COVER SHEET

FEDERAL ENERGY REGULATORY COMMISSION

DRAFT ENVIRONMENTAL IMPACT STATEMENT
FOR THE NIAGARA PROJECT
Docket No. P-2216-066

Section 3
Environmental Analysis
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3.0 ENVIRONMENTAL ANALYSIS

3.1 General Description of the Niagara River Basin

The Niagara River is located in the western portion of New York State. This 37-mile-long river serves as a connecting waterway between Lake Erie and Lake Ontario. It also forms the boundary between the State of New York and the Province of Ontario, Canada. The river flows from south to north and drains four of the five Great Lakes, a drainage basin of 263,700 square miles. The Niagara River has an average flow of 212,300 cfs, providing 83 percent of Lake Ontario's tributary flow. From its head at Lake Erie (Buffalo, New York, and Fort Erie, Ontario) to its mouth at Lake Ontario (Youngstown, New York, and Niagara-on-the-Lake, Ontario), the river falls approximately 326 feet. This steep descent and the relatively high and consistent flows create an ideal situation for hydropower generation.

The river is divided into upper and lower segments, with Niagara Falls (Falls) at the boundary of these segments. The upper Niagara River extends about 22½ miles north from Lake Erie to the Falls. The lower Niagara River extends an additional 15 miles north from the Falls to Lake Ontario (figure 3-1).

Approximately 6½ miles from the head of the river (at Buffalo/Fort Erie), at the south end of Grand Island, the upper Niagara River divides into two channels. The west channel is known as the Canadian or Chippawa Channel, and the east channel is known as the American or Tonawanda Channel. At the north end of Grand Island, the channels reunite to form the 3-mile-long Chippawa-Grass Island Pool at an elevation approximately 9 feet below the normal level of Lake Erie. The International Niagara Control Structure (INCS) is located at the downstream end of the Grass Island Pool. This gated flow-control structure is located approximately 4,500 feet upstream of the Falls and extends out from the Canadian shoreline to the approximate midpoint of the river. Below the INCS, the river surface elevation falls 50 feet through the Cascade Rapids before being divided into two channels by Goat Island. These channels convey the flow to the brink of Niagara Falls: the Horseshoe Falls (Canadian Falls) on the west side and the American Falls on the east. At the Falls, the river surface drops approximately 167 feet.

The lower Niagara River itself may be divided into two distinctly different sections; from the Falls to the Niagara Project tailrace and from the tailrace to the mouth of the river at Lake Ontario. From the Falls to a point approximately 5 miles downstream (and just below the Robert Moses Plant tailrace), the lower river is known as the Niagara

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Gorge. The river's surface elevation drops approximately 95 feet through the Gorge. Below the tailrace, the river widens, and water velocity slows: the overall vertical drop in this portion of the lower river, to the mouth at Lake Ontario (about 10 miles downstream), is about 5 feet.

Water levels and flows associated with U.S./Canadian power generation are regulated by the IJC and fluctuate consistent with the 1950 Treaty and electrical power demand. The 1950 Treaty requires a minimum flow of 100,000 cfs over the Falls during the tourist season (April 1 to October 31) during daylight hours and a minimum of 50,000 cfs at all other times. The 1950 Treaty further provides that, except for certain designated portions of the outflow from Lake Erie, the remaining flow is divided equally between the United States and Canada and available for power generation.

In addition to the Treaty-mandated flow requirements and power generation, water level and flow fluctuations in both the upper and lower Niagara River are influenced by a number of factors. Natural factors include flow surges from Lake Erie, wind, ice conditions, regional and long-term precipitation patterns and water levels of Lake Erie and Lake Ontario, as well as manmade factors such as boat wakes and navigation diversion for the New York State Barge Canal. Because the influence of these factors on water levels is interrelated and dynamic, it is difficult to determine the exact amount of fluctuation that is attributable to each factor. Therefore, for many of the analyses that were conducted for re-licensing the Niagara Project, the reported water level fluctuations in the Niagara River include the influences from all the factors. One exception was the effects of storm and wind induced water level fluctuations that were differentiated through a combination of gauge data analysis and empirical calculation of surface wave height and wind set-up. Water level fluctuation in the upper Niagara River, from all causes, normally amounts to less than the 1.5 feet per day as allowed by the International Niagara Board of Control's 1993 Directive in the lower river, daily fluctuations above and below the Robert Moses Plant tailrace differ significantly. From the Falls to the tailrace, water levels normally fluctuate 10-12 feet per day during the tourist season (April through October).

Water level fluctuations also occur in the Lewiston Reservoir due to project operation. The reservoir is operated on a daily and weekly schedule, with daily water level fluctuations ranging between 3-18 feet (URS Corporation (URS) et al., 2005). Due to partial refilling each weekday night, Monday through Friday daily net drawdown averages 6-7 feet. The reservoir is completely refilled on the weekends. At full pond, the reservoir is approximately 42 feet deep. The average water depth at maximum drawdown is just over 3 feet.

Local Environment

The project vicinity includes seven municipalities, (the City of Niagara Falls, the Town of Grand Island, the Town of Lewiston, the Town of Niagara, the Town of Porter, the Village of Lewiston, and the Village of Youngstown). These communities vary in population density from the highly urbanized City of Niagara Falls, to the less densely populated suburban and agricultural communities on the Tuscarora Nation, in the Towns of Porter, Lewiston, Niagara, and Grand Island, to relatively small population centers such as the Villages of Lewiston and Youngstown.

As of the year 2000, the population of these seven municipalities was 111,107. The City of Niagara Falls had a population of 55,593 in 2000 (US Census Bureau, 2000). The Niagara Frontier Transportation Committee (NFTC) population projections (1998) for the year 2020 anticipate a slight decline in the population of the City of Niagara Falls to 55,500, with a 9 percent increase in the population of the seven municipalities as a whole (NFTC, 1998).

The Tuscarora Nation lands are situated within the external boundaries of the Town of Lewiston and are included in the area surrounding the project. The Tuscarora Nation does not participate in the U.S. Census; therefore, information on Tuscarora Nation population density is not readily available.

<u>Project Area</u>

The Robert Moses Plant component of the Niagara Project is located on the east side of the Niagara River, approximately 5 miles downstream of Niagara Falls. The Niagara Project also includes the Lewiston Plant and the associated Lewiston Reservoir, both of which are located east of the Robert Moses Plant. The 1,900-acre manmade Lewiston Reservoir serves as the headwater storage for the Robert Moses Plant. The Robert Moses Plant and the Lewiston Plant receive water via two 4-mile-long, low-head underground conduits. The intakes for these conduits are located just downstream of the North Grand Island Bridges, in the upper river. From these intakes, the underground conduits deliver water to the Robert Moses Plant forebay, about 4 miles away.

The FERC project boundary establishes the perimeter of those lands needed for project-related purposes. For the most part, the FERC project boundary is coincident with the boundary of Power Authority-owned land. The project boundary encloses all the project features including the Lewiston Reservoir, the forebay, both the Robert Moses and the Lewiston Plants, the conduits, the intake structures, some additional shoreline along approximately one third of a mile in the vicinity of the intake structures, and approximately 8,000 feet of shoreline in the City of Niagara Falls (figure 3-1).

3.2 Cumulative Effects

According to the Council on Environmental Quality regulations for implementing NEPA, 40 CFR 1508.7, an action may cause cumulative effects on the environment if its effects overlap in space and/or time with effects of other past, present, and reasonable foreseeable future actions, regardless of what agency or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions over a period of time, including hydropower and other land and water development activities.

Where appropriate, we address potential cumulative effects in the cumulative effects sub-sections of each specific resource section in this DEIS. This analysis includes any Settlement measures that are not intended to be included in the project because they are related to the relicensing the project even though they may not be related to a project effect. In many cases, these measures are intended as mitigation for past effects resulting from the construction of the project or indirect effects of the project on the larger regional area due to the size and influence of the project's power output. Because the scope and influence of the project interact with a wide variety of other activities in the project area, we analyze cumulative effects in the following resource areas of this DEIS: geological, water, aquatic, terrestrial, cultural, recreation, land management and aesthetics, and socioeconomics.

3.2.1 Geographic Scope

The geographic scope of the cumulative effects analysis defines the physical limits or boundaries of the proposed action's effects on the resources. Because the proposed action may affect the resources differently, the geographic scope for each of the resources may vary. The geographic scope of analysis generally encompasses the Niagara River corridor from the Peace Bridge to its outlet at Lake Ontario. This includes all U.S. waters of the mainstream Niagara River and associated tributaries and riparian habitats.

3.2.2 Temporal Scope

The temporal scope of analysis includes a consideration of past, present, and future actions and their effects on cumulatively affected resources. Based on the likely term of a new license, we projected 30 to 50 years into the future, concentrating on the effects on the resources from reasonably foreseeable future actions. The historical discussion is limited, by necessity, to the amount of information available for each resource. We identify the current resource conditions based on the license application, comprehensive plans, and scoping comments received from various agencies and other stakeholders.

3.3 Proposed Action and Action Alternatives

3.3.1 Geological Resources

3.3.1.1 Affected Environment

Physiography/Topography

The land surface in the Greater Niagara Region is relatively flat. Except for the deep Niagara gorge, the geomorphology of the area is defined only by two east-west trending, north-facing escarpments (rock cliffs), both formed by erosion. Erosive forces have included both physical erosion (the work of running water) and chemical erosion (the dissolution of carbonate rocks by slightly acidic rainwater). The approximately 250-foot-high Niagara Escarpment crosses just north of the project, intersecting the Niagara River at the mouth of the Niagara Gorge. The less imposing Onondaga Escarpment is most evident east of the City of Buffalo, tailing off within the city. West of the city its location is marked by the Niagara River rapids just below Peace Bridge. Between the two escarpments lies a poorly drained lowland known as the Tonawanda Plain. It is the former site of glacial Lake Tonawanda and is the topographical feature upon which the project is located.

The ground surface in the vicinity of the project ranges from approximately 660 feet National Geodetic Vertical Datum (NGVD) at the top of the northern Lewiston Reservoir berm to about 250 feet NGVD at the base of the Niagara Gorge near the Robert Moses Plant.

Overburden Geology

Soils

Within an approximate 5-mile radius of the project, the dominant soils consist of lake-laid clays and silts. Lesser areas are made up of lake-laid sands, very fine sands, and silts. Soils to the east of the Lewiston Reservoir were formed in glacial till.

Glacial Deposits

A large part of the region's surface area is covered by glacial till, which also underlies most lake sediments in the region. Glacial deposits encountered regionally include ground moraines, drumlins, elongated till ridges, and terminal moraines. Of these, ground moraines and till ridges predominate in the project vicinity.

Additionally, sediments such as varved clays accumulated in temporary lakes that formed at the margins of retreating ice sheets when ice blocked eastward drainage of meltwater. Meltwater streams sorted and redistributed some of the glacial tills to form sand and gravel deposits.

A relatively thin layer of unconsolidated deposits, 3 to 80 feet thick, overlies bedrock in the area surrounding the Project. Along the upper Niagara River, bedrock is directly overlain by fill or alluvial fine sand or by a lacustrine clay and till layer that is in turn overlain by the fill/sand layer. In the middle and lower reaches of the river, a layer of till 5 to 20 feet thick overlies bedrock. This till consists of a silty clay or sandy matrix that was formed by the transport and lodgment of material beneath the flowing continental ice sheet (Tesmer, 1981). Because of this, it is compacted and relatively impermeable.

Bedrock Geology

Stratigraphy

The Niagara region is underlain by sedimentary rocks. Well drilling records show the thickness of these sedimentary rocks regionally to be about 1,980 feet at Newfane (located approximately 15 miles northeast of the project), 3,000 feet at Niagara Falls, and 4,200 feet in south Buffalo. Only a portion of the upper 1,000 feet of the total sedimentary sequence is visible in the region (primarily along the Niagara River from approximately Fort Niagara to Fort Erie, Ontario at the mouth). This includes about 200 feet of the upper Ordovician system near Fort Niagara, some of the 800 feet of the Silurian (much of Upper Silurian being concealed), and 8 feet of the Devonian near Fort Erie (Tesmer, 1981).

Seismicity

The area around the project lies in the Central Stable Region seismic zone, which extends from just west of the Appalachian Mountains to the Rocky Mountains, and from the Canadian Shield in the north to the Coastal Plain in the south. Within a 200-mile radius of the site, approximately 90 seismic events having a magnitude of 3.0 or greater have been documented as occurring from between 1823 to 1975 (Bechtel, 1983). From 1973 to August 2004, approximately 27 magnitude 3.0 or greater earthquakes have been documented as occurring within an approximate 200-mile radius (USGS, 2005). The most significant earthquake within this area, having an epicenter near Attica, New York (Wyoming County), occurred on August 12, 1929. The estimated magnitude of this earthquake was 5.8 on the Richter scale, with a damage intensity of VIII on the Modified Mercalli scale. Although earthquakes of lesser magnitude have occurred closer to the site, no Niagara Project structures have ever sustained damage due to seismic incidents.

No faults have been identified either at the surface or in the subsurface within 20 miles of the Niagara Project.

Shoreline Erosion

To support its license application, the Power Authority inventoried the project area for erosion sites (Baird, 2005). The study area for Baird's study (2005) was the U.S. side of the international boundary from Peace Bridge to Lake Ontario. Figure 3-2 shows the locations of erosion sites in the upper and lower river.

Only 3 percent of the upper river shoreline or river bank within the study area has been identified as eroding (Baird, 2005). The lack of more widespread river bank erosion is partly due to the extent of shoreline protection. Approximately 63 percent of the upper river shoreline within the study area is protected by some form of structure (i.e., steel sheet pile wall, rip rap, concrete block, etc.). In most cases along the upper river, the eroding shore type is cohesive, consisting of low banks of lacustrine clay.

Within tributaries it was determined that a total of 4 percent of the creek banks are actively eroding. In addition, 16 percent of the total creek bank length is experiencing erosion scarping, which is a common process in most creeks. Some form of structural protection exists along approximately 40 percent of the total creek bank length within the Study Area. However, most of the structural protection is located on Tonawanda Creek and Gill Creek. Both of these creeks have protection along the majority of their studied reach lengths and represent two of the longest creek lengths studied.

Fourteen percent of the shoreline length in the lower river was identified as eroding. Compared to the upper river, less of the lower river shoreline is protected (37 percent of the lower river study area length).

Sedimentation

The high flow velocities in the main channel of the Niagara River generally scour the bottom of any fine-grained sediment. Sediment accumulation is therefore limited to the low velocity nearshore areas, the mouths of some tributaries, Sir Adam Beck and

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Lewiston Reservoirs, and the mouth of the river itself at Lake Ontario. In addition to these areas, Baird (2005) identified two other potential depositional areas– the Turning Basin for the Federal Navigation Channel immediately downstream of Tonawanda Island and the Power Authority intake bay downstream of the North Grand Island Bridge.

A qualitative summary of sediment sources, transport pathways and sinks for the entire Niagara River, was prepared by Baird (2005) based on field investigations and published data from other sources. Since sediment sources and sinks are interrelated within a river basin and are unaffected by international boundaries, it was necessary to study the Niagara River from its source at Lake Erie to its mouth at Lake Ontario.

The four primary sediment sources for the Niagara River are suspended sediment and bed load from the shores of Lake Erie, bank erosion, riverbed downcutting, and input from tributaries. Five potential sediment sinks are dredging, deposition of sediment on the riverbed and associated floodplain, deposition in the Lewiston Reservoir, suspended sediment or bed load lost to the Welland River and the Sir Adam Beck Power Plant Reservoir, and the Niagara Bar, a shoal located at the mouth of the river on the bed of Lake Ontario. The amount of sediment lost from the Niagara River Basin due to dredging is a relatively small amount compared to the other sediment sinks (Baird, 2005)

3.3.1.2 Environmental Effects and Recommendations

Erosion/Sedimentation

Erosion in both the upper and lower Niagara River is caused mostly by water level fluctuations resulting from a number of factors, including U.S./Canadian power generation, wind, natural flow variations, ice conditions, the water levels of Lake Erie and Lake Ontario, and regulation of Niagara Falls flow for Treaty-mandated requirements. These water level fluctuations can cause erosion of islands and banks/shoreline in the upper and lower Niagara River and tributaries.

To a lesser extent, the project also has a minor effect on sediment transport and deposition because some sediment is trapped in the U.S. and Canadian reservoirs that would otherwise be transported downstream to the mouth of the river. Sediments in the Niagara Project forebay may be transported to Lewiston Reservoir. Over the past 40 years the average deposition rate for the entire reservoir has been approximately 0.3 inch/year (Louis Berger, 2005). The Power Authority does not propose, nor does any entity recommend any measures to address sedimentation. Because we consider sedimentation within Lewiston reservoir to be mostly an issue of storage capacity, rather than any identified environmental effect, we do not discuss sedimentation further.

The primary driving forces for shoreline erosion are wind-generated and ship/boat-generated waves and river currents on the upper and lower rivers (Baird, 2005). The influence of these driving forces is modulated to different degrees by water level fluctuations that can expose a wider band of shoreline to erosive forces than would be exposed under static water level conditions. The degree of exposure is dependent on the nearshore profile shape, geology, natural/artificial shore protection characteristics, and location along the river.

Water level fluctuations may influence erosion rates for two actively eroding reaches of the upper river, which are located on Grand Island. Both are about 3,000 feet long and feature wide, shallow, nearshore shelves devoid of submerged aquatic vegetation. The nearshore shelves are effective at dissipating wave energy at low, and possibly average water levels. However, when maximum water levels are increased, or when the frequency of high levels increases, less wave energy is dissipated on the shelf and more energy reaches the shoreline, accelerating erosion (Baird, 2005). In addition, the absence of submerged aquatic vegetation for these two reaches may result in increased wave action reaching the shore. Some erosion areas along the Tonawanda Channel were observed to have a steep nearshore profile, a situation that is more common along the lower river. Water level fluctuation implications for these steep profile conditions are summarized below.

Erosion along the lower river is primarily driven by currents and wind-generated waves, rather than fluctuations due to project releases to the lower river during generation (Baird, 2005). In general, the steep, nearshore slopes along the lower river are less sensitive to fluctuating water levels than the wide, shallow nearshore shelves because they do not significantly attenuate wave action. These steep nearshore profile areas on both the upper and lower river, however, are still susceptible to erosion at high water levels.

Habitat Improvement Projects (HIPS)

The Power Authority proposes three HIPS that would have some effect on erosion: Strawberry Island Wetland Restoration, Motor Island Shoreline Protection, and Frog Island Restoration. All three of these projects would occur within the area of project fluctuation effects and be located approximately 15 miles upstream from the project intakes. Figure 3-3 shows the location of all eight proposed HIPs. All of these HIPs, including the three discussed below, are section 10(j) recommendations from Interior as well as mandatory conditions of the certification issued by New York DEC.

The Strawberry Island HIP would extend existing shoreline protection measures to northern parts of the island (owned and managed by the New York DEC). The purpose of the project is to protect and enhance island habitat for aquatic and terrestrial species by increasing the size and long-term stability of the island using breakwaters along the newly created shoreline.

The Motor Island HIP would provide shoreline protection measures along the western and eastern shorelines and at the southern tip of the island where either erosion processes are currently occurring or where shoreline protection structures are deteriorating. Motor Island is owned and managed by the New York DEC. The purpose of the project would be to protect and enhance island habitat for aquatic and terrestrial species.

The Frog Island HIP would create about 5.5 acres of island surrounded by a U-shaped perimeter of breakwater structures in the approximate vicinity of an historic island complex that no longer exists. The purpose of the project would be to restore island habitat that was lost in the past primarily due to dredging operations.

Our Analysis

Operation of the project contributes to water level fluctuations, although the effects are not as significant as fluctuations due to wind and boat-generated waves and river currents. Water lever fluctuations, in turn, contribute to erosion. It is reasonable to assume that the project would continue to contribute to fluctuation-related erosion at the same rate over the next license term because no change in project operations is proposed or recommended. The Strawberry Island and Motor Island HIPs would protect these areas from ongoing erosion. The Frog Island HIP would create an island where one or more islands used to exist. We note, however, that the disappearance of Frog Island was primarily caused by dredging activities and not erosion. The habitat benefits of these HIPs to aquatic and terrestrial species are discussed in those respective sections of this DEIS.

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Habitat Enhancement and Restoration Fund

The Power Authority proposes the HERF to fund future HIPs, land acquisition, habitat improvements, habitat research, fish, wildlife, and indigenous plant species restoration, and stewardship activities throughout the Niagara Basin. Projects would be approved by the ESC based on several criteria which are not all mandatory but would guide the decision process.[8] Some of these future projects and stewardship activities may have effects on project area geology and soils. The HERF is a section 10(j) recommendation from Interior as well as a mandatory condition of the certification issued by New York DEC

Our Analysis

Because no details are currently available on measures that would be funded through the HERF, we cannot assess whether or to what degree specific measures would affect project area geology and soils. Based on the criteria to be used in approving projects, however, we can assume these measures could protect or enhance habitat affected by erosion or sedimentation.

3.3.1.3 Cumulative Effects

Rivers by their nature are dynamic systems that cause erosion of the river bed and at times the river banks. This is particularly true for the Niagara River where much of the shoreline type is cohesive, and thus susceptible to erosion. A variety of factors cumulatively affect shoreline erosion in the Niagara River. In addition to the Niagara project, Ontario Power Generation operates the Sir Adam Beck Hydroelectric Project. Together, the projects contribute to shoreline erosion by causing fluctuation of water levels in both the upper and lower rivers.

Non-project activities that could affect shoreline erosion include, but are not limited to, past and present land use such as marinas, industrial and residential shoreline development, wind and boat-generated waves, river current, natural flood events in the

[8] Address a demonstrated project impact; preserve RTE species or habitat; strong scientific foundation, protect RTE species or habitat; achieve multiple ecological goals; preserve and restore Haudenosaunee cultural, religious, and historic features; involve multi-stakeholder collaboration; consistent with local, state, and federal resource management plans; feature matching resources; are time-sensitive; have documented municipal, county, and tribal support; are feasible froma cost/probability of success perspective.

river and its tributaries, municipal water supply diversions, water diversions for navigation on the Erie Canal, and lake levels in Lake Erie and Lake Ontario.

The Power Authority has proposed three HIPs (out of eight total) on the upper Niagara River which would involve shoreline stabilization and erosion control. Considering the proposed habitat improvement projects, and possible future projects funded through the HERF, we expect the Power Authority's proposal to result in net beneficial cumulative effects on geological resources in the area.

3.3.1.4 Unavoidable Adverse Impacts

None.

3.3.2 Water Resources

3.3.2.1 Affected Environment

Water Use

Surface Water

As discussed in section 2.1.3, uses of the Niagara River for purposes of generating electricity are primarily subject to two regulatory regimes - the 1950 Treaty and the 1993 Directive of the INBC. The Treaty specifies that flow over Niagara Falls be at least 100,000 cfs during tourist season (April 1 – October 31) daylight hours and at least 50,000 cfs at all other times.

The 1993 INBC Directive instructs the Power Authority and OPG to maintain a long-term mean water level of 171.16 meters (562.75 feet in USLSD 1935) in the Chippawa-Grass Island Pool. It also allows a 1.5-foot daily fluctuation within a normal 3-foot range between 561.24 and 564.22 feet USLSD as measured at the Material Dock gauge. Under unusual conditions (e.g., high flow, low flow, ice), the allowable range of the Chippawa-Grass Island Pool water level is extended to 4 feet and the 1.5-foot daily water level fluctuation tolerance can be waived by the INBC.

The affected environment related to surface water use and quality can be geographically separated into five distinct locations: (1) the upper Niagara River, (2) the U.S. tributaries to the Niagara River, (3) the Lewiston Reservoir, (4) the lower Niagara River upstream of the Robert Moses Plant tailrace, and (5) the lower Niagara River downstream of the Robert Moses Plant tailrace.

Upper Niagara River

The upper Niagara River extends about 22½ miles from Lake Erie to Niagara Falls. At Grand Island (approximately 6½ miles downstream of Lake Erie), the upper Niagara River divides into the west channel, known as the Canadian or Chippawa Channel, and the east channel, known as the American or Tonawanda Channel. The Chippawa and Tonawanda Channels are 11 and 15 miles long and carry approximately 58 percent and 42 percent of the river flow, respectively. At the north end of Grand Island the channels unite to form the 3-mile-long Chippawa-Grass Island Pool. The INCS is located at the downstream end of the Chippawa-Grass Island Pool approximately 4,500 feet upstream of the Falls. The INCS extends from the Canadian shoreline to the approximate midpoint of the river. The project intake is located within the Chippawa-Grass Island Pool. The purpose of the INCS is to increase the surface elevation of the upper Niagara River to facilitate the diversion of water to the Canadian and U.S. hydroelectric projects.

The water level in the Chippawa-Grass Island Pool is regulated to provide Treaty-mandated flows and for U.S./Canadian hydroelectric generation. Water level fluctuations in the Chippawa-Grass Island Pool are limited to 1.5 feet per day in accordance with the 1993 INBC Directive. The magnitude of water level fluctuations associated with the pool decreases further upstream in the upper Niagara River. The effect of pool fluctuations on water level fluctuations in the mainstem portion of the upper Niagara River can extend as far upstream as the Peace Bridge (URS et al., 2005) (figure 3-4).

U.S. Tributaries

Water levels in the U.S. tributaries to the upper Niagara River are influenced, to varying degrees, by water level fluctuations in the upper Niagara River (URS and Gomez and Sullivan, 2005). Generally the influence is limited to the lower reaches of the tributaries.

Gill Creek, a tributary to the upper Niagara River, was rerouted around Lewiston Reservoir when the project was developed. Its natural flow is augmented by groundwater recharge from Lewiston Reservoir (URS et al., 2005a) and, during the summer months, by discharges from Lewiston Reservoir. This augmentation flow ranges from a high of approximately 3 cfs in the summer to zero in the winter and spring. In 2003, flow from the Lewiston Reservoir was supplied to Gill Creek from June 2 through September 23. The purpose of the augmentation flow was to enhance recreational use of Gill Creek in the Hyde Park area. The portion of Gill Creek between Porter Road and Pine Avenue in Niagara Falls is referred to as Hyde Park Lake, a 484-acre impoundment that was

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dammed at Pine Avenue in the late 1920s. Downstream of the dam, the creek continues south through residential and industrial developments and discharges into the upper Niagara River approximately 1,000 feet downstream of the Power Authority water intake structures.

Fish Creek, a tributary to the lower Niagara River, was also rerouted around Lewiston Reservoir. Like Gill Creek, its natural flow is increased by groundwater recharge from Lewiston Reservoir (URS et al., 2005a). The headwaters of Fish Creek, like those of Gill Creek are located east of the Lewiston Reservoir. Flow in Fish Creek varies seasonally depending on precipitation and groundwater discharge (URS et al., 2005a).

Lewiston Reservoir

The 1,900-acre Lewiston Reservoir is the upper reservoir for the Lewiston pumped storage development, the forebay being the lower reservoir. The Lewiston Reservoir also stores water for the Robert Moses conventional hydroelectric development (Robert Moses Plant).

The Niagara Project and the Lewiston Reservoir operate on a daily and weekly cycle. The Power Authority is allowed to divert more Niagara River water at night for power production because the Treaty-mandated Falls flow is 50,000 cfs at night instead of the 100,000-cfs daytime flow. Nighttime, however, is a period of relatively low electrical demand. So as not to lose the benefit of water not required for immediate power production, the Lewiston Reservoir is used to store river water at night (and on weekends) for power generation during peak demand periods. Daily drawdown is normally 3-18 feet and weekly drawdown is 11-36 feet, depending on the season and river flow (URS et al., 2005b). Weekly drawdowns are typically greater during the tourist season (21-36 feet) than the non-tourist season (11-30 feet); Lewiston Reservoir water levels are not drawn down as low during the non-tourist season because storage in the lowest part of the reservoir is held in reserve for potentially reduced diversions caused by ice problems. On Monday morning, the reservoir is at its highest water level. During weekdays, the reservoir water level decreases as water in storage is used for power generation. Each weeknight, the reservoir is partially refilled. By the end of the week (i.e., Thursday or Friday), when the reservoir is drawn down to its lowest water level, portions of the reservoir bottom may become exposed. Refilling of the reservoir typically begins late Friday night and continues through the weekend.

Lower Niagara River upstream of the Robert Moses Plant

Upstream of the Robert Moses Plant tailrace and below Niagara Falls, the lower Niagara River runs 6 miles through the narrow Niagara gorge. The upper portion of this reach, which is navigable, extends from the base of the Falls to the Whirlpool Rapids, which is not navigable. The fall through this upper reach, known as the Maid of the Mist Pool, is approximately 5 feet. In the Whirlpool Rapids, the water surface elevation drops approximately 50 feet over the course of a mile. At the Whirlpool (a 1,700-foot-long, 1,200-foot-wide, 125-foot-deep basin downstream of the rapids), the river bends nearly 90 degrees to the northeast. Below this point the river drops another 40 feet through the Devil's Hole Rapids.

Water level fluctuation in the lower Niagara River (upstream of the Robert Moses Plant tailrace) during tourist season are normally between 10-12 feet (as measured at the Ashland Avenue gauge). This daily fluctuation is due to the change in the Treaty-mandated flow over Niagara Falls. The median daily water level fluctuation at the Ashland Avenue gauge in the gorge, approximately 3.6 miles upstream of the Robert Moses Plant tailrace, was 11.1 feet during the 2003 tourist season while just 1,500 feet upstream of the tailrace the median daily water level fluctuation was 6.9 feet during a portion of the 2003 tourist season (URS and Gomez and Sullivan, 2005).

Lower Niagara River downstream of the Robert Moses Plant

Downstream of the Robert Moses Plant tailrace, the lower Niagara River widens and emerges from the gorge at Lewiston, New York, subsequently dropping another 5 feet to Lake Ontario. Water levels in this reach are influenced by Treaty-mandated flows, generation flows, and Lake Ontario water levels. Water level fluctuations downstream of the Robert Moses Plant tailrace are typically much less than those observed upstream of the tailrace and are approximately 1.5 feet per day. The average daily water level fluctuation 1.4 miles downstream of the Robert Moses Plant tailrace, during the 2003 tourist season, was 1.44 feet. The daily fluctuations decrease progressively downstream (URS and Gomez and Sullivan, 2005).

Water Uses

Almost all of the upper Niagara River flow in excess of that required by international agreement for minimum flow over Niagara Falls is diverted for hydroelectric power generation in the United States and Canada. Pursuant to IJC regulation, the Niagara Project and OPG's Sir Adam Beck 1 and 2 plants in Canada withdraw water from the Chippawa-Grass Island Pool and discharge it into the lower Niagara River at Lewiston, New York, and Queenston, Ontario, respectively, and the

Canadian Niagara Power Generating Station withdraws water just upstream of the Horseshoe Falls and discharges it into the Maid of the Mist Pool.

In addition to the water used for power production, water is withdrawn or diverted from the Niagara River for municipal and industrial water supply, wastewater assimilation, commercial and recreational navigation, and as described above, via Lewiston Reservoir for flow augmentation in Gill Creek. Diversion of water by the United States and Canada from the Lake Erie outflow for domestic, sanitary, and canal navigation purposes are not included in the computation of each nation's power generation entitlement (Power Authority, 1984).

Groundwater

Groundwater is used by some industries in Niagara Falls and Lewiston for process or cooling water. The source of potable water for most local residents is the Niagara River; however, some residents of the Tuscarora Nation use the aquifer as a source of potable water.

The only regionally extensive aquifer system in the project vicinity occurs in bedrock in a geologic formation known as the Lockport Group. The aquifers of this group consist of vertical and horizontal fractures and joints, dissolution zones along bedding planes, and other small cavities. Nine regionally extensive, horizontal aquifers have been defined within the Lockport Group (Yager, 1996). A tenth zone occurs within the fractured and weathered rock at the overburden/bedrock interface. The geologic formation beneath the Lockport group is known as the Rochester Formation. The Rochester Formation consists of low permeable shale, which inhibits the flow of groundwater (formations such as this are known as aquitards). The top of this zone is therefore considered the base of the Lockport Group aquifer in the project vicinity. Groundwater in the Lockport Group is under artesian, semi-artesian and water table conditions (artesian means the aquifer is under pressure and when tapped, groundwater will rise to a level above the aquifer itself and in some cases above ground surface). Artesian flow above ground surface was seen temporarily at one of the wells drilled for this relicensing. In the thickest portion of the Lockport Group, there are 10 separate aquifers, each at a different elevation.

Groundwater Flow Patterns

In general, regional groundwater flow in the Lockport Group is from topographic highs near the escarpment toward the Niagara Gorge and the Niagara River. The Niagara Gorge downstream of the Falls is the foremost groundwater receptor in the project vicinity, although some discharge also occurs via migration of groundwater through overburden deposits to Niagara River tributaries (e.g., Cayuga, Fish, and Gill Creeks) and via direct seepage at the face of the Niagara Escarpment.

Discharge to manmade structures also occurs. The Falls Street Tunnel (tunnel), an unlined storm sewer constructed in the upper Lockport Group bedrock, provides a groundwater "sink" through which groundwater can discharge to the Niagara gorge via the Niagara Falls wastewater treatment plant or directly to the river during wet weather events (Yager, 1998). The tunnel the Power Authority conduits near the corner of 40th Street and Royal Avenue in the City of Niagara Falls. It has been reported (Miller and Kappel, 1987) that the greatest discharge of groundwater to the tunnel occurs at this point, although grouting of the tunnel performed immediately west of this intersection has reduced infiltration to the tunnel.

The groundwater hydraulic head contour map presented in "Niagara Falls Regional Groundwater Assessment" (DuPont et al., 1992) indicates that the project's underground conduit drains affect the groundwater flow regime. Groundwater in the vicinity of the conduits flows towards the conduits from both west and east. This indicates that groundwater discharges to the conduits along their entire length.

Falls Street Tunnel Groundwater Infiltration

The tunnel is part of a combined sewer system/sanitary sewer overflow system. During dry weather, water infiltrating into the tunnel is typically treated at the Niagara Falls Water Board (Water Board) wastewater treatment plant (WWTP) prior to being discharged to the Niagara River. During some larger magnitude wet weather events, however, when tunnel flows exceed the capacity of the WWTP Gorge Pump Station, some portion of this excess flow must be discharged directly to the lower Niagara River without treatment.

Water Quality

Surface Water Quality

Water Quality Standards and Water Body Classifications

New York State classifies all surface waters based on their "best uses", such as drinking, bathing, fish propagation, and/or fish survival. The entire length of the Niagara River has been designated Class A-Special (A-S). The best uses of Class A-S waters are as water supply for consumption purposes, primary and secondary contact recreation (swimming and boating), and fishing. Class A-S waters shall also be suitable for fish propagation and survival. Lewiston Reservoir is also considered a Class A-S water body due to its connectivity to the upper Niagara River. The U.S. tributaries to the Niagara River are classified as either Class B or Class C by New York DEC. The best usages of Class B waters are primary and secondary contact recreation and fishing. These waters shall be suitable for fish propagation and survival. The best usage of Class C waters is fishing. Class C waters shall be suitable for fish propagation and survival and the water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes (New York DEC, 2000a). Table 3-1 lists the water body classification and any impairment status of each water body.

New York DEC has designated the Niagara River as water-quality limited for benzo(a)anthracene, chrysene, DDT, DDD, DDE, 1,1-dichloroethylene, endosulfan, heptachlor, hexachlorocyclohexane, hexachlorobenzene, mirex, and total phenolics. The Niagara River is not water-quality limited for conventional pollutants such as biochemical oxygen demand and nutrients (New York DEC, 1987). New York DEC has classified the Niagara River water as impaired with regard to water use due to fish consumption advisories. The cause of contamination in fish is primarily priority organic pollutants from contaminated sediment and landfills/land disposal (New York DEC, 2000a). The advisory for the Niagara River above Niagara Falls (eat no more than one meal per month of carp) also applies to all tributaries to the upper Niagara River up to the first barrier impassable by fish. In the lower Niagara River below Niagara Falls, the fish consumption advisory is more restrictive due to PCBs, dioxin, and mirex (discussed further in section 3.3.3).

Background on Niagara River Water Quality

Water quality studies in the Niagara River have been conducted for more than 20 years by Environment Canada and the New York DEC. Environment Canada maintains stations in the upper and lower Niagara River at Fort Erie and Niagara-on-the-Lake, respectively. New York DEC maintains a station in the lower Niagara River at Fort Niagara. Environment Canada, the U.S. Environmental Protection Agency (EPA), the Ontario Ministry of the Environment (OMOE) and the New York DEC - the “Four Parties” - signed the Niagara River Declaration of Intent in 1987, the purpose of which was to reduce the concentrations of toxic pollutants in the Niagara River. As a result of the Declaration of Intent, the Niagara River Toxics Management Plan (NRTMP) was developed, in which eighteen persistent and bioaccumulative chemicals were targeted for reduction and were designated as “priority toxics” (Niagara River Secretariat, 2003). The 18 priority toxics were selected based on their occurrence in the Niagara River or Lake Ontario at levels exceeding water, fish, or sediment criteria values.

Since sampling began in 1986, organic chemicals such as mirex, PCBs, hexachlorobenzene, dieldrin and others have been detected at the Niagara-on-the-Lake station as part of Environment Canada's Niagara River Upstream/Downstream Water Quality Monitoring Program. The concentrations and loads of many of the 18 NRTMP priority toxics in the Niagara River such as mirex, mercury, hexachlorobenzene and PCBs, have decreased significantly, and in nearly all cases the concentrations have decreased more than 70 percent since 1986/87. However, levels of others, such as benzo(a)pyrene, benzo(b)fluoranthene, and benzo(k)fluoranthene increased, or no significant trend in loadings was detected. The improvements noted are due, at least in part, to the remedial efforts at contaminant sources to the Niagara River.

Recent Water Quality Data

As part of the Niagara Project relicensing effort, the surface water quality of the Niagara River, its U.S. tributaries, and Lewiston Reservoir was examined in 2003. The tributaries studied included: Cayuga, Gill, Fish, Tonawanda, Ellicott, Burnt Ship, Woods, Gun, Spicer, and Big Sixmile Creeks. Continuous water level data collected at 25 gauges from March/April to November 2003 supplemented that which was collected at 15 permanent gauges year-round. Discrete turbidity and dissolved oxygen data were collected 17 times at 29 locations between May to November 2003 for dry and wet conditions. In addition, water samples collected from the upper Niagara River, Lewiston Reservoir, and Fish and Gill Creeks for three events in 2003/2004 were analyzed for an extensive list of organic, inorganic, and biological parameters (URS and Gomez and Sullivan, 2005).

Table 3-1. New York DEC Water Body Classifications and Impacted/Threatened Segments of the Niagara River and U.S. Tributaries**.**

Water Body	Classification	Impacted segment	Primary use affected	Problem severity	Primary pollutant/cause
Big Sixmile Creek	B		water body in need of verification of impairment		
Burnt Ship Creek	B	not impaired			
Cayuga Creek	C	Walmore Rd. to mouth	fish consumption	precluded	priority organics
Ellicott Creek	B	mouth to 20 miles upstream	aquatic life	stressed	aesthetics
Fish Creek	C	not impaired			
Gill Creek	C	Hyde Park dam to mouth	fish consumption	precluded	priority organics
Gun Creek	B		water body in need of verification of impairment		
Niagara River/Lewiston Reservoir	A-special	entire length	fish consumption	impaired	priority organics
Spicer Creek	B		water body in need of verification of impairment		
Tonawanda Creek	B	mouth to 10 miles upstream	aquatic life	stressed	silt/sediment
Woods Creek	B		water body in need of verification of impairment		

Note: Water Body Impairments Needing Verification are segments that are thought to have a use impairment or water quality impact, but for which there is not sufficient or definitive documentation. These segments are designated for verification by New York DEC (New York DEC, 2000a).

A review of the surface water quality data in the literature as well as the data collected in 2003/2004 (URS and Gomez and Sullivan, 2005) reveals that the water quality of the upper and lower Niagara River has improved greatly over the past 20 years. The current surface water quality conditions in the Niagara River, the Lewiston Reservoir, and the U.S. tributaries are generally good. Problems associated with persistent organic contaminants in sediment and fish tissue in the Niagara River are, however, still prevalent. These problems have impaired some of the designated uses of the target water bodies in this study.

Dissolved Oxygen

Water quality sampling results from 2003 showed that dissolved oxygen levels in both the upper and lower Niagara River were always above the state standard of 6.0 milligrams per liter (mg/L) for Class A-S waters. In the lower Niagara River upstream of the tailrace, dissolved oxygen levels were almost always above saturation, due in large part, to the turbulence of the river in the Whirlpool and Devil's Hole rapids (as well as Niagara Falls) (URS and Gomez and Sullivan, 2005). Below the tailrace, dissolved oxygen levels ranged from 89-126 percent saturation at the two monitoring sites in the lower Niagara River.

Dissolved oxygen levels measured in Lewiston Reservoir in 2003 were always above the NYS standard of 6.0 mg/L for Class A-S waters. Lewiston Reservoir does not stratify with regards to temperature or dissolved oxygen due to the high flushing rates caused by the continuous pumping of water into the reservoir for storage and the outflow for generation. Saturation levels for dissolved oxygen in the reservoir ranged from 70 to 106 percent.

Dissolved oxygen levels in Cayuga, Burnt Ship, Woods, Gun, and Spicer Creeks did not meet the instantaneous state standard of 4.0 mg/L for Class B and C waters at all times (URS and Gomez and Sullivan, 2005).

Water Temperature

Surface water temperatures in the Niagara River, U.S. tributaries of the Niagara River, and Lewiston Reservoir were investigated by the Power Authority in 2003 (URS, 2005a). In the tributaries of the Niagara River, temperature changes ranging from –6.5 to +2.3 degrees Celsius per hour (ºC/hour), occurred mostly in the lower reaches of tributaries near the confluence with the Niagara River. In the shoals of the upper Niagara River, temperature changes ranging from -4.1 to +4.4 ºC/hour occurred at two of seven locations, both at, or immediately downstream of, tributary mouths (URS, 2005a).

Total Dissolved Gas

Total dissolved gas (TDG) saturation levels occurring in the lower Niagara River as they relate to naturally occurring background levels and U.S./Canadian power generation were studied in 2005 (Parametrix, 2005). TDG supersaturation occurs when entrained atmospheric gases (air) pass into solution in greater amounts than the water would normally hold at surface pressure. Based on laboratory studies, the EPA water quality standard for TDG is equal to or below 110 percent of saturation, to protect aquatic life.

Monitoring results showed significantly higher levels of TDG saturation in the Niagara River upstream of the Robert Moses Plant tailrace, as compared to levels downstream of the Robert Moses Plant tailrace. The TDG levels upstream of the Robert Moses Plant tailrace were consistently greater than 122 percent of saturation during the tourist season monitoring period (averaging 127.2 percent), while TDG levels about a mile or more downstream of the tailrace were consistently below 119 percent of saturation (averaging 114.2 percent). At the same time, TDG levels recorded in the Robert Moses Plant turbine discharge plume were consistently below 108 percent of saturation (averaging 103.5 percent). Similar differences between stations were observed in November (non-tourist season); although the TDG levels at all locations were typically at least 3 percent of saturation lower than in August.

Turbidity

Turbidity in the upper and lower Niagara River is generally low. During dry, calm weather conditions, river water is clear with low turbidity, less than 4 Nephelometric Turbidity Units (NTUs). Upper river turbidity increases, but is still relatively low, after storm events that increase turbidity in the tributaries. Additionally, strong wind events can resuspend sediments in Lake Erie and cause wave action that can erode shorelines, causing some minor turbidity in the upper Niagara River. Given the comparatively lower turbidity levels in the reservoir and at the project intake, the slightly higher turbidity levels in the lower Niagara River may be attributed to combined sewer overflows (CSOs) and/or stormwater discharges to the lower river gorge. The data collected in 2003 shows that turbidity levels in the Lewiston Reservoir are low. Turbidity values in the U.S. tributaries are typically higher than those of the Niagara River and may be related to many factors including land use, soil type, CSOs, stormwater discharges, and erosion. Turbidity values in the U.S. tributaries ranged between 1 and 208 NTUs.

Other Parameters

In addition to dissolved oxygen, temperature, turbidity, and TDG, a full suite of other water quality parameters were analyzed from surface water samples collected from the upper Niagara River, Lewiston Reservoir, and Fish and Gill Creeks in 2003/2004. Samples collected from the upper Niagara River reveal that metals, nutrients, and biological parameters were all within the standards for Class A-S waters. There was one exceedence of the total dissolved solids (TDS) standard in the March 2004 sample taken from the upper Niagara River. Results of the laboratory analyses for organic contaminants revealed all parameters were below the quantitation limit at the upper Niagara River site.

Based upon the 2003/2004 surface water quality results, the surface water quality of the Lewiston Reservoir is similar to that of the upper Niagara River. With one exception (total coliform in the March 2004 sample), metals, nutrients and biological parameters were all within the standard for Class A-S waters. The results of the laboratory analyses for organic contaminants revealed that all parameters were below the quantitation limit for the two sites in the Lewiston Reservoir, except that the two samples collected in November from the reservoir (sites SW03-006 and SW03-011) detected the pesticide derivative delta-BHC. For the two sites, the concentration of delta-BHC was detected below the practical quantitation limit, but above the method detection limit and therefore, qualified as estimated values of 0.040 and 0.043 micrograms per liter (µg/L). The source of delta-BHC, a by-product of the pesticide Lindane (gamma-BHC), in reservoir water samples is unknown. The pesticide Lindane is registered for use in the state as a seed protectant, so its dispersal by surface runoff or wind blown erosion from croplands in the area is a potential source. Delta-BHC was infrequently detected by piezometers monitoring groundwater entering the Conduit Drainage System , where it was present at low concentrations equivalent to that reported in the reservoir water. Since groundwater is significantly diluted as it mixes with surface water, groundwater is not a likely source of delta-BHC. BHC compounds have also been detected in surface water collected from the Niagara River Upstream/Downstream monitoring program and in tissue from mussels in the upper Niagara River (URS and Gomez and Sullivan, 2005).

For Gill Creek, all parameters sampled in 2003/2004, except for a single TDS sample, were in compliance with NYS surface water quality standards for Class C waters. For the October 2003 sample from Gill Creek (approximately 1,500 feet upstream of the flow augmentation channel), TDS were measured at 546 mg/l, which is in excess of the Class C water quality standard (500 mg/l). Because there was no flow augmentation to Gill Creek from the reservoir upstream of the sampling site, there is no connection between the TDS at the sample site and the TDS in the reservoir.

For Fish Creek, the analytical surface water results report a high level of total coliforms from the October 2003 samples taken downstream of Lewiston Reservoir. Subsequent results from this site showed low total and fecal coliform counts. Additionally, the results for total and fecal coliform in samples collected simultaneously from Lewiston Reservoir were much lower than those from Fish Creek indicating the elevated level of bacteria in Fish Creek in the October sample was an isolated incident and not due to any influence from the reservoir. All other parameters were within water quality standards.

Mercury Bioavailability

The influence of changing water levels in the Lewiston Reservoir on the mercury concentrations found in the water and biota of the reservoir was studied (Tetra Tech 2005). Aqueous sampling in the reservoir indicated that most samples had total mercury and methylmercury concentrations below detection levels and that the one sample with detectable methylmercury had a very low concentration supporting the conclusion that Lewiston Reservoir is not a site of enhanced methylation. Nonetheless, fish throughout the Niagara River corridor, and indeed throughout New York, may have elevated levels of mercury due to the widespread nature of this metal.

Sediment Quality

The Power Authority conducted an investigation of sediment quality in the upper and lower Niagara River, Lewiston Reservoir, and forebay in 2003 (ESI, 2005). In this study, sediments were analyzed for multiple constituents, including 18 priority toxic pollutants identified in the Niagara River Toxics Management Plan and five additional parameters of interest (total polynuclear aromatic hydrocarbons (PAHs), cadmium, total organic carbon (TOC), total volatile solids, and grain size) to the New York DEC.

Sediment collected from the upper and lower Niagara River was generally coarse material (primarily sand and gravel with lesser amounts of silt and clay) while sediment collected from the reservoir consisted primarily of silt and clay. The reservoir sediments typically had significantly higher carbon content than the coarser grain sediments encountered in the Niagara River. Although contaminant levels in sediment can be affected by a variety of factors, the physical and chemical characteristics of the sediment found in the reservoir (i.e., finer-grained and higher organic carbon content) increases the adsorption potential of contaminants to these sediments compared to those from the Niagara River.

In general, however, the constituents detected in the Lewiston Reservoir sediments (PAHs, PCBs, mirex, arsenic, lead, and mercury) were also detected in the Niagara River sediments. The detected constituent levels in the Lewiston Reservoir samples were similar to, and in some instances considerably less than, the levels detected in the Niagara River sediments (ESI, 2005). With the exception of one PCB Aroclor (Aroclor 1242), there were no constituents detected in the Lewiston Reservoir that were not detected in the upper Niagara River and/or the lower Niagara River, upstream of the tailrace. Sediment samples from the reservoir exceeded New York DEC sediment criteria for total PCBs, PAHs, mirex, arsenic, lead, and mercury. But as with the detections discussed above, any exceedence of a constituent in the Lewiston Reservoir was also exceeded in the upper Niagara River and/or the lower Niagara River upstream of the tailrace (ESI, 2005).

<u>Groundwater Quality</u>

Groundwater in the study area may be thought of as two systems: a freshwater flow system, and a deeper saline water flow system. The regional freshwater flow system has been characterized as a wedge that thins to the south above the denser saline water (Kappel and Tepper, 1992). The primary source of the freshwater flow system is recharge in the area of the Niagara escarpment. The Lewiston Reservoir also acts as a substantial source of recharge to the freshwater flow zone. A freshwater/saline water mixing zone occurs at the interface between the two flow systems.

Generally, groundwater in the freshwater flow system is moderately to highly mineralized, containing sulfates dissolved from soluble gypsum within the dolomite and calcium and magnesium bicarbonate, also dissolved from dolomite. The highest mineral content was typically found in groundwater from the deeper saline water flow system. Chloride concentrations (salinity) measured in the upper zone were on the order of 100 to 500 mg/L, whereas chloride concentrations in the lower zones were on the order of 10,000 to 100,000 mg/L.

Groundwater Contamination

Contaminants in the Conduit Vicinity

Toxic chemicals from various industrial processes in the Niagara Falls area have contaminated the soil and underlying groundwater as a result of either leaks and spills from industrial operations or from the disposal of waste products in lagoons, dump sites, and landfills. In the Niagara Falls area, approximately 41 sites have been investigated for the presence of hazardous waste (DuPont et al., 1992). In addition to hazardous waste sites, other potential significant sources of groundwater contamination are the numerous fuel service stations that are located throughout the study area.

The known contaminant groundwater plumes in the Niagara Falls area have been thoroughly characterized by past and ongoing investigation and remediation efforts. Movement of contaminants associated with these plumes is influenced by many factors, including regional groundwater flow patterns, relative effectiveness of remediation programs, area groundwater extraction activities, vertical fracturing, contaminant characteristics (e.g. specific gravity and solubility), vertical hydraulic gradients, and the location and presence of the conduits. In many cases, contaminants have been identified throughout the entire thickness of the Lockport Group. In some cases, dense non-aqueous-phase liquids (DNAPLs) have migrated downward and act as continuing sources of dissolved-phase groundwater contamination.

Groundwater in the vicinity of the project conduits is affected by numerous contaminant plumes associated with former and current active industrial sites. Several groundwater samples were analyzed as part of a groundwater study conducted by the Power Authority during 2003 (URS et al., 2005a). Contaminants detected during this sampling effort may be classified into the following contaminant groups.

Group 1 – Chlorinated Volatiles: 1,2-DCE (cis), TCE, PCE, vinyl chloride, 1,1,1-TCA, dichlorobenzenes, 1,1-DCA, and 1,1-DCE.

Group 2 – BTEX Compounds: benzene, toluene, ethylbenzene, xylenes.

Group 3 – Nonchlorinated Volatiles: acetone, methyl ethyl ketone, cyclohexane, methylcyclohexane, carbon disulfide, and isopropylbenzene.

Group 4 – Phenol and Methylphenols: phenol, 2,4-dimethylphenol, 2-methylphenol, and 4-methylphenol.

Group 5 – Chlorophenols: 2-cholorophenol.

Group 6 – Chlorobenzenes and Chlorotoluenes: chlorobenzene.

Group 7 – PAHs: naphthalene, pyrene.

Group 8 - Highly Chlorinated Non-Aromatic Semivolatile Compounds: No compounds detected.

Group 9 – Phthalates: bis(2-ethylhexyl) phthalate, Di-n-octylphthalate.

Group 10 – Pesticides/PCBs/Dioxins: alpha-BHC, beta-BHC, delta-BHC, Aroclor 1242.

Group 11 – Heavy Metals: arsenic, cadmium, lead.

Contaminants in the Lewiston Reservoir Vicinity

The most predominant chemical contaminants detected in groundwater in the vicinity of the Lewiston Reservoir were gasoline-related VOCs, such as BTEX and methyl tertiary-butyl ether (MTBE). BTEX compounds and MTBE were detected in all of the aquifer layers in the area, with the highest concentrations in the deepest aquifer layers east of the reservoir. The two deepest aquifers, which exhibit the highest gasoline contaminant concentrations, are not subject to reservoir-induced groundwater flow. As these compounds were not detected in water samples collected from the Lewiston Reservoir itself, their detection in wells installed near the reservoir is likely related to the presence of fuel service stations in the area, with possibly leaking underground storage tanks.

Significant BTEX concentrations at reservoir area wells were generally detected in deeper saline aquifers that exhibit high chloride levels (greater than 500 mg/L). The upper weathered bedrock aquifer generally exhibited low contaminant concentrations. Gasoline related contaminants likely migrate downward through vertical fracturing to the deeper zones. Higher contaminant concentrations in the deeper zones may be caused by relative lack of groundwater flow in these zones, which would allow contaminants to accumulate, whereas the relatively higher groundwater flow in the upper aquifers may act to dilute or disperse contaminants in these zones.

Non-gasoline-related analytes detected in samples collected from reservoir area wells included acetone, methyl ethyl ketone, 1,1,1-trichloroethane, chloroform, carbon disulfide, arsenic, cadmium, lead, methylmercury, bis (2-ethylhexyl)phthalate, phenol, and caprolactum. One or more of these compounds were detected in all water-bearing zones present in the reservoir vicinity. The source or sources of these contaminants is unknown. With the exception of methylmercury, none of these contaminants was detected in water samples collected from the Lewiston Reservoir itself. However, methylmercury was also detected at concentrations higher than the reservoir samples in surface water samples collected in the reservoir vicinity. This is likely indicative of regional atmospheric depositional sources.

3.3.2.2 Environmental Effects and Recommendations

Water Level Fluctuations

Project operation, along with several other non-project factors, contributes to water level fluctuations in the upper and lower Niagara River and its tributaries. The project's contribution to fluctuations in the upper Niagara River is the result of water in the Chippawa-Grass Island Pool being diverted through the intakes and conduits and into the project forebay. In the Lower Niagara River, the project's contribution to water level fluctuations is the result of peaking discharges from the Robert Moses Plant tailrace. The Lewiston Reservoir experiences large fluctuations because it serves as the storage reservoir for both the Lewiston Plant and the Robert Moses Plant. The Power Authority does not propose any changes in project operations, the certification does not require any project changes, and no entity has recommended changes in project operations. Below, we assess the project's ongoing effect on water level fluctuations. We don't discuss Lewistion Reservoir fluctuations because the reservoir is not a natural feature like the Niagara River. Rather, it is a project structure designed, constructed, and used strictly for the purpose of storing and releasing water for power generation. Because the river and tributary fluctuations affect erosion and habitat for aquatic and terrestrial species, those effects are discussed in sections 3.3.1, 3.3.3, and 3.3.4. We also discuss the effects of water diversion on aquatic habitat in section 3.3.3.

Our Analysis

A water level and flow fluctuation study that examined data for the period of record 1991-2002 (URS et al., 2005) indicates that water level fluctuations in both the upper and lower Niagara River are caused by a number of factors in addition to U.S./Canadian power generation. Natural factors include flow surges from Lake Erie, wind, ice conditions, regional and long-term precipitation patterns, and water levels of

Lake Erie and Lake Ontario. Manmade factors include regulation of Niagara Falls flow for Treaty-mandated requirements, operation of power plants on the Canadian side of the river, and operation of the Niagara Project. Because the influence of these factors on water levels is interrelated and dynamic, it is difficult to determine the exact amount of fluctuation that is attributable to each factor. Therefore, for many of the analyses, such as the duration analyses, the reported water level fluctuations in the Niagara River include the influences from all the factors. One exception was the effects of storm and wind induced water level fluctuations that were differentiated through a combination of gauge data analysis and empirical calculation of surface wave height and wind set-up.

In accordance with the 1993 INBC Directive, the Chippawa-Grass Island Pool fluctuations are limited to 1.5 feet per day within a 3 foot operating range. Water level fluctuations on the lower Niagara River below the Robert Moses Plant are also approximately 1.5 feet per day.

The frequency and magnitude of the daily tributary water level fluctuations appears to be directly related to the creeks' spatial relation to the Chippawa-Grass Island Pool in the upper Niagara River. The median daily water level fluctuations in the tributaries studied during the 2003 tourist season were less than 1 foot (URS and Gomez and Sullivan, 2005). Fluctuations decrease as one proceeds upstream in the tributaries or to the point where creek bed elevation or a hydraulic constriction such as a culvert or weir prevents the Niagara River from affecting the upper reaches of the tributaries.

In addition to being influenced by power generation, local precipitation, and storm surges from Lake Erie, water levels in Tonawanda Creek and Ellicott Creek are also influenced by dredging, flood control, and water diversions for the New York State Barge Canal System. These operations have altered the hydraulics and hydrology in the tributaries and the relationship of the tributaries to the upper Niagara River (URS et al., 2005b). The exact zone of influence of Niagara River water levels on Tonawanda and Ellicott Creeks was not determined; however, a conservative estimate was made of the potentially affected length. For the median Niagara River water level condition, the extent of influence of Niagara River water level was estimated based on extending the median water level of the Niagara River to where it intersects each creek bottom. This analysis determined that the influence of Niagara River water level influenced 13.7 miles of Tonawanda Creek and 7.3 miles of Ellicott Creek. These estimates seem reasonable as they coincide with riffles in both creeks that act as hydraulic controls limiting the upstream influence of Niagara River water level fluctuations due to U.S./Canadian power generation on creek water levels. In Tonawanda Creek, riffles are located 13.6 and 14.1 miles upstream of the mouth and for Ellicott Creek, a major riffle begins 6.9 miles upstream of the mouth of Ellicott Creek (Gomez and Sullivan and E/PRO, 2005). For the annual maximum Niagara River water level, the affected stream length was estimated to be nearly 19 miles for Tonawanda Creek and 7.1 miles for Ellicott Creek based on extending the annual maximum water level of the Niagara River to where it intersects each creek bottom (URS et al., 2005b). The annual maximum hourly water level occurred during an unusual storm event and is not representative of the range of daily water levels due to U.S./Canadian power generation.

No change in operations is proposed or recommended. Therefore, water level fluctuations in the upper and Lower Niagara River and its tributaries would not change as a result of the Power Authorities proposal.

Water level monitoring study for Tonawanda and Ellicott Creeks

The Public Power Coalition (PPC, which includes the Town of Amherst) requests that the Power Authority conduct a water level monitoring study in Tonawanda and Ellicott Creeks to determine what portion of the water level fluctuations are attributable to the operation of the project.

Our Analysis

As discussed above, there are many causes of water level fluctuations in the upper river and its tributaries, and project operation is one of the causes. Other significant causes of fluctuations are wind and storms that effect the upper Niagara, natural stream flow variation in the tributaries and the Niagara River, dredging, Canadian power generation, and operation of the New York State Barge Canal System. The Power Authority's study of fluctuations used monitoring wells, although the most upstream of the wells was not situated far enough upstream to capture the full zone of influence. The Power Authority supplemented the field data by conservatively estimating the zone of influence using stream bottom elevations and flood insurance studies for the towns along the creeks, including Amherst. Given the numerous contributing causes to tributary water level fluctuations, both natural and artificial, it is not clear that a study could be designed to accurately attribute the percentage of fluctuation cause by each source of influence.

We note that the stream bank erosion that is documented in the tributaries, some of which is probably attributable to past and ongoing project operations, could potentially be addressed via restoration or enhancement projects funded through the HERF proposed by the Power Authority. This would depend on whether the ESC recommended funding for such a project(s). A study of water level fluctuations, on the other hand, would have no effect on erosion.

<u>Water Quality</u>

The operation of the project has some effects on water quality in the upper and lower Niagara River. The Power Authority does not propose any measures to address water quality. Additionally, Interior does not make any section 10(j) recommendations addressing water quality and the certification does not contain any conditions requiring water quality monitoring or enhancement measures. Below, we summarize the project's effects.

Our Analysis

Dissolved oxygen levels in the reaches of U.S. tributaries that are affected by Niagara River water levels seem to be influenced by many factors. These factors include loadings from point and non-point sources, land use, abundance of aquatic plants or algae, the amount of turbulence (surface to air mixing), water temperature, and the organic sediment loading into the stream.

For some of the tributaries such as Cayuga Creek near its mouth, water level fluctuations in the upper Niagara River can have a positive effect on tributary dissolved oxygen levels when water from the river (which generally contains higher dissolved oxygen than the tributaries) mixes with water from lower reaches of the creeks (URS and Gomez and Sullivan, 2005). On the other hand, the influence of upper Niagara River water levels on creek water levels may reduce flow velocities in the tributaries. This reduced velocity could in turn decrease the rate of reaeration of any oxygen-depleted water in the affected areas. The contribution of U.S./Canadian power generation alone on dissolved oxygen levels in the upper Niagara River and tributaries cannot be separated out from other influencing factors, but its impact is probably minimal.

Project presence and operation enhances dissolved oxygen levels in Gill and Fish Creeks. Summer flows in Gill Creek are augmented by well-oxygenated Lewiston Reservoir surface water resulting in improved dissolved oxygen levels in the creek. In addition, the presence of Lewiston Reservoir provides additional groundwater recharge to both Fish and Gill Creeks. The cooler groundwater helps keep the creek temperatures relatively cool thereby increasing the stream's potential to hold dissolved oxygen (URS and Gomez and Sullivan, 2005).

Analysis of the temperature study results revealed that water level fluctuations did not affect the normal range of seasonal or diurnal water temperatures and did not affect the hourly rate of temperature change anywhere in deeper portions of the upper Niagara River (the channel), the lower Niagara River both upstream and downstream of the Robert Moses Plant, or in Lewiston Reservoir (URS, 2005a). Water level fluctuations did, however, cause more rapid changes in water temperature at several locations in the tributaries of the Niagara River as well as shallower portions of the upper Niagara River (shoals) as compared to those at locations not affected by water level fluctuations in the Niagara River.

In summary, operation of the project has minor effects on dissolved oxygen and temperature in the Niagara River. The Power Authority would continue to operate the project as it is currently operated. There would be no change in the project's effect on water quality.

Groundwater Flow Patterns

As a result of project construction, several project features, including the intake conduits, the Lewiston Reservoir, and the project forebay, have altered natural groundwater levels and flow patterns in the project area. Additionally, groundwater quality in the vicinity of the Power Authority conduits contains various organic chemicals and other contaminants as a result of groundwater contamination plumes associated with the area's historical industrial operations and current and former hazardous waste sites. Therefore, the project influences the movement of these contaminants.

When the Lewiston Reservoir was constructed, it altered the local groundwater flow patterns. Flow patterns in the area of the reservoir that were generally southwestward from the recharge area of the Niagara escarpment toward the Niagara River prior to reservoir construction, now move radially outward from the reservoir. This flow pattern creates a groundwater divide (on Tuscarora Nation lands) approximately 1,500 feet east of Lewiston Reservoir where groundwater flow traveling eastward from the reservoir meets groundwater flow from the northeast. The groundwater flow divide is not static, however; it moves laterally in response to reservoir water levels and seasonal variations in the regional groundwater levels. The result is that southwesterly flowing groundwater from the Niagara escarpment recharge area is directed either north or south around the reservoir when it hits the divide.

Lewiston Reservoir and forebay operations also affect groundwater flows and levels. The reservoir, situated above ground surface, acts as a substantial and relatively stable source of groundwater recharge. Fluctuations in groundwater levels occur in the vicinity of the Lewiston Reservoir as a result of cyclic fill/discharge operations. Groundwater fluctuations are typically on the order of 1 foot or less with maximum observed fluctuations, near the reservoir berm, of approximately 2.5 feet. The area of influence on groundwater flow is limited north and east of the reservoir, due to the presence of groundwater flow divides in these areas. The effects related to the forebay mainly influence groundwater levels within approximately one half of a mile of either side of the conduits.

In addition to effects induced by the Lewiston Reservoir and the project forebay, the presence of the Conduit Drainage System also alters groundwater flow patterns. The Conduit Drainage System acts as a linear groundwater flow sink along the entire 4.3-mile length of the conduits. Groundwater flow within approximately one half of a mile of the conduits flows toward the conduits. Some of the groundwater influenced by the conduits discharges into the Conduit Drainage System. The groundwater then follows the Conduit Drainage System toward the forebay.

Contaminated groundwater influenced by the Conduit Drainage System migrates toward the conduits (both east and west of the conduits) and ultimately drains into the project's Conduit Drainage System or the City of Niagara Falls' Falls Street tunnel (URS et al., 2005a). Contaminants transported into the Conduit Drainage System can either travel to the tunnel or forebay, depending on various factors including fluctuating river and forebay levels that can affect hydraulic conditions in the Conduit Drainage System. However, analytical results determined that no contaminants were detected in water samples collected from the forebay. Therefore, other than the possible infiltration of contaminated groundwater into the tunnel, no significant adverse impacts were identified with respect to project effects on groundwater contaminant transport in the vicinity of the conduits.

Although contaminants were identified in the vicinity of Lewiston Reservoir, there is no direct evidence that project operations affect the movement of these contaminants in the area of the Lewiston Reservoir.

Niagara Falls Water Board Capital Improvement Fund

To address the issue of movement of contaminated groundwater into the tunnel, the Power Authority proposes, under the terms of the Settlement, to establish a $19 million capital improvement fund. The fund would support a grouting rehabilitation project of the tunnel in the area of the conduits. This measure is not a requirement of the certification nor is it contained in Interior's section 10(j) recommendations.

Our Analysis

Operation of the project conduits in relation to groundwater flow and the tunnel causes the City of Niagara Falls to treat substantially more water than they would otherwise have to without the conduits. Groundwater enters the Conduit Drainage System and flows toward the tunnel. Because portions of the tunnel leak, groundwater enters the tunnel. Approximately 80 percent of the groundwater (5.2 mgd) that enters the tunnel is attributable to the Conduit Drainage System, a project feature. This water is also known to contain contaminants from the surrounding area. Past grouting efforts of the type proposed have reduced infiltration by approximately 70 percent. If the grouting project is successful, the Power Authority's funding proposal would help to minimize this ongoing project effect. The City of Niagara Falls' water treatment costs would be reduced, while at the same time reducing one mechanism for the transport of contaminants to the Niagara River.

3.3.2.3 Cumulative Effects

The water quality of the Niagara River is affected by municipal/industrial discharges and waste disposal sites (EPA, 1997). Pollutants from past industrial practices caused contaminated sediments, hazardous waste sites, and contaminated groundwater. By the time construction of the Niagara Project began in 1958, surface water and groundwater resources had been significantly impaired by the cumulative effects of these changes and developments.

During more recent decades, both surface and groundwater quality have improved. The EPA and New York DEC have required remedial controls for sites responsible for toxic loadings and put owners/operators on ambitious remediation schedules. Remediation of the sites is intended to virtually eliminate the migration of toxic pollutants from the sites. Based on various simplifying assumptions, EPA estimates that remediation to date have reduced the potential inputs into the Niagara River by approximately 93 percent.

The Power Authority proposes to provide funding to the Niagara Falls Water Board to reduce groundwater infiltration into the Falls Street tunnel. Reducing groundwater infiltration would, in turn, reduce the amount of contaminated groundwater that enters the river during wet weather conditions. We expect this measure would result in a net beneficial cumulative effect on water quality.

3.3.2.4 Unavoidable Adverse Impacts

The project would continue to contribute to water level fluctuations in the upper and lower Niagara River and its tributaries (Ellicott Creek, Tonawanda Creek, Spicer Creek, Gun Creek, Woods Creek, Cayuga Creek, and Ergots Creek). As a result of these surface water fluctuations, and because of the existence and location of the conduits relative to existing aquifers, the project would continue to influence groundwater levels and movement patterns.

3.3.3 Aquatic Resources

3.3.3.1 Affected Environment

The geographic investigation area of the affected environment relative to Aquatic Resources is the same as that in section 3.3.2, Water Resources. This section is divided into four subsections: aquatic habitat; aquatic fauna; rare, threatened and endangered species; and management and protection plans. Within each subsection, aquatic resources are described for: (1) the upper Niagara River, (2) the lower Niagara River, (3) the portions of U.S. tributaries affected by Niagara River water levels, and (4) the Lewiston Reservoir.

Aquatic Habitat

<u>Habitat Distribution</u>

The aquatic habitat is described according to the following parameters: hydrological characteristics, substrate, abundance of SAV, and abundance of emergent aquatic vegetation (EAV).

<u>Upper Niagara River</u>

The upper Niagara River region consists of about 22.5 miles of river, from the mouth of Lake Erie to Niagara Falls. The slope from shore, and resultant water depth increase, is generally gradual in much of the upper Niagara River.

From Lake Erie to Strawberry Island (a distance of about 5 miles), the river is relatively narrow (generally about 1,500 feet wide) and very fast flowing. Channel velocities at the Peace Bridge (about 2 miles downstream from Lake Erie) average about 5 - 8.5 feet per second (fps) (URS et al., 2005b). Most of the upper Niagara River in this area is greater than 20 feet deep and, because of the very high velocities, the substrate is bedrock and boulder.

Strawberry Island is located just upstream from Grand Island. The Strawberry Island/Motor Island area, which includes the southern tip of Grand Island, is an especially large shoal where water depth rarely exceeds 6 feet. Substrate in this area primarily consists of sand, pebble, and cobble, with some boulder along the shoreline of Strawberry Island.

At Grand Island (approximately 6 1/2 miles downstream of Lake Erie), the Niagara River splits into the Tonawanda (East) and Chippawa (West) Channels. The Tonawanda and Chippawa Channels have similar physical characteristics; each is generally less than 20 feet deep in most places and their widths range from about 1,500 – 3,700 feet. However, water depths in the Tonawanda Channel along the east side of Grand Island and several areas in the Chippawa Channel are greater than 30 feet deep. Substrate found in these channels is typically sand, silt and gravel, but some areas contain cobble, boulder, and bedrock.

At the north (downstream) end of Grand Island, the channels converge to form the 3-mile-long Chippawa-Grass Island Pool. Water depth in the pool is generally 5 to 12 feet, and the substrate is gravel, cobbles, and rock. The Cascade Rapids, which are downstream of the Chippawa-Grass Island Pool, are shallow and have very high velocity water with standing waves, and the substrate is primarily bedrock and some large boulders.

Although most of the upper Niagara River is relatively fast flowing water, areas with little or no velocity exist. These areas are important components of the physical habitat needed by many species. The largest of these areas is located in the main river along the north shore of Grand Island. Other areas of little or no velocity are: just offshore of the northern side of Grand Island that includes Grass Island and its sand/gravel shoal; the Strawberry Island/Motor Island Shoal and the southern shore of Grand Island; the shallows adjacent to the mouth of Spicer Creek; the Little River in Niagara Falls; the shoreline in the City of Tonawanda, downstream of a major river bend at the South Grand Island Bridge; an area immediately to the east of Cayuga Island; the tributaries of Grand Island (Big Simile Creek Marina, much of Spicer Creek, Gun Creek, and Woods Creek, and Buckhorn Marsh from the Chippawa Channel of the Niagara River to Woods Creek); and Cayuga, Tonawanda, and Ellicott Creeks.

In general, SAV is extremely abundant in most areas of the upper Niagara River at depths less than 20 feet, where the substrate is sand or silt (Static et al., 2005). Predominant species of SAV found in the upper Niagara River include wild-celery, milfoil species, and pondweed species. The largest SAV beds in the upper Niagara River are found in the Strawberry Island/Motor Island Shoal (including the southern shore of Grand Island), the Grass Island shoal, the shoreline near the Little River (both east and west of Cayuga Island), and the eastern shore of Grand Island north of Spicer Creek. A thinner strip of SAV exists along much of the remaining shoreline in the upper Niagara River.

EAV is significantly less abundant in the upper Niagara River than SAV (Static et al., 2005). Narrow strips of EAV have been identified along the upper Niagara River shore (e.g., island shorelines) and in larger areas associated with backwatered, lower energy habitats (e.g., near the mouths of creeks). Predominant species of EAV found in the upper Niagara River include bulrush species, common arrowhead, sedges, broad-leaf cattail, and great burreed. Larger areas of EAV include the southern side of the mouth of Burnt Ship Creek; Grass Island; the backwaters of Strawberry Island; the old ferry docks site on the Grand Island shore across from Motor Island; the mouth of Big Sixmile Creek; the mouth of Spicer Creek; along both shores of the Little River (at Cayuga Island); along the northern shore of Grand Island in Buckhorn Island State Park; and along most of the western Grand Island shoreline (Chippawa Channel). Smaller areas of EAV occur along the shoreline of the Tonawanda Channel, which has been extensively disturbed and heavily riprapped except for two sites along the eastern shoreline of the Tonawanda Channel that each have approximately two acres of created EAV wetland.

The U.S. Fish and Wildlife Service (FWS) National Wetlands Inventory and New York DEC have mapped wetlands in the investigation area. Most of the mapped wetlands are well above the zone directly exposed to water level fluctuations and/or are not contiguous with the river surface water. However, a few of the mapped wetlands are contiguous with the river and are potentially influenced by water fluctuations occurring along the upper portion of the Niagara River (Stantec et al., 2005). These wetlands include Buckhorn Marsh (outside of the water control weirs), a large wetland on Grand Island just north of Spicer Creek, the backwater channel in Beaver Island State Park, and a wetland near the old ferry dock site on Grand Island across from Motor Island.

Lower Niagara River

The Niagara Gorge portion of the lower Niagara River is a mix of elevation drops and intermittent pools with depths of approximately 35 feet and greater, with maximum depths of about 200 feet in some areas. The lower Niagara River above the Robert Moses Plant ranges from about 300 to 800 feet wide and has boulder, cobble, and bedrock substrates. No SAV is present due to the lack of suitable substrate and possibly also due to relatively high water velocities (Aquatic Science and E/PRO, 2005). EAV is not present except in a very narrow strip near Devil's Hole Rapids.

The lower Niagara River from the Robert Moses Plant tailrace to Lake Ontario is typified by a narrow zone (less than 100 feet) along the shorelines where depth is less than 20 feet and the banks are steep-sided. Water depths in the channel are typically about 45 feet with a range of about 30 – 150 feet. The substrates are primarily bedrock and boulder with smaller substrates (cobble, small boulder, and some sand and silt) near shore. SAV is present downstream of the Robert Moses Plant tailrace where water depths are less than 20 feet and substrates are sand. The three predominant species of SAV that occur in these areas include wild-celery, Eurasian water milfoil, and sago pondweed. Little EAV occurs in this river reach (Stantec et al., 2005).

Coastal wetland habitats do not occur in the lower Niagara River because of the relatively steep slopes leading down to the water, coarse substrates, fast water velocities, and the lack of shallow water areas. These combined factors are not conducive to the development of large, fringe riverine wetlands, and these habitats likely have never existed in the lower river to any great extent (Stantec et al., 2005).

U.S. Tributaries

There are eleven U.S. tributaries to the Niagara River that may potentially be affected by water level fluctuations. Six of the tributaries originate on the mainland, and five others originate on Grand Island.

Mainland Tributaries

Of the six mainland tributaries that are potentially subject to influence by Niagara River water level fluctuations, Cayuga, Ellicott, and Tonawanda Creeks are the largest. Two minor tributaries, Gill Creek and Twomile Creek, drain into the upper Niagara River as well. Fish Creek, also a minor tributary, empties into the lower Niagara River. The habitat parameters of each of these creeks are described herein.

The downstream section of Cayuga Creek, near its confluence with the upper Niagara River, is relatively shallow, with a uniform depth of about 6 feet and a channel width of about 40-70 feet. Cayuga Creek's substrate is primarily silt and mud. Much of the shoreline in this area is altered with bank protection features, such as sheet piling, timber cribs, stone, and concrete bridge abutments. Areas of SAV and EAV occur sporadically. SAV is most common close to the upper Niagara River and is composed of curly leaf pondweed, duckweeds, variable milfoil, and coontail. Predominant species of EAV include fowl meadow grass, soft rush, purple loosestrife, fowl grass, common arrowhead, great burreed, northern water plantain, rice cutgrass, spike rush, and watercress.

Ellicott Creek is wider and somewhat deeper than Cayuga Creek, with depths commonly greater than 8 feet. The hydraulic and hydrologic characteristics of the creek have been altered by dredging and flow diversions (URS et al., 2005b). The thalweg depths are about 16 feet in the downstream sections, and slowly decrease towards the upstream sections with no abrupt changes. The substrate is muck and silt, with SAV beds occurring intermittently and often only in narrow bands near shore. Predominant species include wild-celery, sago pondweed, and coontail. A limited amount of EAV exists in the creek.

Of the three major mainland tributaries of the upper Niagara River, Tonawanda Creek is the widest and deepest. As part of the New York State Barge Canal System, a significant reach of Tonawanda Creek (extending from the confluence with the upper Niagara River to approximately 11.6 miles upstream) has been dredged and has a flat hydraulic slope and uniform width (typically 150 – 250 feet) and depth (typically 15 –20 feet). In general, the banks of Tonawanda Creek are steeper than either of the other creeks and have been protected with dumped stone and steel sheet pile, timber crib, stacked blocks, and/or concrete walls (Baird, 2005). The creek bottom is composed of silt, although coarser material exists in some areas along the shores. Tonawanda Creek upstream of the confluence with the New York State Barge Canal System is not dredged and the shoreline is much less developed (i.e., more natural). SAV is more abundant and the beds much denser in Tonawanda Creek than in Ellicott or Cayuga Creeks. Predominant species include wild-celery, water star-grass, Eurasian water milfoil, sago pondweed, curly leaf pondweed, duckweeds, and coontail. EAV is sparse, is limited to narrow bands along the shoreline, and is composed of broad-leaf cattail, water willow, and common arrowhead.

The headwaters of Gill Creek are found on the lands of the Tuscarora Nation. Much of Gill Creek, downstream of the lands of the Tuscarora Nation, has been altered. The portion of Gill Creek that runs along the east and south sides of the Lewiston Reservoir is a channelized streambed (cut through bedrock). This channel was created during construction of the Lewiston Reservoir to reroute Gill Creek around the newly constructed dike. During the summer months, surface water from Lewiston Reservoir is discharged to Gill Creek at the downstream end of this channelized section to augment naturally occurring flow conditions. Gill Creek also receives enhanced groundwater inflow in the reach within approximately 1,500 feet east of the reservoir. This inflow is the result of seepage to the aquifer that occurs due to the presence of Lewiston Reservoir. At its mouth, the creek is lined with concrete where it flows through an industrial area into the upper Niagara River. Between the mouth and the Hyde Park Lake dam, the creek is wide and shallow with a narrow riparian buffer.

Like Gill Creek, Fish Creek was channelized along the east and north sides of the Lewiston Reservoir dike during project construction. Fish Creek, in this area, consists of low gradient channelized streambed. Its natural flow is increased by the recharge from

Lewiston Reservoir (URS et al, 2005a). At its mouth, Fish Creek flows over a waterfall and into the lower Niagara River. Because of this physical drop in elevation, Fish Creek is not affected by water level fluctuations in the lower Niagara River. Predominant species of SAV found in both Gill and Fish Creeks include common elodea, water milfoil, coontail, curly leaf pondweed, lemna spp., najas spp., wild-celery, and sago pondweed. A diverse assemblage of EAV is found in these two creeks. Predominant species include water purslane, blue flag, great burreed, narrow-leaf cattail, watercress, spike rush, softstem bulrush, common arrowhead, sweetflag, northern water plantain, great burreed, mild waterpepper, purple loosestrife, and water smartweed.

Twomile Creek enters the Tonawanda Channel of the upper Niagara River in the Town of Tonawanda. It is a small, shallow (less than 4 feet deep) tributary with a substrate consisting generally of mud, clay, and organic muck, with some sand and gravel. SAV occurs in several areas and the predominant species is water star-grass. No EAV has been observed in Twomile Creek (Stantec et al., 2005).

Grand Island Tributaries

The tributaries to the upper Niagara River that drain Grand Island include Woods, Burnt Ship, Gun, Spicer, and Big Sixmile Creeks. These creeks are shallow, rarely exceeding 4 feet in depth with the exception of a portion of Woods Creek near its mouth and the lower section of Big Sixmile Creek (Big Sixmile Marina). The substrates are generally mud, clay and organic muck, but sand and slightly larger substrates are present in faster flowing sections of the tributaries. SAV is generally common at the mouths of the creeks and for some distance upstream, where physical conditions such as substrate composition and water velocity are conducive to its growth. The predominant species of SAV found in these tributaries include water star-grass, Eurasian water milfoil, coontail, and wild-celery. EAV is common in all of the Grand Island tributaries. The most common species include broad-leaf cattail, sweetflag, spatterdock, swamp milkweed, purple loosestrife, pickerelweed, rushes, sedges, rice cutgrass, arrow arum, water horehound, and smartweeds.

Lewiston Reservoir

The interior of the Lewiston Reservoir consists of steep-sided riprap, which slopes vertically about 45 feet over a linear distance of about 200 feet. This slope extends down to a relatively flat bottom. Substrates on the bottom of the reservoir are primarily clay, mud, muck and silt (Stantec et al., 2005). The water in the reservoir appears to have little or no velocity except in the vicinity of the Lewiston Plant; velocity in this location occurs only during pumping or generating. There are no EAV or wetland areas associated with the reservoir, and very little SAV occurs there (Stantec et al., 2005).

Upon request of New York DEC, an additional study was conducted to map the location and extent of SAV in Lewiston Reservoir (Gomez and Sullivan and E/PRO, 2005). During the survey, no extensive SAV beds were observed and areal coverage was determined to be sparse. Species of SAV that were documented in the Lewiston Reservoir included sago pondweed, redhead grass, common elodea, and wild celery. In addition to these vascular plants, two types of algae, Muskgrass, and filamentous green algae, were found.

New York Department of State Significant Coastal Fish Habitat

The New York Department of State (New York DOS) Division of Coastal Resources and Waterfront Revitalization maintain data on Significant Coastal Fish and Wildlife Habitat (SCFWH), including information on habitats identified by the New York DEC Natural Heritage Program. Three aquatic natural communities, located upstream of Niagara Falls, have been determined to meet the 'significant' criteria: the Buckhorn Island Wetlands, the Strawberry Island/Motor Island Shallows, and the Grand Island tributaries. Below Niagara Falls, the natural community in the Lower Niagara River Rapids has also been determined significant (New York DOS, 1987).

The largest of the three significant aquatic habitats in the upper Niagara River is the Buckhorn Island Wetlands. This 525-acre area at the northwestern tip of Grand Island is located within, and adjacent to, Buckhorn Island State Park. It is a complex of forested wetlands with extensive emergent marshes and aquatic habitats with SAV and includes Buckhorn Island, Navy Island, Burnt Ship Creek, the Chippawa Channel east of Navy Island, and approximately the lower 2 miles of Woods Creek. This area is used by coolwater and warmwater fishes for spawning and as a nursery. Woods Creek, and to a lesser extent Burnt Ship Creek, provide extensive littoral areas used by warmwater fishes of the Niagara River. Studies have shown that Woods Creek is used by northern pike for spawning in the spring and as a nursery in the summer. Juvenile muskellunge also use Woods Creek, indicating that it may be an important nursery ground for this species. Woods and Burnt Ship Creeks support other warmwater fish species, including sunfish, black crappie, bullhead, rock bass, and white sucker. Studies during the mid-1970s indicated that the littoral area between Burnt Ship Creek and Navy Island was one of two principal spawning grounds for muskellunge in the upper Niagara River (the other being the Strawberry Island-Motor Island Shallows). This area is also one of the most productive spawning areas in the river for smallmouth bass (New York DOS, 1987).

The Strawberry Island-Motor Island Shallows is the second largest significant aquatic habitat in the upper Niagara River. This 445-acre area at the southeastern end of Grand Island is located within, and adjacent to, Beaver Island State Park. It includes Beaver Island, Strawberry Island, and Motor Island. This area contains SAV beds in water generally less than 6 feet deep (below mean low water), and patches of emergent vegetation along the shorelines. The Strawberry Island-Motor Island Shallows is the largest area of riverine littoral zone in the Niagara River. Areas such as this are rare in the Great Lakes Plain ecological region, and they provide important fish habitat. The Strawberry Island-Motor Island Shallows is one of the most important spawning areas for coolwater and warmwater fishes in the upper Niagara River. Studies during the mid-1970s indicated that this was one of two principal spawning grounds for muskellunge in the river (the other being the littoral area between Burnt Ship Creek and Navy Island). This area is also one of the most productive spawning areas in the upper Niagara River for smallmouth bass, yellow perch, and various other resident freshwater fish species. Strawberry Island-Motor Island Shallows contains relatively large concentrations of many fish species throughout the year (New York DOS, 1987).

The Grand Island tributaries rank third in size among significant aquatic habitats in the upper Niagara River. This habitat includes the lower portions of four tributaries: Gun, Spicer, Woods, and Big Sixmile Creeks and a 10-acre wetland adjacent to Beaver Island State Park. The tributaries are slow, meandering streams, less than 6 feet deep, with heavily silted bottoms and low flow except during periods of heavy runoff. The five areas that comprise this habitat are an important part of the upper Niagara River ecosystem and are used by coolwater and warmwater fishes for spawning and as a nursery.

Downstream of Niagara Falls, the Lower Niagara River Rapids lie within the Niagara River gorge and extend from the Whirlpool Rapids Bridge downstream approximately 4.5 miles to the Lewiston Village line. It is classified as a significant aquatic habitat because the deep, fast-moving water of this segment of the river is rare.

Aquatic Fauna

Aquatic fauna, as they exist in the Niagara River, its U.S. tributaries, and the Lewiston Reservoir, are described below under the categories of: Benthic Macroinvertebrates; Fish Community; Invasive Species; and Rare, Threatened, and Endangered (RTE) Species.

Benthic Macroinvertebrates

Sampling of macroinvertebrate communities (aquatic insects and mussels) from the 1970s to the early 1990s reveals that the health of macroinvertebrate communities in the Niagara River has steadily improved with better water quality (NYSDEC, 1997). During this time period, the number of species collected increased in both the upper and lower Niagara Rivers. The benthic macroinvertebrate community in the Lewiston Reservoir in 1982-1983 consisted of species similar to those found in the Niagara River during the same time period (Ecological Analysts, 1984).

Field surveys for native mussels were conducted during the summers of 2001 and 2002, and during the winter of 2003-2004. These field surveys revealed that the mainstem Niagara River is almost completely devoid of living native mussels, primarily due to the invasion of exotic zebra and quagga mussels. The surveys did reveal, however, that live specimens of four species of native mussel, including fragile papershell, eastern lampmussel, pink heelsplitter, and giant floater, occur in good numbers in a Grand Island tributary, and that live specimens of two species, fragile papershell and round pigtoe, occur in the vicinity of Buckhorn Island State Park. Both of these sites are in the project area.

Of these species, three are listed by the New York Natural Heritage Program (NYNHP). These include the fragile papershell, pink heelsplitter, and round pigtoe (see RTE Species, below). Zebra and quagga mussels, exotic and invasive species have recently become abundant in the Niagara River. These are discussed under the heading of Invasive Species, below.

Fish Community

Since 2001 the Power Authority has conducted seven studies associated with fish communities. These studies include: a fish survey of the Lewiston Reservoir (EI, 2001) and the upper and lower Niagara River (Power Authority, 2002a); recreational angler surveys of the Lewiston Reservoir (Stantec, 2005), lower Niagara River (Stantec, 2005a), and upper Niagara River (Normandeau, 2005); a study on the use of Buckhorn Marsh and Grand Island tributaries by northern pike for spawning and as a nursery (POWER AUTHORITY and Gomez and Sullivan, 2005); and a fish survey of Gill Creek (Gomez and Sullivan and Power Authority, 2005). The descriptions of the fish community in the upper and lower Niagara River and its U.S. tributaries and the Lewiston Reservoir are derived from these studies. All fish species caught in the Niagara River, its U.S. tributaries, and the Lewiston Reservoir from 2000 to 2004 are listed in Table 3-2. Since the 1920s, a total of 92 fish species have been known to occur in the Niagara River (Power Authority, 2002b), however not all of these species were caught in the surveys conducted from 2000 to 2004.

Table 3-2. Fish Species Caught (indicated by an X) in the Niagara River, its New York Tributaries, and the Lewiston Reservoir, 2000-2004**.**

Common name	Upper Niagara River	Lower Niagara River	Lewiston Reservoir
Alewife	X	X	X
American eel		X	X
Banded killifish	X	X	
Black crappie	X	X	X

Common name	Upper Niagara River	Lower Niagara River	Lewiston Reservoir
Blackchin shiner	X		
Blacknose dace	X		
Bluntnose minnow	X	X	X
Bluegill	X	X	X
Brindled madtom	X		X
Brown bullhead	X	X	X
Brook silverside	X		
Brook stickleback	X		
Bowfin	X	X	
Carp	X	X	X
Central mudminnow	X		
Central stoneroller	X		
Channel catfish	X		X
Common shiner	X	X	X
Creek chub	X		
Emerald shiner	X	X	X
European rudd	X		
Fathead minnow	X		
Freshwater drum	X	X	X
Gizzard shad	X		
Golden shiner	X	X	X
Goldfish	X	X	

Common name	Upper Niagara River	Lower Niagara River	Lewiston Reservoir
Greater redhorse	X	X	X
Green sunfish	X		
Hornyhead chub	X		
Iowa darter	X	X	
Johnny darter	X	X	X
Lake trout		X	
Largemouth bass	X	X	X
Logperch	X	X	X
Longnose gar	X	X	
Mottled sculpin	X		
Muskellunge	X	X	X
Northern hog sucker	X		
Northern pike	X	X	X
Pumpkinseed	X		X
Quillback	X	X	X
Rainbow darter	X		
Rainbow smelt	X	X	X
Rainbow trout	X	X	X
River redhorse	X		
Rock bass	X	X	X
Round goby	X		X
Shorthead redhorse	X	X	X

Common name	Upper Niagara River	Lower Niagara River	Lewiston Reservoir
Silver redhorse	X	X	X
Smallmouth bass	X	X	X
Spotfin shiner	X		X
Spottail shiner	X	X	X
Tadpole madtom	X		
Threespine stickleback		X	
Walleye		X	
White bass	X	X	X
White crappie	X		
White perch	X	X	
White sucker	X	X	X
Yellow bullhead	X		
Yellow perch	X	X	X

The upper and lower Niagara River, the tributaries, and Lewiston Reservoir support very active sport fisheries and are discussed in section 3.3.6.

Upper Niagara River

The upper Niagara River supports self-sustaining warmwater and coolwater fisheries; while a coldwater fishery is sustained primarily through a New York DEC stocking program in Lake Erie, although some natural recruitment may occur. Currently, no fish are stocked in the upper Niagara River. Chinook salmon, coho salmon, brown trout, lake trout, and rainbow trout (resident and steelhead) are stocked in the New York State waters of Lake Erie and its tributaries, with brown trout and rainbow trout predominating in the stocking efforts.

Lower Niagara River

The lower Niagara River supports warmwater, coolwater, and coldwater fisheries. Recruitment may occur from upper river fish populations through the Robert Moses and Sir Adam Beck Plants. The upper river populations are not expected to enhance lower river populations through passage over Niagara Falls, in particular over the American Falls, as survival is believed to be low. Salmonid populations in the lower Niagara River are directly supplemented through annual stocking of Lake Ontario and the lower Niagara River. Chinook salmon, coho salmon, brown trout, lake trout, rainbow trout (resident and steelhead), and Atlantic salmon are stocked in the lower Niagara River and/or the western basin of Lake Ontario. The lower Niagara River Rapids supports a productive coldwater fishery that is remarkable for its spawning runs of steelhead (rainbow trout). During spawning runs, this area supports one of the largest concentrations of steelhead known to occur in New York State. Substantial numbers of coho salmon, Chinook salmon, and brown trout also occur in the area during the spring and fall. Other species found in the lower river rapids include smallmouth bass, walleye, white bass, yellow perch, lake trout, and rainbow smelt (New York DOS, 1987).

U.S. Tributaries

Coolwater and warmwater fish species, similar to those assemblages found in the mainstem river, are commonly found in tributaries of the upper Niagara River. Several of the creeks, particularly Woods Creek on Grand Island, are occupied by spawning and juvenile northern pike (Power Authority and Gomez and Sullivan, 2005). The Grand Island tributaries are considered by New York DOS to be a significant coastal fish habitat. The Hyde Park Lake dam, located near the mouth of Gill Creek (a mainland tributary), is a significant barrier to any fish movement up that creek from the Niagara River.

Lewiston Reservoir

Surveys of the Lewiston Reservoir were conducted for the Power Authority in June 1975; November 1982; May, July, and August 1983; and May, July, and October 2000. During the most recent survey in 2000, the families of fish taken included salmonids (trout and salmon), centrarchids (sunfishes), esocids (pike), percids (perches), and cyprinids (minnows) - all of which are common in Lake Erie and the upper Niagara River. The most abundant fish in all three surveys was yellow perch, followed by rock bass.

Invasive Species

Zebra and quagga mussels, both exotic, invasive species, have recently become abundant in the Niagara River. These small, filter-feeding bivalves have caused dramatic changes in the Great Lakes ecosystem. Zebra and quagga mussels filter huge volumes of water, and, by doing so, have two important effects. First, these two species ingest large amounts of plankton and other organic matter. Consequently, this has greatly increased water clarity in the Great Lakes, enabling sunlight to penetrate deeper into the water. This is thought to have led to the establishment of SAV in much deeper water than prior to the extensive presence of invasive mussels (Skubinna et al., 1995). This has increased the spatial abundance and often the density of SAV, an important component of the aquatic habitat. Second, since zebra and quagga mussels concentrate contaminants in their body tissues and the fecal (waste) pellets they produce, contaminants can bioaccumulate in the tissues of fish species that consume them.

In 1999 or 2000, round goby, an exotic invasive fish species, first appeared in the Niagara River; by 2003, they seemed to have become abundant. Anglers reported catching round goby from the reservoir in 2002 (Stantec, 2005). Being new to the area, it is unknown what effect round goby will have on the fish community of the Niagara River, its tributaries, and/or the Lewiston Reservoir. Although no empirical data has been found specific to round goby in the Niagara River, substantial research has been conducted in reference to this species in Lake Erie and Lake Ontario; it is expected that the impacts of round goby in the Niagara River will be similar to the impacts described by studies on these contiguous water bodies. Round goby can have potentially detrimental effects on native fish species and can detract from recreational angling as anglers may catch large numbers of round goby instead of the species they are targeting (Marsden and Jude, 1995). Furthermore, round gobies eat zebra mussels (which accumulate toxins in their body tissues) and are in turn preyed upon by other fish, including important sport fish. This has led to the concern that the presence of round gobies may exacerbate the bioaccumulation of contaminants, particularly PCBs, in the tissues of sport fish (Marsden and Jude, 1995). In Lake Erie, round goby have been found in the stomachs of yellow perch, smallmouth bass, white bass, freshwater drum, white catfish, and walleye, and New York DEC believes round goby will continue to form a link between contaminants in zebra mussels and important sport fish (NYSDEC, 2002a). Round goby are also implicated in the botulism outbreaks that have occurred for several years in Lake Erie. During these outbreaks, many fish such as lake sturgeon, smallmouth bass, freshwater drum and rock bass and several birds such as gulls, loons, mergansers, and long-tailed ducks have died. The stomach contents of dead fish and birds often contain round goby and zebra mussels (New York DEC, 2002a).

Niagara River Fish Consumption Advisory

Niagara River Fish

A variety of contaminants (e.g., mercury, PCBs, organic compounds) have been detected in various species of fish in the Niagara River. As a result of these contaminant levels, consuming any portion of certain fish species, or too much of any fish from the Niagara River, poses a health risk. As of late 2004, New York State Department of Health (New York DOH) recommends the following consumption limits for Lake Ontario and Niagara River fish:

- American eel, channel catfish, carp, lake trout over 25 inches, brown trout over 20 inches, Chinook salmon taken from Lake Ontario and Niagara River below the Falls and white perch taken from the Niagara River below the Falls: eat none.

- White sucker, rainbow trout, smaller lake and brown trout, and coho salmon over 25 inches taken from Lake Ontario and Niagara River below the Falls and smallmouth bass taken from the Niagara River below the Falls: one meal per month.

- Carp taken from the Niagara River above the Falls: one meal per month.

Lewiston Reservoir Fish

In 2003, a study was conducted to describe the contaminant levels of fish in the Lewiston Reservoir using water quality and sediment data collected from the upper Niagara River and Lewiston Reservoir, probable exposure pathways, existing fish tissue data for the upper Niagara River, and the life histories of the fish that occur in the reservoir. Tissue analyses of fish previously collected from the Niagara River detected mercury and organic compounds. In addition, contaminant levels in the water and in the fine-grained sediment of Lewiston Reservoir and the upper Niagara River are comparable. Fish in Lewiston Reservoir may not be permanent long-term residents of the reservoir; therefore, they may be exposed to (and represent) conditions from both the upper river and the reservoir.

Rare, Threatened and Endangered (RTE) Species

There are no federally listed threatened or endangered aquatic species known to occur in the project vicinity. A 2001 study revealed, however, that there are eleven state-listed extant aquatic Rare, Threatened, and Endangered (RTE) species within the project vicinity. These include one species currently listed as threatened and ten species that are rare and inventoried by the New York NHP (Riveredge, 2005a). Taxonomically, these eleven species include seven fish, one crayfish, and three mussels.

A follow-up investigation revealed the presence of aquatic RTE species in Tonawanda Creek and its short tributary, Mud Creek, over 13.5 miles upstream of the confluence of the upper Niagara River and Tonawanda Creek (Riveredge, 2005d). These species include one state listed threatened fish and nine species of rare but unprotected native mussels. The fish, longear sunfish, has been repeatedly documented in Tonawanda Creek. The nine unprotected native mussel species are threeridge, Wabash pigtoe, pocketbook, fragile papershell, black sandshell, pink heelsplitter, kidneyshell, deertoe, and Rainbow.

Management and Protection Plans

Upper Niagara River

Fisheries of the upper Niagara River are managed, in conjunction with the fisheries resources of eastern Lake Erie, by New York DEC. Management activities are summarized in the annual reports to the Lake Erie Committee. Fisheries management priorities in the upper Niagara River focus on self-sustaining populations of coolwater and warmwater game fish (New York DEC, 2002c). A management priority for this area is the protection and enhancement of fish spawning and rearing habitat. These habitats produce game species, such as muskellunge and smallmouth bass, many of which may recruit to Lake Erie.

Studies of muskellunge have been conducted for several years to identify habitats and develop a young-of-the-year abundance index. The muskellunge studies have also included angler diaries, collected to determine the temporal and geographic distribution of muskellunge in Buffalo Harbor and the upper Niagara River. More recently, New York DEC has placed an emphasis on walleye, although the emphasis has been on use of Cattaraugus Creek (which flows into lake Erie), rather than on mainstem Niagara River habitat (New York DEC, 2002c).

Lower Niagara River

Fishery resources of the lower Niagara River are managed by New York DEC in conjunction with the agency's management of Lake Ontario fisheries. Management activities and fish community objectives for Lake Ontario, including the lower Niagara River, are summarized in the Annual Reports to the Lake Ontario Committee. Unlike the upper Niagara River, the management priority in the lower Niagara River has been coldwater species. Large numbers of salmonids, including rainbow trout (steelhead), Chinook and coho salmon, brown trout, and landlocked Atlantic salmon, are stocked annually in the western basin of Lake Ontario and/or the lower Niagara River. These fish support important recreational fisheries in Lake Ontario, as well as in the lower Niagara River. The lower Niagara River is also managed for some of the same species as the upper Niagara River, including muskellunge and walleye (New York DEC, 2002d).

In recent years, lake sturgeon, which is currently listed as threatened by New York DEC, has been increasingly important in the management plan for the lower Niagara River. The state has developed a Recovery Plan specifically for lake sturgeon (New York DEC, 2000b) in the lower Niagara River. The goal of this plan, developed in 1994 and updated in 2000, is to establish or maintain a sufficient number of self-sustaining populations of lake sturgeon (in eight waters) to warrant its delisting from Threatened to Special Concern (New York DEC 2000b). One of these waters is the lower Niagara River. Management activities for the restoration of lake sturgeon include mark-and-recapture experiments and radio telemetry studies to identify spawning habitats. Results of lake sturgeon research and management activities are documented in detail in FWS (2002).

U.S. Tributaries

New York DEC annually stocks rainbow trout into Ellicott Creek, a major tributary to the upper Niagara River. There are currently no other fisheries management programs directly associated with the U.S. tributaries.

Lewiston Reservoir

There are currently no fisheries management programs associated with the Lewiston Reservoir.

3.3.3.2 Environmental Effects and Recommendations

Effect of water level fluctuations on aquatic habitat

The project affects aquatic habitat by diverting water from the Chippawa-Grass Island pool in the upper Niagara river, and returning the water to the lower Niagara River at the Robert Moses Tailrace. The effect of this diversion is that the project contributes to water level fluctuations in the upper and lower Niagara River and its tributaries. As discussed in section 3.3.2, the magnitude of the fluctuations in the Chippawa-Grass Island Pool are limited to 1.5 feet per day by the 1993 INBC Directive. In the lower river below the Robert Moses Plant, water level fluctuations are also about 1.5 feet per day. Tributaries of the upper Niagara River also experience fluctuations, partly caused by the U.S. and Canadian hydroelectric diversions. Generally, the project influence is limited to the lower reaches of tributaries and the further upstream the tributary is from the Chippawa-Grass Island Pool, the less the magnitude of the project effect. Tributaries as far upstream as the Peace Bridge are influenced by project-related water fluctuations.

The aquatic habitat that is most influenced by these fluctuations is near the river bank or along the perimeter of islands. Many species of fish use near-shore habitat because these areas also tend to be the areas where aquatic plants are most abundant. Aquatic plants helps support macroinvertebrate populations which many fish feed on, provides cover and spawning habitat for many species, and provides velocity shelters. The fry and juveniles of many species of fish often prefer shallower, low-velocity, vegetated near-shore habitat because they are not strong swimmers and are vulnerable to predation from larger fish.

Under the settlement, the Power Authority proposes several measures to enhance flora and fauna in the Niagara River Corridor. These measures include: 1) establish a HIPs Fund in the amount of $12,000,000 (NPV 2007) for construction of 8 HIPS, the following six of which would enhance aquatic habitats : Strawberry Island Wetland Restoration; Motor Island Shoreline Protection; Frog Island Restoration; Beaver Island Wetland Restoration; Fish Habitat/Attraction Structures; and Control of Invasive Species – Buckhorn and Tifft Marshes; and 2) establishing a HERF of $16,180,000 (NPV 2007).

Interior recommends, and the certification would require, all eight of the proposed HIPs, including these six that would affect aquatic habitat.

Details of HIPs applicable to aquatic resources are presented below. Figure 3-3 shows the locations of the proposed HIPs. Details of the HERF are discussed in sections 2.2.2 and 3.3.1.

Strawberry Island Wetland Restoration

Strawberry Island is a relatively small island located in the upper Niagara River immediately upstream of the southern tip of Grand Island, approximately 15 miles upstream from the project intakes. It is owned by the State of New York and is part of Beaver Island State Park. The island contains upland and emergent marsh habitats not typically found in the upper River. The island was once mined for gravel, dramatically reducing its size. In addition, island size has been further reduced over the years due to erosion caused by severe storms. In 2001, the New York DEC implemented shoreline protection and wetland enhancement measures on the island. The southern tip of the island and both the east and west shorelines were armored with rip-rap, and wetland areas were created behind the rip-rap berms. The wetland areas were planted with appropriate wetland plants and protected from geese with exclusion barriers.

The proposed Strawberry Island HIP would extend protection measures to the remaining downstream shallow-water habitats of the island while at the same time creating complex marsh and high-energy wetland habitats for fish and wildlife. This project would increase the size and long-term stability of Strawberry Island using breakwaters along the newly created shoreline. Functionally valuable wetlands would be created behind the breakwaters through the placement of fill material to build elevations to optimal levels for target habitats. The primary target function created would be enhanced fish and wildlife habitat. However, other wetland functions, including recreational opportunity (*i.e.,* fishing, hunting, bird watching, *etc*.) and water quality (*i.e.,* sediment settling, nutrient retention, *etc*.) would be enhanced as well. The new breakwater structures would be installed just downstream of similar measures recently completed by the New York DEC. Breakwaters would be constructed primarily of rip-rap. Geotextile tubes would also be investigated as an alternative material for the more protected segments (*i.e.,* interior portions of breakwaters).

Our Analysis

The Strawberry Island-Motor Island Shallows is the largest area of riverine littoral zone in the Niagara River. Areas such as this are rare in the Great Lakes Plain ecological region, and they provide important fish habitat. The Strawberry Island-Motor Island Shallows is one of the most important fish spawning areas in the upper Niagara River. Strawberry Island-Motor Island Shallows contains relatively large concentrations of many fish species throughout the year. This area of the river experiences water level fluctuations and associated erosion due to a number of developmental activities, including water withdrawal for the Niagara Project.

The Strawberry Island HIP would extend protection measures to the remaining downstream shallow-water habitats of the island initiated by New York DEC in 2001 while at the same time creating complex marsh and high-energy wetland habitats for fish and wildlife. Numerous native warmwater and coolwater fish species could benefit from the enhanced spawning, nursery, and foraging habitat created through this HIP. This HIP would result in approximately 7 acres of new habitat, including the footprints of, and the area located between, the breakwaters.

Motor Island Shoreline Protection

Motor Island, located near Strawberry Island approximately 15 miles upstream of the project intakes, is owned by the State of New York and managed by the New York DEC for the protection and enhancement of fish and wildlife. Shoreline erosion is currently occurring at the southern tip and along the western shoreline of Motor Island. Additionally, existing shoreline protection structures along the eastern shoreline are in various stages of disrepair. This side of the island is often subject to impacts from boat wakes due to commercial and recreational boating traffic in the navigation channel.

The Motor Island HIP would be designed to minimize further damage to this important habitat feature of the upper Niagara River by providing shoreline protection measures along the western and eastern shorelines and at the southern tip of the island. Shoreline protection measures would incorporate bioengineering wherever possible to provide vegetation up to the water's edge and help stabilize erosion protection. In addition, anthropogenic structures such as the boat docking facilities along the western shoreline would be removed in an effort to restore the island shoreline to as natural an appearance as possible and to minimize future maintenance activities.

Also included in this HIP is a boat landing area on the northeast portion of the island. The boat landing would be used for landing construction equipment during the initial island improvements and later for monitoring activities that may be associated with this project and enhancements to the Motor Island Heron Rookery. Wooden pilings or similar structures would be incorporated for mooring work vessels.

Our Analysis

Motor Island, which is included in the Strawberry/Motor Island Significant Coastal Fish and Wildlife Habitat described above, is owned by the State of New York and managed by the New York DEC for the protection and enhancement of fish and wildlife. This area of the river experiences water level fluctuations and associated erosion due to a number of developmental activities, including water withdrawal for the Niagara Project. Shoreline erosion processes are currently occurring at various locations along the island's perimeter. This HIP would benefit aquatic habitat by providing shoreline protection measures along the western and eastern shorelines and at the southern tip of Motor Island. Shoreline protection would decrease erosion from the site, thus creating water clarity conducive to nearby SAV growth. SAV growth, in turn, would benefit many species of fish and other aquatic biota that use such habitat for spawning, nursery, and feeding.

Frog Island Restoration

Historically, a small group of islands could be found between Motor Island and Strawberry Island. Anecdotal data indicates that these islands were mined for gravel many decades ago leaving only relatively homogenous shallow water habitat that lacks complexity and structure. The Frog Island HIP would be designed to restore habitat complexity and create marsh and submerged coarse substrates for fish and wildlife in the area formerly occupied by the islands.

Our Analysis

This project would restore/create approximately 5.5 acres of island and associated habitat using a U-shaped perimeter of breakwater structures in the approximate vicinity of the historic island complex, approximately 15 miles upstream of the project intakes. The project would create diverse habitat conditions within, and between, the breakwaters including coarse (boulders, cobbles, and gravel) and fine (muck, silt, clay, and sand) substrate at variable depths ranging from just above the normal water level to several feet below the normal water level to facilitate the development of wetland interspersed with deeper areas and shoal habitat. The resultant aquatic habitats are expected to be beneficial to several fish species common to the Niagara River. This area of the river experiences water level fluctuations and associated erosion due to a number of developmental activities, including water withdrawal for the Niagara Project, although past habitat effects on Frog Island appear to be due to dredging activities, not project operation.

Beaver Island Wetland Restoration

The quantity and quality of habitat on Beaver Island and in the Beaver Island State Park is limited by a lack of emergent marsh and shallow pond habitat. Historic wetlands were dredged and filled in this area, and the resulting topography and hydrology do not optimize wetland structure and function. A crescent-shaped area of open water and wetlands on the inside of Beaver Island (known as Little Beaver Marsh) historically (before 1960) included hemi-marsh (marsh interspersed with shallow open water with irregular edges and in roughly even proportions) with excellent structural and vegetative diversity (New York OPRHP photograph files). Around 1960, this area was filled and the hemi-marsh was replaced with poor quality habitat such as mowed lawn. This project would restore hemi-marsh and shallow pools to the inside (northeast) shoreline of Beaver Island through removal of fill, site grading, plantings, and invasive species control.

This project would assess the approximate historical extent and structure of Beaver Island wetlands using aerial photographs, historic records, and site plans/engineering drawings (as available). The wetland restoration design would include a grading plan that would specify elevations and associated hydrologic regimes that would result in the development of a complex system of marsh emergent and shallow pond habitat. The grading plan would require some wetland fill removal (cut), but would not involve fill, *i.e.*, the fill would need to be removed from the site for an off-site application. Wetland planting plans would also be developed. These plans would emphasize diverse native species with high wildlife food and cover values and bank stabilization capacity. Lastly, due to the existence of common reed, purple loosestrife, and other exotic/invasive species in the subject area, the control of such species would be incorporated into the design, implementation, and monitoring and maintenance phases of this HIP.

Our Analysis

This area of the river experiences water level fluctuations and associated erosion due to a number of developmental activities, including water withdrawal for the Niagara Project. This HIP, located approximately 15 miles upstream of the project intakes would result in the restoration of approximately 36 acres of deep emergent marsh habitat. This HIP is aimed at restoring hemi-marsh and shallow pools to the inside (northeast) shoreline of Beaver Island. Once completed, there would be a surface water connection between these ponds and the upper Niagara River; therefore, Niagara River fish would be able to access these ponds and emergent marsh habitat for potential use as spawning and nursery habitat.

Fish Habitat/Attractions Structures

This HIP would provide large-object cover which would function as fish attraction structures in deep water areas (i.e., >10 ft) where fish can seek shelter, forage, and otherwise maintain activities as expected in a lotic environment. The primary fish species that are intended to benefit from the HIP are muskellunge, northern pike, walleye, largemouth, and smallmouth bass. The proposed locations of these attraction structures include just downstream of the Peace Bridge, upstream of Strawberry Island, near the South Grand Island Bridge, and downstream of Tonawanda Creek. Other locations would be possible if the locations are deep enough to allow a minimum of 8 feet between the low-water surface elevation and the top of the structures.

Our Analysis

Diving observations in the upper Niagara River indicate that the amount of large-object cover where fish can seek shelter from water velocity is limited. It is likely that this lack of cover is largely due to dredging operations that have historically occurred to aid commercial navigation. Dive observations found that the little cover that is available appears to be highly utilized, especially by large predator species such as muskellunge and smallmouth bass. This habitat is important because adult and juvenile fish of numerous species can seek shelter from the current and use these areas to prey on, and/or hide from, other fish. Therefore, this HIP is likely to increase habitat diversity which in turn will increase fish community diversity and ecological functions of the upper Niagara River. However, we note that this project does not address a direct project effect because the abundance and quality of deep water cover and habitat is unaffected by the project.

Control of Invasive Species – Buckhorn and Tifft Marshes

Several exotic and invasive plants of concern occur in, and near, Buckhorn Marsh (Buckhorn) and Tifft Farm Nature Preserve (Tifft). Buckhorn is located at the downstream end of Grand Island and Tifft is located upstream of the Peace Bridge in Buffalo. The species of greatest concern in Buckhorn and Tifft, as well as in the Niagara River area in general, are purple loosestrife and common reed. These two wetland species occur primarily in palustrine emergent marsh habitat with little to no canopy cover (*e.g.,* wet meadows and marshes). This project would control exotic and invasive plant species and promote the growth of a diverse community of native wetland species to enhance and preserve wetland function.

The first task of this project includes surveying the existing extent of purple loosestrife, common reed, and other exotic/invasive species of concern in Buckhorn and Tifft marshes. This information would be used to create cover type maps showing the extent of native emergent communities (with few to no invasives) and the locations of wetlands dominated or co-dominated by various species of concern. Once the extent of the problem is fully known, an area-specific plan for minimizing further spread of these species into wetlands dominated by natives and controlling them in existing strongholds would be developed. Control techniques would include biological, chemical, and mechanical approaches.

Our Analysis

Many species of fish and other aquatic biota use marsh habitat for spawning, nursery areas, and feeding. The removal of invasive species would increase habitat heterogeneity and promote the growth of a diverse wetland community of native species. Therefore, we expect that this HIP would enhance and preserve wetland functions and increase the value of the marsh to native fish. The project's contribution to water level fluctuations in the upper river has probably contributed to the increased abundance of invasive species in riparian wetlands. We note that the Buckhorn site is clearly within the area affected by project-related fluctuations and the Tifft Marsh is located on the shores of Lake Erie in Buffalo, near what appears to be the extreme upstream end of project-related effects.

Habitat Enhancement and Restoration Fund

Under the settlement, the Power Authority proposes of the HERF to fund future HIPs, land acquisition, habitat improvements, habitat research, fish, wildlife, and indigenous plant species restoration, and stewardship activities throughout the Niagara Basin. The ESC would select projects based on criteria discussed in section 3.3.1.2. The HERF is one of Interior's section 10(j) recommendations as well as a condition of the certification.

Our Analysis

Because specific projects have not been identified for funding under the HERF, it is difficult to assess this measure's effect. However, the Committee would evaluate HERF projects according to the stated criteria. However, it appears that having a link to a specific project effect is not a mandatory criterion for project funding. Therefore, not all projects funded via the HERF may be related to effects of the project. On the other hand, many of the projects funded through the HERF, may in fact address a documented project effect. To the extent that they do, such measures could potentially protect or enhance aquatic resources.

<u>Entrainment of fish into the Niagara Project</u>

The project withdraws water from the Chippawa-Grass Island Pool through its intake structures downstream of Grand Island. To address the issue of fish entrainment, an assessment was done to determine the potential for young-of-the-year (YOY) and older fish to be entrained through the intakes and turbines of the project (Acres, 2005). In addition, an assessment was performed of various technologies to reduce entrainment and increase survival of fish entrained at the project. The assessment of YOY and older fish includes the relative sizes of fish that are likely entrained and the typical rate of survival that has been documented at other hydroelectric projects. The assessment of technologies addressed the biological effectiveness and engineering feasibility of constructing intake protection devices.

Based on the entrainment assessment, the Power Authority does not propose any measures directly related to addressing fish entrainment at the project. Interior did not file any section 10(j) recommendations related to entrainment and the certification does not contain any conditions related to entrainment.

Our Analysis

The likelihood of most resident fish being entrained at the project intakes is small due to the limited fish habitat near the intakes and the small ranges or territories of the probable fish community in the Chippawa-Grass Island Pool. However, fish may enter the Chippawa-Grass Island Pool due to migratory behavior, density dependent movements, or as drift in the strong currents. These fish probably include pelagic species and YOY that cannot maintain their position in the strong river currents and would likely be more susceptible to entrainment at the project intakes. However, if these fish are not entrained into the project intakes, strong water currents are likely to transport most of them downriver to the Falls. Survival of fish that pass over the Falls is unlikely due to the long falling distance and impact with the boulder field at the base of the Falls. Mature game fish with maximum sustainable swimming speeds above ambient current velocities may also be entrained into the intakes as the current velocities may exceed their maximum swimming speed (Acres, 2005).

In tests conducted at other hydroelectric plants, immediate survival of fish passed through a turbine is highly variable. On average, however, immediate survival through vertical Francis turbines is about 75 percent. Survival through turbines is generally more dependent on fish size than fish species, with higher survival among smaller fish. Since there have been no survival tests conducted at sites with similar characteristics to the Niagara Project, estimates of turbine survival at the project cannot be made (Acres, 2005).

The assessment of entrainment exclusion devices found that physical barriers that could exclude fish from project facilities are not considered practicable due to the large size of the facilities and the amount of ice, debris, and aquatic vegetation in the upper Niagara River. Behavioral devices, such as strobe lights and sound, have not been shown to be effective in excluding most fish species typical of the upper Niagara River from intakes (Acres, 2005).

Entrainment and mortality of fish at the project does occur; however, data collected during recreational fishery surveys (see section 3.4.6) suggests a healthy fish population indicating that the rate of entrainment does not significantly adversely impact fish populations.

Fish Passage on Gill Creek

Crandall Johnson, in his motion to intervene and comments from December 19, 2005, requested that the issue of fish passage on Gill Creek be considered.

Our Analysis

As noted in section 3.3.3.1, Gill Creek was relocated to accommodate the construction of Lewiston Reservoir and the creek now has a more channelized shape compared to the natural shape of the channel prior to construction. Also, Hyde Park Lake dam near the mouth of the creek, impedes the upstream and downstream movement of fish and fragments fish habitat between upper Gill Creek and the lower creek and Niagara

River.   Hyde Park Lake dam is not a project facility and was constructed about 35 years before the Niagara Project was constructed.

At this time, there is not ample information in the record to assess the biological feasibility of fish passage on Gill Creek. However, from an engineering standpoint, Gill Creek fish passage does not present any obvious problems. One mechanism for assessing the feasibility of fish passage on Gill Creek would be a study funded through the HERF. If such a project was deemed feasible from a biological standpoint, then providing fish passage on Gill Creek would be consistent with the stated mission and purpose of the HERF. If fish passage were provided on Gill Creek, the fish community could potentially be more diverse and exhibit the seasonal variations that fish migrations create. This would depend on the effectiveness of fish passage measures and the suitability of Gill Creek for fish spawning. Finally, we note that although Gill Creek was adversely affected by the construction of the project, this measure would not be addressing a direct project effect because fish passage on the creek was already impeded by Hyde Park Lake dam when the project was constructed.

3.3.3.3 Cumulative Effects

Current U.S./Canadian power generation contributes to cumulative impacts on aquatic resources through flow fluctuations downstream of the projects, water level fluctuations upstream of project intakes, water diversion, fluctuations downstream of the Robert Moses Plant tailrace, and entrainment.

During daylight hours of the tourist season, approximately half of the flow in the Niagara River goes over the Falls to preserve aesthetics. During all other times, approximately 25 percent of the flow goes over the Falls. The water that does not go over the falls is diverted equally from the Chippawa-Grass Island Pool into the Niagara Project and Sir Adam Beck hydroelectric project intakes.

Other developmental activities in the basin that affect flows and water levels, and therefore habitat, include municipal water withdrawals, dredging operations and diversions for navigation (Tonawanda and Ellicott creeks, two major tributaries of the upper Niagara River), and withdrawals for industrial process water.

The water quality of the Niagara River has been and remains affected by municipal/industrial discharges and waste disposal sites (USEPA, 1997). Pollutants from past industrial practices caused contaminated sediments, hazardous waste sites, and contaminated groundwater. By the time construction of the Niagara Project began in 1958, surface water and groundwater resources had been significantly impaired by the cumulative effects of these changes and developments. While water quality has improved in recent decades, especially for parameters such as DO, temperature and turbidity, contamination can still have adverse effects on aquatic biota by increasing mortality and disease, and by reducing fecundity. These effects are present at all levels of the food chain, but especially at the top predator levels because many contaminants bioaccumulate.

Several habitat types and associated fish and aquatic macroinvertebrates are affected by water level fluctuations along the Niagara River and in the Lewiston Reservoir. While most species are able to accommodate the water level fluctuations through movement to adjacent suitable habitat, water level fluctuations may impact those species that have immobile life stages (e.g., egg stages, nesting, hibernation) and therefore could be susceptible to short-term habitat changes.

Although entrainment and mortality of fish into the project does occur, data collected during recreational fishery surveys suggest a healthy fish population; therefore, there is no evidence that the rate of entrainment significantly adversely impacts fish populations.

Measures that would be implemented under the proposed HIPs and through the HERF (assuming the criteria are applied) would help address these ongoing cumulative impacts.

In addition, the Relicensing Agreement includes several measures the parties do not intend to become license conditions but could cumulatively benefit aquatic resources in the basin:

- establish a Greenway Ecological Fund to support the creation, improvement, and maintenance of conservation areas and ecological projects along the Niagara River that will promote tourism, enhance the environment, advance the economic revitalization of riverfront communities, and support the creation of a Greenway. The Greenway Ecological Fund, which would have a value of $16,180,000 (NPV 2007), would be funded in the amount of $1 million annually for the term of the New License;

- establish a Land Acquisition Fund of $1 million (NPV 2007). Monies from this fund would be available to acquire land parcels identified by New York DEC for conservation purposes; and

- implement a Cayuga Creek restoration project. We are unable to find any information in the record describing what this project would entail. However, given the name of the project, we assume it could potentially have some beneficial effects on aquatic resources.

Cumulatively, these measures could benefit aquatic habitats and species by creating, restoring, enhancing, or preserving coastal wetlands and shallow and deepwater aquatic habitat for fish species.

3.3.3.4 Unavoidable Adverse Effects

The project would continue to entrain fish at the same present and unquantified level. However, there is no evidence that the fish community is being adversely effected by entrainment and mortality of fish.

3.3.4 Terrestrial Resources

3.3.4.1 Affected Environment

General Setting

The area in the vicinity of the Niagara River has experienced significant alteration since the 1700s. Much of the U.S. shoreline, especially along the upper river (Lake Erie to Niagara Falls) has been protected through the installation of various stabilization measures. Specifically, 63% of the upper river shoreline and 37% of the lower shoreline is stabilized by protection measures (e.g., riprap, sheet piling, etc.) (Baird 2005). Very little riparian vegetation currently exists along the mainland shoreline of the upper river, which is now used for industrial, commercial, and residential purposes. In addition, invasive species such as purple loosestrife (Lythrum salicaria) and common reed (Phragmites australis) are now common throughout the region. As a consequence of these conditions, wildlife habitats have similarly been diminished (Evans et al. 2001c; 2001a).

Upland Vegetation

A variety of upland and wetland vegetation resources are found in the vicinity of the project. For the purposes of this section, the project vicinity consists of the Niagara River and its tributaries from Peace Bridge downstream to the mouth of the river at Lake Ontario and the sections of any U.S. tributaries that are influenced by water level and flow fluctuations.

Upland cover-types in the project vicinity have been classified at the subsystems and community levels according to Ecological Communities of New York State (Reschke 1990) and New York State Land Use and Natural Resources Inventory (LUNR) (CLEARS, 1988). Twenty-three communities within four subsystems have been identified, classified, and mapped (Beak, 2002). The subsystems identified are: open uplands, barrens and woodlands, forested uplands, and terrestrial cultural lands.

Open Uplands,Barrens and Woodlands, Forested Uplands

Undeveloped lands in the project vicinity are primarily of the open upland and forested upland subsystems that consist mostly of abandoned agricultural fields that have created a patch work of successional old field, successional shrubland, and successional northern hardwoods communities. Scattered among these early successional communities are mature woodlots of barrens and woodlands, and forested uplands subsystems that consist of limestone woodland, oak-hickory forest, and beech-maple mesic forest communities. Undeveloped lands in the Niagara Gorge along the lower Niagara River are calcareous cliff, calcareous talus slope, and limestone woodland communities. These communities are within the open uplands, barrens and woodlands, and forested uplands subsystems, respectively.

Terrestrial Cultural Lands

This upland cover type consists of ecological communities that have been either created, maintained, or substantially modified by human activities, make up the majority of land area in the project vicinity. The terrestrial cultural lands consist of lands used for agricultural, commercial, community, industrial, recreational, residential, quarry, and transportation purposes as well as managed and mowed grassland.

Coastal Wetlands and Riparian Vegetation

Eleven wetland and deepwater communities within three systems and five subsystems have been identified and mapped in the project vicinity. These systems (and corresponding subsystems parenthetically) are riverine (natural stream, riverine cultural), lacustrine (lacustrine cultural), and palustrine (open mineral soil wetlands, forested mineral soil wetlands). These were classified based on Rescke (1990). Palustrine communities were described in accordance with the FWS guidance manual, Classification of Wetlands and Deepwater Habitats of the United States (Cowardin et al., 1979).

The natural stream habitat found in the project vicinity consists of the Niagara River and its tributaries (e.g., Cayuga Creek, Gill Creek). Riverine cultural habitats include the Niagara Power Project forebay and forebay canal and man-made ditches. Lacustrine cultural habitat includes the Lewiston Reservoir, farm ponds, and several quarry ponds within the Bond Lake County Park in the Town of Lewiston, Niagara County. Open mineral soil wetlands are found at Buckhorn Island State Park, Beaver Island State Park, east of the Lewiston Reservoir, and along the western shoreline of Grand Island. Forested mineral soil wetlands in the project vicinity are found on Grand Island and east and north of the Lewiston Reservoir. Communities within these habitat subsystems include main channel stream, mid-reach stream, intermittent stream, canal, artificial pond, reservoir, quarry pond, aquatic bed, emergent wetland, scrub-shrub wetland, and forested wetland. This section primarily focuses on the coastal palustrine communities including emergent wetland, scrub-shrub wetland, and forested wetland (those habitats that are considered wetland and riparian). The lacustrine and riverine habitats are discussed in the Aquatic Resources section of the EA (see section 3.3.3).

Several exotic and invasive plants of concern occur in, and near, Buckhorn Marsh (Buckhorn) and on Grand Island. The species of greatest concern in Buckhorn, as well as in the Niagara River area in general, are purple loosestrife and common reed. These two wetland species occur primarily in palustrine emergent marsh habitat consisting of wet meadows and marshes.

Upper and Lower Niagara River

The fluctuation zone along the upper river provides an interface between terrestrial and aquatic habitats, and often contains riverine habitat with established EAV.

No significant riverine habitats occur in the lower river because of the relatively steep slopes leading down to the water, the lack of shallow water areas with flat bathymetry, coarse substrates, and fast water flows. These combined factors are not conducive to the development of large, fringe riverine wetlands, and these habitats likely have never existed in the lower river to any great extent.

Small fringe areas of riparian wetlands are found in the Niagara Gorge associated with calcareous talus slope woodland and limestone woodland communities.

Lewiston Reservoir

No wetland habitat occurs in the Lewiston Reservoir. The steep, rip-rapped interior walls of the reservoir and the extreme weekly water level fluctuations (up to 36 feet) are not conducive to the development of EAV or SAV. A total of 22 species of amphibians, 19 reptiles, 293 birds, and 49 mammals are known or likely to occur within the investigation area (Beak, 2002). Based on Breeding Bird Atlas records, 116 species of birds have been documented as confirmed or probable breeders within the investigation area (Andrle and Carroll, 1988). In 2001, field surveys were conducted to document wildlife species occurrence in the project vicinity. The results of these surveys are found in the Wildlife Resource Inventory and Description (Beak, 2002). In total, 162 species of wildlife were documented.

Terrestrial Rare, Threatened, and Endangered Species

A 2001 study investigated occurrences of federal- and state-listed RTE species in the vicinity of the Niagara Power Project (Riveredge, 2002). This was a literature-based study, with limited field surveys conducted to confirm the presence or absence of selected rare species.

The study revealed that one federally listed threatened species, (bald eagle), and 32 state-listed (New York DEC or New York Natural Heritage Program (New York

NHP) terrestrial RTE species occur in the project vicinity. These include 22 species currently state-listed as threatened and endangered (T&E), eight species listed as special concern (SC), and three species that are rare (R). All of these species have been inventoried by the New York NHP (Riveredge, 2002). The rare state listed species are not protected by federal or state endangered species legislation, though they may be protected under other authority. Taxonomically, these 33 species include 14 plants, 18 birds, and one amphibian.

A follow-up investigation revealed that there are no other terrestrial RTE species that occur in the project vicinity (Riveredge, 2005d).

Significant Ecological Communities

The New York NHP, in cooperation with New York DEC, maintains inventories and a database of significant natural communities found in the state. The database includes significant occurrences of five natural communities in the project vicinity: Silver Maple-Ash Swamp, Maple-Basswood Rich Mesic Forest, Calcareous Cliff, Calcareous Talus Slope Woodland, and Deep Emergent Marsh communities. The Calcareous Cliff and Calcareous Talus Slope Woodland communities are found primarily in state parks and protected areas of the Niagara Gorge. Localized portions of these communities are affected by road maintenance, such as salt and sand applications to roads in the vicinity of the project, particularly the Power Authority's Area 6, the location of the Discovery Center, a portion of the Great Gorge Railway Right-of-Way Trail, and portions of Robert Moses Parkway. The Deep Emergent Marsh community is found at Buckhorn Island State Park (Riveredge, 2002) and is the largest and highest quality remaining marsh along the Niagara River (New York DEC and New York PRHP, 1995; Evans et al., 2001a).

Several SCFWH are found in and along the Niagara River in the project vicinity, including: Lower Niagara River Rapids, Buckhorn Island-Goat Island Rapids, Strawberry-Motor Island Shallows, Grand Island Tributaries, Buckhorn Island Wetlands, and Buckhorn Island Tern Colony (New York DOS, 1987). The Lower Niagara Rapids, Buckhorn Island-Goat Island Rapids, and Strawberry-Motor Island Shallows are aquatic habitats and provide fish habitat and significant feeding and roosting areas for large congregations of gulls and waterfowl.

A significant heron rookery is located on Motor Island in the upper Niagara River. Motor Island is the only large wooded island occupied by herons in eastern Lake Erie or the Niagara River and is the site of the only great egret nesting colony in upstate New York. The number of nesting pairs of birds and the number of species of birds on Motor Island is limited by the availability of live, healthy nesting trees and shrubs. Black-crowned night herons are particularly sensitive to habitat degradation and only nest in live trees or shrubs surrounded by thick cover.

The Grand Island tributaries contain aquatic, wetland, and riparian habitat that are important fish spawning and nursery habitat and locally significant wildlife habitat. Specifically, there is SAV and EAV available as fish spawning and nursery habitat, and riparian vegetation provides food and cover for small mammals and perching and nesting habitat for a variety of bird species. SAV and EAV also provide forage and nesting habitat for wading birds and waterfowl. In addition, one Grand Island tributary is locally significant habitat for rare, native mussels.

The Buckhorn Island Wetlands SCFWH and Buckhorn Island Tern Colony SCFWH are wetland and upland habitats, respectively. The Buckhorn Island Wetlands are comprised of emergent marsh and deciduous forested wetlands associated with Burnt Ship Creek and Woods Creek.

The Buckhorn Island Tern Colony SCFWH consists of a man-made rock and boulder dike designed to divert water toward the project water intake structures. Though listed as tern nesting habitat, common terns are not currently nesting in this area.

The entire Niagara River Corridor has been designated a globally significant Important Bird Area (IBAs) (Beak, 2002). IBAs represent the most valuable habitats for the survival of birds and the conservation of bird species. The National Audubon Society and Canadian Nature Federation are currently developing a comprehensive bird conservation plan for the Niagara River Corridor IBA (IBA Working Group, 2002; National Audubon Society, 2001).

Existing Land Management

A 2003-2004 study examined the effects of land management practices on aquatic and terrestrial habitats on Power Authority-owned land and lands within the project boundary (E/PRO. 2005). This study found that land management practices that affect vegetation and wildlife resources include such activities as vegetation management, road maintenance, recreation, and nuisance wildlife management.

Vegetation Management

Vegetation management, which includes mowing, cutting of woody vegetation, landscaping, agriculture, and herbicide application, is a predominant land management practice in the project area. Mowed areas include electric transmission ROW, grassed areas around buildings or structures, shoulders of road ROW, and recreation areas.

Road Maintenance

The transportation network in and around the project includes a combination of highways, regional connectors, and local roads. A branch of the New York State Thruway, I-190 (Niagara Expressway), passes through the project boundary just west of the Lewiston Plant. Access from the Niagara Expressway, connecting with the project, occurs at two interchange points: Witmer Road (Route 31) and Military Road/Upper Mountain Road (Route 265/County Route 11). The Robert Moses Parkway also passes through the project and connects the Robert Moses Plant with the twin river intake structures located along the Niagara River. The parkway roads and bridges are owned, operated, or maintained by New York OPRHP and the New York DOT. The various maintenance measures and precipitation on the portions of these roads within the project area pose a potential adverse effect on vegetation and wildlife resources. Typical maintenance measures include salt and sand application. During precipitation events, runoff of polluting chemicals, like metals and hydrocarbons, is likely to have an adverse effect on roadside vegetation and wildlife habitat.

Invasive Species

Invasive species recognized by the Invasive Plants Council of New York (http://www.nysm.nysed.gov/ipcnys) were identified and mapped in the project area. A number of these species occurred in every habitat subsystem identified as part of this investigation. Purple loosestrive and common reed grass were the predominant invasive species found. The purpose of this mapping effort was to determine if there is a link between land management practices in the investigation area and the growth and spread of these species. The only discernible connections between project related land management practices and growth and spread of invasive plants are 1) the planting of invasive species for landscaping purposes, 2) application and subsequent runoff of road salt that may encourage the growth of common reed, 3) removal of tall woody vegetation that may increase the opportunity for the establishment of invasive plants that are shade-intolerant, and 4) managing the Lewiston Dike to maintain the growth of crown vetch, a potentially invasive species.

Recreation

Investigation of the area between the project intakes and tailrace determined that there are limited impacts to terrestrial habitats from recreation (e.g., foot traffic-authorized and unauthorized, and plant collection) (Riveredge, 2005c, Aquatic Science and E/PRO, 2005).

Management of Nuisance Wildlife

As part of its maintenance of the Lewiston Reservoir dike, the Power Authority has implemented a nuisance-species control plan to remove woodchucks. This species favors the open habitats associated with the Lewiston Reservoir dike. Woodchucks are known for digging extensive burrows that have the potential to damage the structural integrity of the earthen dike. Woodchucks have been documented as common in the area (Beak, 2002 – see the “Mammalia Matrix”).

Water Level Fluctuations

Water level fluctuations do not affect upland habitats and species, as these habitats are above the zone of water level fluctuation. Water level fluctuations do, however, affect some terrestrial communities and species. For example, coastal wetlands such as portions of the deep emergent marsh community (the portion outside of the water control structures) found at Buckhorn Island State Park and Grand Island experience impacts to habitat structure, distribution, and species composition. Examples of those species that potentially use suitable habitat within the zone of water fluctuation for one or more immobile life stage include: nesting and hibernating life stages of green frog (upper and lower river), northern leopard frog (upper river), common mudpuppy (upper and lower river), common snapping turtle (upper river, lower river, Lewiston Reservoir), midland painted turtle (upper and lower river), and nesting life stage of Virginia rail (upper river), American coot (upper river), and spotted sandpiper (upper and lower river).

Wildlife species that feed in nearshore or shallow water habitats of the upper river and its tributaries, the lower river, and the Lewiston Reservoir experiences adverse impacts because of forage availability loss.

RTE species (federal and state) that may be present in the project vicinity include the bald eagle, pied-billed grebe, least bittern, common tern, lesser fringed gentian, elk sedge, Ohio goldenrod, and southern blue flag. Water level fluctuations may affect the productivity of the pied-billed grebe. The lesser fringed gentian, elk sedge, and Ohio goldenrod may be affected by exceptionally high water levels. Additionally, the gentian could be affected by changes in water availability in the gorge from seeps- or Falls-generated mist, and the goldenrod would be affected if the riparian banks where it grows were undercut by waves or boat wakes.

These varying water level effects would continue to occur under existing conditions and on-going project operations. Coastal wetlands along the Niagara River would continue to be affected by water level fluctuations. However, results of a recent study (Stantec, et al. 2005) indicate that for those wildlife species that utilize nearshore habitats for one or more immobile life stage (i.e., nesting and hibernation), there is either suitable habitat for these life stages either above or below the zone of water level fluctuation or these species are known to use strategies that enable them to adapt to fluctuating water levels. Of the RTE species that may be present in the project vicinity, bald eagle, least bittern, common tern, and southern blue flag are unlikely to be impacted.

Land Management

Land management practices may impact vegetation communities or species in the following ways:

Portions of the calcareous cliff and the calcareous talus slope woodland communities located downslope of the project access road may be impacted by sand and salt applied to the road during the winter, and by other pollutants such as metals and hydrocarbons that can be removed from the road surface by runoff and deposited into these natural communities.

Vegetation management practices at the project maintain some areas in non-climax successional stages, encouraging potentially invasive species, which cause an adverse impact on wildlife habitat.

Land management practices may encourage the establishment of invasive plant species, which may in turn impact some RTE plant species.

The RTE species sky-blue aster, slender blazing-star, smooth cliff brake have the potential to be impacted through uncontrolled public recreation, landscaping and mowing, and the application of salt and sand on roads during winter.

The Power Authority proposes to develop a post-license Land Management Plan that would direct the use of project lands. The Land Management Plan would include policies and guidelines for the protection and enhancement of terrestrial resources, including road maintenance practices, vegetation management, invasive species control and the use of project lands.

3.3.4.2 Environmental Effects and Recommendations

Studies have shown that hydropower operations on the Niagara River (both U.S. and Canadian) are a contributing factor to water level fluctuations in the upper and lower river. Water level fluctuations affect coastal wetlands and wildlife habitat that are within the fluctuation zone. Therefore, operation of the project, through water level fluctuations, contributes to terrestrial habitat impacts. Additionally, studies have found that management of project lands has the potential to beneficially affect terrestrial habitats.

Upper Niagara River

The fluctuation zone along the upper river provides an interface between terrestrial and aquatic habitats, and often contains riverine habitat with established EAV. This section of river offers existing and potential vegetation and wildlife habitat. Most of the vegetation and wildlife enhancements proposed by the Settlement are proposed for this area. Because of the steep slopes, lack of shallow water areas with flat bathymetry, coarse substrates, and fast water flows, the Lower River offers little habitat for vegetation and wildlife resources or the potential for enhancements. Small fringe areas of riparian wetlands are found in the Niagara Gorge associated with calcareous talus slope woodland and limestone woodland communities.

To address project-related impacts, under the relicensing agreement, the Power Authority proposes to fund HIPs and the HERF. The Power Authority also proposes 3 HIPs not discussed above in section 3.3.3.2. These include enhancements for Osprey Nesting, and enhancements for Common Tern Nesting.

The Power Authority also proposes to develop a Land Management Plan for project lands. The Land Management Plan would identify and explain the policies, standards, guidelines, and land use designations utilized to protect and manage environmental resources, public use, aesthetics, and safety.

Affects on vegetation and wildlife resources from these measures are discussed below.

Habitat Improvement Projects

The proposed HIPs, developed in consultation with stakeholders, would benefit terrestrial habitats, wildlife, and terrestrial RTE species by creating, restoring, enhancing, or preserving coastal wetlands, riparian vegetation, nesting habitat for several bird species, several RTE species (bald eagle, pied-billed grebe, least bittern, common tern, northern harrier, sedge wren, great egret, great blue heron), and by improving habitat by controlling invasive plant species.

Strawberry Island Wetland Restoration

Our Analysis

The Strawberry Island HIP project would increase the size of Strawberry Island by approximately seven (7) acres and improve long-term stability of the shoreline by using breakwaters along the newly created shoreline. High value wetlands would be created behind the breakwaters through the placement of fill material to build elevations to optimal levels for target habitats. The primary target function created would be enhanced fish and wildlife habitat. In addition, other wetland functions, including recreational opportunities (i.e., fishing, hunting, bird watching, etc.) and water quality (i.e. sediment settling, nutrient retention, etc.) would be enhanced as well. (see figure 3-3)

Frog Island Restoration

As discussed in section 3.3.3.2, Frog Island was one of several islands between Motor Island and Strawberry Island, approximately 15 miles upstream of the project intakes, that were historically mined for gravel. (see figure 3-3) The Frog Island HIP would be designed to restore habitat complexity and create wetlands and submerged coarse substrates for fish and wildlife in the area formerly occupied by the islands.

Our Analysis

This project would restore/create approximately 5.5 acres of island and associated habitat using a U-shaped perimeter of breakwater structures in the approximate vicinity of the historic island complex. The project would create diverse habitat conditions within, and between, the breakwaters including coarse (boulders, cobbles, and gravel) and fine (muck, silt, clay, and sand) substrate at variable depths ranging from just above the normal water level to several feet below the normal water level to facilitate the development of wetlands interspersed with deeper areas and shoal habitat. The resultant wetland and aquatic habitats are expected to be beneficial to several fish species and wildlife common to the Niagara River. This area of the river experiences water level fluctuations and associated erosion due to a number of developmental activities, including water withdrawal for the Niagara Project. However, because effects on Frog Island appear to be due to past dredging activities, it is unclear how this measure addresses a project effect.

Motor Island Shoreline Protection

Our Analysis

This HIP would provide a number of enhancements on Motor Island. The objective is to protect the island's eastern, western, and southern shoreline from additional erosion using a variety of measures. An additional enhancement is focused on the Motor Island Heron Rookery.

Shoreline protection measures would incorporate bioengineering wherever possible to provide vegetation up to the water's edge and help stabilize erosion protection. In addition, anthropogenic structures such as the boat docking facilities along the western shoreline would be removed in an effort to restore the island shoreline to as natural an appearance as possible and to minimize future maintenance activities.

Also included in this HIP is a boat landing area on the northeast portion of the island. The boat landing would be used for landing construction equipment during the initial island improvements and later for monitoring activities that may be associated with this project and enhancements to the Motor Island heron rookery (specific enhancements not identified). Wooden pilings or similar structures would be incorporated for mooring work vessels.

Stabilizing- the shoreline of Motor Island would benefit both aquatic and terrestrial biota. The shoreline stabilization would prevent future losses of land area, maintaining a stable shoreline for vegetative plantings; which would improve wildlife habitat. Aquatic biota would benefit from a stabilized vegetated shoreline as an improved feeding area. Although specific measures for enhancing the existing heron rookery were not given, a major enhancing measure would be excluding human disturbance during the nesting season. Such a measure, if considered, could be facilitated by New York DEC since they owned and manage the island for the protection and enhancement of fish and wildlife.

Beaver Island Wetland Restoration

Our Analysis

This project would restore valuable hemi-marsh and shallow pools to the inside (northeast) shoreline of Beaver Island through removal of fill, site grading, plantings, and invasive species control, the effects of which are thought to have been caused by project operations.

Wetland planting plans emphasizing diverse native species with high wildlife food and cover values and bank stabilization capacity would be developed and implemented. At the same time control of exotic/invasive species (e.g., common reed, purple loosestrife) would be incorporated into the design, implementation, and monitoring and maintenance phases of this HIP. Our analysis shows that this HIP would result in the restoration of approximately 10.7 acres of deep emergent marsh habitat. The effects of varying water levels with project operations has led to the development of exotic/invasive species.

Control of Invasive Species – Buckhorn and Tifft Marshes

Several exotic and invasive plants of concern occur in, and near, Buckhorn Marsh (Buckhorn) and Tifft Farm Nature Preserve (Tifft). These species are thought to have developed as a result of varying water levels with project operation, which has produced a disturbed zone along the shorelines of the various islands that attracts invasive species. Buckhorn is located downstream of Grand Island in the area of the project intake on the Niagara River. Tifft is located in the Upper Niagara within the city of Buffalo. The species of greatest concern in Buckhorn and Tifft, as well as in the Niagara River area in general, are purple loosestrife and common reed. These two wetland species occur primarily in palustrine emergent marsh habitat with little to no canopy cover (e.g., wet meadows and marshes).

Our Analysis

This project would control exotic and invasive plant species and promote the growth of a diverse community of native wetland species to enhance and preserve wetland function. The project includes surveying the existing extent of purple loosestrife, common reed, and other exotic/invasive species of concern in Buckhorn and Tifft marshes. Once the extent of the problem is fully known, an area-specific plan for minimizing further spread of these species into wetlands dominated by natives, and controlling them in existing strongholds, would be developed. Control techniques would include biological, chemical, and mechanical approaches.

The removal of invasive species should increase habitat heterogeneity and promote the growth of a diverse wetland community of native species. This HIP would enhance and preserve wetland functions and increase the value of the marsh to native fish and wildlife.

Osprey Nesting

Osprey nest in trees along rivers and in wetlands. Osprey are present on the Niagara River during migration (New York DEC and New York OPRHP, 1995), but a local breeding population has not currently been established. This HIP would increase nest site availability for osprey by installing pole-mounted nesting platforms.

Our Analysis

Given the success of osprey nest platforms in other areas, implementation of this HIP could be an effective way of attracting nesting ospreys to the Niagara River area. To accomplish the proposed osprey enhancements, structures would be placed in existing wetlands and in wetlands created, enhanced, or restored through other HIPs. Osprey platforms could be installed at or near Buckhorn Weir, Beaver Island State Park (East River marsh), Strawberry Island, Bird Island Pier, and Tifft Farm Nature Preserve. Two platforms would be installed at Tifft Farm, and one platform would be installed at each of the other locations. Since osprey currently use the project area during spring migration north to the breeding area, it is likely that this HIP would be successful.

Common Tern Nesting

This HIP would provide nesting habitat for common terns and increase the local population of terns by creating or enhancing nesting sites and increasing tern breeding productivity. The locations of these nesting sites are to be identified in consultation with New York DEC staff. Potential locations for this project include current (e.g. Buffalo Harbor breakwalls) and historical (e.g. Buckhorn Island Tern Colony SCFWH) tern nesting sites.

Our Analysis

Nesting habitat for common tern would be restored and enhanced by adding appropriate gravel nesting substrate, removing vegetation, installing gull or cormorant exclusion devices, installing perimeter fencing and chick shelters, and the use of tern nesting rafts or barges. These methods should increase tern productivity by increasing hatching success and fledging success.

Land Management Plan

The Power Authority proposes to develop a land management plan post-license that would direct the use of project lands. The land management plan would identify and explain the policies, standards, guidelines, and land use designations utilized to protect and manage environmental resources, public use, aesthetics, and safety and include policies and guidelines for the protection and enhancement of terrestrial resources, including road maintenance practices, vegetation management, invasive species control and allowable uses of project lands.

Road Maintenance

The presence of project area roads and the inherent associated road maintenance can affect upland habitats. Stormwater runoff from impervious road surfaces may carry pollutants (e.g., sand and salt, metals, hydrocarbons, etc.) into adjacent habitats affecting the species diversity and vitality of the vegetation. Potential road maintenance-related impacts from Power Authority road maintenance activities are primarily limited to portions of two natural communities including the Calcareous Cliff Community and the Calcareous Talus Slope Woodland. Specifically, portions of these two communities located downslope of the project access road could be impacted by road maintenance activities including salt and sand application. One impact of runoff of road salt may be to encourage the growth of common reed, an invasive species, in these communities.
Vegetation Management

Mowing, cutting of woody vegetation, landscaping, agriculture, and herbicide application, are the predominant vegetation management practices in the project area. Such practices have both direct and indirect effects on upland vegetation and wildlife. Direct effects include plant removal by mowing or herbicide application. Direct effects on wildlife species may include mortality from mowing. Landscaping-related planting also directly affects habitats by introducing non-native species.

Anywhere that vegetation management is conducted,, indirect effects on upland habitats may result from erosion of disturbed soil, runoff of fertilizers or herbicides, and by changing plant community composition and altering vegetative cover types. Indirect effects on wildlife species include changes in habitat due to vegetation management practices. For example, maintenance of open field and shrub habitat interrupts natural succession, thereby sustaining a habitat type that would otherwise succeed to forested habitat. Maintaining these open habitats is beneficial for many species of wildlife such as neotropical migrant birds, raptors, and small mammals. Agricultural practices can also be beneficial as they also maintain open habitats and may provide a food source for several species of wildlife.

Our Analysis

The total area within the project boundary of the Niagara Project is 3,222 acres. Vegetation maintenance along the various roads and other structures has the potential to adversely affect some plant and wildlife species. A land management plan would guide the management of environmental resources at the project and would help avoid misunderstanding about how project lands are to be used.

Coastal Wetlands

In the upper Niagara River (up to Peace Bridge) and Grand Island tributaries, water levels fluctuate from natural and man-made factors. These fluctuations, averaging around 1.5 feet, could adversely affect coastal wetlands resulting in changes to habitat structure, distribution, and species composition.

Our Analysis

Seasonal and daily water level fluctuations affect the nearshore zone by exposing a wider area of this zone to wave action than if there were no fluctuations. Energy associated with wind and waves is an important factor affecting the local extent of EAV and SAV in nearshore habitats, because it can physically uproot and remove EAV and SAV, thus creating bands of coarse substrate in exposed nearshore habitats.
The enhancements proposed in sections 4.1.2 and 4.1.3 of the Settlement would help to promote the growth of EAV and SAV in the project area, thus providing improved habitat to aquatic life, such as waterfowl, wading birds, aquatic mammals, reptiles, and amphibians.

Lewiston Reservoir

The Lewiston Reservoir provides little vegetation and wildlife habitat, because of the extreme weekly fluctuations. Preferred substrates and hibernacula for the common snapping turtle are absent from Lewiston Reservoir but suitable nesting habitat is found outside the zone of water level fluctuations. Great blue heron, canvasback, and greater scaup do not nest along the reservoir but they do forage there. Foraging opportunities for the great blue heron and spotted sandpiper are likely enhanced during low water levels in the reservoir because of the increased availability of forage area and easier access to more concentrated prey. Conversely, the foraging efficiency of the canvasback is potentially indirectly affected by water level fluctuations because the extreme weekly fluctuations in Lewiston Reservoir may preclude the development of extensive SAV beds. The effects on the foraging efficiency of greater scaup are expected to be minimal because this species forages in a wide range of water depths (similar to those found in the reservoir).

During the fall and winter when this species typically occurs on the reservoir, water depths in most areas of the reservoir are at least 10 feet or greater.

Rare, Threatened, and Endangered (RTE) Species

Riveredge Associates (2005c) conducted a qualitative assessment of the effects of water level and flow fluctuations and land management practices on federal and state listed RTE fish, wildlife, and plant species and their habitats, from the Peace Bridge northward to the mouth of the Niagara River at Lake Ontario, including adjacent lands (in New York). In addition, other species were included in this analysis because they are unusually rare, declining, or exceptionally important or unique to the local ecology. Results of this study indicate that 11 terrestrial RTE species (seven plants and four birds) occur in areas influenced by water level and flow fluctuations or land management activities on Power Authority lands and could be affected by these factors. The terrestrial threatened species potentially affected include the sky-blue aster, elk sedge, lesser fringed gentian, southern blue flag, slender blazing star, smooth cliff brake, Ohio goldenrod, bald eagle, common tern, least bittern, and pied-billed grebe.

Federally Listed Threatened and Endangered Species

The bald eagle is the only federally listed T&E species that is known to occur in the project vicinity. Bald eagles do not nest in the project vicinity, but forage along the Niagara River during the winter and during their spring and fall migration (Riveredge 2005a). There is no evidence that water level fluctuations adversely affect the foraging of this species (Riveredge, 2005c), and Buehler (2000) reports that hydroelectric facilities in the U.S. have increased food and habitat availability for bald eagles. In New York, hydroelectric projects may provide suitable wintering habitat for eagles (New York DEC, 2003).

Our Analysis

The federally threatened bald eagle's uses the project area for foraging in the river and reservoir. No nesting or roosting has been documented. The varying water levels of project operation should not cause foraging difficulties because eagles are opportunistic feeders in water bodies. Eagles generally forage in quiet pools, which occur to some extent with varying river water levels. In fact, the proposed wetland and fishery enhancements, should also enhance eagle foraging because of the formation of quiet pools among the proposed wetlands where fish would tend to congregate. Therefore, we conclude that the continuing operation of the project is not likely to adversely affect the bald eagle.

State-listed Threatened and Endangered Species

Our Analysis

Three state-listed wildlife species, the threatened pied-billed grebe, least bittern, and common tern, are known to occur in the vicinity of the upper Niagara River. The common tern forages along the upper Niagara River and nests in areas well above the influence of water level fluctuations. Based on these habits, they are not adversely impacted by water level fluctuations. Least bitterns build their nests in cattails above the influence of water level fluctuations. Pied-billed grebes build floating nests in areas where water level fluctuates. However, especially rapid, steep, and frequent water level fluctuations such as those created by wind-generated waves and boat wakes, could lower grebe productivity (Riveredge, 2005c).

Of the RTE plant species found in the project vicinity, water level and flow fluctuations could affect the lesser fringed gentian, elk sedge, and Ohio goldenrod where they occur along the Niagara River shoreline. The gentian, sedge, and goldenrod all occur in areas where exceptionally high water levels could wash them away. The gentian and sedge occur in the upper river at Niagara Reservation State Park. Both of these plants also occur in Whirlpool State Park, but not in areas close to the river. The gentian also occurs near the brink of the Falls, and it also could be affected by changes in water availability from seeps or from Falls-generated mist. The goldenrod occurs along steep slopes of the lower river where waves or boat wakes undercut the unstable bank.

A fourth plant, southern blue flag, may be, but is probably not, affected by water level and flow fluctuations. This species of iris has been documented in Niagara River wetlands for over 100 years. It is well adapted to diverse conditions and may be found in areas that range from damp soil to areas that are completely saturated or inundated. Recent surveys suggest this plant is more common in the lower Great Lakes than previously thought (Eckel and Bissell, 2002).

Summary

Of the 10 state listed threatened species, pied-billed grebe, least bittern, and common tern, are found in the Upper Niagara River vicinity. The current water level variations should have little or no effect on these species because these birds nest in habitats that are not within the zone of water level effects. Implementation of the proposed enhancements such as wetland enhancements, restoration of Frog Island, and common tern nesting enhancements would benefit these species.

Continued operation of the Niagara Project and the resulting water level variations could have a continuing and future adverse effect on the RTE species that inhabit the project shorelines affected by the project, including the lesser fringed gentian, elk sedge, Ohio goldenrod and southern blue flag. However, many of the HIP measures, particularly those that would restore and protect wetlands, could protect and enhance some, if not all of these species. A greater benefit could be achieved if plantings of these species on the restored islands were feasible.

Significant Ecological Communities

The Silver Maple-Ash Swamp and Maple-Basswood Rich Mesic Forest communities are not affected by water level fluctuations or Power Authority land management practices.

Much of this marsh has been isolated from water level fluctuations in the Niagara River by weirs installed as part of a New York DEC and New York OPRHP habitat restoration project initiated in 1993 (New York DEC and New York OPRHP, 1995). Water level data indicate that the weirs have been successful at increasing and stabilizing water levels in the marsh and suggest that the water levels in the marsh between the weirs are independent of the Niagara River (URS et al. 2005, Stantec et al. 2005). Areas of the marsh outside of the weirs are potentially affected by the regulation of water level fluctuations in the Niagara River and may be undergoing habitat change as a result (Stantec et al. 2005).

As a result of being excluded by nesting gulls, common terns have not nested in the designated SCFWH area since 1987. On the Niagara River, the number of terns has dropped from 518 nesting pairs in 1977 to 126 nesting pairs in 1998 (Cuthbert et al. 2003) and only 92 nests in 2003 (New York DEC, 2003). Common terns are limited by the availability of high-quality nesting habitat. Most tern nesting sites in the area experience competition with ring-billed gulls and double-crested cormorants and/or have unsuitable nesting substrate of coarse rock or cement. Although some Buffalo/Niagara tern colonies are among the largest in the U.S., Great Lakes, productivity is very low, ranging from 0.1 to 0.3 chicks fledged per nest in 2003 (New York DEC, 2003). In contrast, Harper and Wait (2003) report productivity values up to 1.8 chicks per nest in colonies of common terns on the St. Lawrence River.

3.3.4.3 Cumulative Effects

A variety of factors including bank erosion and water level variations cumulatively affect shoreline wetland and upland vegetation and wildlife species along the Niagara River. The dynamic flows of the river cause erosion of the river bed and at times the river banks. Bank erosion is the primary factor affecting wetland and upland vegetation, and associated wildlife in the upper and lower river. The Power Authority has proposed three habitat improvement projects on the upper Niagara River; an integral part of each improvement project involves shoreline stabilization and erosion control. These habitat improvement projects, and possible future projects funded through the HERF, would result in net beneficial cumulative effects on shoreline terrestrial resources.

3.3.4.4 Unavoidable Adverse Impacts

None.

3.3.5 Cultural Resources

3.3.5.1 Affected Environment

The Niagara River corridor between Lake Erie and Lake Ontario has an extensive history of human occupation dating back to when the region became free of glacial ice. The river and associate lands provided food, water, and an important means of transportation.

The Power Authority conducted a Phase 1A investigation of the project area to identify cultural resources. The investigation area includes locations within the project boundary and locations within the Niagara River corridor (as well as tributaries to the upstream extent of influence of Niagara River water levels) on the American side of the Niagara River between the Peace Bridge in the City of Buffalo, Erie County, and the mouth of the Niagara River at Lake Ontario, Niagara County that may be affected by water level fluctuations, including associated upland areas that may be impacted by project features. The area also includes a 500-foot buffer beyond the project boundary and a 50-foot strip along the American shore of the Niagara River between the Peace Bridge and Lake Ontario that is subject to water level fluctuations related to power generation at both the Niagara Power plant and the Canadian plant. It also includes a 50-foot strip along the shoreline of some of the tributaries. These areas include portions of the Cities of Buffalo and Tonawanda and the Towns of Grand Island and Tonawanda, Erie County, and the Cities of Niagara Falls and North Tonawanda, the Towns of Wheatfield, Niagara, Lewiston, and Porter, and the Villages of Lewiston and Youngstown, and Niagara County, New York. The investigation area also encompasses some lands of the Tuscarora Nation.

Several kinds of cultural resources exist in and around the project investigation area and are described below.

Archaeological Resources

The Phase 1A investigation identified the archaeological sensitivity of the area and ascertained whether archaeological sites were present within the investigation area.[9] The sources for archaeological site data include files maintained by the New York OPRHP, the New York State Museum, and the University of Buffalo. A total of 201 known sites were identified; 147 villages and camps, earthworks, middens, burials, and "traces of occupation" have been identified as precontact sites and 33 sites date to the historic period.[10] The quality of information available on each site is variable and dependent on a

[9] Sensitive areas are those areas where archaeological sites occur within a zone that is being affected or could be affected by erosion.

[10] The precontact era is defined as the period before European settlement.

number of factors, such as when the site data was gathered, who collected it, and whether the site was examined by a collector or professional archaeologist as part of a research project or cultural resources management investigation.

Among all of the sites identified, 37 precontact period and historic period sites are believed to be either located or possibly located within the project investigation area. An exact determination of inclusion within the investigation area is not possible for some of these sites, because locational information is imprecise. Each of the remaining sites would be further evaluated during the next phase of studies to determine whether they are in the project investigation area and whether they are eligible for listing in the National Register of Historic Places.

In addition, there are approximately 79 locations within the investigation area where erosion is occurring and where archaeological sites may be present. Additional field studies of these areas are planned to determine: (1) whether archaeological sites are present at these locations of erosion; (2) if sites are present, then whether any of them are eligible as historic properties for listing in the National Register of Historic Places; and (3) whether any of the historic properties eligible for listing are impacted by project operations.

Historical/Architectural Properties

As part of the Phase 1A investigation, an architectural reconnaissance survey was conducted for all buildings and structures within the project investigation area. The purpose of this survey was to identify historic properties and/or districts previously listed in or determined eligible for the National Register of Historic Places as well as those properties that demonstrate potential eligibility.

The architectural field investigation focused on the exteriors of structures and involved photographic documentation of selected, representative buildings 50 years of age or older, as well as general streetscapes within the investigation area. Basic data gathered for selected structures included location, function, and age of construction, as available. Other pertinent information collected in the field focused on building materials, architectural features and details, visible exterior modifications, integrity, associated outbuildings and landscape features.

A review of the files at the New York OPRHP was undertaken to identify building and structures that were previously nominated or identified as eligible for listing in the National Register of Historic Places. The Power Authority plans additional investigations that would include: (1) archival and documentary research (including examination of previous research, as well as historic maps and photographs); (2) determining, if possible, the age and type of the original construction; (3) developing an historic context for those structures potentially eligible; and (4) assessing potentially eligible buildings and structures for their eligibility to be listed in the National Register. Buildings and structures will also be assessed to determine possible effects from project operation.

The investigation determined that given the extraordinary circumstances associated with its creation, the significance of its design and construction, and impact it had on the surrounding environment, all the components of the Robert Moses Niagara Project are likely eligible for listing in the National Register. When it began producing power in 1961, the project was the largest hydropower generating facility in the western world and continued a history of developments on the Niagara River that utilized the energy of Niagara Falls that began in 1759. The project likely meets National Register-eligibility Criterion A for its association with broad patterns of history, Criterion B for its association with a significant individual (in this case Robert Moses, arguably one of the most influential city planners in the nation's history), and Criterion C for the significance of its engineering and design.

The original hydroelectric facility (the Schoellkopf Project, owned by Niagara Mohawk Power Company) on the Niagara River was located between the project intakes and the powerhouse. The facility collapsed into the gorge in 1956 precipitating the development of the Niagara Project. All that remains are portions of stone walls and foundations. The Schoellkopf Project is likely eligible for listing in the National Register under Criterion A for its association with broad patterns of history.

Properties listed in the National Register of Historic Places

The Lower Landing Archaeological District and five historic properties: the Spaulding-Sidway Boathouse, Fort Niagara Light, Niagara Falls Reservation, Old Fort Niagara, and the U.S. Customhouse are listed in the National Register of Historic Places. Most of these properties are within the investigation area they are located miles from the project boundary. Niagara Falls Reservation includes the falls and the area above and below the falls. A portion of the Niagara Falls Reservation is located within the project boundary shown as area 6 in figure 3-6 (in section (3.3.7). The Power Authority proposes to remove area 6 from the project boundary (see section 3.3.7.2).

Traditional Cultural Properties

Members of the Seneca Nation of Indians, the Tonawanda Seneca Nation of Indians, and the Tuscarora Nation (Nations) are providing information on traditional cultural properties (TCPs) that may be within the investigation area which they believe are historically significant. These sites would be assessed to determine whether they are eligible for listing in the National Register of Historic Places and, if so, whether they are impacted by project operations.

Oral History

At the request of the Tuscarora Nation, information was collected through oral interviews with members of the Tuscarora Nation regarding the recollections of their lives before and after construction of the Niagara Project. The rationale for the investigation was to capture qualitative (albeit subjective) information that might not be otherwise obtained in any of the other studies performed for the relicensing effort of the Niagara Project. Thirty-seven Tuscarora elders were interviewed on a wide range of subjects including Tuscarora language use, farming, fishing, hunting, traditional events, social organization, and related cultural topics. Tuscarora interviewers conducted most of the interviews and more than 800 transcribed pages of anecdotal interview data were obtained. A report on the methods used to collect information and how it was studied was prepared and reviewed by the Tuscarora Nation.

3.3.5.2 Environmental Effects and Recommendations

Historic Properties

Area of Potential Effect

Pursuant to section 106 of the National Historic Preservation Act, the Commission must take into account whether any historic properties within the project's area of potential effects (APE) could be affected by a proposed new license. Section 106 defines the APE as the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. The APE, therefore, for the Niagara Project is: (a) lands enclosed by the project boundary; and (b) lands or properties outside the project boundary where project operation, recreational development, habitat improvement projects, or other project-related development or use may cause changes in the character or use of historic properties, if any historic properties exist.

Historic Properties Management Plan

Under section 4.3 of the relicensing agreement, the Power Authority proposes to implement the provisions of a programmatic agreement, which would include, among other things, a provision to develop and implement an historic properties management plan (HPMP) in consultation with the SHPO, the ACHP, and the Nations.

In the explanatory statement of the relicensing agreement, the Power Authority's proposes that the HPMP would include, but not be limited to:

1. completion, if necessary, of the identification of historic properties within the project's APE;

2. continued use, maintenance, protection and preservation of historic properties within the APE, including the development and implementation of rehabilitation standards and an oversight protocol, as well as a monitoring protocol and provisions for enforcement, as appropriate;
3. consideration and, where appropriate, adoption of prudent and feasible project alternatives that would avoid adverse effects on historic properties within the APE;
4. consideration and implementation of appropriate treatment that would mitigate any unavoidable adverse effects to historic properties within the APE;
5. consultation with the SHPO, the Nations, NPS and other parties regarding identification and evaluation of historic properties, determination of effects, and ways to avoid, minimize or mitigate adverse effects;
6. an action plan for unanticipated discoveries during project-related construction;
7. measures for the treatment and disposition of any human remains that may be discovered, taking into account applicable state laws and, with respect to any federal lands, the Native American Graves Protection and Repatriation Act, 25 U.S.C. § 3001-3013;
8. measures for the treatment of previously unidentified historic properties discovered during project operation;
9. compliance with section 14.09 of the New York State Historic Preservation Act of 1980;
10. Public interpretation of the historic and archeological values of the project;
11. Identification and proposed treatment, avoidance or mitigation of effects to historic properties of traditional and cultural importance to the TN, SNI and TSN through the development and implementation of a traditional cultural properties treatment plan after consultation with the SHPO and the Nations;
12. procedures for training Power Authority staff in their responsibility to protect historic properties and the requirements of the HPMP;
13. identification of activities and routine maintenance not requiring consultation with the SHPO, the Nations, and other parties; and
14. coordination with the SHPO, the Nations, NPS and other parties during the implementation of the HPMP, including provisions for periodic reporting, meetings, review and revision of the HPMP.

The Power Authority is also proposing habitat improvement projects (see section 3.3.4.2) and recreation facility enhancements (see section 3.3.6.2) that could affect historic resources.

The SHPO, in commenting on the Power Authority's response to the Commission's request for additional information, requested that the cultural resource investigation report include a Phase 1A literature search and sensitivity study for the Lewiston Reservoir. The SHPO also requested that the Tuscarora Nation be given the opportunity to participate in the creation of the study. Further, the SHPO recommended, because of the size and density of the built environment in and around the City of Niagara Falls, limiting the investation of historic structures to the current list of properties listed on or eligible for the National Register at this time. The SHPO also noted that? additional consultation and limited historic property surveys can be conducted as needed in the future in the event of construction projects that involve buildings and structures 50 years of age or older in order to determine eligibility for the National Register and any possible effects (letter from Nancy Herter, Historic Preservation Program Analyst, Historic Preservation Field Services Bureau, Waterford, New York to William Slade, New York Power Authority, White Plains, New York dated January 5, 2006).

Our Analysis

Because archaeological sites are often found immediately adjacent to water bodies, shoreline erosion can affect historic properties at hydropower projects. The operation of the project contributes to water level fluctuations. Water level fluctuations, in turn, contribute to erosion. Other potential impacts may include project-related ground-disturbing activities (i.e., constructing recreation facilities and habitat improvement projects), looting, and vandalism.

To resolve any potential adverse effects arising from project operation, the HPMP, as proposed by the Power Authority, would include procedures and measures to address the continued use and maintenance of properties that are listed or may be eligible for listing on the National Register, and principles and procedures to respond to accidental discovery of cultural resources during project operations, which would ensure that such cultural resources would be accorded proper treatment and, as appropriate, protection, over the term of the license.

Lewiston Reservoir Survey

Prior to construction of Lewiston Reservoir, the area was used for agriculture, scattered homesteads, or was undeveloped. Approximately 470 acres of land used to construct the reservoir were lands of the Tuscarora Nation. Two drainages, Fish Creek and Gill Creek, crossed the area but were rerouted around the reservoir. Construction of the reservoir altered this entire area. In addition to the disturbance that occurred during reservoir construction, project operation results in daily and weekly water level fluctuations that may also affect the integrity of the original ground surface and any potential historic sites within the reservoir.

Because the area was so disturbed during construction the Power Authority's Phase 1A survey did not include the reservoir. However, Native Americans have inhabited the area for generations and the potential exists that archaeological sites are be present in the reservoir. The Phase 1A survey could be expanded to include the reservoir.

Such a survey would include a literature search to record previously identified sites and a sensitivity study (the probably that archaeological resources would be present and an assessment of the probably that the sites are intact) of the lands inundated by the reservoir. The results of the survey could be included in the HPMP.

Historic Buildings and Structures

The Phase 1A survey identified historic properties and/or districts previously listed in or determined eligible for the National Register of Historic Places as well as those properties that demonstrate potential eligibility within the project investigation area. In the next phase of the investigation, the Power Authority proposes to assess potentially eligible buildings and structures located within the investigation area for their eligibility for the National Register. Structures would also be assessed for impacts from the operation of the project.

The project is located in a densely populated urban environment. Many of the buildings and structures located within the investigation area, including those listed in or eligible for the National Register, are not located close to project facilities and, therefore, have very little chance of being effected by project operation.

Based on data in the Phase 1A report, the Niagara Project is likely eligible for listing in the National Register. The project is likely eligible for its association with broad patterns of history (Criterion A), for its association with a significant individual (Criterion B), and for its significance of engineering and design (Criterion C).

Public Access, Recreation, and Habitat Improvement Projects

To improve public access at the project, the Power Authority proposes improvements at three project-related recreation sites and to establish a Parks and Recreation Fund for capital improvements at recreation sites owned by OPRHP (see Recreation Resources, section 3.6). The plans to improve the recreation sites include: improving parking, pathways, trails, stairways, sport play areas, landscaping, and stabilizing erosion areas.

The Power Authority proposes to fund 8 identified HIPs. These projects would include restoring and creating wetlands, nesting areas, and stabilizing soil erosion in some cases. In addition, the Power Authority proposes to establish the HERF for unidentified projects, that could included but not be limited to future HIPs, land acquisition, habitat improvement, habitat research, fish, wildlife, and indigenous plant species restoration, and stewardship activities throughout the Niagara River area (see sections 3.3.3 and 3.3.4).

The proposals to improve public access, recreation sites, habitat areas, and stabilize soil erosion would likely involve ground-disturbing activities. The improvements planed for the recreation sites are at established sites that were extensively modified when the sites were constructed. Thus, it is unlikely that intact historic resources remain. However, there is still the possibility that there could be significant undiscovered properties in the area where new construction activities would occur. If there are, they could be exposed to an adverse impact potentially resulting from the proposed development. Additionally, although site specific details are not known, development of the HIPs could also expose undiscovered historic resources. An HPMP would include procedures that would be followed prior to construction and if undiscovered historic resources are found.

The Power Authority proposes to remove a 98.2-acre parcel (labeled as Area 6) from the project boundary (see Land Management and Aesthetic Resources section 3.7). The remains of the Schoellkopf Power Plant, which is likely eligible for listing in the National Register, is located on this parcel. The Power Authority would retain ownership of the parcel and any activities that are planned would need the Power Authority's approval. The New York State Historic Preservation Act of 1980 requires state agencies to consult with the SHPO if it appears that projects being planned may affect historic properties. It requires that state agencies, to the fullest extent practicable, avoid or mitigate affects to historic properties. Thus, because the Power Authority is a state agency, adequate procedures would remain in place to protect historic resources, without the Commission's oversight.

3.3.5.3 Cumulative Effects

In addition to the measures discussed above, the Power Authority in its Settlement with the Tuscarora Nation agreed to, among other things, the following two measures:

- The Power Authority would provide up to $5,000 per year to promote the arts, history, cultural history, and historic preservation of the Nation and the Tuscarora people.

- The Power Authority would work with the Tuscarora Nation and other parties in the development, implementation, and maintenance of a new exhibit at the Power Visa facility that is devoted to the Haudenosaunee people and their associations with the project. The Power Authority would contribute up to $150,000 for the development and implementation of the exhibit and would be responsible for its maintenance.

Implementing these two measures would enhance the opportunities for the Tuscarora Nation to share their history and culture among the Nation's people and the public.

3.3.5.4 Unavoidable Adverse Impacts

None.

3.3.6 Recreation Resources

3.3.6.1 Affected Environment

Regional Recreational Opportunities

Recreation facilities within, and in the vicinity of, the project area include community parks, waterfront parks, fishing access points, playgrounds, trails, informational/educational attractions, and state parks. Facility amenities available at the various recreation sites include picnic areas, shelters, vista points, overlooks, boat ramps, fishing piers, trails, playgrounds and organized sports fields. These facilities support sightseeing, fishing, boating, hiking, and a variety of outdoor sports.

Three separate studies were conducted to assess recreational facilities and use in the project area. The study area was the United States side of the Niagara River from the Peace Bridge (located in the City of Buffalo) to the confluence with Lake Ontario. This includes all of Grand Island with a focus on opportunities and facilities located along the Niagara River or adjacent to project features. The study area has been divided into four geographical areas (the upper river, Niagara Falls, the Niagara Gorge, and the lower river), each of which offers a variety of recreation opportunities (KA, 2005b). The upper river includes the area upstream of Niagara Falls south to the Peace Bridge and is characterized by an urban setting. Niagara Falls (the Falls), consists of the area in the immediate vicinity of the Falls and includes Niagara Reservation State Park, also known as Niagara Falls State Park. The Niagara Gorge consists of the area immediately below the Falls north to the Town of Lewiston. The Niagara `Project and associated Lewiston Reservoir are located within this area. The Niagara Gorge is characterized by steep gorge walls and swift moving water. The lower river extends from the end of the Gorge north to Lake Ontario, with a generally flatter shoreline.

The existing recreation facility infrastructure and access support a diversity of recreation opportunities in the recreation study area. This is particularly true along the Upper Niagara River and at Niagara Falls. Existing public access is more limited along the Niagara River Gorge (due in part to steep topography) and the Lower Niagara River (particularly with respect to boating access, due to private ownership of shoreline property). With regard to connectivity of recreation facilities to one another, the Recreation Needs Assessment stated “there is an outstanding network of existing trails in the study area, including the Riverwalk, which connects most of the Upper Niagara River sites and several walking/hiking trails within the Niagara Falls and Gorge areas.” Table

3-3 lists the recreation facilities that are located within the project boundary. The recreation facilities associated with the project area are described below.

Table 3-3. Recreation Facilities located within the Niagara Project boundary

Facility	**Owned and maintained**
Reservoir State Park/ Lewiston Reservoir Fishing Access	New York OPRHP Power Authority
Robert Moss Fishing Pier located at the power plant	Power Authority
Niagara Project Visitor Center (Power Vista)	Power Authority
Upper Niagara River Observation Site, located at the intake structures	owned by Power Authority maintained by New York DOT
Upper River Trail located near the intake structures	City of Niagara Falls
Hyde park Golf Course (portions) located near Lewiston Reservoir and the water conduits	City of Niagara Falls
Great Gorge Railway Right-of-Way Trail begins at the Discovery Center and transverses the bypassed reach	New York OPRHP
Discovery Center located in the bypassed reach	New York OPRHP
Robert Moss Parkway (5.9 miles) located in the bypassed reach	New York DOT

Recreation Facilities

Upper Niagara River

The upper river has 15 developed recreation sites, three of which are located within the project boundary. The sites located within the boundary include the Upper Niagara River Observation Site, portions of the Upper River Trail and portions of Hyde Park Golf Course. Also located along the upper river are Niawanda Park, Isleview Park, Ontario Street Boat Launch, Sheridan Drive Boat Launch, Buckhorn State Park, Beaver Island State Park, Big Sixmile Creek Marina, Gratwick Park, Griffon Park Boat Launch, Hyde Park, Tow Path Park, Broderick Park and Bird Island Pier. These facilities offer a variety of recreation opportunities which include: boat launching, fishing, walking, sightseeing, picnicking, biking, wildlife viewing, and swimming. The facilities located within the project boundary are discussed in more detail below. Facility locations can be seen in figure 3-5.

Upper Niagara River Observation Site: This facility is located at the site of the water intakes and consists of a parking area, walking/bike trail and a fishing platform. The parking area contains 40 parking spaces and is owned by the Power Authority and maintained by the New York DOT.

Upper River Trail: Portions of the Upper River Trail pass through the project boundary near the water intake structures. The trail is a paved biking/walking trail that begins at the North Grand Island bridge and continues west to Niagara Falls State Park. The trail is maintained by the City of Niagara Falls.

Hyde Park Golf Course: Portions of the Hyde Park 9-hole golf course are located over the project water conduits. The golf course is owned and maintained by the City of Niagara Falls.

Niagara Falls

Recreation facilities in the area of Niagara Falls include Niagara Falls State Park, the Aquarium of Niagara Falls, and the Niagara Gorge Discovery Center (Discovery Center), which is the only facility in this river section that is within the existing project boundary. Niagara Falls State Park is a popular tourist destination that provides views of Niagara Falls, concessions, walking paths, and many additional recreation opportunities. The Aquarium of Niagara Falls provides exhibits on marine life and interactive shows.

Discovery Center: The Discovery Center is operated by the New York OPRHP. The facility offers exhibits on the geological and natural history of Niagara Falls and the Niagara Gorge and a 26-foot-high artificial rock-climbing wall.

Niagara Gorge Area

There are eight developed recreation sites located along, or within proximity of, the Niagara Gorge. The six sites located within the project boundary include: portions of the Robert Moses Parkway, the Great Gorge Railroad Right-of-Way Trail, Niagara Project Visitor Center, Robert Moses Fishing Pier, Lewiston Reservoir Fishing Access, and Reservoir State Park. The other two facilities are: Whirlpool State Park and Devil's Hole State Park. These facilities offer a variety of recreation opportunities including: hiking, biking, fishing, picnicking, sightseeing, scenic overlooks, softball, soccer, and educational exhibits.

Non-Internet Public

DRAFT ENVIRONMENTAL IMPACT STATEMENT
FOR HYDROPOWER RELICENSING

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Section 3
Figure 3-5
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Overall access opportunities in the Niagara Gorge are limited, due largely to the physical constraints of the gorge geography. Stairs to the base of the Niagara Gorge floor are available at Whirlpool State Park, Devil's Hole State Park and near the Robert Moses Fishing Pier. Access along the Niagara Gorge rim and in the Niagara Gorge itself is currently provided by several formal and informal trails (KA, 2005b). The Power Authority does not own or maintain the trails. Facilities located within the project boundary are described below.

Niagara Project Visitor Center (Power Vista): The visitor center is located at the Robert Moses Plant. The facility is owned and operated by the Power Authority. The visitor center is open to the public, free of charge, year round. The visitor center offers many educational and hands-on exhibits. The observation deck offers scenic views of the Niagara River and the Niagara Project.

Great Gorge Railroad Right-of-Way Trail: The Great Gorge Railroad Right-of-Way Trail, which is owned and operated by the New York OPRHP, begins north of the Discovery Center and continues into the Niagara Gorge, ending beneath the Whirlpool Bridge. The trail descends gradually into the gorge and offers views of Niagara Falls and the Niagara River.

Robert Moses Parkway: Portions of the parkway lie within the project boundary. The parkway is a two to four lane limited-access highway that begins at the North Grand Island Bridges and ends at Fort Niagara (a total distance of approximately 17 miles), although the route is interrupted as it passes through the City of Niagara Falls in the vicinity of the Niagara Falls State Park. The 5.85-mile portion of the parkway that lies within the project boundary is maintained by the New York -DOT. A section of the parkway between the Discovery Center and the northern end of the Robert Moses Plant (approximately 5 miles) has been reduced to two traffic lanes to allow pedestrian and bicycle use of the remaining two lanes.

Robert Moses Fishing Pier: The Power Authority owns and maintains the fishing pier which includes a fish-cleaning facility, restrooms, and handicap-accessible elevator at the south end of the Robert Moses Plant. In addition to the fishing pier, nearby stairs lead down to the Niagara River shoreline upstream of the plant. An access road and three Americans with Disabilities Act (ADA) compliant parking spaces are available just outside the plant fence. A 20-car parking lot for all other anglers is located at the top of the Lower Plant Access Road hill.

Lewiston Reservoir Fishing Access: The Lewiston Reservoir Fishing Access is a foot trail that provides public access to the Lewiston Reservoir. A parking lot and paved trail are located on the southwest side of the reservoir, at the base of the dike. The parking lot holds approximately 35 vehicles and is available for Reservoir State Park users as well. There are also approximately 6 miles of gravel road that circles the reservoir atop the dike. This Power Authority-maintained roadway is used by hikers, joggers, and anglers, as well as the Power Authority for operational needs.

Reservoir State Park: The 133-acre Reservoir State Park is a New York OPRHP-operated facility that includes portions of the Lewiston Reservoir. The park is located adjacent to the Niagara Project. The park offers many recreational opportunities including softball, basketball, soccer, walking, sledding, golf driving, picnicking, and tennis. The park has a restroom facility and approximately 200 parking spaces.

<u>Lower River</u>

There are seven developed recreation sites located along the lower Niagara River, all of which are located outside of the project boundary. Sites included along the lower river are Earl W. Brydges Artpark State Park, Lewiston Branch Gorge Trail, Joseph Davis State Park, Lewiston Landing, Fort Niagara, Youngstown Boat Ramp and Constitution Park (KA, 2005b). These facilities offer a variety of recreation opportunities including hiking, fishing, sightseeing, scenic overlooks, boat launching, and picnicking. Earl W. Brydges Artpark State Park is a New York OPRHP-operated facility that provides fishing access to the Niagara River, as well as a performing arts center. Fort Niagara State Park facilities include a boat ramp, soccer fields, picnic facilities and the historic Fort Niagara.

Fishing

Three separate surveys were conducted to document angling activity in the project area.

About 95 percent of all anglers interviewed resided locally, i.e., in Erie County, Niagara County, or nearby portions of the five adjacent counties; most of the others were from out-of-state.

<u>Upper Niagara River</u>

This section of the river is bordered on the south by the Peace Bridge (located in the City of Buffalo) and on the north by the navigation-restriction boundary about 2.5 miles above Niagara Falls. Boat anglers made an estimated 16,741 trips to the upper Niagara River and spent an estimated 65,050 hours fishing. Seasonally, the greatest number of trips (54 percent) and hours spent fishing (56 percent) occurred during the summer. More boat trips (6,880) were made to the Tonawanda Channel (east side of Grand Island) than to the Chippewa Channel (4,219) (west side of Grand Island) or mainstem of the river, which received an estimated 5,642 trips.

Shore anglers made an estimated 44,854 trips to the upper Niagara River and spent an estimated 91,530 hours fishing. Seasonally, the estimated greatest number of trips (47 percent) and hours spent fishing (47 percent) occurred during the summer. Most anglers (71 percent) accessed the shore at sites in the City of Buffalo.

The upper Niagara River recreational fishery is similar to the Lake Erie fishery (i.e., predominantly cool/warmwater species). Results of the creel survey indicated that shore anglers generally do not target a particular fish species, whereas boat anglers predominately sought to catch smallmouth bass and muskellunge. The catch rates for smallmouth bass (one of the most highly sought species in the river and Lewiston Reservoir) were relatively good in the upper Niagara River compared to other bass fisheries in New York State.

Two surveys were conducted to document angler success in the upper Niagara River; one in 1999 and one in 2003. The results of the surveys show that the success rate for catching yellow perch and smallmouth bass was down slightly, while the success rate catching northern pike and muskellunge has increased. The estimated largemouth bass catch by boat anglers was considerably higher during the 2003 survey.

Lower Niagara River

In the lower Niagara River shore anglers can reach the water from the City of Niagara Falls to Lake Ontario. However, from the City of Niagara Falls to just below the project's tailrace, access is limited and it is relatively difficult to reach the shore on trails down the cliffs of the Niagara Gorge. The Power Authority provides angler access to the tailrace and the shoreline immediately upstream of the tailrace. Boat anglers generally do not venture to or upstream of Devil's Hole (adjacent to Devil's Hole State Park) due to the rapids and the need for specialized boats.

The lower Niagara River fishery is similar to the Lake Ontario fishery (i.e., coldwater, cool/warmwater species). Most boat anglers fish for smallmouth bass and walleye in the summer and salmon, rainbow trout, brown trout, and lake trout in the fall and winter. Shore anglers generally fish for whatever they can catch.

Two surveys were conducted to document angler success in the lower Niagara River; one in 1987-1989 and one in 2002-2003. The results of the surveys suggest that the quality of fishing has increased since the 1987-1989 survey.

Lewiston Reservoir

Anglers spent an estimated 8,032 hours fishing at the Lewiston Reservoir between April 5 and November 30, 2002. Most (63 percent) fishing effort occurs in the spring, principally in April. Anglers can traverse most of the perimeter of the reservoir by foot.

The Power Authority has signed and gated much of the western shore to exclude public access for safety and security.

The Lewiston Reservoir fishery is similar to the upper Niagara River fishery, but anglers (limited to shore angling only) catch primarily yellow perch and smallmouth bass. The mean daily catch rate was 1 fish per hour for all fish species, but as high as 1.87 per hour for yellow perch in April. The smallmouth bass catch rate ranged from 0.15 to 0.66 fish per hour.

Estimated Use Compared to Estimated Physical Capacity at Existing Recreation Sites

On an annual basis, recreation sites along the Niagara River from the Peace Bridge in the City of Buffalo downstream to Lake Ontario attract an estimated 8.9 million recreation days of use. The vast majority of this use (7.6 million recreation days) is associated with Niagara Falls State Park. Use within the project boundary accounts for a relatively small percentage (approximately 3 percent) of the estimated total for the area.

During 2002 and 2003, a recreational facility use and capacity investigation was conducted at 29 recreation sites to determine the amount of public use of facilities, the capacity of each facility, and the percent of capacity at which the facilities are currently being used (KA, 2005a). A subsequent study of three additional recreation sites was conducted from May 2003 to November 2003 (KA, 2005c). Seasonal use estimates were generated for each site. Use was relatively even during April and May, with a significant increase in July, August, and September. After September, use began to show a decline and continued to drop through the fall and into the winter (KA, 2005b).

Overall, facilities are being used at levels well below their design capacity, though estimated use did exceed facility design capacities at six sites. Those facilities, which are located outside of the project boundary, are Ontario Street Boat Launch, Lewiston Landing, Youngstown Boat Launch, Constitution Park, Fort Niagara, and Tow Path Park. High use events at these sites occurred during the summer months, particularly on peak weekends.

The populations of Erie and Niagara Counties are projected to decrease over the next 16 years by an average of approximately 1.75 percent (KA, 2005b). This information suggests that recreational use within the study area may remain relatively constant, or potentially decline between 2003 and 2019. However, Niagara Falls is a significant national and international destination that draws visitors from well outside the region. As such it is not unreasonable to expect that visitation will increase at a rate greater than the population projections for the surrounding communities, at least for facilities associated with, or in direct proximity to Niagara Falls.

Greenway Legislation

In 2004, the State of New York established the Niagara River Greenway Commission. The Greenway Commission will develop a plan for the creation of the Niagara River Greenway. The plan will include the following: a designation of the Greenway boundaries, an inventory of the existing parks and other lands, an identification of lands that can contribute to the Greenway, and recommendations on how to link the Greenway to interior communities (New York State Assembly, 2004). The Niagara River Greenway will extend the length of the Niagara River and could include some lands located within the project boundary. The plan will be submitted to the New York OPRHP within 2 years of the effective date of the act.

3.3.6.2 Environmental Effects and Recommendations

The Power Authority proposes several measures to enhance recreational access, use, and opportunities at the project and along the Niagara River Corridor. The Power Authority proposes to: (1) implement public access improvements at project-related recreational facilities; (2) establish a Parks and Recreation Fund; and (3) develop and implement a recreation plan.

Public Access Improvements At Project Recreation Facilities

To enhance and maximize public access at the project, the Power Authority proposes (section 4.2 of the Settlement) various improvements at the following areas located within the project boundary:

Upper Mountain Road Parking Lot/Fishing Access. The Power Authority would construct: (1) a parking area for sixteen vehicles; (2) a gravel trail across the Niagara Mohawk Power Company transmission right-of-way for pedestrian use; and (3) a gravel path to traverse the reservoir dike in an area located on the northwest side of Lewiston Reservoir near the Upper Mountain Fire Company Station. The Power Authority would also implement measures, including the placement of signage and large boulders, to discourage vehicle access and use of the Upper Mountain gravel trail.

Robert Moses Plant Fishing Pier Parking Area. The Power Authority proposes to provide up to six additional angler parking spaces at the Fishing Pier. The parking would be adjacent to the main gate to the Robert Moses Plant.

Upper River Intake Observation Facility. The Power Authority proposes to make improvements at this site that would include: (1) resurfacing the 40-vehicle parking lot and driveways; (2) removing and replacing the concrete curbs; (3) delineating the parking spaces; (4) designating ADA parking spaces; (5) installing curb cuts to allow ADA access to park walkways; (6) installing appropriate signage; (7) replacing the asphalt pavement of the access roadway along the riverfront walkway; and (8) repairing the cobblestone walkways to the eastern gate tower. The walkway repairs would include filling the joints with stone dust and replacing missing cobblestones. The Power Authority also proposes to reconfigure the fence along the downstream portion of the shoreline bulkhead to allow angling access along the entire structure.

The Power Authority estimates the costs for the improvements to be approximately $3,090,000.

Parks and Recreation Fund Enhancements

To address the need for rehabilitation at New York OPRHP facilities, the Power Authority proposes (section 5.1.1 of the Settlement) to establish a Parks and Recreation Fund in the amount of $9,260,000 (NPV 2007) for capital improvements to be undertaken by New York OPRHP on lands located within, or in the vicinity of, the project boundary. The Power Authority proposes to submit any improvements undertaken within the project boundary to the Commission for approval as part of the recreation plan. The Power Authority, as licensee, would be responsible for ensuring that improvements within the project boundary funded by the Parks and Recreation Fund are implemented and maintained in accordance with any FERC-approved recreation plan. Specific projects to be funded are described below:

Reservoir State Park. Reservoir State Park, which is located within the project boundary, would be allocated approximately $3,710,000 (NPV 2007) to make various improvements, which may include but not limited to: (1) restoration of green space near Parking Lot One; (2) rehabilitation of the maintenance building; (3) replacement and expansion of the restroom; (4) expansion of the existing basketball courts; (5) upgrade of the tennis courts; (6) rehabilitation of existing ball diamonds; (7) expansion of the parking lot near the baseball diamonds to accommodate 120 cars; (8) addition of 20 parking spaces for model airplane use and casual golfing; (9) creation of a new perimeter exercise path in compliance with the ADA; (10) planting of tree and shrub islands in open areas of the park; (11) enhancement of entry features, signage and tree plantings; (12) general upgrade of playground areas; (13) replacement of outdoor site furniture; (14) creation of 20 parking spaces at the sledding hill; (15) repaving of existing path to the top of the reservoir dike; (16) construction of a winter pavilion and comfort station; (17) improvement of drainage in soccer fields and installation of soccer field bleachers; (18) enhancement of entry features, signage and tree plantings; and (19) installation of a new playground.

Niagara Gorge Area. The Niagara Gorge Area would be allocated approximately $3,550,000 (NPV 2007) for improvements which may include but are not limited to: (1) upgrades to the Gorge trails; (2) construction of overlooks and fishing platforms near the lower trail; (3) installation of interpretive signage along the Gorge trails; (4) construction of a new Whirlpool Trailhead; (5) upgrade to the Rim Trail; (6) construction of new Whirlpool Rapids access stairs; (7) construction of a new rapids overlook; (8) reduction of excess paved areas and restoration of green space near the Discovery Center; (9) rehabilitation and relocation of existing rock garden features near the Discovery Center; (10) reconfiguration of Discovery Center parking lot; (11) removal of chain link fence and planting of trees and shrubs near the Discovery Center; (12) replacement of the safety rail along the Gorge; (13) rehabilitation of paved pathways into the Discovery Center and associated landscaping; (14) upgrades to seating and audio visual equipment at Cataract Theatre; (15) addition of a sound barrier door to the front of the elevator at the Discovery Center; (16) upgrades to the web cam; (17) improvements to the Gift Shop; and (18) exhibit modifications. The Discovery Center is within the project boundary. It is unclear if the trails and trailheads are within the project boundary.

Earl W. Brydges Artpark Improvements. Earl W. Brydges Artpark, located outside the project boundary along the lower Niagara River, would be allocated approximately $2,000,000 (NPV 2007) to make various improvements which may include but are not limited to: (1) repairs to address erosion; (2) installation of ditching in the Lewiston Gorge Trail and the Fishing Access Trail; (3) replacement of all three existing stairways and landings; (4) repair of existing erosion areas; and (5) other facility enhancements.

Recreation Plan

The Power Authority proposes to develop and implement a recreation plan for the project. The recreation plan would govern the continued operation, management, and maintenance of the following recreation facilities: (a) Reservoir State Park; (b) Upper Niagara River Observation Facility; (c) Lewiston Reservoir Fishing Access; (d) a portion of the Upper Niagara River Trail; (e) The Power Authority's Visitor's Center; (f) Robert Moses Plant fishing pier; (g) a portion of Earl W. Brydges Artpark State Park; and (h) a portion of the Great Gorge Railroad Right-of-Way Trail. All of the facilities, with the exception of Earl W. Brydges Artpark State Park, are within the project boundary.

The recreation plan would also address recreation-related improvements at recreational sites located within the project boundary. Specific plans for the improvements are discussed below. The improvements would be funded, administered, and implemented by the Power Authority and would include improvements at: (a) Upper Mountain Road Parking Lot/Lewiston Reservoir Fishing Access; (b) Robert Moses Fishing Pier Lower Parking Area; and (c) Upper Niagara River Intake Observation Facility. The recreation plan would include provisions for the following:

(a) final designs, estimated costs, and an implementation schedule for proposed recreational enhancements within the project boundary, including those that would be funded by the Parks and Recreation Fund;

(b) soil erosion and sedimentation control measures for the above enhancements;

(c) a map showing the upgraded or new facilities in relation to existing project recreation facilities;

(d) a discussion on how each project recreation facility would be operated and maintained during the term of the license, including a discussion of existing management agreements and plans for amendment, revision, and/or extension thereof;

(e) a discussion of how the needs of the disabled were considered when designing and developing project recreation facilities; and

(f) a description of reasonable and prudent measures, developed in consultation with the Tuscarora Nation, to reduce and prevent, as practicably as possible, trespass on Nation lands by users of the project's recreational facilities.

The Power Authority would also prepare and file with the Commission a report on the need for any additional recreational improvements to meet recreational demand every 12 years during the term of the new license. This would require consultation with New York OPRHP, New York DEC, local communities, and the Tuscarora Nation. This report would be in addition to Form 80 reports filed with the Commission.

Our Analysis

Public Access Improvements At Project-Related Facilities

Results of recreation investigations revealed that recreation facilities located within the project boundary generally received light recreation pressure and that the supply of recreation facilities associated with the project are currently accommodating demand. In addition to public access provided at project facilities (i.e., the Lewiston Reservoir, the water intakes, and the Robert Moses Plant), there is an abundance of public access opportunities elsewhere in the project boundary.

However, some sites are in need of repair and upgrades to address issues associated with aging infrastructure, and in some cases what appears to be deferred maintenance. This includes a general need to improve access for the disabled. Several facilities within the project boundary were identified as being in need of rehabilitation and upgrade. Those facilities, which were discussed earlier, are the Upper River Observation Facility, Lewiston Reservoir Fishing Access and Reservoir State Park, and the Upper River Trail. Additionally, The Power

Authority's proposal to increase parking at the Robert Moses Plant Fishing Area would provide more parking adjacent to the facility so that anglers would not have to cross the parkway.

Parks and Recreation Fund Enhancements

Recreation investigations revealed that estimated recreational use exceeded facility design capacities at six sites (primarily boat launch facilities) that provide access to the Niagara River. These facilities, all of which are located outside of the project boundary, are Ontario Street Boat Launch, Lewiston Landing, Youngstown Boat Launch, Constitution Park, Fort Niagara and Tow Path Park. While there were times when use exceeded capacity at these facilities, the facilities are not affected by the presence and/or operation of the project because they are located well downstream of the project. Additionally, there are significant site constraints (i.e., topography, existing development, and land use) associated with all of these facilities that make expansion difficult. Nothing is proposed for these areas.

Several recreation facilities operated by New York OPRHP were identified as being in need of rehabilitation. These facilities include Earl W. Brydges Artpark State Park, Devil's Hole State Park, Whirlpool State Park, Niagara Falls State Park, Reservoir State Park, and the Discovery Center. The Power Authority proposes funding for rehabilitating these facilites. While these facilities provide access to Niagara Falls and the Niagara River Gorge, they are not affected by the presence and or operation of the project because the project does not affect access to or use of the facilities. Reservoir State Park and the Discovery Center are within the project boundary and the bypassed reach.

The recently enacted Greenway legislation would require the Greenway Commission to inventory the existing parks and other lands, identify lands that can contribute to the Greenway, and recommend how to link the Greenway to interior communities. It is envisioned that recreation, tourism and the local communities would benefit significantly from the presence of a Greenway along the Niagara River. The Power Authority's proposal would assist in funding the recommendations of the Greenway Committee, which could include rehabilitating the above mentioned facilities.

Recreation Plan

Implementation of the recreation management plan would provide for the continued maintenance of existing resources and recreational facilities within the project boundary. Several entities, including the Power Authority, provide recreational opportunities in the project area. The plan would provide the framework for the Power Authority to implement recreational site measures and coordinate management of recreational resources with other land managers in the project area. Furthermore, the plan would provide guidance on how and where to upgrade recreational sites and improve barrier-free access to recreational resources as the project's recreational sites are improved and facilities replaced. Overall, the plan would guide management of recreational resources and provide a framework for the licensee's implementation of the site improvements and management measures included in the plan.

Fishing

The Power Authority's proposal to reconfigure the fence along the shoreline bulkhead at the Upper River Intake Observation Facility for the purpose of allowing angling access would improve fishing opportunities. In addition, the HIPS projects proposed by the Power Authority have the potential to enhance the fisheries resource in the project area. Therefore, angling catch rates could potentially improve in the future as a result.

3.3.6.3 Cumulative Effects

The project is located adjacent to Niagara Falls, a worldwide tourist destination. The vast majority of recreation use occurs at facilities located outside of the project boundary. Although some recreation use occurs at the Discovery Center and the Great Gorge Railroad Right-of-Way Train, which are located in the project's bypassed reach, within the project boundary. These recreation facilities are not project-related and are owned and operated by entities other than the Power Authority. The Power Authority proposes to develop a recreation plan, and improve public access at project-related recreation facilities. The proposals include mechanisms to improve cooperation and coordination between the recreation providers. The Power Authority's proposal to fund a Parks and Recreation Fund would assist in rehabilitating facilities owned by the New York OPRHP that are located within, or in the vicinity of the project boundary. We expect these measures would have a beneficial cumulative effect with regard to recreational access, use, and opportunities in the project area.

In addition to the measures discussed above, as part of the relicensing agreement and the agreement with the Tuscarora Nation, the Power Authority proposes additional recreation enhancements that would benefit regional recreational access and use. Specifically, the Power Authority proposes to:

- establish a State Parks Greenway Fund to support the construction and/or rehabilitation of parks, recreation, and related facilities that would promote tourism, enhance the environment, advance the economic revitalization of riverfront communities, and support the creation of a Greenway. The State Parks Greenway Fund would have a value of $48,539,000 (NPV 2007); and

- the Power Authority, upon request of the Tuscarora Nation, would make a good faith effort to facilitate open communication and consultation between the Tuscarora Nation and New York OPRHP regarding New York OPRHP's management of lands outside the project boundary.

A survey was conducted to access the effects of the Robert Moses Parkway on the regions transportation and recreation facilities and impediments to implement improvements. The configuration of the parkway is perceived as an impediment to waterfront access (upper and lower river and the gorge rim). In addition the need for increased access points to the Niagara Gorge from the City of Niagara Falls was identified as an item to assess. The parkway and associated lands are jointly owned by the Power Authority and New York DOT. The parkway is administered by New York DOT and New York OPRHP and is not a project facility. However, a 5.85-mile portion of the parkway is located within the project boundary. The State Parks Greenway Commission could use the State Parks Greenway Fund to implement appropriate enhancement measures.

The public's opportunity and use of recreation facilities on the Niagara River and within the project boundary would be significantly enhanced with the measures being proposed by the Power Authority. Additionally, the public and local communities would benefit from the implementation of the Greenway legislation including promotion of tourism and the advancement of economic revitalization of the riverfront communities. The Power Authority's proposal to provide annual Greenway funding would assist in the development of the Niagara River Greenway. Improving dialog between the Tuscarora Nation and New York OPRHP could increase the Tuscarora Nation recreational opportunities. Cumulatively the measures discussed above, would benefit recreational access, use, and opportunity in the region.

3.3.6.4 Unavoidable Adverse Impacts

None.

3.3.7 Land Management and Aesthetic Resources

3.3.7.1 Affected Environment

Land Ownership and Use

The existing Niagara Project boundary encompasses an area of approximately 3,222 acres including the Lewiston Reservoir, forebay, and conduit right of way. These lands are located in the Town of Lewiston, the Town of Niagara, and the City of Niagara Falls. The water area of the reservoir and forebay cover approximately 1,953 acres, leaving approximately 1,269 acres of upland area in the project boundary. This includes approximately 1,113 acres of land which is owned by the Power Authority, 123 acres within the project boundary that are owned by the City of Niagara Falls with the Power Authority holding an easement for operation and maintenance of water transmission conduits for almost all of this acreage, and another 33 acres of land within the project boundary that are not owned but which are under easement by the Power Authority. See table 3-4 for a breakdown of these acreages.

Table 3-4. Land types and acreages within the project boundary of the Niagara Project.

Land type	**Area (acres)**
Open water	
Reservoir	1,885
Forebay	68
Upland	
Power Authority-owned	1,113
City of Niagara Falls-owned	123
Owned by others	33
Total area in project boundary	**3,222**

Project Lands

Lands in the project boundary directly managed by the Power Authority total approximately 490 acres. This area includes all structures and facilities that are related to project operations and public recreation facilities.

The remainder of project lands are managed by other entities subject to Power Authority oversight to ensure consistency with applicable license requirements. These lands include (managing entities are identified parenthetically) the Upper Niagara River Trail (City of Niagara Falls), portions of the Hyde Park Golf Course (City of Niagara Falls, which also owns this land), Reservoir State Park (New York OPRHP), Discovery Center (New York OPRHP), portions of the Great Gorge Railroad right-of-way (New York OPRHP), various electric transmission rights-of-way (Niagara Mohawk Power Corporation and New York State Electric and Gas), and portions of the Robert Moses Parkway (New York OPRHP and New York DOT), the Upper Niagara River Intake Structures and Observation site (Power Authority & New York DOT), and portions of other state and local roads (New York DOT and local governments).

Project Setting and Aesthetic Features

<u>The Natural Landscape</u>

The Niagara Project is situated on the Ontario Lake Plain, a relatively flat expanse of land that stretches from the Niagara River eastward around the rim of Lake Ontario and southerly, blending with the Erie Lake Plain. The Niagara River, including the

Niagara River Gorge, flows from Lake Erie to Lake Ontario and has a commanding presence. Its sharp drop (almost 200 feet) creates Niagara Falls.

Niagara Falls, located approximately 5 miles upstream of the Robert Moses Plant is, perhaps, the most significant natural scenic resource in the State of New York. Niagara Falls is an internationally recognized aesthetic resource that attracts many visitors from around the world.

The river's natural character ranges from flat, calming waters with a gentle and shallow embankment in the upper reach to the dynamic, exciting cataracts and precipitous cliffs of the lower reach. In the upper reaches, the river can be up to 6,000 feet wide; in the Gorge it is, at points, less than 500 feet across.

Beginning in the south and progressing north, important natural features include Strawberry Island, Motor Island, Grand Island, Cayuga Island, Navy Island, the Chippewa-Grass Island Pool, Goat Island, the Horseshoe Falls, the Maid-of-the-Mist Pool, the American Falls, Whirlpool Rapids, and Devil's Hole Rapids. That each is named is a measure of their distinctiveness and place in western New York's history and culture.

At the Falls, Goat Island separates the river flow into two distinct cataracts—the Horseshoe Falls and the American Falls. The Horseshoe Falls' linear crest measures about 2,200 feet, while the American side is about 1,100 feet. Visual and aesthetic characteristics include mists and fogs; rainbows and other ephemeral atmospheric effects; the powerful sound of the moving water; and the striking linear rhythmic pattern of streaming water cascading over the crest down through the mists below.

Associated upland areas are mostly developed or established parkland, and the remaining landscape is a patchwork of agricultural and undeveloped lands. A large wetland complex is located in undeveloped land east of the Lewiston Reservoir. Other important undeveloped areas are found in steep areas within the Gorge.

The Developed Landscape

The developed lands north of the Robert Moses Plant, the Lewiston Plant, and the Lewiston Reservoir are suburban in character. This includes a variety of housing and residential subdivisions and an extensive network of roads and highways. The area south of these primary power-generating facilities includes a number of industrial sites, the switchyard and transmission lines, undeveloped open lands used for recreation, and Niagara University's Main Campus.

The larger regional landscape consists of a variety of land uses, some of which are generally referred to as "open spaces," such as agricultural fields, a variety of parks, baseball diamonds, soccer fields, and the like, and certain low-density residential developments. Hyde Park, one of the largest, typifies the visual condition observed at local parks. It consists of a golf course, picnic pavilions, tennis courts, and other recreational infrastructure.

Reservoir State Park is located along the Town of Lewiston/Town of Niagara line just south of the Lewiston Reservoir. The park includes a sledding hill that coincidently provides views south of the switchyard. The area surrounding the site is highly developed.

Devil's Hole State Park and Whirlpool State Park, each located west of the Robert Moses Parkway, provide important views of the Niagara River. These parks take full advantage of the dramatic views of the Niagara River and Gorge area.

Another important feature of the Niagara River is the substantial presence of infrastructure that supports power development, manifested by the project's twin intakes, the International Niagara Control Structure, the Robert Moses Plant, the Canadian power generation infrastructure, and a number of high voltage transmission lines. These structures are visually significant, as are industrial developments with equally strong character determinants in the project area.

The Rainbow Bridge, the Whirlpool Rapids Bridge, and the Lewiston-Queenston Bridge are commanding visual presences and, by virtue of their size, elevated position over the river are some of the most visually important man-made elements in the project area. Large chemical and industrial processing complexes, the water conduit right-of-way, and a complex arrangement of electric transmission facilities in addition to the project facilities form a matrix of visually complex structures. A large Niagara Mohawk switchyard (Packard) station completes one of the most heavily industrialized areas in western New York.

Roads and parking lots with associated vehicular traffic, and rail systems and trains are also a significant visual presence. The transportation network in and around the project includes a combination of highways, regional connectors, and local roads. A branch of the New York State Thruway, I-190 (Niagara Expressway), passes through the project boundary just west of the Lewiston Plant. Access from the Niagara Expressway, connecting with the project, occurs at two interchange points: Witmer Road (Route 31) and Military Road/Upper Mountain Road (Route 265/County Route 11). The Robert Moses Parkway also passes through the project and connects the Robert Moses Plant with the twin river intake structures located along the Niagara River. The parkway roads and bridges are owned, operated, or maintained by New York OPRHP and the New York DOT.

Project Features

An aesthetic analysis of the area around the Niagara Project was performed by Saratoga Associates (2005). The study utilized a key vantage point approach to assess the viewshed from up to 20 key vantage points that, when combined, describe the visual and aesthetic effects of project facilities and operations. Some components of the project create an interesting contrast with the surrounding environment, while other components detract from the visual quality of the area. Several of these vantage points were project facilities and many of the vantage points had one portion or another of the project facilities within their viewshed. All of the major project facility components were visible from at least one key vantage point. Each of the project facilities, in the context of visual impact, is discussed below.

Robert Moses Niagara Power Plant

Because of its size, the Robert Moses Plant is a dominate visual component of the landscape. The concrete makeup of the plant walls does not significantly contrast with the exposed grey earthy tints and tones of limestone layers that define the gorge. However, the red gantry cranes are prominent by virtue of their size, bright red color, and uncommon bench-like form and do contrast with the setting. There is an unimpeded view of the gorge area and the Robert Moses Plant from the trail near the parking lot at Devil's Hole State Park. The vertical drop into the gorge and the rushing torrent below are the main focal points. However, the massive concrete wall of the Robert Moses Plant is the man-made element that captures viewers' attention. Users of the upper trail at the Whirlpool State Park experience intermittent views of the Robert Moses Plant. As the Robert Moses Plant is located about 2 miles from the park, the visual impact is diminished by optical effects of size perspective and "washout" from atmospheric perspective.

Power Vista Visitor Center and Overlook

The Power Vista is clearly visible from the Robert Moses Parkway and Niagara University. The Power Vista is an example of 1950's style architecture and landscape architecture and is well maintained.

Niagara Project Service Facilities

The service facilities are made up of buildings and a fenced outdoor storage area and are adjacent to the Niagara University campus. Various piles of supplies and materials can be seen from the University through the chain link fence because of missing vegetation which provided screening. This facility is also visible from the student housing complex at Niagara University.

Lewiston Switchyard/Transmission Towers/Communication Tower

The Lewiston switchyard which is adjacent to the Niagara University campus is a large, dominant facility. The switchyard contains lattice-like structures that are aesthetically undesirable. A preponderance of these structures, its large size, and its utilitarian appearance adds to the visual contrast between this area and the Niagara University campus. The electric transmission lines connected to the project switchyard are also very dominate. None, however, are project works, and the majority of such lines are neither owned nor maintained by the Power Authority.

Lewiston Reservoir

The Lewiston Reservoir dike is a substantial visual presence in the immediate area of the structure. A distinct aspect of the dike is the panoramic views available from the rim of the dike. In general the vegetative slope of the exterior dike wall appears as a tall, unmowed grass like environment. There is also an erosion scar from four-wheel drive access up the east side of the dike from Garlow Road.

Intake Structures

The large, twin intake structures on the shore of the upper Niagara River provide viewers with architectural details and stylistic features that are compatible with other structures along this area of the river.

3.3.7.2 Environmental Effects and Recommendations

Land Use

Under the relicensing agreement, the Power Authority proposes to develop a land management plan. The Power Authority also proposes to revise the project boundary by removing eight areas from the current project boundary.

Land Management Plan

The land management plan would identify and explain the policies, standards, guidelines, and land use designations for protecting and managing environmental resources, public use, and safety on lands within the project boundary.

The land management plan would direct use of project lands and would include policies and guidelines for the protection and enhancement of terrestrial resources, including:

- road maintenance practices: the land management plan would designate appropriate techniques for winter maintenance and road infrastructure maintenance.
- vegetation management: the land management plan would designate appropriate techniques associated with mowing, herbicide use, hand and mechanical removal, standard agricultural practices, and landscaping. Provide guidelines for restrictions on mowing specific areas and/or habitats, integrated vegetation management (IVM) practices, and the utilization of native plants for landscaping purposes.
- invasive species control: the land management plan would outline techniques to discourage the spread of invasive species located on project lands. One such area is found on the Lewiston Reservoir Dike, where crown vetch, an invasive species, has been planted and maintained.
- nuisance wildlife: the land management plan would designate appropriate techniques for managing nuisance wildlife.
- use of project lands: the Power Authority would ensure that use of project lands would continue in public areas that are not otherwise restricted for project and public safety purposes.
- aesthetic enhancements: the Power Authority would implement several measures recommended by the visual assessment study (e.g., debris clean-up, lighting adjustments, etc.) as part of normal project operation and maintenance activities. Other Power Authority proposals would include: reestablishing a vegetative screen at the Project Service Facilities, and utilization of native herbaceous plants on the Lewiston Reservoir dike.
- customary land use plan (CUP) for the people of the Tuscarora Nation: the land management plan would include a CUP that recognizes customary uses of project lands by the Tuscarora people. The CUP, which would be developed by the Power Authority and the Tuscarora Nation, would include, as reasonably and practicably as possible, customary uses of the Tuscarora people on lands within the project boundary, including, but not limited to, fishing and gathering activities.

Project Boundary

The Power Authority proposes to remove eight areas totaling approximately 156 acres from the project boundary. Figure 3-6 shows the location of the parcels to be removed from the project boundary.

Non-Internet Public

DRAFT ENVIRONMENTAL IMPACT STATEMENT
FOR HYDROPOWER RELICENSING

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Our Analysis

Land Management Practices

Vegetation management (such as, mowing, herbicide application, and landscaping) and road maintenance are the Power Authority land management practices that have the greatest potential for directly and indirectly affecting habitats in the project boundary. The effects of these practices on wildlife habitat are discussed in the Terrestrial Resources section 3.4.

Project Boundary

The Power Authority proposes the removal of eight areas of land totaling approximately 156 acres from the project boundary (figure 3-6).

Area 1 (2.0 acres) is not owned by the Power Authority. The land is currently part of an old road system that was used to access a former chemical plant. There are no recreation facilities located within this area. The majority of the site is paved and it is anticipated that use of the property will continue to be the same once the property is removed from the project boundary.

Area 2 (1.0 acre) is not owned by the Power Authority. A cemetery is located on this parcel. There are no recreation facilities located within this developed area. It is anticipated that the property would continue to be used as a cemetery if it is removed from the project boundary.

Area 3 (1.9 acres) is not owned by the Power Authority. There are no recreation facilities and there is no formal use of this area. The area is vegetated and the habitat is considered open upland. It is anticipated that use of the property, if removed, would continue to be the same as the current use.

A transmission corridor is located on the parcel in area 4 (14.9 acres). The parcel is owned by the Power Authority, however, the transmission line is not a project facility. There are no recreation facilities located within this area. The habitat found in this area is open upland. It is anticipated that the property would continue to be used as a transmission corridor if it is removed from the project boundary.

Area 5 (36.0 acres) is owned by the City of Niagara Falls and contains a portion of the Hyde Park Golf Course. The City owns and operates the golf course, and would continue to do so if this area is removed from the project boundary.

The Power Authority owns Area 6 (98.2 acres) which is non-contiguous with the project boundary and includes the Discovery Center, a portion of the Great Gorge

Railway Right-of-Way Trail, and portions of the Robert Moses Parkway. New York OPRHP owns and manages the Discovery Center, and manages and maintains the Great Gorge Railway Right-of-Way Trail. These facilities are the subject of a use and occupancy agreement between New York OPRHP and the Power Authority that extends until 2025. The portion of the Robert Moses Parkway that passes through Area 6 is managed and maintained by New York DOT. The Power Authority anticipates retaining ownership of all of Area 6 indefinitely. Management and maintenance of the recreation facilities and the Robert Moses Parkway would not change if they were removed from the project boundary.

A small portion of Area 7 (0.4 acres) is not owned by the Power Authority. A parking lot is located on a section of the area. There are no recreation facilities located within this developed area. It is anticipated that the site would continue to be used in a similar manner if removed from the project boundary.

Area 8 (1.5 acres) consists of three parcels that are not owned by the Power Authority. A portion of the area is currently used as a parking lot which is associated with a private business. There are no recreation facilities located on the parcels. It is anticipated that use of the parcels if removed from the project boundary would be consistent with the current use.

In terms of project operation and maintenance, there are no project facilities within the 156 acres that would be removed from the project boundary. Additionally, with the exception of Area 6, none of the parcels are needed to provide access to the Niagara River shoreline.

The recreation facilities that would be affected by the proposed boundary modification include are a portion of the Hyde Park Golf Course (area 5) and the Discovery Center, a portion of the Great Gorge Railway Right-of-Way Trail, and portions of the Robert Moses Parkway (area 6).

The Disscovery Center provides interpretative displays of the Niagara Gorge and falls and the Great Gorge Railroad Right-of-Way Trail provides access along the gorge and views of the river. Although these facilities are not operated and maintained by the Power Authority, they do provde access to the bypassed reach. Removing them from the project boundary would limit the Commission’s ability to require the Power Authority to ensure these areas are maintained.

With respect to environmental resources, there are two significant occurrences of natural communities in Area 6. The communities, as designated by New York DEC, are calcareous cliff and calcareous talus slope woodland. The primary project-related effects to these resources are caused by road maintenance (see section 3.3.4.2, Terrestrial

Resources). Removing these areas from the project boundary would limit the Commission's ability to require the Power Authority to ensure these areas are protected.

Aesthetic Resources

To maintain the visual qualities of Niagara Falls, the 1950 Treaty requires that a minimum of 100,000 cfs flow over the Falls during daylight hours during the tourist season, and that a minimum of 50,000 cfs flow over the Falls at all other times. The 1950 Treaty provides that, except for certain designated portions of the outflow from Lake Erie, the remaining flow is divided equally between the United States and Canada and could be used for power generation purposes.

The Niagara Project service facilities contain various piles of supplies and materials that can be seen from the Niagara University campus because of a lack of vegetation that would provided screening. In the license application the Power Authority proposes to clean up and maintain the yard area and replace the missing vegetation adjacent to the fence. Implementing these measures would improve the visual quality of the area.

The project's aesthetic resources would be protected through the proposed land management plan, which includes plans for vegetation management, as well as detailed plans for proposed recreational improvements.

3.3.7.3 Cumulative Effects

Cumulatively, the project along with other developments activities, such as residences, roads and highways, other power generating facilities, and industrial sites affects the visual characteristics of the regional viewshed.

The Power Authority proposes to develop and implement a land management plan which, among other things, includes measures for vegetation management and aesthetic enhancements (e.g., debris cleanup, lighting adjustments, reestablishing a vegetative screen at the Power Service Facilities, and utilization of native herbaceous plants on the Lewiston Reservoir dike). Implementing these measures would improve the visual quality of project facilities and land.

In its Settlement with the Tuscarora Nation the Power Authority proposes to convey a 52-acre parcel, which is located within the Town of Lewiston and adjacent to the project boundary.

The agreement between the Power Authority, City of Buffalo, and Erie County provides for the Power Authority to transfer the 14-acre waterfront property currently used to store the ice boom to the New York State Erie Canal Harbor Development

Corporation for nominal consideration. The transfer would be made once the Power Authority finds an alternative site to store the ice boom.

The agreement also specifies that the Power Authority would offer eight parcels of surplus lands, located outside of the project boundary to adjoining landowners and/or local governments. Parcels 1 through 6 range in size from 0.1 acre to 3.6 acres and adjoin public roads and a transmission line easement. Parcels 7 and 8, 48.6 acres and 47 acres, respectively, would be offered to the City of Niagara Falls.

The agreement between the Power Authority and Niagara University provides for, among other things, the Power Authority to establish a Landscape Development Fund in the amount of $1,000,000. The fund would be used for projects to enhance the aesthetic appearance of the campus, such as construction of a new campus entrance, contouring, planting, and similar projects, at the University's discretion.

Conveying the 52-acre parcel to the Tuscarora Nation would increase the amount of land available to the Tuscarora for their use. Conveying the 14-acre parcel currently used to store the ice boom is consistent with plans to develop the Buffalo waterfront, and to enhance the environmental and recreational greenway along the Niagara River.

Potential future uses of the 8 parcels that the Power Authority would convey to adjoining landowners and/or local governments are not specified. However, it is anticipated that use of parcels 1 through 6 would not change. Transferring parcels 7 and 8 to the City of Niagara Falls would enable the City to use the land.

The landscape Development Fund that the Power Authority proposes to establish for the Niagara University could be used to construct projects that would minimize the effect that some of the project facilities (e.g., Niagara Project Service Facilities and Lewiston Switchyard/transmission towers/communication tower) have on the aesthetic quality of the campus.

3.3.7.4 Unavoidable Adverse Impacts

None.

3.3.8 Socioeconomics

3.3.8.1 Affected Environment

Geographic Area

The Niagara Project is located in Western New York. Project facilities are located within or adjacent to several local or county entities including: Niagara County; the Town of Lewiston; the City of Niagara Falls, the Town of Niagara; and Niagara University. In addition, the Tuscarora Nation owns lands adjacent to Lewiston Reservoir.

Population

The population of the state grew by approximately 28 percent between 1950 and 2000. In contrast, Western New York's total population has been in continual decline since 1970, though it has remained above its 1950 population. Erie and Niagara Counties and the local communities have experienced population trends similar to that of Western New York over the last half-century.

Age Distribution

The population of the state has aged in the period since 1970 with the population of people under 20 falling from over 35 percent to nearly 27 percent from 1970 to 2000, while the number of people from 35 to 64 years of age has grown from 34 percent to nearly 39 percent. Meanwhile, the percent of those between 20 and 34 years of age is about the same in 2000 as in 1970 (roughly 20 percent). The age trends in Western New York and Erie and Niagara Counties have generally followed the trends for the state as a whole. Most of communities have experienced similar declines in the proportion of the youth population and increases in the proportion of the senior population.

Table 3-5. Selected socioeconomic characteristics for the project area.

Place	Total Population	Population Increase from Project	Median Family Income	Poverty Rate (%)	Labor Force	Total Employment
United States	281,422,000	264,905	$54,041	12.4	138,820,935	167,511,297
New York State	18,976,000	264,905	$55,818	14.6	9,046,805	10,485,174
Western NY	1,591,708	259,682	N/A	12	776,375	856,015
Counties						
Erie County	950,265	202,156	$53,441	12.2	465,413	557,847
Buffalo City	292,648	50,816	$33,058	26.6	130,510	168,720
Communities						
Niagara County	219,846	31,967	$51,634	10.6	107,560	95,661
Town of Lewiston	16,257	2,971	$63,300	5.8	8,419	5,558

Village of Lewiston	2,781	253	$54,485	8.6	1,401	1,421
Town of Niagara	8,894	1,293	$47,177	9.3	4,275	9,395

Note: Population increase from the project is based upon the NERA 2004 analysis of the impact of industrial and manufacturing jobs (expansion power and replacement power customer jobs) on the regional economy. See discussion below.

Income

Real per capita income in Erie County and Niagara County was above the Western New York level in the 1999 Census, but below the state level. Poverty rates in both counties have also grown since 1969, though they remained below the state level in the 1999 census.

The direct payroll of the Project's 341 employees represents approximately $26 million in salaries and benefits (all values are in 2002 dollars), of which benefits totaled over $6 million. A 2004 socioeconomic study prepared by NERA Consulting shows that state income related to project-generated activity (direct plus indirect or multiplier effect income) is more than $591 million.

Labor, Employment and Taxes

The state's labor force has grown from 6.4 million in 1950 to 9.0 million in 2000. The labor force of Western New York increased from 1950 to 1990 then declined slightly by 2000. Likewise, the labor force in many of the host and local communities saw their first declines between 1990 and 2000. In this 10-year period, the size of the labor force in Niagara and Erie Counties both fell slightly.

A recent socioeconomic study of the region provides information on employment by industry and indicates shifts in jobs for all sectors from 1969 to 2000. These data show that manufacturing dropped from 20 million jobs in 1969 to 19 million jobs in 2000, but manufacturing jobs as a percent of all jobs dropped about in half from 22.6 percent in 1969 to 11.4 percent in 2000 (NERA, 2004).

In 2000, New York had about 10.5 million employed, while Erie County and Niagara Counties contained 557,847 and 95,661 employed individuals respectively for the same year. The state and Western New York have followed unemployment trends in the nation relatively closely, as have Niagara and Erie Counties.

The Project directly employs approximately 341 employees. Based on information provided to the Power Authority by its expansion and replacement power customers mentioned above, due to their access to low cost power these companies employ 43,422 workers. These jobs along with their economic multiplier effect are calculated to add up to 172,600 jobs in NYS, 94 percent of which (162,800) are in Western New York, with 136,700 of them in Erie County and 14,800 in Niagara County.

Under section 1012 of the New York State Public Authorities Law and other provisions of law, the Power Authority is exempt from state and local taxation. As a result, the Project does not pay sales tax or local property taxes, nor does it make a Payment in Lieu of Tax (PILOT) payment (although it does pay payroll taxes such as the unemployment tax). There are approximately 3,222 acres of land within the Project boundary. Approximately 900 acres of the land within the Project boundary were tax-exempt property prior to the construction of the Project (NERA, 2004). Of those 900 acres, approximately 500 acres were lands the Power Authority acquired from the Tuscarora Nation.

Since 1990, the Power Authority has contributed over $11 million (in 2002 dollars) to economic development in the vicinity of the project. Also, the Project contributed over $7.6 million between 1990 and 2001 to education in the local communities. During that same period the Project has contributed approximately $50,000 to local fire and rescue operations (NERA, 2004).

Tourism

The approximately 6.5 million leisure visitors and 1.9 million business visitors (8.4 million total) to the region are estimated to spend $1.3 billion per year while visiting. The Project maintains the Power Vista, a visitor's center that attracts a steady number of visitors throughout the year (over six million tourists since it opened in 1963).

Allocation of Project Power

The current license for the Niagara project (Articles 20 and 21) requires the Power Authority to make at least 50 percent of the project power available for sale and distribution primarily for the benefit of the people as consumers, particularly domestic and rural consumers, to whom such power is to be made available at the lowest rates reasonably possible and in such manner as to encourage the widest possible use. When disposing of this half of the project power, the Power Authority is to give preference and priority to public bodies and non-profit cooperatives within economic transmission distance. The Power Authority is also required to make a reasonable portion of this half of the project power available for use within reasonable economic transmission distance in neighboring states.

A significant portion of the project's electricity is sold to manufacturing companies, primarily located in Erie and Niagara Counties. Based on information provided to the Power Authority by these customers, due to their access to low-cost power, they employ 43,422 people and have a total annual payroll of approximately $2.1

billion. NERA performed a specific assessment of the economic impact of these jobs that are tied contractually to the project. Taking into account the economic multiplier effect of the employment level of 43,422 by the project customers, the impact on the state is an additional 172,600 jobs and $8.1 billion of personal income. Most of this impact is in Western New York, where the effect is 162,800 jobs (94 percent of the total state impact) and $7.6 (94 percent of the total) billion in personal income (NERA, 2004).

Niagara Project power is divided among three main types of allocations – preference power, expansion power, and replacement power – and sales to three upstate investor-owned utilities for resale at cost to residential customers. Half of the project's firm power generation (940 MW) is allocated to preference customers, which are municipal electric and rural cooperative utilities (40 percent in New York State and 10 percent out-of-state), 445 MW are allocated to replacement power, 250 MW are allocated to expansion power, and the remaining power is sold to investor-owned utilities.

The Power Authority's current wholesale rates for this power are approximately 0.9 to 1.1 cents per kWh for preference customers and to the three investor-owned utilities (for rates effective May 2005), 1.2 cents per kWh for replacement customers, and 1.5 cents per kWh for expansion power customers (for rates effective January 2005).

The firm capacity of the Project is expected to increase by an estimated 35 MW when the on-going upgrades at the Robert Moses Plant are completed, of which one-half will be available for new allocations with the other one-half directed to preference power customers.

3.3.8.2 Environmental Effects and Recommendations

Project Power

The low-cost power and direct spending from the project have brought jobs and, with those jobs, an associated increase in residents relative to the situation that might exist if the project were not present. Traditional economic analysis (REMI Model) shows the project is estimated to be responsible for approximately 10,000 additional 2004 residents within all of Erie and Niagara Counties and 24,000 in the state. The project sells low cost power to industrial and manufacturing firms in Western New York. Based on information supplied by these customers, they collectively employ 43,422 workers that are contractually tied to the project power. An economic analysis, assuming that, but for the project, none of these jobs would be located in Western New York, shows that the effect of these jobs is to add approximately 234,000 to the population of Erie and Niagara Counties and 265,000 in the state (NERA, 2004).

The socioeconomic analysis prepared by NERA in 2004 estimated that, based on the price difference between project rates and wholesale electric market rates in Western

New York and the Northeast U.S. region, customers of the project, both in state and out-of-state, saved an estimated $512 million in 2004. NERA estimated the project creates approximately 12,300 jobs, results in a population increase of 24,000 in the state, and contributes approximately $1 billion in Gross Regional Product (GRP) and almost $600 million in personal income.

NERA notes, however, inherent limitations of traditional regional economic modeling in estimating the economic impacts of the Project's low-cost electricity. The model cannot reflect the detailed circumstances of the individual businesses that receive power from the project. Thus, the analysis may not reflect the particular importance of low-cost electricity to the individual customers and the potentially larger role the low-cost power has in a given facility's competitive cost structure. These considerations mean that the actual economic benefits of the project may be greater than those that can be estimated using any regional economic model absent very costly and time-intensive plant-level modeling, which would rely on proprietary data. A second scenario, therefore, was analyzed which assumed that the direct impact of the project on the expansion and replacement power customers would be equal to the jobs at these facilities that are contractually tied to the project. That is, it was assumed that, if not for the project, none of the 43,422 expansion/replacement power jobs that are contractually tied to project power would be located in Western New York. The significantly greater impact of the project on the regional economy under this scenario was shown to be an additional 172,600 jobs, $17.8 billion of GRP and $8.1 billion of personal income.

The relicensing agreement includes two proposed license articles under which the current license requirements for allocation of project power would continue through a new license term. Assuming at least half of the project's low cost power continues to be allocated to the local region, the benefits of low cost power that have accrued to the local area and region during the past license term would continue through a new license term.

The Power Authority proposes several measures that are part of the other agreements filed in conjunction with its license application. Although these measures do not address an identified project effect, they are measures that would be implemented as a result of relicensing the project and could have socioeconomic effects. As such, we discuss these measures below under cumulative effects.

3.3.8.3 Cumulative Effects

The Power Authority is proposing a number of measures in agreements (side agreements), that consist primarily of funding mechanisms. Although these measures do not address a project effect and are not intended to be included in a new license, they are connected to relicensing. Specifically, under these side agreements the Power Authority would:

- establish a Greenway Ecological Fund for the creation, improvement, and maintenance of conservation areas and ecological projects along the Niagara River basin. The fund would have a value of $16,179,645 (NPV 2007), and be funded in the amount of $1 million annually for the term of the license;

- establish a Land Acquisition Fund with a value of $1 million for the purpose of purchasing parcels of land identified by the New York DEC;

- establish a State Parks Greenway Fund to support the construction and/or rehabilitation of parks, recreation and related facilities. The fund would have a value of $48,538,934 (NPV 2007), and be funded in the amount of $3 million annually for the term of the license;

- establish a Host Communities[11] Fund (HC Fund) for the benefit of the host communities. The HC Fund, would have a value of $89,929,000 (NPV 2007), and be funded in the amount of $5 million annually for the term of a new license after an initial payment of $8 million; the purpose of the fund is to benefit the City of Niagara Falls, Town of Niagara, Town of Lewiston, Niagara County, and three local school districts.

- provide firm power and associated energy to the host communities (or to entities designated by the host communities to receive such power and energy on their behalf) of 25 MW at the Power Authority's cost-based rate for Niagara Project power and energy;

- establish a Host Community Greenway Recreation/Tourism Fund to support the construction and/or rehabilitation of parks, recreation and related facilities. The fund would have a value of $48,538,934 (NPV 2007), and be funded in the amount of $3 million annually for the term of the license;

- establish a Tuscarora Nation Fund with a total value of $21,824,176 (NPV 2007), over which the Tuscarora Nation would have sole and absolute discretion over all expenditures and investments, as well as all associated management and administrative responsibilities;

[11] The Power Authoritie's definition of host community includes the Niagara Power Coalition, City of Niagara Falls, City of Niagara Falls School District, Lewiston-Porter School District, Niagara County, Niagara Wheatfield School District, Town of Lewiston, and Town of Niagara.

- make available an allocation of firm power and associated energy to the Tuscarora Nation, the purposes of which are to meet the Tuscarora Nation's current electricity requirements and accommodate reasonable increased electricity requirements of the Nation during the term of a new license; provided, however, that under no circumstances would the Power Authority allocate more than a total of 1 MW (with associated energy at the Tuscarora Nation's actual load factor) to the Tuscarora Nation;

- offer eight surplus parcels outside the project boundary to adjoining landowners and local government entities. An additional 52-acre surplus parcel outside the project boundary would also be made available to the Tuscarora Nation;

- fund programs and events sponsored by the Tuscarora Nation that promote the arts, history, cultural heritage, and historic preservation of the Tuscarora Nation and the Tuscarora people, up to a total of $5,000 per calendar year;

- work with the Tuscarora Nation, and other parties in the development, implementation and maintenance of a new exhibit at the Power Vista facility that is devoted to the Haudenosaunee people and their associations with the project. The Power Authority would contribute up to $150,000 (NPV 2007) for the development and implementation of this exhibit, and the Power Authority would be responsible for ongoing maintenance of the exhibit;

- develop and implement, in consultation with the Tuscarora Nation and other parties, a scholarship and internship program to promote educational opportunities;

- establish an Erie County Greenway Fund to support the construction and/or rehabilitation of parks, recreation and related facilities. The Power Authority would make annual payments to the fund of $2 million;

- pay the New York Empire State Development Corporation $1 million annually for Buffalo waterfront revitalization activities;

- pay the Erie Canal Harbor Development Corporation (ECHDC) $4 million for waterfront development and revitalization activities;

- consult with ECHDC, fund a feasibility study, and attempt to obtain a new location for the storage and maintenance of the ice boom, subject to the approval of the IJC; the parcel of land currently used for this purpose would then be conveyed to the ECHDC;

- establish a Buffalo Waterfront Development Fund with annual payments of at least $2.5 million to support economic development and revitalization activities within the vicinity of the Buffalo waterfront; and

- establish a "Niagara University Capital Fund" with a value of $9.5 million, a "Landscape Development Fund" of $1 million, convey a 24-acre of land located to the university, and make available to Niagara University 3 MW of firm project power.

These side agreement proposals would have cumulative socioeconomic benefits for the communities adjacent to and/or near the project. They could increase direct and indirect employment in the local area and enhance and diversify the tourism-related offerings in the region. Additional employment and earnings benefits could come from the various funds, depending on how these funds are spent.

The allocations of low-cost power to the host communities and the Tuscarora Nation could decrease municipal and school taxes and benefit economic development, infrastructure, education, and other projects. The surplus lands the Power Authority would offer to the adjoining landowners and/or local governmental entities are exempt from state and local taxation. Socioeconomic benefit could result from some of the parcels being returned to the local tax bases or from the parcels being developed. Rough estimates of the value of these nine parcels is $2,380,000. In addition, the provision of low-cost power to the host communities and the Tuscarora Nation and the return of lands to the Tuscarora Nation, to certain of the host communities, and to certain private adjoining landowners, would support the economic recovery of the region by keeping energy costs low, freeing up additional areas for development, and generally making the region more attractive to parties that might otherwise choose to locate or invest elsewhere.

Environmental Justice

Executive Order 12898 on Environmental Justice requires each federal agency to address, as appropriate, disproportionately high and adverse health or environmental effects of its programs, policies, and activities on minority populations and low-income populations, including Native Americans. In the memorandum to heads of departments and agencies that accompanied Executive Order 12898, the President specifically recognized the importance of procedures under the National Environmental Policy Act for identifying and addressing environmental justice concerns. The memorandum particularly emphasizes the importance of NEPA's public participation process, directing that "each Federal agency shall provide opportunities for community input in the NEPA process." (Council on Environmental Quality (CEQ), 1997)

When considering environmental justice under NEPA, the CEQ guidelines suggest that agencies consider the composition of the affected area to determine whether minority populations, low-income populations, or Indian tribes are present in the area affected by the proposed action, and if so whether there may be disproportionately high and adverse human health or environmental effects on minority populations, low-income populations, or Indian tribes.

Niagara Improvement Association

The Niagara Improvement Association (NIA), on behalf of the African American community within the City of Niagara Falls, raises environmental justice issues in its comment letter of April 7, 2006. NIA notes that its neighborhood (Highland Avenue Community) begins less than a mile from the Niagara Project. NIA is primarily concerned about the loss of jobs and brownfields created by Power Authority customers and about the Power Authority's hiring practices. Specifically, NIA requests that the Power Authority provide: (1) brownfield remediation funding for the African American community; (2) funding for revitalization of the Highland Avenue Community; (3) funding for African American cultural initiatives; (4) an affirmative action policy for the Niagara Project; and (5) a commitment to employ at least 341 people at the Niagara Project to include African Americans and people who reside within the City of Niagara Falls. NIA does not believe the Power Authority's funding agreements with the local communities, described above, address their needs.

Tuscarora Nation

Approximately 470 acres of land used to construct Lewiston Reservoir were lands of the Tuscarora Nation. The Tuscarora Nation currently retains about 2,000 acres of land adjacent to the reservoir. As noted earlier in this section, under the Power Authority's agreement with the Tuscarora Nation, the Power Authority would make payment to the Tuscarora Nation totaling $12.8 million, provide up to 1 MW of power at the Power Authority's cost-based rate, convey a 52-acres parcel outside the project boundary, convey other potential parcels in the future, provide $5,000 per year to fund tribal programs and events, include a customary use plan in the land management plan, provide a tribal exhibit at the Power Vista, and provide internships and college scholarships.

Our Analysis

To address the issue of environmental justice, we assess whether there are disproportionately high and adverse health or environmental effects from the proposed action. The proposed action in this case is to issue a new license for the continued operation of the Niagara Project.

We do not believe there would be disproportionately high and adverse health or environmental effects on minorities, low-income populations, or Indian tribes from continuing to operate the Niagara Project. The project produces a large amount of clean, renewable, and relatively low-cost electricity that helps reduce the need for fossil-fueled generation. The project also directly employs over 300 people. Continued operation of the project would extend these benefits into the future. The primary environmental effects of continuing to operate the project would be: the project's contribution to the continuation of water level fluctuations in the upper Niagara River; the continued diversion of water around a section of the Niagara River, including Niagara Falls; and the project's contribution to flow fluctuations downstream of the tailrace. While we would agree that the availability of low cost power likely attracted industry to the Niagara region, it is unclear to us how continuing to operate the project is connected to those industries and their associated jobs leaving the area. As we describe above, there are several measures proposed by the Power Authority in side agreements that could benefit local communities, including the City of Niagara Falls where the Highland Avenue community is located. It would be the City of Niagara Falls' decision whether to use some of these funds to address NIA's concerns. The Tuscarora Nation has not raised environmental justice concerns, and we assume, by signing their agreement with the Power Authority, their concerns about the project have been addressed.

3.3.8.4 Unavoidable Adverse Impacts

None.

3.4 No-action Alternative

Under the No-action Alternative as defined by the staff, the project would continue to operate as it is currently. There would be no significant change to the existing environmental setting or project operation. No new environmental measures would be implemented.

3.5 Irreversible and Irretrievable Commitment of Resources

Our recommended action alternative to relicense this existing project would not irreversibly or irretrievably commit any significant developmental or nondevelopmental resources in the basin. At any point in the future, project facilities could be modified or removed and any operational effects altered. There is no major new capacity or construction proposed or recommended that would commit lands or resources in an irreversible manner.

3.6 Relationship between Short-term Uses and Long-term Productivity

Our recommended alternative for the project is expected to provide an average of 13,700,000 MWh of energy each year to the region. This long-term energy productivity would extend for at least as long as the duration of a new license. Our recommendations are designed to enhance aquatic and terrestrial habitat, enhance local and regional recreational opportunities, foster sound land management practices, and protect cultural and historic properties.

If the project were operated solely to maximize hydroelectric generation, many efforts to enhance aquatic and terrestrial habitat and recreational opportunities in the project area would be foregone.

With the proposed and existing operating mode, as well as with proposed and recommended enhancement and protection measures, the project would continue to provide a low-cost, environmentally sound source of power. The project, with our recommended measures, would further many of the goals and objectives identified by agencies, tribes, and other interested parties.