to recommend that Governments review the situation in the future prior to its intended construction. Any new information that may become available before construction of the second phase of the project, including monitoring data from the first phase, should be considered in undertaking the recommended binational review of the second phase. The Commission considers that, in general, binational reviews are a good practice for any project with potential transboundary effects.

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[2]Ontario Power Generation Inc. has now replaced Ontario Hydro as the proponent of the project.

## II. Background

The *Boundary Waters Treaty* of 1909 makes provision for the International Joint Commission, in response to a "reference" by the U.S. and Canadian Governments, to undertake investigations of specific issues and make recommendations to the two governments. It also provides for the Commission, in response to an "application" submitted by a company through the U.S. and Canadian Governments, to issue Orders of Approval regarding the obstruction or diversion of waters that flow along, and in certain cases across, the boundary if such uses affect the natural water levels or flows on the other side. The International Joint Commission has been requested by the governments of Canada and the United States of America, pursuant to Article IX of the *Boundary Waters Treaty* of 1909, to examine and make recommendations with respect to an Ontario Hydro proposal to develop additional hydroelectric generating capacity on the Niagara River.

The international boundary between Canada and the United States passes along the Niagara River, which flows north for approximately 58 kilometres (36 miles) from Lake Erie to Lake Ontario. The river is the uncontrolled, natural outlet from Lake Erie. It drops a total of 99 metres (326 feet) over its course, dropping approximately 95 metres (310 feet) between the head of the Cascades, immediately upstream from the Niagara Falls, and the Lower Rapids, approximately 10.5 kilometres (6.5 miles) downstream, with a sheer drop of approximately 55 metres (180 feet) occurring at the Falls (see Figure 1). In addition to the flows over Niagara Falls, water from Lake Erie reaches Lake Ontario by way of diversions from the Niagara River (for hydroelectric power production, with water taken from just above the Falls and returned to the lower Niagara River), the Welland Canal and the New York State Barge Canal (see Figure 2).

For over a century, Niagara Falls has been recognized as a tourist attraction. The river has also been considered an important source of energy for both countries. The first hydroelectric generating station was built on the Niagara River in 1881 and large-scale commercial production of electricity at Niagara Falls began in 1895, with the completion of the first of two Adams stations in Niagara Falls, New York. This was followed by the second Adams plant and the Schoellkopf plant in the United States. At about the same time, three generating stations were built in Canada using the head available in the vicinity of the Falls. Subsequently, the Queenston-Chippawa Power Development (later known as the Sir Adam Beck

Figure 1

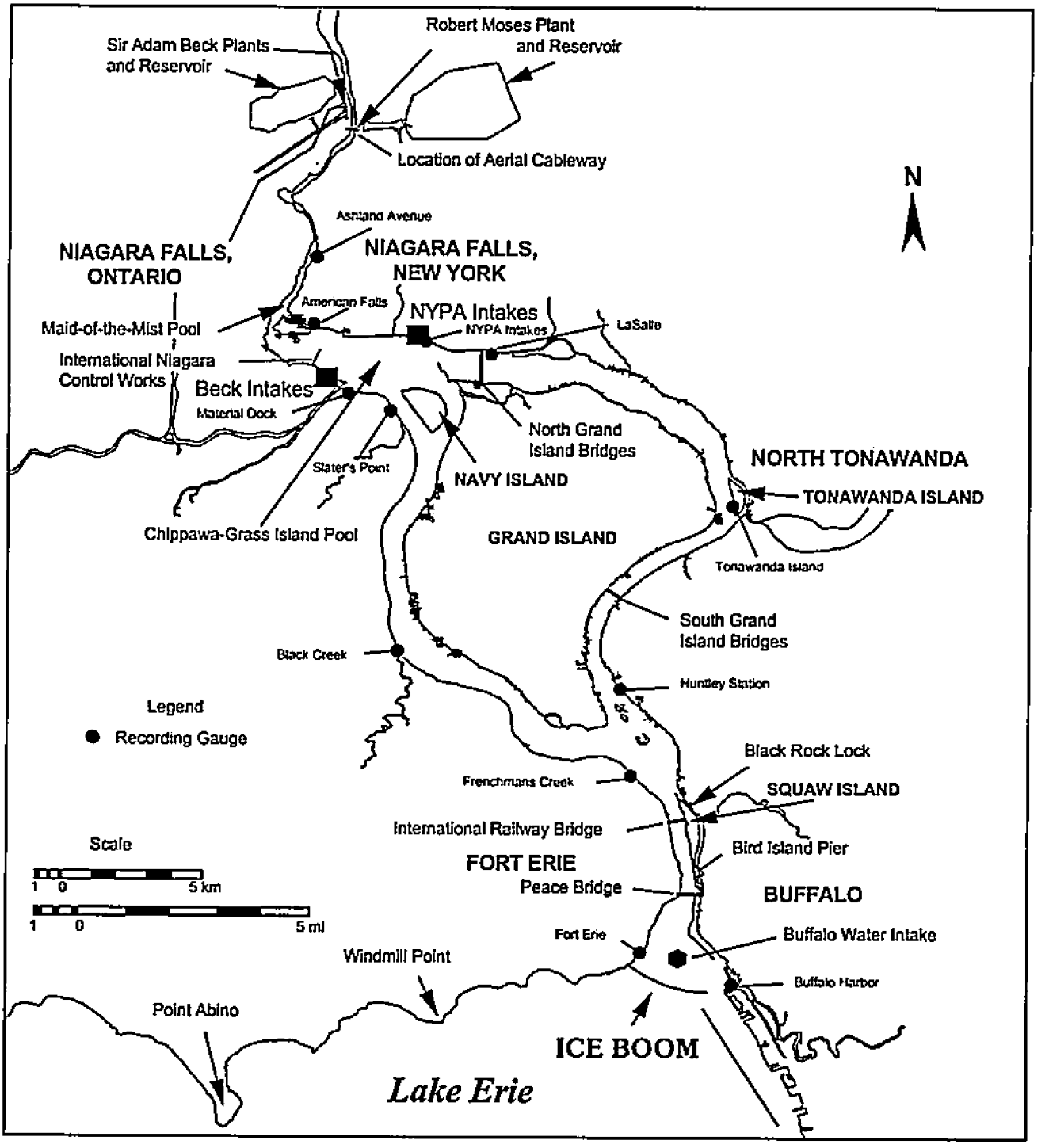
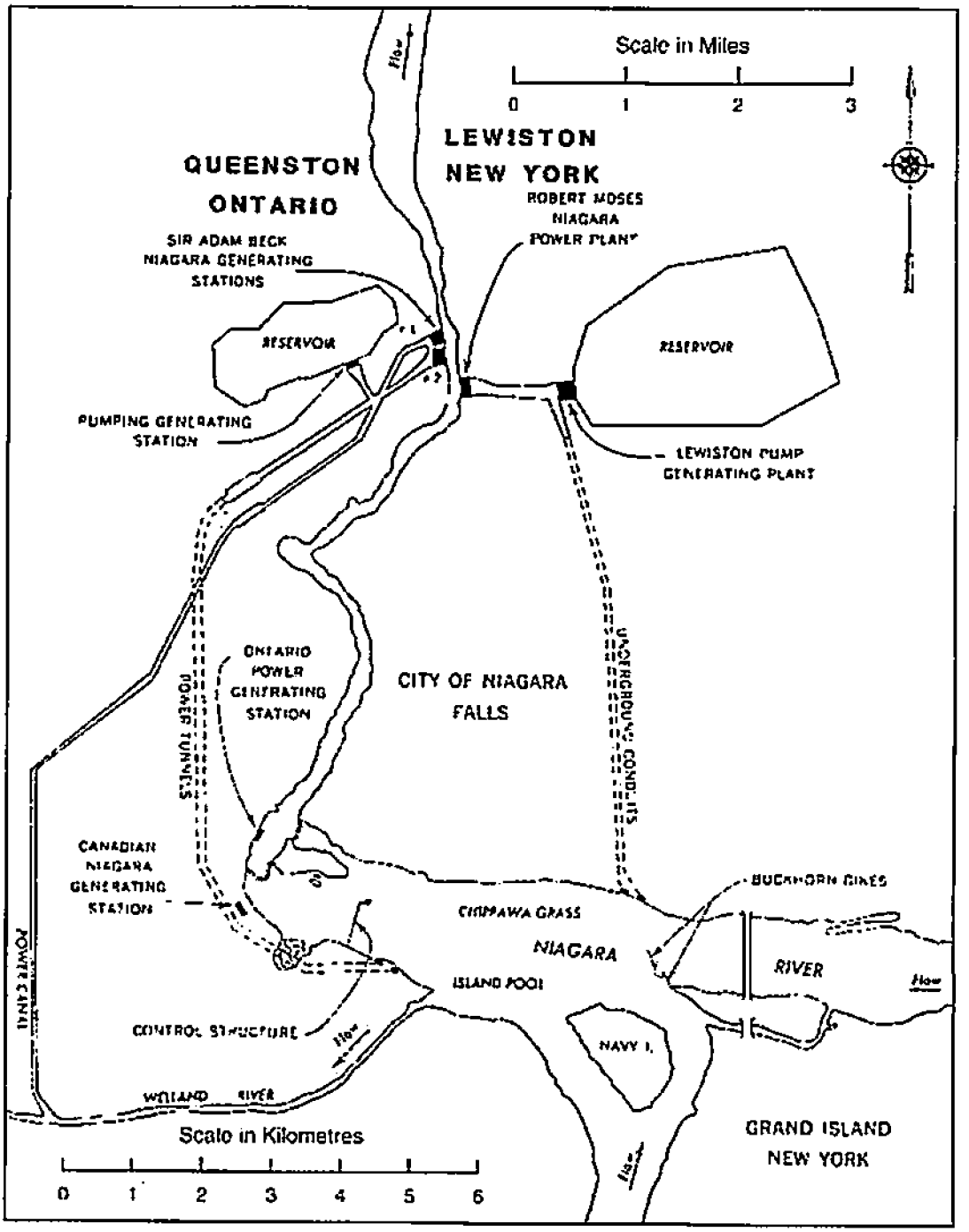

Robert Moses Plant
and Reservoir
Sir Adam Beck Plants
and Reservoir
Location of Aerial Cableway
N
Ashland Avenue
NIAGARA FALLS,
ONTARIO
NIAGARA FALLS,
NEW YORK
American Falls
NYPA Intakes
NYPA Intakes
LaSalle
Maid-of-the-Mist Pool
International Niagara
Control Works
Beck Intakes
Material Dock
North Grand
Island Bridges
NORTH TONAWANDA
Slater's Point
NAVY ISLAND
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
Scale
Bird Island Pier
FORT ERIE
1 0 5 km
Peace Bridge
BUFFALO
1 0 5 mi
Fort Erie
Buffalo Water Intake
Windmill Point
Buffalo Harbor
Point Abino
ICE BOOM
Lake Erie

Figure 2


Scale in Miles
0
1
2
3
Flow
LEWISTON
NEW YORK
QUEENSTON
ONTARIO
ROBERT MOSES
NIAGARA
POWER PLANT
SIR ADAM BECK
NIAGARA GENERATING
STATIONS
RESERVOIR
RESERVOIR
PUMPING GENERATING
STATION
LEWISTON PUMP
GENERATING PLANT
ONTARIO
POWER
GENERATING
STATION
CITY OF NIAGARA
FALLS
POWER TUNNELS
UNDERGROUND CONDUITS
CANADIAN
NIAGARA
GENERATING
STATION
BUCKHORN DIKES
CHIPPAWA GRASS
NIAGARA
RIVER
ISLAND POOL
POWER CANAL
CONTROL STRUCTURE
NAVY I.
WELLAND RIVER
Scale in Kilometres
0
1
2
3
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5
6
GRAND ISLAND
NEW YORK

Generating Station No. 1) was completed in 1923. It diverted water from the Grass Island Pool, near Chippawa, Ontario, through a more than 20 kilometre (12 mile) long open-cut canal, to the crest of the Niagara Gorge near Queenston, Ontario.

Article V of the *Boundary Waters Treaty* contains provisions concerning the Niagara River. Canada and the United States, among other things, agreed that,

> " ... it is expedient to limit the diversion of waters from the Niagara River so that the level of Lake Erie and the flow of the stream shall not be appreciably affected."

Some of the other provisions of Article V have subsequently been amended by the 1950 *Niagra River Diversion Treaty.*

The 1950 *Niagara River Diversion Treaty* provides, among other things, that:

- Canada and the United States agree to complete certain remedial works which are necessary to enhance the beauty of the Falls by distributing the water to produce an unbroken crestline on the Falls, and to ask the International Joint Commission to make recommendations as to the nature and design and to supervise construction of the remedial works;

- Certain prescribed amounts of water shall be available for scenic and power purposes and the waters made available for power purposes by the provisions of the 1950 treaty shall be divided equally between Canada and the United States, provided, however, that until such time as there are facilities in the territory of one party to use its full share of the diversions of water for power purposes, the other party may use the portion of that share for the use of which facilities are not available; and

- Waters which are being diverted into the natural drainage of the Great Lakes System through the existing Long Lac-Ogoki works shall continue to be governed by the notes exchanged between the

> Government of the United States of America and the Government of Canada at Washington on October 14 and 31 and November 7, 1940, and shall not be included in the waters allocated under the provisions of this Treaty.

The 1950 *Niagara River Diversion Treaty* also provides in Article IX that "Neither party shall be responsible for physical injury or damage to persons or property in the territory of the other which may be caused by any act authorized or provided for by the Treaty."

In 1953, the Commission recommended, among other things, construction of the remedial works envisaged in the 1950 *Niagara River Diversion Treaty*, including the Chippawa-Grass Island Pool control structure (also known as the International Niagara Control Works). The Chippawa-Grass Island Pool control structure is located in the Niagara River immediately upstream from the Falls and assists in apportioning flows between the Falls and power generation in accordance with the 1950 *Niagara River Diversion Treaty*. The Commission also recommended that the governments authorize it to establish a control board to supervise the operation of the proposed control structure to ensure it accomplishes what it is intended to do and to ensure that the levels of the Niagara River and Lake Erie will not be adversely affected. The governments approved these recommendations, the control structure was built and the Commission established the International Niagara Board of Control to supervise its operation.

In 1956, the Schoellkopf power plant, located on the United States side of the river near the crest of the Falls, was partially destroyed in a landslide and the Power Authority of the State of New York (now the New York Power Authority) constructed new power generating facilities, the Niagara Power Project, that began to produce power in 1961. The New York Power Authority's Niagara Power Project, the biggest electricity producer in New York State, is located about 7.2 kilometres (4.5 miles) downstream from the Falls and consists of two main facilities, the Robert Moses Niagara Power Plant and the Lewiston Pump-Generating Plant. These facilities use water withdrawn upstream from the Falls and conveyed through conduits under the City of Niagara Falls, New York to Lewiston. The Robert Moses Niagara Power Plant and the Lewiston Pump-Generating Plant are capable of using all the water that the United States is entitled to for power purposes under the 1950 *Niagara River Diversion Treaty* under most flow conditions.

In the period since the conclusion of the 1950 *Niagara River Diversion Treaty*, the Hydro-Electric Power Commission of Ontario (later to become Ontario Hydro whose generating facilities have now been transferred to Ontario Power Generation Inc.) completed the Sir Adam Beck Generating Station No. 2. The Sir Adam Beck Generating Station No. 2 and the New York Power Authority's Niagara Power Project were both built without governments sending a reference to the Commission. Changes in withdrawals of water caused by the New York Power Authority's Niagara Power Project, however, led to a change in flow pattern in the Niagara River that was different from that contemplated when the remedial works (the Chippawa-Grass Island Pool control structure) were originally designed, approved and built. In 1961, the governments requested the Commission to report on the measures or works necessary to permit compliance with the objectives of the Commission's 1953 report, when full use is being made of the waters available for power purposes under the 1950 *Niagara River Diversion Treaty*. (The Commission was also requested to report whether flows over the Falls could be less than those specified in the 1950 *Niagara River Diversion Treaty* without being detrimental to the scenic beauty of the Falls, but this request was withdrawn the following year.)

The Commission submitted an interim report to the governments on June 23, 1961, in which it recommended extension of the existing Chippawa-Grass Island Pool control structure by adding five sluices, construction of a training wall and removal of the top of a submerged weir. The Commission also recommended that the Chippawa-Grass Island Pool control structure continue to be operated under the supervision of the International Niagara Board of Control. Although the original Chippawa-Grass Island Pool control structure had been built without Commission approval, the Power Authority of the State of New York and the Hydro-Electric Power Commission of Ontario applied through the U.S. and Canadian governments and received Commission approval to construct the works that the Commission had recommended in its interim report of June 23, 1961. According to the Commission's Order of Approval of August 15, 1961, construction of the works was to be carried out under the general supervision of the Commission and the five additional sluices were to be operated under the control and supervision of the International Niagara Board of Control. Moreover, the Hydro-Electric Power Commission of Ontario and the Power Authority of the State of New York would be responsible for the disposition of claims for physical injury or damage to persons or property occurring in Canadian and United States territory, respectively, in connection with the construction, maintenance or operation of any of the approved works.

On April 8, 1963, the Power Authority of the State of New York applied to the Commission, with the support of the Hydro-Electric Power Commission of Ontario, through the Governments of Canada and the United States, for approval to reduce the elevation of a shoal in the Niagara River. The Commission issued an Order of approval for this work on May 17, 1963.

The Sir Adam Beck Generating Station No. 1 has recently had several units upgraded, with units at Sir Adam Beck Generating Station No. 2 presently being upgraded. The New York Power Authority has received a conditional licence from the United States Federal Energy Regulatory Commission to upgrade its Niagara Power Project. All of these upgrades were undertaken without the governments sending a reference to the Commission.

The terms for maintaining the long-term mean level in the Chippawa-Grass Island Pool, while facilitating minimum Treaty flows over the Falls and the power diversions, are defined by Directives issued by the International Niagara Board of Control. The latest Directive, issued in 1993, (see Appendix 1), establishes the operational long-term mean level of the Chippawa-Grass Island Pool at 171.16 metres (561.58 feet) (International Great Lakes Datum, 1985), as recorded at the Material Dock gage[3]. In addition to other tolerances, the Directive specifies that the Chippawa-Grass Island Pool shall not exceed 171.77 metres (563.58 feet) or be less than 170.55 metres (559.57 feet).

[3]Official water level requirements are in metres; English units are provided for informational purposes only.

## III. The Proposed Ontario Hydro Redevelopment Project

The proposed Ontario Hydro Redevelopment Project (which is sometimes also referred to as the Ontario Hydro - Niagara River Hydroelectric Development or NRHD) is designed to divert water from the Chippawa-Grass Island Pool (upriver from Niagara Falls) to the Sir Adam Beck power complex. The project, when completed, would consist of two diversion tunnels, a powerhouse and associated transmission facilities.

The project was initiated in the late 1980's to address Ontario Hydro's existing lack of diversion capacity to use all the water available to it under the 1950 *Niagara River Diversion Treaty* or to operate the existing Sir Adam Beck generating stations at full capacity.

The proposed diversion facilities would include water intake facilities at the International Niagara Control Works (at the downstream end of the Chippawa-Grass Island Pool), two new tunnels, each approximately 10 kilometres (6.2 miles) in length under the City of Niagara Falls, Ontario and a short open canal connected to the existing canal system. Proposed generating facilities include a three-unit 1050 megawatt underground generating station, penstock tunnels under the Niagara Parkway, and a tailrace discharging to the lower Niagara River, just downstream (north) of Sir Adam Beck Generating Station No. 1. Proposed transmission facilities include a new 76 kilometre (47 mile) long double circuit 230 kilovolt transmission line, upgrading of existing 230 kilovolt transmission lines on the Niagara Peninsula, and underground cables between the new powerhouse and Sir Adam Beck switchyard.

With the proposed facilities, water would be diverted from the Chippawa-Grass Island Pool through two new submerged intakes located at the International Niagara Control Works. The water would pass through two concrete-lined tunnels to an enlarged portion of the Sir Adam Beck Generating Station No. 2 canal. The tunnel alignment would be similar to the existing tunnels under the City of Niagara Falls, Ontario, but at a greater depth.

From the canal, water would flow directly to the intakes of the existing Sir Adam Beck generating stations or would be pumped to the pumping generating station reservoir. The headworks for the new generating station would be located next to the Sir Adam Beck Generating Station No. 1 forebay and water would flow

from the headworks through the penstocks to an underground powerhouse at the base of the gorge. The discharge from the powerhouse would pass through tailrace tunnels to an outlet in the lower Niagara River.

The new power station would be operated in a peaking mode. Water would be pumped into the reservoir, by the pumping generating station, during the nighttime period when the requirement for a scenic flow over the Falls is reduced to a minimum of 1416 cubic metres per second (50,000 cubic feet per second). During the peak daytime demand period, the new station would generate power by utilizing the water stored in the reservoir (i.e., by drawing down the reservoir level) to supplement water from the tunnels and the open-cut canal. This is similar to what takes place at the New York Power Authority's Niagara Power Project and Ontario Hydro's Sir Adam Beck Complex.

The new diversion tunnels would be excavated by a tunnel boring machine, starting at the outlet near the pumping generating station reservoir and surfacing at the International Niagara Control Works. The tunnels would pass below the City of Niagara Falls, Ontario and the buried St Davids Gorge at depths of 150 to 200 metres (492 to 656 feet) below ground level. The tunnels would have an internal diameter of 12.4 metres (40.7 feet) and would be lined with 0.45 metre (1.48 feet) of concrete. Material excavated from the tunnel would be removed from the outlet end and stockpiled on Ontario Hydro property. Emergency closure gates for the tunnels would be located at the tunnel outlets near the pumping generating station. The submerged tunnel entrances would not be visible at the International Niagara Control Works.

Ontario Hydro proposes to implement its Niagara River Hydroelectric Development in stages.

The first stage of the development would include one intake structure, one tunnel capable of diverting 500 cubic metres per second (17,655 cubic feet per second), a dewatering station, an outlet structure and canal. The intake to the tunnel would consist of a submerged bell-mouth located below gate 4 of the existing International Niagara Control Works structure and would be fed by a shallow 200 metre (656 foot) approach channel. The intake structure would include a concrete portal structure into which sectional gates could be installed to close the tunnel if dewatering is required. This structure would be constructed behind a cellular cofferdam. Excavation would be carried out sequentially down to the crown of the

tunnel where an extensive grouting program would be required to seal the permeable formations prior to the excavation of the tunnel. The intake configuration would also require the demolition of the existing ice accelerating wall and construction of a new wall, aligned one bay further to the east. Construction of the approach channel and work on the accelerating wall would require working in the wet.

Ontario Hydro anticipates that in-water work at the intake area would commence late in the summer of 1999 with underwater drilling and blasting of the intake channel and extension of some of the International Niagara Control Works piers. The cofferdam for the intake would be completed early in 2000, at which time excavation would proceed, working all year round until the middle of 2002. It is expected that the tunnel boring machine would surface at the intake late in 2002. At that time, the old accelerating wall would be demolished and the new one constructed, to be operational by the summer of 2003. The construction would be designed and phased so as not to interfere with the ice flushing capabilities and the operational requirements of the International Niagara Control Works.

The subsequent stages would, as stated above, include construction of a second tunnel, a three-unit 1050 megawatt underground generating station, penstock tunnels under the Niagara Parkway, a tailrace discharging to the lower Niagara River, and new transmission facilities. Documents provided by Ontario Hydro address the entire project.

## IV. The Reference

On December 21, 1998, the Governments of Canada and the United States wrote to the International Joint Commission that they had agreed to request the Commission, pursuant to Article IX of the *Boundary Waters Treaty* of 1909, to examine and report upon matters concerning the proposed redevelopment and expansion of Ontario Hydro's water diversion facilities in the Niagara River. (A copy of the letters that were sent to the Commission by the Governments are attached as Appendix 2.)

The Governments' letters of December 21, 1998 stated that they agreed that the 1950 *Niagara River Diversion Treaty* is a special agreement within the meaning of Article XIII of the *Boundary Waters Treaty* and that, therefore, the approval of the International Joint Commission, under Article III of the *Boundary Waters Treaty,* is not necessary . Moreover, the Governments stated that they agreed that certain Orders of Approval made by the Commission in the context of the Report and Recommendations under Article II of the *Niagara River Diversion Treaty* for remedial works in the Niagara River would be treated as recommendations under Article IX of the *Boundary Waters Treaty.* The Governments formally approved those recommendations, requested the Commission to continue carrying out its existing responsibilities with respect to the remedial works, and said that they had agreed that future questions put to the Commission with respect to those remedial works would be referred pursuant to Article IX of the *Boundary Waters Treaty.*

The Governments' letters of December 21, 1998 went on to say that, accordingly, in view of Ontario Hydro's latest plans to redevelop and expand its generating facilities in the Niagara River, the Governments had decided to refer the Ontario Hydro project to the Commission for recommendations under Article IX of the *Boundary Waters Treaty.* In the conduct of its work, the Commission was requested to consider all effects that Ontario Hydro's proposed project might have on the functioning of the remedial works, and the Commission was told that, where it considered it helpful or necessary to its work, the Commission should also consider other transboundary effects of the project, including environmental effects. The Commission was asked to provide its recommendations to the Governments in four months.

## V. The Board's Investigation

The Commission requested the assistance of its International Niagara Board of Control in reviewing the reference regarding the expansion of Ontario Hydro's diversion facilities in the Niagara River. Specifically, the Commission requested that the Board provide advice on the following matters:

- Will the proposed redevelopment conform with the objectives recommended by the Commission in its 1953 report on the preservation and enhancement of Niagara Falls and subsequently adopted by the U.S. and Canadian Governments? Will any changes to the structure or operation of the remedial works be required either during or after construction to conform with these objectives? Are any mitigation measures warranted?

- Will the project affect water quality in the Niagara River either during or after construction? If so, should mitigation measures be considered?

- Will the project affect fish habitat either during or after construction? If so, how will fish populations likely be affected and what, if any, mitigation measures should be pursued?

- Are there any other matters the Commission should take into account in responding to the reference?

The Board was also requested to consult with Ontario Hydro and the Buffalo and Fort Erie Public Bridge Authority, the applicant for proposed twinning of the Peace Bridge over the Niagara River, to obtain the information necessary to determine the potential cumulative effect of the two projects.

The International Niagara Board of Control provided a written report to the Commission on January 21, 1999. The Commission immediately made the report available to the public on its website, prior to public hearings held later that month. The Board's report assessed hydraulic and environmental considerations and provided conclusions.

Hydraulic Assessment

The International Niagara Board of Control considered both physical and computer models. The Board reviewed physical model studies performed by

Ontario Hydro at its Flow Systems Laboratory in Toronto with consultation from Acres Bechtel Canada. The key to this evaluation was to assure that the location of the new tunnel intakes would not have a negative impact on the existing intakes operated by Ontario Hydro or New York Power Authority, or on the operation of the International Niagara Control Works. The physical model considered two tunnels, located at Gates 1 and 4 of the control structure, with a total diversion flow of 1000 cubic metres per second (35,310 cubic feet per second). Associated works included two excavated channels within the ice accelerating channel (one for each intake), a realigned and shorter accelerating wall, and a vertical wall along the shoreline. The model was operated and measurements and observations were recorded for both open-water and ice-affected flow conditions. In the open-water case, only slow circulations without any surface dimples were observed over the intakes. Under the normal ice-affected flow case, no ice entrainment into the intakes was observed. In the case of heavy ice runs having a 100% surface ice concentration, diversion flows had to be reduced and the Chippawa-Grass Island Pool level raised to prevent ice entrainment into the intakes. Similar actions are required for the existing submerged intakes for the Sir Adam Beck Generating Stations and the New York Power Authority's Niagara Power Project, and have been already incorporated into Ontario Hydro's and the New York Power Authority's ice management procedures. The tests were carried out for the following water level requirements in the Chippawa-Grass Island Pool (IGLD 1985):

| | | |
|---|---|---|
| Absolute minimum: | 170.55 metres | (559.57 feet)[4] |
| Normal minimum: | 170.71 metres | (560.10 feet) |
| Leakage level[5]: | 171.01 metres | (561.08 feet) |
| Normal mean: | 171.16 metres | (561.58 feet) |
| Normal maximum: | 171.62 metres | (563.09 feet) |

[4]Official water level requirements are in metres; English units are provided for informational purposes only.

[5]Defined as the level at which 1416 cubic metres per second (50,000 cubic feet per second) flows around the control structure

The physical modeling not only investigated tunnel configurations which would maintain the Chippawa-Grass Island Pool levels and minimum Falls flows as mandated by the 1993 Directive and the Niagara Treaty of 1950, respectively, but also considered the case when coffer dams would be required during construction.

The Board noted the following conclusions and recommendations from an Ontario Hydro report regarding the physical modeling, entitled "Diversion Intake Model Study," dated December 1993:

a. Performance of the intake configuration developed through this model study is satisfactory under open-water and ice conditions. Detailed design of the diversion intakes for the planned Niagara development should be based on the recommended configuration (I.13) as illustrated by Figures 11a and 11b (Figures 4 and 5 in the Diversion Intake Model Study report).

b. The cofferdam arrangement tested to facilitate construction of Intake 3 (the intake at Bay 1) performed satisfactorily under both open-water and ice conditions; therefore, it is recommended that this arrangement be adopted as the basis for the detailed design.

c. The vortex breakers over the intakes were instrumental in eliminating surface dimples under open-water conditions; however, to ensure optimal placement of the vortex breakers in the prototype, it is recommended that the final design includes provision for relocation of these elements.

d. The final design should incorporate removable hatches over the service gate openings to prevent vortex induced air and ice entrainment through these openings during normal operation.

e. The test results provide the basis for preliminary operational guidelines; however, model limitations, particularly with respect to ice simulation, dictate that experience operating the prototype will be necessary before finalization of these guidelines. Under severe ice conditions, diversion flow reduction and raising of the Chippawa-Grass Island Pool water level will likely be required. To assist the operators, it is recommended that instruments for monitoring ice thickness, concentration and entrainment should be incorporated into the final design.

The Board stated that the physical model allowed the assessment of the hydraulic impact within the established international guidelines and also facilitated a determination of operational factors necessary to deal with various ice conditions.

In addition to the physical model studies, the Board noted the results of various mathematical models which indicate that changes in operation of the Chippawa-Grass Island Pool have the potential to cause a very small impact on the water levels of Lake Erie. Extensive water level and flow measurement programs have been undertaken using both traditional methods, such as the moving-boat method, and non-traditional methods, such as an acoustic velocity meter (AVM). Results of these assessments vary from no measurable impact to up to a 2 to 5 centimetre (approximately one to two inches) lowering in Lake Erie's level but are generally inconclusive due to limitations in flow measurement accuracy and the dynamic nature of Lake Erie levels and Niagara River flows.

The Board determined that during construction and operation of Ontario Hydro's proposed new intakes, the requirements specified in the International Niagara Board of Control's 1993 Directive for operation of the Chippawa-Grass Island Pool will be maintained. Normally, about five of the 18 gates are used to meet the minimum 2832 cubic metres per second (100,000 cubic feet per second) tourist season Falls flow. Construction activities will make up to three gates unavailable for use, leaving a minimum of 15 gates available for water management. The Board therefore stated that the entire project will not alter the current hydraulic regime within the river and will not impact Lake Erie water levels.

Environmental Assessment and Approvals

The Board noted that the engineering concept development and geological investigations for the project took place between 1983 and 1989, followed by detailed environmental and socio-economic studies between 1989 and 1990. In late 1989, a Community Liaison Committee was formed to discuss issues, alternative development strategies and mitigation measures. Ontario Hydro filed a provincial environmental assessment on March 25, 1991, that was amended on June 3, 1993. An "Environmental Assessment Summary," dated July 1991, contains the findings and describes the parameters used to determine the intake and tunnel layout. Ontario Provincial Environmental Assessment Approval was granted on October 14, 1998. Although above-ground diversion structures/waterways were considered, tunneling was determined to have the least environmental impact. The material removed from the tunnels will be stored at the Sir Adam Beck Complex for future use. For

example, the Queenston shale could be used for manufacturing bricks.

The Board also noted that Canadian Federal Fisheries Act authorizations were received in January 1995, negating the possibility of the need for assessment of cumulative effects under the recently proclaimed Canadian Environmental Assessment Act.

Relative to international boundary waters during construction, the Board stated that no increase in sediment suspension is expected to occur in the river at the intake since the excavation will be through bedrock. Normal construction precautions to preclude introduction of material into the river will be undertaken to address water quality issues. The Board noted that the pattern of daily fluctuations of the Chippawa-Grass Island Pool and lower Welland River might be altered but will continue to be within the limits set by the International Niagara Board of Control's 1993 Directive. As specified in the Niagara Treaty of 1950, the scenic Falls flows will be maintained, as will an unbroken crestline. However, at the new tailrace outlet in the lower Niagara River, an instantaneous increase in water levels of up to 21 centimetres (approximately 8 inches) may occur during the day. This change will be negligible within about one hundred metres (approximately 325 feet) downstream of the Queenston plant site.

Board Conclusions

Based on its review of reports pertaining to the project, the International Niagara Board of Control concluded the following:

a. Since the level and flow requirements specified in the Niagara Treaty of 1950 and the International Niagara Board of Control's 1993 Directive for operation of the Chippawa-Grass Island Pool will be maintained during construction and operation of the new intakes, the hydraulic regime within the river will be maintained with no impact on Lake Erie water levels. This conclusion re-states findings by the International Niagara Board of Control in a report dated February 14, 1991, which assessed the potential impact within the upper, middle and lower reaches of the river during and after construction.

b. Since the project is underground, and excavation for and construction of the intakes is through bedrock, the environmental impacts on the Niagara River are expected to be minimal.

c. Since the entire project is being performed in Canada and within Canadian waters, the United States has no jurisdiction from an environmental permit standpoint, unless there is an impact on water levels and/or water quality across the international boundary.

The Board also addressed a question posed by the Commission regarding potential impacts of discharges to the Niagara River immediately downstream of Ontario Hydro's proposed additional generating station. The Board stated that it had no additional information to address this issue, and that to do so would likely require a significant expenditure of funds. However, the Board concluded, based upon information available to the Board and the judgement of engineers associated with the Board, that there appears to be little likelihood of significant adverse impacts. The Board suggested that this may be an issue to be addressed further prior to construction of the powerhouse.

In summary, the Board did not identify any reasons why the project as a whole should not proceed.

U.S. Agency Consultations

The International Niagara Board of Control provided to the U.S. Fish and Wildlife Service and the U.S. Environmental Protection Agency for comment copies of the Environmental Assessment prepared for the entirety of the Niagara River Hydroelectric Project, the Ontario Ministry of the Environment's *Notice of Approval to Proceed with the Undertaking*, and the Canadian Department of Fisheries and Oceans' *Authorization for the Destruction of Fish by any Means other than Fishing.*

The U.S. Fish and Wildlife Service noted that, after reviewing the proposed project, the main concern coming from its Lower Great Lakes Fishery Resources Office is the effect this project will have on aquatic habitat. It noted that the summary indicated that there would be minimal or no change in water levels and an insignificant change in the flow regime. It cited an ongoing project identifying sighting of Lake Sturgeon, a threatened species in New York State, within the Upper and Lower Niagara River. The U.S. Fish and Wildlife Service's area of concern for the proposed project is the Middle Reach of the Niagara River, mainly downstream of the Whirlpool. It stated that little is known about the habitat preferences or spawning areas located within the Lower/Middle Niagara River Reach and current efforts have begun to identify areas of numerous sightings. The U.S. Fish and Wildlife Service concluded that as long as current regulations and continued

monitoring exists with little disruption in the aquatic habitat, there should be no objection to the current plan.

The U.S. Environmental Protection Agency cited the project sponsors' extensive outreach effort with the local community and interested parties during the development of the project, and noted that as a result many of the potential social and environmental impacts associated with the proposed project have been addressed early on in the process. The U.S. Environmental Protection Agency noted that locating the new tunnels below ground minimized the disturbance and impacts to the local environment; that placing new transmission lines, to the extent practicable, in existing rights-of-way minimized their impacts; that major tourist amenities in the area would not be affected by the project; and that the scenic flow requirements of the 1950 *Niagara River Diversion Treaty* between the United States and Canada would continue to be met. As such, the U.S. Environmental Protection Agency stated that it believes the proposed project would not have significant adverse environmental impacts.

## VI. Public Hearings

The Commission conducted two public hearings in Niagara Falls, Ontario, and Amherst, New York, to provide convenient opportunity for all those interested in the proposed redevelopment and expansion of Ontario Hydro's water diversion facilities in the Niagara River to present their views. The hearings also covered the possible effects of a proposed expansion of the Peace Bridge between Buffalo, New York, and Fort Erie, Ontario, and any possible cumulative effects of the two projects. Only those portions of the hearings related to the Ontario Hydro redevelopment are addressed in this report. The Commission also accepted written submissions prior to and subsequent to the hearings. Statements were made by private individuals, citizen groups and government officials. (The names of the individuals who spoke at the hearings, and the names of individuals who provided written submissions, are listed in Appendix 3.)

Verbatim transcripts of all hearings and copies of all written submissions are on file and available for examination at the offices of the Commission in Ottawa and Washington, D.C. The key points raised in the testimony and statements are summarized below.

Concern was raised regarding any man-made project that will affect Great Lakes water levels. Several suggestions were made, including the regulation of Lake Erie outflows, the removal of unpermitted fills in the Niagara River, increased outflows through the Black Rock Canal and the removal of underwater obstacles such as the old Buffalo water intake located just north of the Peace Bridge (which, although currently unused, is reserved for emergency use). One specific suggestion was that new projects in the river should be started only after mitigation for past projects obstructing the flows in the Niagara River have been carried out.

Concern was also raised with two aspects of the operation of the existing Ontario Hydro projects. First, it was felt that the operation of the Chippawa-Grass Island Pool was causing problems, particularly when water levels are kept too low during wildfowl nesting and fish spawning seasons. It was stated that the International Joint Commission should review the current procedures for the operation of the pool and establish a more restrictive "normal" range for water levels in the pool with allowances and reporting requirements for unusual deviations.

Second, concern was expressed about the operation of the current diversion

facilities in the Welland River. It was felt that an improved flow situation would provide significant benefits to the watershed as a whole. The proposed redevelopment provides an opportunity to discuss this situation with Ontario Hydro, and discussions are underway.

Concern was also expressed about possible adverse impacts of changed flows in certain locations in the lower Niagara River as a result of the new tunnel being proposed by Ontario Hydro. Specifically, the increased flow might scour the river bottom and disrupt spawning areas.

After considering the report by the International Niagara Board of Control and public comments, the Commission posed additional questions to Ontario Hydro for response. These questions addressed such issues as potential transboundary impacts of the project, the scope and timing of permits received and to be obtained, compensation issues, impacts to the Welland River, planned construction schedule and possible incremental impacts, follow-up to points raised during the hearings, and project monitoring.

## VII. Impacts of the Project

The Commission concerned itself primarily with potential transboundary impacts. It has left to Canadian institutions the questions associated with any effects that may be confined to Canada, although some of those effects may be briefly noted.

Water levels upstream of the proposed intake, in the Chippawa-Grass Island Pool, are maintained within levels prescribed in the International Niagara Board of Control Directive of 1993 (see Appendix 1). Based on statements by Ontario Hydro and the conclusions of the Commission's International Niagara Board of Control, which are based on physical modeling performed for the proposed project, while the pattern of daily fluctuations of the Chippawa-Grass Island Pool and lower Welland River might be altered following the addition of the two tunnels for the project, the levels in the Chippawa-Grass Island Pool would be maintained within the levels prescribed in the International Niagara Board of Control Directive of 1993. Similarly, during construction when cofferdams are installed in the river at the International Niagara Control Works, the levels in the Chippawa-Grass Island Pool would be maintained within the levels prescribed in the International Niagara Board of Control Directive of 1993. Water levels further upstream in the Niagara River and Lake Erie would be unaffected.

The minimum flows which must pass over the Falls would be maintained during and following construction of the project, and an unbroken crestline at the Falls would be maintained. Currently, one country is entitled to use the portion of the share of water allocated to the other country for power purposes but for which facilities are not available. Construction of the project would further enable Ontario Hydro to withdraw the portion of flows to which it is currently entitled under the 1950 *Niagara River Diversion Treaty*. Under certain higher flow conditions where the United States might currently divert a portion of Canada's share of water or where flows in excess of minimum would pass over the Falls, a greater portion of these flows would be diverted by Ontario Hydro after construction of the project. Flows diverted in the United States and Canada are returned to the Niagara River downstream of Niagara Falls.

After construction of one or both tunnels, but prior to construction of the proposed additional generating station, Ontario Hydro would return additional diverted flows through its current generating stations. Diverted water would flow

either directly to the existing stations or be stored in the Pumping Generating Station Reservoir for use during the peak hours of daily power demand. Fluctuations in the reservoir will increase; however, the reservoir is located wholly within Canada. During periods of above average river flows, there would be greater frequency of maximum discharge from the existing generating stations. Conversely, with Ontario Hydro making greater use of its share of water, there would be a lesser frequency of maximum discharge from the existing New York Power Authority generating stations on the U.S. shore under certain high flow scenarios. Total flow in the Niagara River downstream of the returned diversion would be changed only to the degree that diverted flows are stored in the Pumping Generating Station Reservoirs prior to release.

After construction of the proposed additional generating station, diverted flows would return to the river via either the existing generating stations or the new tailrace at the new generating station. The new generating station would be located downstream from the existing Sir Adam Beck No. 1 and No. 2 stations. This would provide an additional entry point for outflows. At the new tailrace outlet, under certain high river flow conditions, there would be an instantaneous increase in water levels of up to 21 centimetres (approximately 8 inches). This change will be negligible within approximately 100 metres downstream of the Queenston plant site. Again, total flow in the Niagara River downstream of the returned diversion would be changed only to the degree that diverted flows are stored in the Pumping Generating Station Reservoir prior to release.

The International Niagara Board of Control noted that no increase in sediment suspension is expected to occur in the Niagara River at the intake since the tunnel excavation will be through bedrock. Normal construction precautions to preclude introduction of material into the river will be undertaken to address water quality issues. Therefore, no sediment or water quality transboundary impacts are anticipated.

Ontario Hydro stated that groundwater issues were considered with respect to inhibiting groundwater movement into and from all excavations for both the tunnels and the powerhouse. Injection grouting will be utilized. Water bearing strata would be locally sealed at the excavations to ensure that there is not groundwater movement into or out of the structures. Hence, Ontario Hydro concluded that there would be no cross contamination between aquifers.

Blasting will occur during construction. Ontario Hydro stated that there will

be no blast effects to the United States side of the river, several hundred metres (several hundred yards) away as blast size will be restricted to maintain the integrity of the International Niagara Control Works structure and associated control building which, in places, are a few metres (a few yards) from the blast area. Blasting will likely affect fish in the river. Ontario Hydro has obtained authorization to destroy fish by any means other than fishing from the Canadian Department of Fisheries and Oceans; the authorization contains mitigation measures.

Ontario Hydro stated that air emissions will be associated with tunnel ventilation, from any concreting batch plant operations and equipment movement. Contract documents specify that dust collection systems must be installed on all appropriate equipment such that any emissions comply with the necessary Ontario Ministry of the Environment Certificates of Approvals. Dust suppressants would be used on roads and material storage piles. Emissions would be monitored and would be maintained below the Ontario Ministry of the Environment requirements. Operations would be halted if emissions exceed these limits. In this way, Ontario Hydro affirms that there would be no transportation of airborne particulate matter to the United States from the project.

## VIII. Considerations and Conclusions

As stated previously, the 1950 *Niagara River Diversion Treaty* provides, among other things, for the waters made available for power purposes by the treaty to be divided equally between Canada and the United States, provided that either party may use any portion of the other party's share which the other party does not have the capacity to use. In the 1960s, the Power Authority of the State of New York (now the New York Power Authority) constructed facilities, pursuant to the 1950 Treaty and without International Joint Commission review, that enabled it to fully use the United States' share under most flow conditions and, at times, part of the unused Canadian share. The Ontario Hydro proposal for redevelopment that is now under consideration would enable Ontario Hydro to more fully use Canada's share under the 1950 Treaty.

The Governments asked the Commission to consider all effects that Ontario Hydro's proposed Project may have on the functioning of the control works, and, where it considers it helpful or necessary to its work, to consider other transboundary effects of the project, including environmental effects. The Commission's response is based on the general information made available to it and its International Niagara Board of Control, but does not include assessment of specific details of the proposed project.

The construction and subsequent operation of the proposed project would not hinder operation of the Chippawa-Grass Island Pool control structure in accordance with the 1993 International Niagara Board of Control Directive governing its operations. The Commission also considered other potential transboundary effects to the extent that it might be helpful to the Governments and identified no concerns that would warrant reconsideration of the proposed project. However, the Commission brings the following concerns to Governments' attention.

1. Reviews and Approvals. Nearly twenty permits and approvals with respect to environmental protection are required in Canada for the proposed redevelopment project. The Provincial environmental assessment approval and the two federal *Fisheries Act* approvals are the only approvals Ontario Hydro has obtained for the whole undertaking, although Ontario Hydro has contacted Transport Canada and may also apply for s.5.2 *Navigable Waters Protection Act* approval for the whole undertaking. The Commission notes that the Ontario Environmental Assessment Act approval is itself conditional

on Ontario Hydro obtaining additional permits and approvals from authorities and bodies in Canada with respect to such matters as the management of excavated material, the management of contaminants, groundwater mapping and monitoring, the effects of flow changes, noise, and fisheries. Ontario Hydro has informed the Commission that remaining approvals are project specific and will be applied for by the contractor once one has been selected. The Commission wishes to emphasize the need for appropriate review of project specifics, with consideration given to potential transboundary impacts of these project specifics, as further consideration of the phased proposed redevelopment project progresses.

2. Age of Environmental Studies. Knowledge of environmental impacts continues to expand in both countries. Many of the environmental studies for the proposed project were performed nearly ten years ago. While the studies addressed the entire project, they did not address the phased approach currently being considered. The Commission believes that the reconvening of all the regulating agencies' reviewers in 1998 by the Ontario Ministry of the Environment to provide them with a project update and for them to reassess the Environmental Assessment document was an appropriate and sensible step. The interval since the studies took place, combined with the anticipated intervals until a second tunnel and additional generating station might be undertaken, suggest that further review of environmental effects should occur immediately prior to proposed construction of the second tunnel and additional generating station.

3. Current Fluctuations of the Chippawa-Grass Island Pool. Concerns were raised during the public hearings and comment period regarding current operations of the Chippawa-Grass Island Pool and the effects of fluctuating water levels on the environment, both in the Chippawa-Grass Island Pool and in the lower Welland River. While the operations are consistent with the 1993 International Niagara Board of Control Directive, adjustments to operations to meet further goals may be possible. The Commission notes that initial contacts have been made between Ontario Hydro, the Ministries of Environment and Natural Resources, the City of Welland, and the Niagara Peninsula Conservation Authority to discuss impacts on the Welland River. The Commission supports information sharing and consideration at the local level of alternatives addressing diverse objectives. Depending on the outcome of such discussions, it may be appropriate for the International Niagara Board

of Control and the Commission to review the 1993 Directive to determine whether any changes are warranted.

4. Discharge in the Lower Niagara River. Concerns were raised during the public hearings regarding potential scouring and effects on fish resulting from the flow vector of the discharge from the proposed generating station. The International Niagara Board of Control stated that while it had no additional information with which to address this issue, there appears to be little likelihood of significant adverse impacts. The Commission believes it would be prudent to give this issue further consideration prior to construction of the additional generating station. If adverse impacts are identified, mitigation may be required to offset their effects.

5. Monitoring. Appropriate monitoring is required to determine that effects during and after construction are as anticipated when the project was planned. In this way, any unanticipated effects can be determined, and any appropriate adjustments or mitigation measures can be developed. The Commission considers that monitoring for potential transboundary effects should be overseen by an entity independent from Ontario Hydro.

## IX. Recommendations

1. Construction. Governments should not interpose any objections regarding construction of the first tunnel. The Commission identified no significant transboundary effects or effects on the operation of the Chippawa Grass Island Pool for this tunnel.

2. Further Reviews. Governments should ensure that as the further Canadian reviews of project specifics proceed, including those addressing current permit conditions, potential transboundary impacts are considered. Governments should also require further binational review of potential transboundary impacts immediately prior to proposed construction of later phases of the proposed redevelopment project (i.e., the second tunnel and additional generating station), including effects resulting from the flow vector of the discharge from the proposed generating station, in order to take into account new information or address new issues that may arise during that interval. This binational review could be conducted either under the direction of the Commission or by the Governments themselves.

3. Monitoring. Governments should ensure appropriate monitoring by Ontario Hydro of the effects of the project on water levels, flows, and the environment. The Commission and its International Niagara Board of Control are willing to assist governments in the monitoring of water levels and flows. For this purpose, it would suggest the Governments require, or authorize the Commission to require, that Ontario Hydro continue to maintain the Material Dock and Slater's Point gages; that following consultation with Canadian agencies it install and maintain a permanent gage below the proposed generating station tailrace at least one year in advance of construction associated with the tailrace; and that it make data from these gages available to agencies in both countries in a format that facilitates real-time access, ready distribution, quality control, and archiving by those agencies. Monitoring for potential transboundary effects should be overseen by an entity independent from Ontario Hydro.

4. Mitigation. Should any adverse transboundary effects occur during or after construction, Governments should ensure that Ontario Hydro undertake timely and appropriate mitigation measures.

**Thomas L. Baldini**
United States Chairman

**Leonard Legault**
Canadian Chairman

**Susan B. Bayh**
Commissioner

**Francis Murphy**
Commissioner

**Alice Chamberlin**
Commissioner

**Robert Gourd**
Commissioner

# Appendix 1

## INTERNATIONAL NIAGARA BOARD OF CONTROL

## 1993 DIRECTIVE

Effective January 1, 1993

ALL ELEVATIONS ARE REFERRED TO INTERNATIONAL GREAT LAKES DATUM, 1985.

1. The Board hereby revokes the Directive of February 27, 1973.

2. The Power Entities, Ontario Hydro and the New York Power Authority, shall control water diversions from the Chippawa-Grass Island Pool (Pool) and operate the gates of the International Niagara Control Works to maintain a long-term mean level of the Pool at elevation 171.16 metres with a view to ameliorating adverse high or low water levels in the Pool. If, for any reason, the Material Dock Gauge is inoperative, the equivalent elevation at Slaters Point shall be controlling.

3. To provide latitude to facilitate control of the Falls flow and of diversions, and to meet the foregoing objective, the Board establishes the following tolerances for the elevations of the Chippawa-Grass Island Pool, which shall apply until revoked by the Board.

a. The continuous, arithmetically accumulated, monthly deviations from elevation 171.16 metres shall not exceed 0.91 metre-month.

b. The change in the monthly mean level from one month to the next shall not exceed 0.15 metre.

c. The maximum range of fluctuation in the Pool level during a calendar day shall not exceed 0.46 metre.

d. The Pool level shall not be raised above 171.61 metres nor lowered below 170.70 metres, except for abnormal flow* or ice conditions.

* Solely for the purpose of determining abnormal flow conditions, monitoring and reporting Niagara River flow at Fort Erie shall be to the nearest 10 cubic metres per second. Abnormal flow conditions are considered to exist when any four consecutive hourly mean Niagara River flows, as determined from levels at the Fort Erie gauge, are greater than 7650 cubic metres per second or less than 4250 cubic metres per second. Under ice conditions, this flow is the discharge indicated by the Fort Erie gauge rating corrected for ice effect.

e. During abnormal flow or ice conditions the following tolerances shall apply:

(i) Pool level shall not exceed 171.77 metres nor be less than 170.55 metres;

(ii) Normal operating procedures shall be resumed within 12 hours following the last abnormal flow period;

(iii) The local representatives of the Board shall be notified as soon as practicable after institution of procedures as outlined in paragraphs e(i) and e(ii) above;

(iv) Days in which abnormal conditions occur shall not be included in the computation of the monthly mean Pool level;

(v) When a period of abnormal flow overlaps calendar days, those days shall be excluded from the monthly calculation;

(vi) Whenever Board sanctioned tests or flow measurements are conducted, tolerances shall be suspended according to instructions from the Board; and,

(vii) On days when an emergency, life threatening situation has required a departure from normal operations of the control structure, those days shall not be included in the computation of the monthly mean Pool level.

4. The method of regulation outlined in paragraph 3 above may be suspended temporarily if, in the opinion of the River Control Officer, or of the Board's local representatives, there exists significant risk of severe property damage or loss of life. Under such circumstances the River Control Officer is expected to use his or her best judgement. Immediately following such an occurrence, the Power Entities shall report in writing to the Board explaining the action taken and the reasons therefor. In this way unusual occurrences will be documented for reporting purposes and placed on record so that they may be taken into account when revision of this Directive is under consideration.

5. Records shall be maintained in the River Control Officer's office and a report submitted to the Board's designated representatives, showing for each day:

a. The actual hourly and daily mean level of Lake Erie as recorded at the Fort Erie Gauge. In case of failure of the Fort Erie Gauge, the alternative shall be the Buffalo Harbor Gage, adjusted to the Fort Erie Gauge;

b. The actual hourly and daily mean level of the Chippawa-Grass Island Pool as recorded at the Material Dock Gauge, or at the alternate Gauge at Slaters Point adjusted to the Material Dock Gauge;

c. The computed natural daily mean level of the Pool at the Material Dock Gauge;

d. The computed hourly and daily mean discharge of the Niagara River at Fort Erie, corrected for ice effect when applicable;

e. The accumulated daily departure from the long-term mean elevation of the Pool, elevation 171.16 metres (IGLD 1985), as recorded at the Material Dock Gauge; and,

f. A detailed log of the operation of the gates.

6. Nothing in this directive shall be construed as obviating the 1950 Treaty requirements that no diversions shall be made for power purposes which will reduce the flow over Niagara Falls to less than amounts specified in Article IV of the Treaty. Minimum Falls flows in metric units, asagreed to by Governments in 1986, are 2832 cubic metres per second for the tourist hours and 1416 cubic metres per second for the non-tourist hours of operation. Recognizing that these minimums are expressed to the nearest cubic metre per second, it is appropriate that this degree of accuracy be used for all related flows for ascertaining, determining, and reporting to Governments on the amounts of water available for the purposes of the 1950 Niagara Treaty as well as the amount used for power purposes.

7. Local representatives referred to in foregoing paragraphs will be named from time to time by the International Niagara Board of Control. For the present, the representatives shall be Mr. Len J. Falkiner of Environment Canada, Burlington, Ontario and Mr. Andrew P. Piacente of the U.S. Army Corps of Engineers, Buffalo, New York. Alternates are Mr. Doug Cuthbert of Environment Canada, Burlington, Ontario and the District Commander, U.S. Army Corps of Engineers, Buffalo, New York.

# Appendix 2

## Text of the December 21, 1998, Reference from the U.S. Department of State and the Canadian Department of Foreign Affairs and International Trade

I have the honor to inform you that the Governments of Canada and the United States have agreed, pursuant to Article IX of the Boundary Waters Treaty of 1909, to request the Commission to examine into and report upon matters concerning the proposed redevelopment and expansion of Ontario Hydro's water diversion facilities in the Niagara River.

The Governments of Canada and the United States (the Governments) agree that the 1950 Niagara River Diversion Treaty is a special agreement within the meaning of Article XIII of the 1909 Boundary Waters Treaty and, therefore, that the approval of the IJC under Article III of the Boundary Waters Treaty for uses, obstructions, and diversions provided for under the Niagara River Diversion Treaty is not necessary.

Pursuant to Article II of the Niagara River Diversion Treaty, on October 10, 1950, the Governments requested the IJC to make recommendations as to the nature and design of certain remedial works in the Niagara River. The IJC made such recommendations on May 5, 1953, which included among the remedial works to be constructed a Chippawa-Grass Island pool control structure and two crestfills. Both governments approved these recommendations and construction of the works was duly completed in 1957.

Subsequently, the IJC issued Orders of Approval under Article III of the Boundary Waters Treaty, including an Order of August 15, 1961, an Order of May 17, 1963, and a Supplementary Order of June 10, 1965, which resulted in, respectively, alterations to the pool control structure, alterations to a shoal located in the Niagara River near Tower Island to prevent ice obstructions, and the construction of a ramp from the pool control structure to Tower Island.

The Governments agree that these Orders of Approval were made in the context of the Report and Recommendations under Article II of the Niagara River Diversion Treaty and consequently agree to treat them as Recommendations under Article IX of the Boundary Waters Treaty. The Governments hereby formally approve those recommendations and request the Commission to continue carrying out its existing responsibilities with respect to the remedial works.

The Governments further agree that future questions put to the International Joint Commission with respect to these remedial works will be referred pursuant to Article IX of the Boundary Waters Treaty.

Accordingly, in view of Ontario Hydro's latest plans to redevelop and expand its generating facilities in the Niagara River, the Governments have decided to refer to the Commission the Ontario Hydro Project for recommendations under Article IX of the Boundary Waters Treaty.

In the conduct of its work, the Commission is requested to consider all effects that Ontario Hydro's proposed Project may have on the functioning of the remedial works.

Where the Commission considers it helpful or necessary to its work, the Commission should also consider other transboundary effects of the Project, including environmental effects.

Based on its findings the Commission shall make recommendations to Governments four months from the time that this Reference is presented to the Commission.

In the conduct of its investigation and the preparation of its report, the Commission shall make use of information and technical data available to the Governments and that may become available to the Governments during the course of its investigations. In addition, the Commission may seek the assistance, as required, of specially qualified personnel in the two countries.

The Commission shall develop, as early as practicable, cost projections for the study under reference, for the information of the Governments.

# Appendix 3

## APPEARANCES AT PUBLIC HEARINGS ON PROPOSED PROJECTS ON NIAGARA RIVER[6]

**Wednesday, January 27, 1999, Niagara Falls, Ontario**

Peace Bridge Authority
George Creary, Keith Harlock, Stephen Mayer, Earl Rowe, Laurence Rubin, Cam Williams, Dave Yaeger

Ontario Hydro
Harry Charalambu, David Heath, Ian Motherwell

International Niagara Board of Control
Doug Cuthbert

Public Comment
Bill Banas - Energize Buffalo, Michael J. Charette, John Cramer - North Shore Coalition, John Daniels, Doug Elliott - Chairman, Niagara Peninsula Conservation Authority, Patrick Luciani, Joe Montgomery - Economic Development Officer, City of Niagara Falls, John Nash - East Shore Coalition, Dr. Joseph Pacsuta - North Shore Coalition, Michael Walker, Bob Waugh

**Thursday, January 28, 1999, Amherst, New York**

Peace Bridge Authority
Deb Chaffee, Keith Harlock, Steve Mayer, Dave Yeager

Ontario Hydro
Harry Charalambu, Joan Frain, David Heath

International Niagara Board of Control

[6]The Commission held simultaneous hearings on the Peace Bridge Capacity Expansion Project and on the proposed redevelopment and expansion of Ontario Hydro's water diversion facilities in the Niagara River.

Colonel James Hougnon, Doug Brown (International Niagara Working Committee)

Public Comment

Bill Banas - Energize Buffalo, Elisa Banas - Energize Buffalo, Jeff Belt - Energize Buffalo, Richard Brox, John Daniels, Melissa Granger, Y. Hreshchyshyn - Buffalo Common Council Greenways Task Force, Mr. Lamore, Jim Laufice, Mary Catherine Malley, Craig Murphy, David Quackenbush, George Richmand, Phil Rumore, Joseph Saccone - Energize Buffalo, Kenneth Seubert - Fellowship of Albert Schweitzer, Robert Lee Tarnay, Donald Thurber, Mary Ann Thurber - International Great Lakes Coalition, Jerry Vershesin

WRITTEN COMMENTS

W.T. Andresen - International Great Lakes Coalition
Bill Banas - Energize Buffalo
John T. Daniels, P.E.
Douglas Elliott - Niagara Peninsula Conservation Authority
Joe Menegon - North Shore Coalition
George Mercier
Senator Daniel Patrick Moynihan
John P. Nash
Dr. Joe Pacsuta, Mike Walker and John Kramer - North Shore Coalition
David S. Quackenbush
J. Ross Robinson
Mary Ann Thurber - International Great Lakes Coalition
Neal E. Thurber