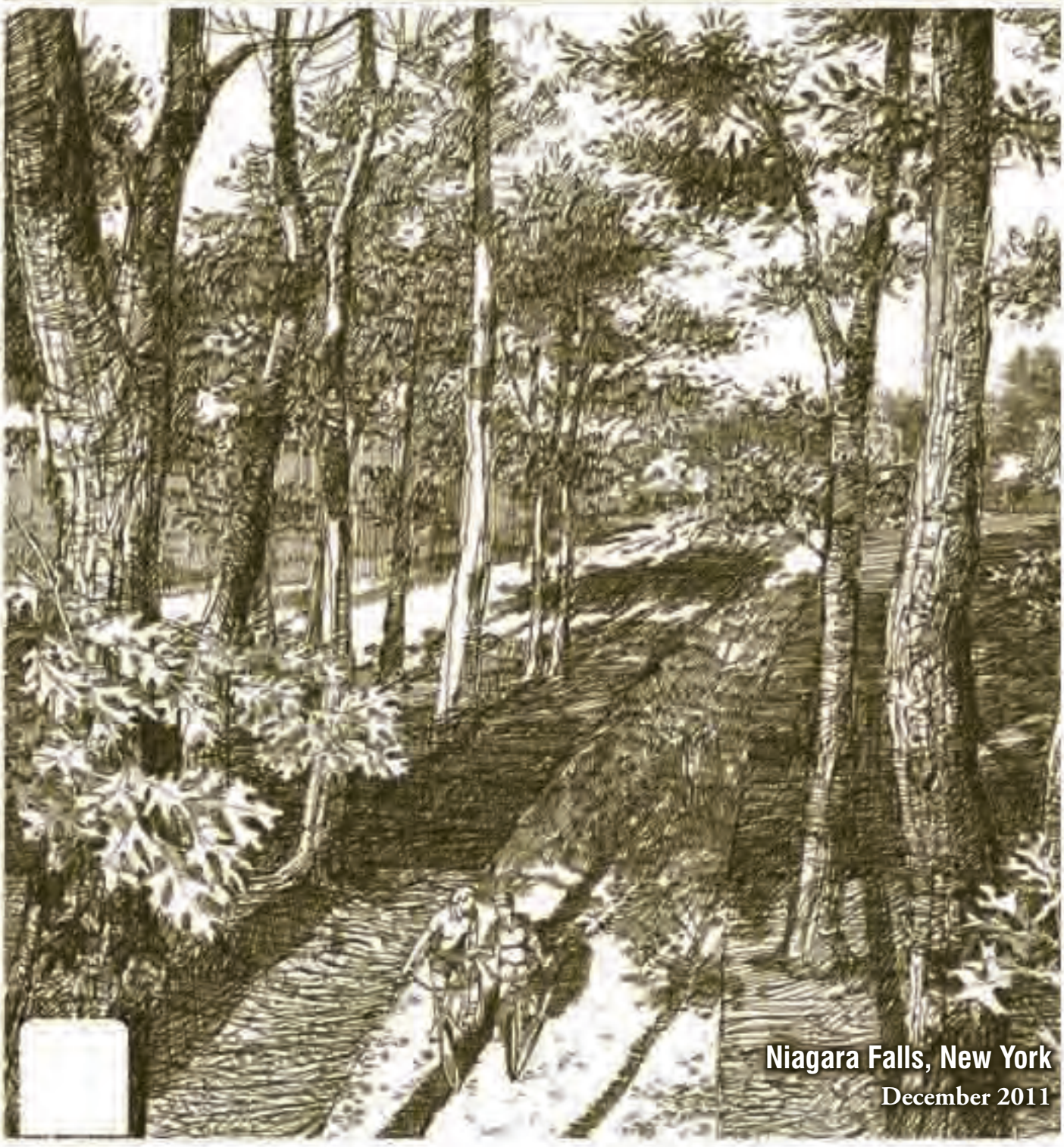
Regional Economic Growth Through Ecological Restoration of the Niagara Gorge Rim



Niagara Falls, New York

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Table of Contents

continued...

Niagara Gorge Rim Restoration Concept
(Actual Figure inserted after Part III)

Figures

Tables

Appendices

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Executive Summary

The Niagara gorge rim has accommodated a variety of land uses throughout its history, but perhaps none has stirred as much debate as its current use as a limited-access parkway. The use, condition, and future disposition of the Robert Moses Parkway (RMP) along the gorge rim have been sources of local concern for decades. At present, there exists an opportunity to re-evaluate the use of that land as a transportation corridor, and to consider the many benefits of a full ecological restoration of this truly unique natural resource.

The use of the gorge rim as a travel route is not a new concept. The rim has played a dominant role in the movement of people and supplies from Niagara Falls to points north for generations. In the early 1960s, the construction of the RMP formalized the use of the Niagara gorge rim as a limited-acess, non-commercial vehicular thoroughfare, facilitating travel through state parks and between the city of Niagara Falls and the neighboring village of Lewiston. For thirty years the RMP operated effectively, servicing both the regional and local community. However, significant population loss and a continuous downturn in the local economy have contributed to a substantial reduction in transportation demand along the RMP. In 2001, the two southbound lanes of the northern section of the RMP were closed to vehicular traffic and dedicated to pedestrian use. Unfortunately, these lanes have never been modified (or improved) and continue to appear as an unmaintained and unused roadway, negatively impacting the quality of experience for local residents and tourists.

As the local debate regarding land use along the gorge rim has continued, various recommendations have been subsequently proposed throughout the community, ranging from re-creation of the original RMP design to reconfiguration or complete removal of the roadway. In 2009, in response to this debate, the Niagara Falls and River chapter of Wild Ones: Native Plants and Natural Landscapes (a national not-for-profit organization) proposed to study the potential for regional economic growth based on full removal of the RMP and restoration of the Niagara gorge rim to its natural ecological condition. The chapter's proposal was funded by the Niagara Greenway Commission's Ecological Standing Committee and the City of Niagara Falls. This study, entitled Regional Economic Growth Through Ecological Restoration of the Niagara Gorge Rim (hereafter, Restoration Study) is the outcome of that proposal.

The area addressed in this study (Study Area) includes approximately 700 acres, from First Street in the City of Niagara Falls north to Center Street in the Village of Lewiston, and from the rim of the Niagara gorge east to where adjacent neighborhoods abut the RMP. The purpose of the study is to 1) review the ecological and economic advantages of an alternative land use within the Study Area, 2) demonstrate the potential for alternate traffic routing between Lewiston and the City of Niagara Falls, 3) develop a Restoration Concept illustrating the future of the Niagara gorge rim without the RMP, and 4) strategically guide successful and sustainable restoration efforts within the Study Area. The Restoration Study begins with a review of the natural and cultural history of Niagara Falls to examine how and why its ecological context has been manipulated over time (see Part I). The region's history sheds light on the current conditions within the city, and provides a baseline upon which to begin planning for the future. This leads to a discussion of potential costs and benefits associated with reconstructing and maintaining the RMP, as compared to those associated with decommissioning the RMP and restoring the rim to its natural conditions (see Part II). An overview of the ecological and economic benefits of the proposed ecological restoration of the Niagara gorge rim and installation of a Niagara Rim Trail is then presented, followed by a Restoration Concept, which presents a vision of what the restored gorge rim could become (see Part III). With an understanding of the future direction as depicted in the Restoration Concept, pilot projects are proposed that could set the stage for phased implementation, so that initial investments can be met with incremental, but no less substantial, success. Finally, the steps necessary to undertake ecological restoration and monitor/manage the restored gorge rim over the long term are also discussed (see Part IV).

Four primary questions frame the discussion of RMP removal and restoration of the Niagara gorge rim. First, is full removal of the RMP financially feasible? Second, what significant impacts will occur due to redistribution of the RMP traffic? Third, what benefits (environmental and economic) are likely to result from the ecological restoration of the Niagara gorge rim, and fourth, how could ecological restoration of the gorge rim be achieved?

Data presented in the study show that the cost of decommissioning the RMP compares favorably to the cost of maintaining it. In light of its age (over 50 years old), maintaining the RMP necessarily includes its reconstruction in the near term. Recent estimates suggest that the reconstruction of the six-mile segment of the RMP within the Study Area could cost as much as (or more than) $55.5 million (based on City of Niagara Falls, 2009b). When compared to an estimated cost of approximately $3.8 million to decommission the same six miles of the RMP (based on NYSDOT, 2010), it becomes evident that removal of the Parkway should not be rejected based on potential cost. In fact, the difference between these two estimates ($55.5 vs. $3.8 million) clearly indicate that RMP removal is the more fiscally attractive alternative.

Redistribution of traffic from a closed RMP should not significantly disrupt local traffic. In light of the many redundant roadways in Niagara Falls, which are also currently operating below capacity, motorists seeking alternate routes will have many options. The low volumes of traffic currently using the RMP and adjacent roadways suggest that diverted traffic will not overwhelm the neighboring areas. If 70% of RMP traffic were diverted to Route 104 and 30% to Highland Avenue, it would result in 1 – 4 additional vehicles per minute traveling in each direction in the northern and southern sections of Route 104 and approximately 1 - 2 vehicles per minute in each direction in the middle section. Computerized models of traffic impacts, in addition to field research incorporating travel runs between the northern and southern termini of the Study Area, demonstrate that the average trip between these points would increase by only three minutes during peak travel times. In addition, this analysis has revealed that the levels of service at intersections throughout these adjacent corridors would remain largely unchanged if all RMP traffic were diverted. Traffic redistribution is expected to cause minimal inconvenience, at worst, for north-south commuters.

Given the favorable cost comparison and lack of significant traffic impacts, the removal of the RMP is certainly feasible. In addition, removal of the parkway will offer new opportunities for land use that could not be realized with the RMP in place. These opportunities could produce a number of environmental and economic benefits, including increased ecosystem services provided by the gorge rim landscape, opportunities for tourism development, potential employment opportunities, and the reconnection of the City of Niagara Falls with its waterfront. Many similar benefits have been experienced in cases across the world and are supported in a growing body of research literature.

The potential environmental benefits of ecological restoration range from improving the quality of air, water, and soil to contributing to regional biodiversity. All of this can be achieved through the removal of pavement, decompaction/restoration of a natural soil profile, and replacement of developed/disturbed landscape and mowed lawn with native vegetation. Many of these improvements have quantifiable ecosystem benefits that further support the position that ecological restoration can yield substantial financial savings and revenue generation that could not be achieved by maintaining current land use patterns within the Study Area. For example, the restoration of mixed deciduous forest conditions throughout a 210-acre portion of the Study Area could yield a net economic benefit of more than $24 million over the course of 40 years, based on U.S. Forest Service estimates of the services that trees would provide in terms of temperature modulation, pollutant sequestration, and water treatment.

The proposed restoration effort could potentially influence economic growth throughout Niagara County by attracting tourists, including "ecotourists," who seek nature-based travel and conservation experiences. Of the 12 million tourists visiting Niagara Falls, 9% of the visitors to the Greater Niagara area visit public parks. If a mere 5% of tourists visiting public parks were to extend their stay by one night to experience the restored Niagara gorge rim, this would contribute approximately $4.5 million to the local economy each year. In addition to the jobs that could be created relative to the removal of the RMP and restoration of the gorge rim, these increased tourist expenditures could drive additional indirect job creation in the regional accommodations, culture, food service, transportation, and retail sectors.

Residents also stand to benefit from general improvements to the quality of life in region, particularly the long-awaited reconnection to their waterfront. Today the RMP essentially cuts off neighborhoods from the Niagara gorge and hinders rather than accommodates the ability of residents and visitors to appreciate this natural feature of international significance. By removing vehicular traffic from the rim, restoring natural communities, and providing safe, convenient public access, the community will benefit from increased property values, and enhanced opportunities to experience the natural beauty of the gorge and rim through biking, hiking, walking, strolling or picnicking along their waterfront.

Although ambitious, the goals of roadway removal and ecological restoration are not unrealistic or without precedent; a number of related precedents demonstrate the potential for both. Various types of disturbed/ developed areas, ranging from reclaimed mines to roadside prairies, have been restored to functional natural systems, . However, prior to undertaking such restoration efforts, some preliminary steps are warranted to ensure a successful outcome. An extensive amount of advocacy, funding support, data collection, and planning will be necessary to support RMP removal and ecological restoration. In light of potential constraints on (and impracticality of) immediate, full-scale funding and implementation, this Restoration Study proposes a phased approach to removal and restoration, in addition to three types of pilot projects that could implement portions of the overall Restoration Concept. According to this approach, four segments of the RMP would be removed sequentially over a period of five to ten years. This phased approach would facilitate incremental traffic transitions and spread capital improvement costs over time.

There is no question that the Niagara gorge rim once served the region as an important, and at times critical, transportation route. Indeed, the history of the rim and surrounding region provides ample evidence that the growth and prosperity of Niagara Falls have, at one time, benefited from such a use. However, the examination presented in this study should compel residents and regional decision-makers to reconsider whether these historic benefits remain valuable in a contemporary setting, where economic, environmental, and cultural patterns are dramatically different than they were when the RMP was constructed. While the RMP may still provide easy (albeit redundant) access between Lewiston and downtown Niagara Falls, this benefit is only experienced by the few drivers that actually utilize the parkway. In contrast, the disadvantages of a degraded environment along the Niagara gorge rim, foregone economic opportunities, and a disconnected waterfront are experienced by the entire region. As the community and its elected officials weigh the merits of options for resolving those disadvantages, the option of full roadway removal and ecological restoration, as described in this Restoration Study, should be considered as the option which offers the most valuable benefits to every constituent within the region. The concept presented herein represents the greatest potential for substantial and quantifiable public benefits to the regional economy and environment.

Introduction

Wild Ones is a national not-for-profit organization dedicated to promoting environmentally sound landscaping practices and the preservation of biodiversity. The mission of the Wild Ones Niagara Falls and River Chapter, hereafter referred to as Wild Ones Niagara or WON, was to "create in Niagara Falls (NY) and the Niagara River region a sense of place through grassroots partnerships, advocacy, and education about regional native plants and natural landscaping with a focus on the restoration, preservation and the protection of the botanically unique habitats of Niagara Falls and the Niagara gorge, their old growth forests and rare calcareous cliff botanicals" (WON, 2010). With funding provided by the Ecological Standing Committee of the Niagara River Greenway Commission and the City of Niagara Falls, **edr** Companies was engaged to prepare an Ecological Restoration Study of the eastern rim of the Niagara gorge (gorge rim).

The restoration concept addressed in this study is based on the premise that all lanes of the Robert Moses Parkway (RMP) and associated vehicular traffic should be fully removed from the Niagara gorge rim. The gorge rim, including the space previously occupied by the RMP, would then be fully restored to native ecological communities. The area being addressed in this study (Study Area) includes approximately 700 acres, from First Street in the City of Niagara Falls north to Center Street in the Village of Lewiston, and from the rim of the Niagara gorge east to where adjacent neighborhoods abut the RMP (see Figure 1). Land within the Study Area is owned by the New York State Power Authority (NYPA) and the NYS Office of Parks, Recreation, and Historic Preservation (OPRHP).

The purpose of this Restoration Study is to educate policymakers and the public as to the many potential environmental, economic, and cultural benefits that could be realized by removing the RMP, eliminating motorized vehicle traffic, improving recreational access, and encouraging a healthy restoration of the native ecology throughout this exceptional natural setting. Many are familiar with these benefits, as is evident in the inclusion of key components of Wild Ones' vision in a number of planning initiatives:

> "What we envision (is) a long gorge rim park with hiking and bicycling trails running through landscapes restored according to the philosophy of Frederick Law Olmsted, new forests being nurtured to extend the old growth forest at DeVeaux and at other appropriate locations, long grass, wildflower meadows attractive to butterflies, ground nesting birds, and other wildlife." (The Niagara Heritage Partnership Proposal for the Removal of the Robert Moses Parkway and Restoration of Natural Landscapes, September 2004)

> "The broad strategy for the upper river is to provide continuous access to the waterfront through completion of the pedestrian and bike trail; to improve the environment through plantings and naturalization; to mitigate the impacts of the Parkway; and to expand the connections between the city and trails, recreation opportunities, interpretive sites and the water itself." (City of Niagara Falls USA, Niagara River Greenway Vision and Projects Proposal, July 2006)

> "Through the reconfiguration of the parkway, it's repurposing and even its elimination in some sections, land can be reclaimed and conveyed back to productive use. The riverfront would certainly gain parkland, functioning 'greenway,' and a heritage corridor, but would also yield new development opportunities capable of stimulating economic growth and reinvestment within the city on lands adjacent to a reconfigured Parkway." (Comprehensive Plan for the City of Niagara Falls, USA, 2009)

The OPRHP is managing a parallel study in which policymakers at the local, regional, and state levels are considering alternative options for the future configuration of the RMP. These alternatives range from expansion to outright removal of the existing roadway. As policymakers debate the future of the RMP, this Restoration Study is intended to advance the dialogue regarding the environmental and economic

benefits of RMP removal and ecological restoration of the Niagara rim. In reviewing the Restoration Study, policymakers and the public are encouraged to consider a number of critical questions regarding the future of the Robert Moses Parkway:

- What are the current ecological and cultural conditions within the Study Area?
- How does the RMP function as a part of the regional and local transportation network?
- How does the existence of the RMP influence the ability of residents and tourists to access the Niagara gorge?
- What is the effect of the RMP on adjacent neighborhoods and the business community?
- What would full removal of the RMP look like?
- How would removal of the RMP and ecological restoration of the rim impact the community?

Wild Ones recognizes that the concept of ecological restoration is not entirely familiar to much of the community. No matter how degraded and redundant, it may still be difficult for some in the community to envision full removal of the RMP and restoration of the gorge rim to a natural landscape. The content of the Restoration Study, and the accompanying multimedia presentation (see Appendix F), will be effective in convincing even the most skeptical that full ecological restoration is not just another potential alternative, but the one that is best positioned to beautify and revitalize the community in a way that no other alternative can.

The restoration alternative is not simple, it is not quick, and it is not without its own sacrifices. It is expected to be a long-term, evolving experience. It will require the support of all levels of government, and most importantly, a critical mass of local residents. Nevertheless, it is the position of Wild Ones that the sacrifices required to pursue this option pale in comparison to the benefits that the region (generally construed as Niagara County) will experience as a result.

Full removal of the Robert Moses Parkway will create a publicly-accessible landscape restored to its natural condition. The restored gorge rim will increase biodiversity, serve as a unique opportunity for environmental education, and provide recreational and aesthetic benefits to local residents. It will also strengthen the local economy by attracting additional visitors to the area, expanding business opportunities in construction, maintenance, and tourism, and producing economic savings associated with the benefits of cleaner air, water, and soil. All of these benefits can be realized with negligible disruption to the local transportation network.

Communities around the world have recognized the benefits of deconstructing underutilized, disruptive infrastructure in favor of reconnecting their communities, improving their environments, and revitalizing their economies. While Niagara Falls may not be the first to explore this option, no other community has ever done so against such a dramatic backdrop. With this Restoration Study, Wild Ones makes the case for an extraordinary opportunity to reclaim the natural heritage of Niagara Falls.

Part I: Niagara Falls: Then and Now

1. Historic Conditions

Before determining the best future use of lands along the Niagara gorge rim, it is important to understand past events that influenced and shaped current conditions. The Niagara gorge and gorge rim is a dynamic environment that has been shaped by a wide variety of environmental and cultural forces over time. The following is a discussion of the historic natural and cultural settings in Niagara Falls, which is followed by a profile of the current conditions in this same area. The intent is to provide a contextual backdrop from which to review the proposed concept for future restoration of the Study Area along the Niagara gorge rim.

A. Natural Setting

The 6.8 mile-long Niagara gorge is comprised of the riverbanks and steep cliffs carved through the Niagara Escarpment by the Niagara River along the U.S. – Canadian border in New York and Ontario. The Escarpment is an ancient geological formation that runs east-west through the Great Lakes region from New York through Ontario and Michigan west to Wisconsin. The escarpment originated approximately 430-450 million years ago, as marine deposits at the edge of a shallow, warm sea. Differential erosion of adjacent softer rock, such as shale and sandstone, eventually exposed the cliffs of the escarpment (NEC, 2010). The upstream end of the Niagara gorge is defined by Niagara Falls, which is comprised of three named flows: the American and Bridal Veil Falls, between Goat Island and the City of Niagara Falls (NY), and the Canadian (or Horseshoe) Falls between Goat Island and the City of Niagara Falls (Ontario, Canada). The Canadian Falls currently drop an average of 188 feet to the Lower Niagara River, and have a brink length of 2,600 feet. The American and Bridal Veil Falls currently combine for a total brink length of 1,060 feet and are 70-110 feet tall, with the height of water reduced by a massive accumulation of rocks at the base of the falls (Niagara Parks, 2011).

Formation of the gorge and falls began with the retreat of the Wisconsin Glacier approximately 12,000 years ago. Melting ice from the glacier drained into the Niagara River, and plunged over the edge of the Niagara Escarpment near what is now Lewiston. Gradual erosion through the force of the river water, annual freezing/thawing cycles, and rockfall has resulted in the falls moving upstream to their present-day location (DNC, 2010). Although the falls are still moving today, the rate of erosion has slowed considerably due to flow control and diversion for hydro-power generation (Niagara Parks, 2011).

Following retreat of the Wisconsin Glacier, the land along with Niagara gorge supported tundra vegetation. After approximately 1,300 years of climate amelioration, boreal forest vegetation became established throughout the lands adjacent to the gorge (the gorge rim), with spruce and jack pine as dominant trees. The area was sparsely populated by nomadic human tribes that hunted indigenous large mammals, including caribou, mastodons, moose, and elk. The spruce and fir forests that dominated the area between 9,000 and 3,000 years ago supported a variety of large mammals, including deer and moose. Starting around 5,000 years ago, the climate became much as it is today, promoting growth of extensive deciduous forest, dominated by sugar maple and American beech. However, the warming of the climate has not been uniform. Conditions became significantly warmer during several periods, allowing the establishment of xerophytic plants, some of which subsist today. In addition, the northern exposures and restricted angles of sunlight in the gorge, along with the spray from the cataracts and ice floes late into the year allowed northern trees, such as paper birch and northern white cedar, to extend down the Niagara Escarpment into the Niagara gorge (Eckel, 2002). These factors combine to make the Niagara gorge an area of unusually rich plant diversity.

Human occupation of the area has greatly influenced the natural history of the Niagara gorge and gorge

rim. Native Americans manipulated the understory of Northeastern forests through the use of fire to enhance hunting opportunities. These tribes also created small clearings for the establishment of villages, hunting camps, and agricultural plots. European settlers exerted a more significant influence on the natural ecological communities of the area by creating more substantial villages, farms, and roads. Early settlement of the Niagara region was followed by more intensive residential and industrial development that largely eliminated or severely altered the natural communities that occurred along the Niagara gorge and gorge rim. Much of what is present today represents either secondary succession back to more natural ecological communities (primarily within the gorge) or a largely planted/managed landscape, primarily associated with the Robert Moses Parkway (RMP) and the state parks that occur along the gorge rim. Detailed information on the current ecological condition of the Study Area is included in Section 2.

B. Cultural Setting

As mentioned above, the ecology of the gorge rim has been influenced by humans for at least 3,000 years. The first human inhabitants of the area were the Palco-Indians or Clovis people. The Clovis people were nomadic hunters that lived along the shoreline of Lake Erie between 12,000 and 9,000 years ago. Between 9,000 and 3,000 years ago (the Archaic Period), the area was occupied by hunter-gathers that subsisted on a diet of deer, moose, fish and plants. Evidence for Indian occupation of the region during the Archaic period has been found at Lockport and Grand Island. The Archaic Period was followed by the Woodland Period (3,000 to 300 years ago), during which the Iroquois inhabited the area. The Iroquois (primarily the Seneca and Tuscarora tribes) were agriculturalists who established small villages in Niagara Falls, Chippewa, and Foster's Flat. Hunters moved seasonally between these permanent settlements and temporary hunting and fishing camps, occupying the river banks during the summer and scavenging on animals that washed over the falls. During this time the gorge rim was part of an overland portage route which bypassed the Niagara River rapids and falls. (Eckel, 2002).

At the beginning of the 17th century, European explorers and missionaries began arriving in the area (Info Niagara, 2011). In 1666, the first French explorer, Rene Robert Chevalier, Sieur de La Salle made a short visit to the east bank of the Niagara River. La Salle's expedition formalized the Portage Trail, and built the first European structures in the region. Fort LaSalle was constructed in 1669, Fort Hennepin in 1678, and Fort Conti in 1679. Other early European settlements established in the area included Fort Joncaire, Fort du Portage, Fort Schlosser, and Fort Demler.

Because Niagara Falls created an insurmountable obstacle for shipping goods and materials by water, the Portage Trail, or detour around the Falls, had to be protected to keep supply and trade routes open. In 1687, the French established Fort De Nonville at the mouth of the Niagara River. Construction of a two-story stone "machicolated house" in 1726 established Fort Niagara, the first permanent French military presence on the Niagara River. (Old Fort Niagara Association, 2011). The French employed hundreds of Senecas to transport goods along the portage from Lewis Town (currently Lewiston) to the Upper Niagara River where the water was again safely navigable. Fort du Portage was located at the upper end of the land route from Fort Niagara, near the current location of the NYPA water intakes. Constructed in 1750, it consisted of three blockhouses with palisades along the river. In 1759, the British attacked the French at Fort Niagara taking control of the fort and surrounding area. The British then took over the Portage Trail and graded a road to allow teams of oxen to pull supply wagons up the escarpment at Lewis Town, eliminating the need for Seneca porters.

On September 14th 1763, a British wagon train was attacked by 500 Senecas along the Niagara gorge

rim above the Devil's Hole Cave. The outnumbered soldiers were killed in what became known as "the Massacre at Devil's Hole". In response to the Native American uprising, Captain John Montresor, a British engineer, was sent to Niagara to strengthen British fortifications (Info Niagara, 2011). In addition to fortifying the area, Captain Montresor also devised the first elevator built in North America which was known as "Crawl On All Fours" to haul goods up the steep bank of the Niagara Escarpment in Lewiston (Info Niagara, 2011). Fort Niagara prospered and the transportation route was protected under British control. During the American Revolution, Fort Niagara served as Britain's most important contact point with the Iroquois and the Indians of the upper Great Lakes region. Protection of the portage for military and commercial purposes remained the chief duty of the Niagara garrison.

While the military was protecting the trade route, the local civilian economy was being shaped and influenced by the region's dominant natural resource: water. Eventually the water was harnessed to produce power. Daniel Joncaire was the first person known to harness the waters of the Niagara River for the production of power. As the operator of a saw mill back to 1759, he harnessed water to power his mill. This lead to growth in local industry, which continued for the next 100 years (Niagara Info, 2011).

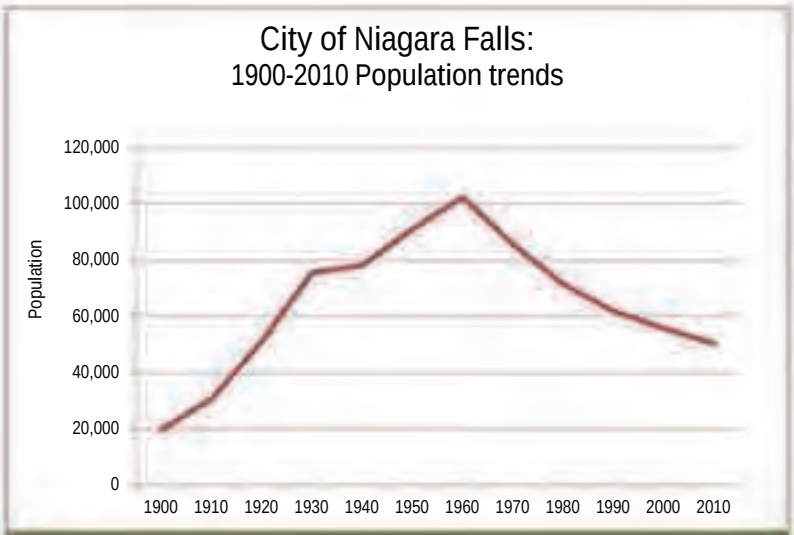
In 1805, the State of New York auctioned off the mile-wide strip of land lining the river banks upstream and downstream of Niagara Falls. By 1810, Niagara Falls, New York consisted of twelve houses, with a grist mill, saw mill, tannery, tavern, and post office. During the first half of the Nineteenth century, transportation infrastructure and industrial development continued on both the Canadian and American sides of the Niagara River. In 1847, the countries joined in commissioning the first suspension bridge over the river, built by Charles Ellet, Jr. at the site of the narrowest crossing, just south of the Whirlpool rapids.

Various industries along the rim of the Niagara gorge and river circa 1890s. Photo courtesy of Niagara County (http://www.niagara2008.com/photos-historical.html).

Eight years, later John A. Roebling, the designer of the Brooklyn Bridge, went on to build the Niagara Railway Suspension bridge in 1855. This was the first rail bridge to cross the Niagara gorge. Two years later the Hydraulic Canal was developed. This was the first large-scale hydroelectric power development in the area. Eventually, in 1881, the first hydroelectric generating station on the Niagara River was built by the Niagara Falls Hydraulic Power and Manufacturing Company. The availability of power resulted in the proliferation of industry along the river, including: the Gaskill Flouring Mill (1875), Pittsburgh Reduction Company (1895, later known as the Aluminum Corporation of America, or ALCOA), Niagara Falls Hydrologic and Manufacturing Power Company (1896, later known as the Schoellkopf Power Station), and the Niagara Mohawk Power Company (1953) (Niagara Info, 2011).

During the rapid industrialization of Niagara Falls, in 1902, the Great Gorge Route Railroad was constructed across the Lewiston-Queenston Suspension Bridge. Later it was extended along the lower Niagara gorge on the American side of the river, from Lewiston to the falls, before connecting back into Canada at the Upper Steel Arch Bridge. Over a half-million passengers each year marveled at the scenic vistas afforded by travel along the Great Gorge Route. The Gorge Route on the American side was destroyed on September 17, 1935 when 5,000 tons of rock broke free from the gorge wall and crashed onto the tracks. The route was never repaired (NCHS, 2009).

In response to the heavy industrial growth within the city, population grew rapidly from 30,445 at the turn of the twentieth century to 102,394 in 1960 (see graph). As the regional and national manufacturing economy began to struggle in the 1960s and 70s, the local population trend followed suit. With not enough local employment choices, many people chose to search for employment outside of Niagara Falls, which led to a steady decline in population over the last 50 years.



Population growth and decline in the City of Niagara Falls (U.S. Census Bureau).

Industrial and population growth in Niagara Falls was paralleled by the growth of tourism. Father Louis Hennepin, a member of LaSalle's group of early explorers, sketched the first published image of Niagara Falls in 1699. Following the American Revolution and the War of 1812, news about the unique beauty and wonder of the Niagara River and falls traveled, and by 1838 the area was attracting approximately 20,000 visitors annually. By 1850 Niagara Falls was experiencing 80,000 visitors annually, and by 1870 tourism was the area's dominant industry. Visitors would travel long distances to view the falls and gorge. These visits could last for weeks or months at a time (Niagara Info, 2011).

The coincidental growth of tourism, along with the growth of the energy and manufacturing sectors in the Niagara Falls area, created competing interests and opinions regarding the value and best use of the area's natural resources. The resulting land use policies and decisions permanently impacted the future quality and accessibility of the Niagara River, falls, gorge and rim (Info Niagara, 2011). In response to these competing interests, by the late 1860s, the Free Niagara Movement was started by a small group concerned about preserving the natural beauty of the falls. It was led by America's first landscape architect, Frederick

Law Olmsted, known for designing New York City's Central Park and Buffalo's Delaware Park. Members of the Free Niagara movement were outspoken and persistent in their efforts to reclaim the land along the Niagara rim for public use and restoration. With the help of prominent Buffalo resident Ansley Wilcox and Senator J. Hampden Robb, the Niagara Reservation Act of 1885 was signed by Governor David Hill. The act appropriated one million dollars toward the purchase of private properties along the river above the falls, for the purpose of establishing the nation's first state park (Welch, 1903).

Though the creation of the Niagara Reservation was a great victory for the Free Niagara movement, many continued to advocate for additional lands to be protected. For years, Wilcox and others pressed the state to extend the reservation beyond the falls, along the gorge rim toward Lake Ontario (Wilcox, 1920). Although ultimately successful in expanding the boundaries of the Reservation, his vision of memorial parks and "riverways" was only partially implemented. While Wilcox and others continued their grassroots campaign, Robert Moses, chairman of the State Parks Council, was maneuvering to ultimately wrestle control over the Niagara Reservation away from the park commissioners in 1928 (Caro, 1974). When the state eventually developed the park system along the gorge rim, it was Moses' vision of power generation, rather than Wilcox's vision of memorial parks, which drove the design of the parkway and shaped the landscape of the gorge and rim.

A view seeker perches on the rim above the Whirlpool Rapids and Great Gorge Route, circa 1902. Photo courtesy of Niagara Falls Public Library, Niagara Falls Heritage Foundation Collection.

The Niagara gorge and rim changed significantly in 1956 with the catastrophic Schoellkopf Station rockslide. When the face of the gorge collapsed at the Schoellkopf site, it took much of the area's electrical generation capacity with it. This disaster led directly to the NYPA's decision to build the Niagara Power Project. The project consisted of the Robert Moses Niagara Power Plant (named in honor of Moses' chairmanship of NYPA; hereafter, the "power plant"), intake structures, underground conduits and pump stations, the forebay, the Lewiston Reservoir and generating plant, and the Niagara switchyard. It also included the construction of 9.3 miles of the RMP, as well as additional work at Goat Island, Niagara Reservation State Park, Whirlpool State Park, and Hyde Park (NERA, 2005). When the Niagara Power Project began operation in 1961, it was the largest hydroelectric project in the Western Hemisphere (NYPA, 2011). Water for the power plant is drawn from the Niagara River 2.5 miles above the falls, at a rate of 600,000 gallons per second (Info Niagara, 2011). The hydroelectric plant consists of thirteen turbines rated at 200,000 horsepower each, with a capacity of power output rated at 2,300 megawatts (NYPA, 2011).

Robert Moses is often referred to as the "master builder" of the mid-twentieth century in New York State, and served as the director of several state agencies and public authorities. He is considered the father of the New York State parkway system due to the parkway projects he spearheaded on Long Island in the 1920s and 1930s. From the 1930s to the 1960s he was also responsible for the construction of numerous bridges and expressways in New York City and on Long Island. However, he was a polarizing figure in the field of urban planning. Like most projects with which Robert Moses was associated, the RMP reflects Moses' general approach, which favored the automobile over mass transit, and was not particularly sensitive to adjacent neighborhoods and the integrity of the existing urban fabric in the areas where his roads were located (Caro, 1974). Additional discussion of the RMP is included in Part II of this study.

Tourists at Prospect Point at the American Falls, circa 1830. Photo courtesy of Niagara Falls Thunder Alley (www.niagarafrontier.com).

A. Natural Setting

The Niagara gorge rim is located within the Great Lakes Plain ecozone, which is a large, relatively level area covering 7,206 square miles in New York State, adjacent to Lakes Erie and Ontario.

1. Topography

Elevation in the Study Area ranges from approximately 260 feet above mean sea level (amsl) along the Niagara River at the Earl W. Brydges Artpark, to approximately 600 feet amsl on the gorge rim in DeVeaux Woods State Park. Topography within the gorge consists of steep slopes and cliffs that descend from the gorge rim to the river. Along the rim itself, topography is more level, but generally slopes upward towards the eastern edge of the Study Area (USGS, undated). Topography on the gorge rim ranges from approximately 320 to 600 feet amsl. Gorge depth averages 209 feet from the top of the gorge rim to the surface of the river (Eckel, 2004).

Topography within the gorge and rim at Whirlpool State Park (USGS).

2. Geology

Surficial geology in the central and southern portions of the Study Area is comprised of variably textured glacial till, that was deposited during and shortly after the last ice age. Bedrock of the Lockport dolomitic limestone formation is exposed at the surface at the Niagara Escarpment, with lacustrine beach deposits found to the north in the Artpark, and a terminal moraine paralleling the Escarpment to the south (NYS Geological Survey, 1999; USDA Soil Conservation Service, 1972). Soils in the Study Area formed in these glacial materials. Glacial till consists of the rocks and soil materials that were picked up and deposited by the glacier as it moved slowly southward. As the ice began retreating north again, coarse materials were deposited in the form of outwash, while melting waters carried fine soil materials into water bodies, which settled out to form lacustrine deposits (USDA Soil Conservation Service, 1972).

3. Soils

The General Soil Map for Niagara County shows two soil associations on the gorge rim: the Rhineback-Ovid-Madalin association and the Odessa-Lakemont-Ovid association (USDA Soil Conservation Service, 1972). Each of these is described in greater detail below:

- Rhineback-Ovid-Madalin Association: This soils association occurs in the Study Area north of the Escarpment. These soils are deep, somewhat poorly drained to very poorly drained soils having a fine textured or moderately fine textured subsoil. The surface layers are usually comprised of silt loam or dark silt loam, with silty clay or silty clay loam subsoils. Underlying materials are varved silt and clay, or loamy glacial till (USDA Soil Conservation Service, 1972).
- Odessa-Lakemont-Ovid Association: This soils association occurs in the Study Area south of the Escarpment. These soils are deep, somewhat poorly drained to very poorly drained soils having a fine textured or moderately fine textured subsoil. The surface layers are usually comprised of silty clay loam or silt loam, with silty clay or silty clay loam subsoils. Underlying materials are clay and silt, or loamy glacial till (USDA Soil Conservation Service, 1972).

Due to early human settlement of the area, detailed soil mapping was not conducted throughout much of the City of Niagara Falls. In the Soil Survey of Niagara County, regions not subject to detailed examination were mapped as Ua, or Unsurveyed area. Such areas comprise approximately 350 acres, or 50%, of the Study Area, including Devil's Hole State Park and all of the area south of University Drive/Hyde Park Boulevard. Detailed soil surveys have only been conducted in the northern half of the Study Area. Within the surveyed area, 26% of the land is comprised of silt loams and gravelly sandy loam; 13% by steep rockland; and 61% by soils that are very disturbed and lack soil profile development. Disturbed soils are concentrated along the rim, and are generally the result of construction operations (e.g., RMP Niagara Power Project). The original soil in these areas has been either stripped away and removed, or compacted and covered with fill materials to a depth of 3 feet or more. According to the USDA Soil Conservation Service (1972), these areas require detailed on-site investigations of the specific soil conditions "if changes in land use are contemplated" in order "to determine suitability for other uses." The characteristics of the soil series mapped within the northern portion of the Study Area are summarized in Appendix A.

4. Hydrology

The Niagara River is the outlet for four of the five Great Lakes. The drainage area for the river totals over 264,000 square miles. The hydrology of the Niagara River between the intakes and tailrace of the Niagara Power Project is largely controlled by the diversion of water for both NYPA and Sir Adam Beck (Canadian) power plants. During the seven-month tourist season from April through October, a minimum flow of 100,000 cubic feet per second (cfs) is required in the river during hours of peak visitation. A minimum flow of 50,000 cfs is required during non-peak hours within the tourist season, and during the non-tourist season from November through March (ASA & E/PRO, 2005).

Water resources within the Study Area are limited. Surface water features include Fish Creek and Bloody Run, which historically drained into the Niagara River in the Artpark and Devil's Hole State Park, respectively. Fish Creek has a long history of modification, beginning with channelization in the early 1900s for construction of a railroad, and again more recently in 1962 during construction of the RMP. Upstream of the Study Area, Fish Creek flows through the Niagara Falls Country Club in a concrete channel, then enters a culvert that runs under the RMP, and finally drains down the gorge walls in a concrete spillway. Bloody Run originally flowed into the gorge near Devil's Hole, but the drainage area

has been gradually filled by construction of residential streets and the RMP. It remained an open waterway until 1992, when remediation for dioxin contamination buried the creek altogether (WNYWS, 2011; Eckel, 2003c). Groundwater in the Study Area is contained primarily within the Lockport Group, a fractured bedrock aquifer (URS & GSE, 2005). Discharge features on-site include seeps and springs that daylight along the cliff face within the gorge and discharge onto "shelves" in the calcareous cliff community. Numerous stormwater drainage outlets also occur within the gorge (ASA & E/PRO, 2005).

The U.S. Fish and Wildlife Service National Wetland Inventory (NWI) maps indicate one small, forested wetland within the Artpark, near the northern edge of the Study Area. In addition, reconnaissance-level field surveys identified a small shallow emergent marsh on the gorge rim, within the wildlife refuge area (Plateau Park) in the Artpark. There are no mapped New York State Freshwater Wetlands within the Study Area.

5. Water Quality

The NYSDEC classifies all waters in the state based on the existing or expected best use of that waterway. The Niagara River is designated as Class A-S, which indicates that the best usage is as a source of drinking water, and for fishing, swimming and other recreation. Tributaries within the Study Area, including Fish Creek and Bloody Run are designated as Class C. This class is unprotected, and indicates that the best usage is for fishing (NYSDEC, 2010b).

The Niagara River and gorge have been subject to various pollutants, both historical and ongoing. The Hooker-Hyde Park landfill, active from 1953 to 1975, was used to dispose of approximately 80,000 tons of waste, including hazardous materials such as volatile organic compounds and dioxin. Contaminants from the landfill entered both the groundwater and Bloody Run, which flowed down the gorge face into the Niagara River. As part of the landfill remediation effort, Bloody Run was excavated to remove contaminated water and sediment, and extraction wells were constructed to maintain an inward groundwater hydraulic regime. Current seeps in the Bloody Run area of the gorge are surface runoff rather than groundwater discharge, and indicate that the extraction wells have been effective at controlling groundwater migration from the landfill into the gorge (USEPA, 2008). Although these remediation activities have successfully removed contaminates from Bloody Run, the altered hydrology in this part of the gorge has result in drier conditions in the calcareous cliff communities and calcareous talus slope woodlands in the vicinity of Devil's Hole. Eckel (2003b) indicated that the Bloody Run remediation and resultant habitat desiccation has likely decreased the floristic diversity in the area.

Runoff from city streets and parking lots along the rim also drains into the gorge through channels and stormwater drainage structures evident along the face of the cliff, introducing a variety of pollutants (e.g., salt and petroleum products) to the natural communities at the base of the cliff, and ultimately to the Niagara River. This runoff represents an ongoing threat to the calcareous talus slope woodlands located below the cliffs. According to Evans et al. (2001), "the introduction of chemicals and fuels into these natural systems could have profound effects on their overall integrity."

6. Ecological Communities

Ecological communities within the Niagara gorge and gorge rim currently include calcareous cliffs, calcareous talus slope woodlands, mowed lawn/ornamental plantings, shallow emergent marsh, successional old field, successional forest, northern hardwoods and disturbed/developed land. Calcareous cliffs and calcareous talus slope woodlands are the dominant communities within the gorge; both are identified as significant natural communities by the New York Natural Heritage Program (NYNHP). A variety of generally more common and/or disturbed communities occur within the Study Area, along the rim. The location of the various communities within the Study Area and the adjacent gorge is shown in the ecological communities map included in Appendix B. Brief descriptions of each ecological community within the gorge and gorge rim are presented below:

Example of Calcareous Cliff Community along the Niagara gorge.

Example of Calcareous Talus Slope Woodland along the Niagara gorge.

Calcareous Cliff Community- As defined by the Ecological Communities of New York State (Edinger et al., 2002), this community occurs "on vertical exposures of resistant, calcareous bedrock (such as limestone or dolomite) or consolidated material; these cliffs often include ledges and small areas of talus. There is minimal soil development, and vegetation is sparse." This community occurs in a narrow band in the gorge immediately below the rim. The cliff averages about 82 feet in height and is largely unvegetated; where present, vegetation consists of herbs and a few stunted trees (Evans et al., 2001). Tree species include northern white cedars, while herbaceous species include wild columbine, bulblet fern, and herb Robert. Despite their diminutive stature, the stunted cedars found along many sections of the Niagara Escarpment have been documented to exceed 1,000 years in age (Larson et al., 2000).

Calcareous Talus Slope Woodland- This forest community consists of "an open or closed canopy community that occurs on talus slopes composed of calcareous bedrock such as limestone or dolomite" (Edinger et al., 2002). Talus derived from cliff rockfall or landslides with slopes of 20-45 degrees makes up at least 50% of the substrate, and soils are usually moist and loamy (NYNHP, 2009). This community is common throughout the

gorge, occurring immediately below the cliffs, and is present in two broad forms: as mature forest and as successional forestland dominated by shrubs (Evans et al., 2001). Dominant or co-dominant tree species observed in mature calcareous talus slope woodlands in the gorge include sugar maple, basswood, white ash, eastern hophornbeam, paper birch, Norway maple, and American beech. Other less common tree species include black cherry, bird cherry, box elder, butternut, northern white cedar, hemlock, and yellow birch. The shrub layer ranges in density, depending on canopy coverage, and includes saplings of the overstory trees, along with red elderberry, chokecherry, flowering raspberry, mountain maple, buckthorn, shrubby honeysuckles, and dogwoods. Common herbaceous species include zigzag goldenrod, herb Robert, small-flowered leafcup, marginal woodfern, garlic mustard, white baneberry, sarsaparilla, and false Solomon's-seal.

Disturbed/Developed- This community consists of a combination of several "cultural communities" as defined by Edinger et al. (2002), including paved road/path and urban structure exterior. Disturbed/developed lands occur throughout the gorge rim, and include buildings, parking lots, sidewalks, and staircases. These developed areas occupy approximately 183 acres (26%) of the Study Area. Vegetation in these areas is generally either lacking or highly managed (i.e., landscape plantings seeded along roadsides for erosion control). Volunteer vegetation at the edges of these areas is generally sparse, and comprised of early successional, often non-native, herbaceous species such as bull thistle, dandelion, curly dock, mullein, yellow rocket, and orchard grass.

Example of Disturbed/Developed landscape along the Niagara gorge rim.

Mowed Lawn/Ornamental Plantings- This community also consists of a combination of several "cultural communities" including mowed lawn, mowed lawn with trees, mowed roadside/pathway, and flower/herb garden (Edinger et al., 2002). Mowed lawn and ornamental plantings occur throughout the gorge rim, along roadsides and in parks. These communities make up approximately 167 acres (24%) of the Study Area. Common plant species include honeysuckles, hawthorns, barberries, lilac, privet, honey locust, horse chestnut, red pine, and Scots pine. Lawns typically include bluegrass,

Example of Mowed Lawn/Ornamental Plantings along the Niagara gorge rim.

dandelion, clovers, and hawkweeds. Components of native flora occur amongst the mowed lawn and ornamental plantings in some locations, particularly at Whirlpool State Park. This community also includes areas along the parkway that have recently been designated as "natural regeneration areas." Although such areas are not currently being mowed, active landscaping (in the form of planting non-native shrub species) continues in these areas, and signs indicate the non-mowing management techniques are "being tested."

Example of Successional Old Field in Earl W. Brydges Artpark State Park.

Example of Successional Forest along the Niagara gorge rim.

Shallow Emergent Marsh– This community is "a marsh meadow community that occurs on mineral soil or deep muck soils (rather than true peat) that are permanently saturated and seasonally flooded" (Edinger et al., 2002). A small community fitting this description occurs on the gorge rim near the northern end of the Study Area, within the wildlife restoration area (Plateau Park) in the Artpark. Common herbaceous species include sedges, cattails, manna grass, green bulrush, wool grass, Joe-Pye weed, soft rush, and boneset. Though not dominant, willow shrubs and silky dogwood are scattered throughout the marsh.

Successional Old Field– This community is defined as "a meadow dominated by forbs and grasses that occurs on sites that have been cleared" and then abandoned (Edinger et al., 2002). This community occurs on the gorge rim near the northern end of the Study Area, in the Artpark. Common species include orchard grass, goldenrods, asters, old field cinquefoil, cow vetch, teasel, white and red clover, dandelion, thistles, and wild strawberry.

Successional Forest- This community is common along the rim on sites that have been cleared and are re-growing, typically adjacent to trails or other disturbed/developed areas. Trees are mostly immature and relatively low in height. Co-dominant trees in these areas consist of black locust, Norway maple, bird cherry, box elder, aspens, ashes, and staghorn sumac. Shrub growth is often

thick, and dominated by honeysuckles, buckthorn, privet, and chokecherry. Vines are abundant, with common species including Virginia creeper, poison ivy, and wild grape. Common herbaceous species include orchard grass, zigzag goldenrod, cleavers, deadly nightshade, weed orchid, and Canada thistle.

Mixed Northern Hardwoods- This community occurs along the gorge rim within both the Artpark and DeVeaux Woods State Parks. Dominant or co-dominant tree species include white oak, red oak, sugar maple, and Norway maple. Other common tree species include beech, black cherry, basswood, black locust, black walnut, shagbark hickory, and horse chestnut. The understory is variable, ranging from open to dense, and includes saplings of overstory trees, along with shrub species such as spicebush, witch hazel, alternate-leaved dogwood, chokecherry, honeysuckle, buckthorn, red elderberry, and maple-leave viburnum. Herbaceous vegetation is similarly variable, sparse in places and very thick in others, and includes native species such as jack-in-the-pulpit, false Solomon's seal, Virginia waterleaf, zigzag goldenrod, enchanter's nightshade, and squawroot, along with invasive species such as garlic mustard, weed orchid, cleavers, fig buttercup, and nipplewort.

Example of Mixed Northern Hardwoods in DeVeaux Woods State Park.

After evaluating DeVeaux Woods, and counting the rings on five fallen oaks that had ages ranging from 150 to 250 years, Kershner (1995) identified the mature forest at DeVeaux Woods as old-growth forest. The site has also been assessed by Eckel (1986, 2008), who described 2-3 acres of old growth forest at the site, and by the NYNHP in 2000. The NYNHP survey found "many very old trees," but also documented that the small size and isolation of the forest makes it vulnerable to wind damage and other edge effects, such as encroachment by invasive species. Evans et al. (2001) concluded, "Although it is recognized that the DeVeaux Woods supports some very old trees, many other characteristics of old growth are lacking, such as fallen logs in various stages of decomposition, standing dead trees, both large and small canopy gaps, an undulating forest floor where trees have fallen over and decomposed, undisturbed soils, and a prevailing lack of human disturbance."

7. Rare Plant Species

In response to a written request for information regarding state-listed threatened and endangered plant species, the NYNHP reported current records for six state-listed plant species in the vicinity of the Study Area (NYNHP, 2011). These include elk sedge (Carex garberi), lesser fringed gentian (Gentianopsis virgata), slender blazing-star (Liatris cylindracea), Ohio goldenrod (Oligoneuron ohioense), smooth cliff brake (Pellaea glabella), and sky-blue aster (Symphyotrichum oolentangiense). With the exception of sky-blue aster, all of these species are found exclusively in the gorge, rather than on the rim.

The NYNHP database also includes records of three additional state-listed plant species in the vicinity of the Study Area: puttyroot (Aplectrum hyemale), basil-balm (Monarda clinopodia), and northern pondweed (Potamogeton alpinus). However, none of these populations have been located since the 1800s, despite extensive botanical work in the area by Eckel (1986; 2001, 2002, 2003a, 2003b, 2004, 2008) and others (Evans et al., 2001; TRC & Riveredge, 2008). While it is possible that these species could occur undetected within the Study Area, such occurrence is unlikely, and they are considered "historical" in the vicinity of the Study Area by the NYNHP (Additional information on rare plant species is included in Appendix B).

Yellow lady's-slipper (Cypripedium parviflorum), a native orchid. Although not endangered, it is fairly uncommon.

8. Non-Native Invasive Species

A non-native invasive species is an organism that has been purposefully or accidentally introduced outside its original geographic range, and is able to proliferate and aggressively alter its new environment, potentially causing harm to the economy, environment, or human health (NYS ISTF, 2005).

Non-native plant species represent a significant portion of the current flora on the gorge rim, but also occur within the gorge as well. Of the 238 species observed by **edr** during field surveys, 105 species (44%) are not native to the western New York region. The plant species list in Appendix B identifies non-native species, and indicates whether each species was observed in the gorge or along the rim. Twenty-one species included on the NYSDEC (2010a) interim list of invasive plant species were documented, including: Japanese knotweed, purple loosestrife, common reed, garlic mustard, mugwort, spotted knapweed, Canada thistle, bull thistle, crown vetch, Fuller's teasel, oriental bittersweet, Norway maple, tree of heaven, Japanese barberry, autumn olive, glossy buckthorn, Amur honeysuckle, shrub honeysuckles, common buckthorn, black locust, and multiflora rose. Most of the invasive species present within the Study Area are both common and widespread outside the Study Area as well.

Non-native invasive species, both in the gorge and along the rim, present a threat to the rare plant populations and natural communities within the gorge (Evans et al., 2001; Eckel 2002, 2003a). Each of the invasive species identified within the Study Area has the ability to spread rapidly and crowd out native plants, changing the vegetative structure of natural areas. Invasive species within the Study Area have typically been planted along the rim or in adjacent communities, or have established populations there through inadvertent introduction during construction, road building, and various other earth moving

activities. Once established along the rim, these populations of invasive species serve as a source of seeds for expanding populations, often within the gorge (Evans et al., 2001; Eckel 2002).

9. Wildlife Habitat

Wildlife occurrence along the gorge rim is limited due to the abundance of disturbed/developed areas, human and vehicular activity, and the general lack of habitat diversity. However, each ecological community that occurs within and adjacent to the Study Area has particular elements that make it valuable to different species of wildlife.

Forested communities typically include a variety of features that provide habitat for wildlife. These features include foliage height diversity and structural complexity, fruit and nut producing plant species, and standing and fallen deadwood. Forests that possess these characteristics provide a wide variety of food and cover that in turn support a high diversity of wildlife species. Unfortunately, along the gorge rim, forest vegetation occurs in relatively small patches, with limited tree species diversity and a poorly developed understory/midstory. In most places, the understory includes a substantial component of non-native invasive species (e.g., garlic mustard, common buckthorn, bush honeysuckle, and Norway maple seedlings/saplings). Other typical forest habitat features, such as abundant leaf litter and standing and fallen deadwood, are also generally lacking. The lack of these habitat features limits the diversity of small mammals, birds, reptiles and amphibians these forested areas can support. Their small size and isolation from other areas of forest (i.e., within the gorge) limits the seclusion they can provide and the ability of wildlife to freely travel from one area of forest habitat to another.

Areas with thick shrubs, such as successional shrubland and forests edges, are essential to sustain diverse songbird populations. Again, the limited occurrence of this habitat future within the gorge rim limits wildlife diversity in the area. Certain species, such as gray catbird, American goldfinch, indigo bunting, common yellowthroat, and yellow warbler, require low bushy vegetation for nesting and escape cover. Without this habitat the occurrence of these species will be limited, and even common species such as American robin, blue jay, and northern cardinal, which utilize a variety of habitats but prefer brushy edge habitat, will be less abundant. The lack of dense stands of shrubs and saplings also limits the area's value as habitat for mammals such as white-tailed deer, raccoon, red fox, and eastern cottontail.

Old-field/meadow communities dominated by native herbaceous plants are also rare along the gorge rim, being essentially restricted to areas within the Artpark. Open fields are important hunting areas for raptors such as red-tailed hawk, and foraging areas for aerial insectivores such as bats, swallows, and flycatchers. The herbaceous vegetation also supports abundant insect populations, which serve as an important food source for nesting songbirds, and the vegetation itself provides forage in the form of seeds and foliage, which is utilized by sparrows, finches, small mammals, and woodchucks. Without herbaceous old fields the occurrence of such species will be limited. This in turn will limit the abundance of predators that feed upon them, such as hawks, owls, foxes, and coyotes.

The calcareous cliff community within the gorge provides potential habitat for wildlife species that require rock faces and/or loose rock for nesting, roosting, or escape cover. These species include cliff swallow, small-footed bat, and a variety of snakes, salamanders, and small mammals. The latter species may also use loose rock at the base of the cliffs as thermal cover/hibernacula during the winter. In addition, cliffs provide important nesting and perching sites for a broad range of raptors, including peregrine falcon (Larson et al., 2000), a state-listed endangered species.

The disturbed/developed areas and mowed lawn/ornamental plantings that dominate the gorge rim provide generally low quality wildlife habitat. Mowed lawn and patches of un-mowed vegetation within these areas are used for foraging by certain birds and mammals (e.g., European starling, eastern cottontail, meadow vole, woodchuck, etc.), while man-made structures and debris can provide cover for small mammals, snakes, and salamanders. In addition, some bird species have adapted to ever-increasing human disturbances and are able to forage in the non-vegetated portions of developed areas (i.e., for roadkill and food left behind by humans). These birds include American crow, various gulls, house sparrow, and European starling. However, the overall habitat value of these areas is low due to high levels of human activity and a lack of adequate food, cover, and water. These areas typically receive irregular use by a limited number of wildlife species.

10. Wildlife Species

Birds- A total of 54 bird species were observed by **edr** within the Niagara gorge and gorge rim during reconnaissance-level field investigations conducted during June of 2010. Commonly observed species included blue jay, cardinal, black-capped chickadee, Herring gull, and American crow. A complete list of these species, including scientific names, is included in Appendix B. In addition, published data from the New York State Breeding Bird Atlas (BBA) and Audubon Christmas Bird Count (CBC) were reviewed to more fully characterize avian species likely to occur within the Study Area. Data from each of these sources are summarized below.

The Study Area occurs within BBA survey blocks 1677A, 1678B, 1678C, and 1678D. The species totals for these blocks range from 46 to 73 species, for a combined total of 86 individual bird species. Most of the species recorded were common birds of forest, forest edge, successional old field, and wetland habitats. However, several state-listed avian species were also documented, including peregrine falcon (endangered), pied-bill grebe (threatened), and American bittern, sharp-shinned hawk, Cooper's hawk, and common nighthawk (all special concern). No federally-listed threatened or endangered species were recorded (NYSDEC, 2007a).

Data from the CBC provides an overview of the birds that inhabit the region during early winter. Food for most birds is likely to be scarce at this time of year, and therefore, a low diversity and density of wintering birds would be expected in and around the Study Area. Those bird species that can be expected to consistently occur within the Study Area (i.e., occur during most winters), such as dark-eyed juncos, are generally common and abundant both on a regional and continental scale. The entire Study Area falls within the Niagara Falls, Ontario CBC count circle. Over the last ten years, annual species counts on this route ranged from 90 to 100 species, for a combined total of 140 individual species. The most common wintering bird species observed were Canada goose, mallard, common merganser, long-tailed duck, Bonaparte's gull, ring-billed gull, herring gull, rock dove, mourning dove, blue jay, American crow, black-capped chickadee, European starling, American tree sparrow, dark-eyed junco, house finch, and house sparrow. The following state-listed avian species have also been documented during the CBC: peregrine falcon and short-eared owl (endangered); pied-billed grebe and northern harrier (threatened); and sharp-shinned hawk, Cooper's hawk, northern goshawk, red-shouldered hawk, red-headed woodpecker, and horned lark (all special concern). No federally-listed endangered or threatened species were recorded (National Audubon Society, 2010).

Mammals- Reconnaissance-level surveys conducted by **edr** in June 2010 confirmed the presence of 16 mammal species within the Niagara gorge and along the gorge rim. Mammals observed within the gorge

included white-tailed deer, eastern chipmunk, gray squirrel, and red squirrel, while species observed along the rim included woodchuck, red fox, and several small mammals (mice and moles). Additional species not observed, but likely to occur along the rim based on suitable habitat conditions include deer, gray squirrel, opossum, raccoon, chipmunk, and various species of bats. All of these species are common and widely distributed throughout New York State.

Reptiles and Amphibians- Reptile and amphibian presence within the Study Area was determined through field surveys and review of the New York State Amphibian and Reptile Atlas (Herp Atlas). Based on these data, along with documented species ranges and existing habitat conditions, it is estimated that approximately 30 reptile and amphibian species could occur in the vicinity of the Study Area. Field surveys conducted by **edr** in June 2010 confirmed the presence of eight amphibian species and three reptile species, all of which occurred in the gorge, either along the riverbank, in seeps, or in damp leaf litter on the gorge slopes. Reptile and amphibian presence along the rim is limited due to a lack of suitable habitat. American toad and garter snake were observed along the rim, and spring peeper and western chorus frog were heard singing. Although no federally- or state-listed endangered or threatened species were observed on site, the Herp Atlas indicates the presence of blue-spotted salamander in the general area (i.e., in the Niagara Falls quadrangle), which is listed as species of special concern in New York State (NYSDEC, 2007b).

Fish- Although not included in the Study Area, the adjacent lower Niagara River rapids support a productive coldwater fishery. Concentrations of steelhead are among the highest in the state. These spawning runs start in September and October, and may continue sporadically throughout the winter, peaking in March and April. Substantial numbers of coho salmon, chinook salmon, and brown trout also occur in the area during spring and fall spawning periods. These populations are the result of an ongoing effort by the NYSDEC to establish and maintain a salmonid fishery in the Great Lakes through stocking; no successful reproduction by salmonids has been documented in the Lower Niagara River Rapids (NYSDOS, 2010).

Other fish species found in the lower rapids include smallmouth bass, walleye, white bass, yellow perch, lake trout, smelt, rock bass, freshwater drum, and round goby (NYSDOS, 2010, Stantec, 2005). It is unlikely that the section of the Niagara River adjacent to the Study Area is used for fish spawning or nursery activities by any of these species to any significant extent, due to the strong turbulent currents, a lack of shallow water littoral areas, and the lack of tributaries (NYSDOS, 2010).

11. Rare Wildlife Species/Significant Wildlife Habitats

Correspondence from the NYNHP (2011) indicated the presence of three sensitive aquatic species in the vicinity of the Study Area: lake sturgeon (Acipenser fulvescens), hickorynut (Obovaria olivaria), and rainbow shell (Villosa iris). No listed terrestrial wildlife species were reported. However, NYNHP correspondence indicated the presence of two significant wildlife habitat features in the vicinity of the Study Area; a waterfowl winter concentration area and a gull colony, both on the Niagara River. In addition, the entire Study Area falls within the Niagara River Corridor Important Bird Area as designated by the National Audubon Society, and the lower Niagara River rapids is designated as a Significant Coastal Fish and Wildlife Habitat by the NYS Department of State, Division of Coastal Resources. The sensitive aquatic species and significant wildlife habitats reported by the NYNHP are described in Appendix B.

B. Cultural Setting

As stated earlier, the entire context of the Niagara gorge rim requires a view of the cultural activities that surround it as well as the natural resources located in or near the gorge rim. The following discussion focuses on the existing conditions of the City of Niagara Falls, with some emphasis on the areas that most influence the gorge rim due to their proximity to the Study Area.

Modern day Niagara Falls continues to be shaped and influenced by the natural features surrounding it, and the falls themselves continue to serve as the main attraction, drawing over 5 million tourists annually. Although the tourism industry has sustained itself over the last three decades, the manufacturing industry has declined dramatically, causing significant economic decline within the region. Four decades of a declining economy has taken a noticeable toll on the community. Today in downtown Niagara Falls, vacant storefronts are common along Main Street, highlighting the cycle of disinvestment that has complicated redevelopment efforts within the city. This cycle has been further compounded in recent years with the downturn in the national economy.

Despite its struggling economy, the City of Niagara Falls nurtured several diverse neighborhoods, many of which are active and vibrant today. These neighborhoods include Little Italy, the North End, DeVeaux, La Salle, Downtown, Niagara Street/East Side, Buffalo Avenue, Park Place, Orchard Parkway, and Hyde Park. Some of the neighborhoods adjacent to the Study Area include Park Place, DeVeaux, and Orchard Parkway. The dense urban residential neighborhoods immediately east of the RMP corridor feature hundreds of single family, two-family, and multi-use units in a wide range of condition and value. Among the more cohesive areas are two designated historic residential districts, Park Place and Chilton Avenue/Orchard Parkway. These two historic districts located west of Main Street and north of Pine Avenue include more than 170 residences built in the late 19th and early 20th centuries, in a series of architectural styles consistent with those periods, including Italianate, Queen Anne, Colonial and Tudor Revival, Arts and Crafts, and Bungalow/Craftsman. Regardless of their historic designation or physical condition, all of the neighborhoods adjacent to the Study Area are almost entirely cut off from the Niagara gorge and rim, (the primary aesthetic and recreational assets within the area) by the RMP. While many local residents use the expansive lawns of DeVeaux Woods State Park for active recreation, there is little or no connection between their neighborhoods and the passive recreation opportunities that exist only a few feet away, on the other side of the RMP.

With the decline of the heavy manufacturing industry, tourism is now the primary economic driver for the City of Niagara Falls and the surrounding area. Tourism-based spending supports the local economy through direct spending on goods and services, which in turn generates employment and municipal revenue, including sales, room, and income taxes. Over the past few years, an increasing amount of local attention has been focused on further developing the local tourism-based economy, increasing both the quantity and quality of attractions available to visitors, with the intention of lengthening their stay and thereby increasing local spending. As indicated in Appendix C, in 2009, 43% of visitors to the city stayed overnight, and approximately $378 million was spent by these overnight visitors on meals, lodging, recreation, retail purchases, and transportation. In light of the obvious long term success in the tourism trade, the city continues to exhibit interest in expanding its tourism attractions to include additional natural and cultural attractions. This fits with the national (and international) upward trend in ecotourism, a sub-sector of the tourism industry that includes nature-based travel experiences and those that "[contribute] to the conservation of the ecosystem, while respecting the integrity of host communities" (Scace et al., 1992). Ecotourism has been noted as one of the fastest growing segments of the tourism market. Over the last 20 years, ecotourism has grown 20% - 34% a year and is expected to continue growing over the next two decades (see Appendix C).

1. State Parks

As mentioned previously, New York State saw the value of protecting the unique natural features that exist along the Niagara gorge and rim by dedicating much of the land as state parkland accessible for enjoyment by the community. In addition, in early 2000 the Niagara gorge rim received federal designation as part of the Niagara Falls National Heritage Area. The four state parks located in the Study Area, include (from north to south) Earl W. Bridges Artpark (which includes Plateau Park), Devil's Hole, Whirlpool, and DeVeaux Woods. The latter three of these parks predate construction of the RMP. Whirlpool and DeVeaux Woods State Parks, once physically connected, were bisected by the RMP. Below is a description of all four parks that occur along the gorge rim.

Aerial image of Earl W. Brydges Artpark State Park (Artpark and Company, Inc.).

Trail along the gorge rim at Devil's Hole State Park.

Earl W. Brydges Artpark State Park- This park, located adjacent to the Village of Lewiston, is home to cultural and historic resources of local and regional interest, and provides a venue for celebrating the arts. The Artpark site is at the base of the Niagara Escarpment at what was once the start of the Portage Trail. Over the years the site accommodated an inclined railway, a stone quarry, and a garbage dump. Between 1957 and 1960, over 26 million tons of excavated spoils from construction of the Niagara Power Project were deposited in the area, creating a 150-foot high plateau covering nearly 100 acres (known as the "spoil pile"). Built atop these spoils, Artpark was opened July 25, 1974, and features a theater, a theater terrace lounge, an outdoor amphitheater, picnic shelters, hiking trails, and fishing access points. An undisturbed portion of the park includes the Lewiston Mound, an Indian burial site dating back to 160 AD. Various groups and individuals throughout the area, including environmental organizations, were instrumental in creating a wildlife refuge at the Park. This refuge, referred to as "Plateau Park", was officially opened to the public on October 17, 2003.

Devil's Hole State Park- Devil's Hole State Park is located just north of the whirlpool rapids on the Niagara River. It provides recreational access through the wooded gorge down to the rapids. Along the gorge in this area is the Devil's cave, which lends it name to this park. This area was also the site of the Devil's Hole Massacre, the costliest battle of Pontiac's Rebellion, which resulted in more than 80 British fatalities.

Facilities at Whirlpool State Park.

The nearby Bloody Run Creek takes its name from the aftermath of this massacre of British troops by the Senecas.

On the gorge rim, the majority of the land within Devil's Hole State Park features mowed lawn, paved surfaces, and a walking trail. A pedestrian bridge crosses over the RMP in the southwestern portion of the park, providing public access to and from adjacent neighborhoods. Along the existing RMP to the north of the park, visitors and commuters cross the footprint of the former Bloody Run Creek, which currently carries a service road to the bottom of the power plant. Along the gorge rim, Devil's Hole State Park features impressive scenic views of the Niagara River, and the bottom of the gorge below the park is a popular fishing spot for local anglers.

Whirlpool State Park- Whirlpool State Park is located at the point where the Niagara River takes an abrupt turn to the west. The resulting currents create a large eddy, or whirlpool, for which the park is named. Within Whirlpool State Park, approximately 250 feet above the river, a marked path follows the remnants of the former Great Gorge Route railway to an old observation station overlooking the rapids. This station was used as a way-point for visitors riding the Great Gorge Railway for its superior views

Abandoned structure at DeVeaux Woods State Park.

overlooking the Whirlpool Rapids. The park provides picnic areas, a playground, a welcome center, and miles of recreational trails on the rim and down the gorge to the river. The river in this area is used by whitewater boaters and fishermen.

DeVeaux Woods State Park- Directly to the east of Whirlpool State Park, across the RMP, lies DeVeaux Woods State Park. The site is named after Judge Samuel DeVeaux (1789-1852), a prominent businessman and landowner in the area. Upon his death in 1852, DeVeaux left a portion of his land holdings to the Episcopal Diocese for the purpose of educating orphans and homeless boys. DeVeaux College opened in 1855, and remained in operation until 1971 (Niagara County Historical Society, 2008). The DeVeaux College site was briefly used by Niagara University for additional dormitory space from 1977 to 1978, and the New York State OPRHP purchased the site in 2001 for use as a state park. Today, this park features ball diamonds, a playground, a nature trial, picnicking facilities and a trail the crosses over the RMP and connects to the additional trails to the gorge and river. The park also includes a number of abandoned structures, and a substantial stand of old growth trees, considered by some to be "the oldest, most unaltered woodland along the entire American Gorge, including the Falls area" (Eckel, 1986).

2. Robert Moses Parkway

The history of travel along the Niagara gorge predates the construction of the Robert Moses Parkway by hundreds of years. As indicated in Part I, the rim of the Niagara gorge has been an important transportation corridor since its use as a portage trail by Native Americans and European settlers. The Portage Trail was upgraded over time and eventually became Lewiston Road, Route 104.

The Robert Moses Parkway (RMP) was opened to vehicular travel in 1962 as a four-lane limited-access freeway, divided by a grassed median. The full length of the roadway stretches more than 18 miles, from the southern terminus at the LaSalle Expressway to the northern terminus at State Route 18 in Youngstown. Like other parkways developed at the time, it was conceived as a limited-access, non-commercial vehicular

View of the Robert Moses Parkway. Automobile access is limited to the original northbound lanes in the foreground, with pedestrian access granted to the original southbound lanes at left.

thoroughfare within a well-landscaped, park-like setting. The parkway was envisioned as a scenic connector between I-90 and towns to the north of Niagara Falls, despite a lack of actual opportunities to view the gorge and river.

Since the construction of the RMP, efforts to alternately improve or remove parkway access points have resulted in a disjointed, redundant facility which accommodates relatively little traffic (see additional discussion in Part II, and full coverage of traffic conditions in Appendix D). In the early 2000s, the southbound lanes of the northern section of the parkway were gradually closed to vehicular traffic and converted to a pedestrian recreational facility, diverting all vehicular traffic onto the former northbound lanes and turning the parkway into a two-lane highway. The RMP is currently operating well below its design capacity, and even with the closure of the northbound travel lanes, is still underutilized. Since its construction, almost 50 years ago, the parkway is widely perceived as a redundant roadway and a barrier between the City of Niagara Falls and the riverfront of the Niagara River. Therefore, various changes to the parkway have been proposed, including full removal and several designs for reconfiguration.

Aerial views of a section of the Niagara gorge rim, during the construction of the RMP and power plant facilities (at left) and 50 years later (at right).

3. Lewiston

The Village and Town of Lewiston are located immediately north of the City of Niagara Falls, at the mouth of the Niagara gorge. Between Lewiston and Queenston (Ontario), the Niagara River widens considerably, and no longer features the steep gorge walls and turbulent rapids that characterize the reaches between the falls and the power plant. The Village and Town of Lewiston are "bedroom communities" that serve as home to many residents that commute to work in Niagara Falls or other communities in the Buffalo-Niagara region. Since it was first surveyed for settlement in 1805, the Village of Lewiston has grown to include 2,700 residents and a thriving downtown business district. Residential areas within the village are largely stable and well-maintained. Access into and out of the village is provided via local roads and highways, including not only the RMP but also Routes 104 and 265 (both of which connect with Interstate Route 190), and Route 18. Within the Study Area, the Niagara Power Project, the Artpark, and a portion of the RMP are in the Town of Lewiston. Also occurring in the Town of Lewiston is Niagara University, which is located immediately southeast of the power plant along Lewiston Road/Route 104.

4. Canada

The context of international relations between the United States and Canada is complex and dynamic, involving trade, transportation, migration, security, and cultural exchanges. The primary channels of economic and cultural exchange between Niagara Falls, New York and Niagara Falls, Ontario are trade and tourism. The course of these exchanges is in constant flux due largely to the value of national currencies with respect to one another, however, suffice it to say that Canada and Canadians have a significant influence on the Niagara region, including the Niagara River and the gorge. Like the U.S., Canada developed a major hydroelectric generating facility (the Sir Adam Beck Hydro Plant) within the Niagara gorge. Residents of Niagara Falls and Queenston, Ontario, as well as Canadian tourists, use the Niagara River and visit the falls to enjoy the scenic and recreational opportunities they afford. Although Canadian use of the gorge and gorge rim on the American side is limited, Canadian visitors represent a significant pool of potential tourists and recreational users of the Study Area.

3. Summary

The history of the Niagara Falls region sheds light on the many complex elements that shaped the current cultural and natural environments within the Study Area. Moving forward, it is necessary to consider how contemporary decisions will shape and influence the future of the City of Niagara Falls and the Niagara gorge and rim. The existing natural and cultural conditions within the Niagara gorge and gorge rim described above define the baseline upon which to begin planning for the future. The Restoration Concept presented next in Part III of this study uses this information to identify ecological and cultural resources within the Study Area that are worth protecting and enhancing, and those where remediation or restoration is required.

Figure 1.0
Study Area

Sheet 1 of 1

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Legend: Study Area

Interpretive Site

Scenic View

Study Area

NORTH

Regional Economic Growth Through Ecological Restoration of the Niagara Gorge Rim

Figure
1.0

Part II: Robert Moses Parkway: Its Current Purpose and Future Prospects

1. Current Purpose

As mentioned in the previous section of this study, the Robert Moses Parkway currently exists as two discrete and disconnected sections. The southern section extends from the western terminus of the LaSalle Expressway to the intersection of Buffalo Avenue and John B. Daly Boulevard, and remains a four lane divided highway. This southern section of the RMP is not being addressed in this study. The northern section of the RMP extends from Main Street (Route 104) in the City of Niagara Falls to its northern terminus at Lake Road (Route 18) in Youngstown. The southern six miles of this northern portion of the RMP, from the intersection with First and Main Streets in Niagara Falls to the interchange at Center Street and Ridge Road in Lewiston, are addressed in this study. The southbound lanes of this portion of the RMP were closed to vehicular traffic in 2001. Two-way traffic was established on the former northbound lanes in this area (through re-striping and other minor modifications), and the former southbound lanes were dedicated to pedestrian use. However, the former southbound lanes were never substantially modified for this new purpose, and still have the appearance of a closed (and unmaintained) roadway. Little has been done to create a truly inviting, pedestrian-oriented atmosphere.

View north from outside of the existing pedestrian lanes.

Although the modified pedestrian access is an improvement over the original condition of the parkway, its uninviting atmosphere is symptomatic of a larger problem that cannot be fully addressed while the RMP remains in place. Since construction of the RMP, adjoining neighborhoods have been cut off from direct access to the Niagara gorge and rim. The parkway has essentially cut these neighborhoods off from what should be their unique and accessible waterfront. The majority of adjacent neighborhood streets dead-end at the parkway, where they meet a chain link fence intended to interrupt direct access to the rim or gorge by local residents. Although the adjacent parks are open to the public, local residents who live within yards of the gorge and its rim are not encouraged to directly and informally enjoy this natural resource. Even if this fence barrier is ignored (as indicated by holes cut in the fence), one must then cross over two lanes of 45 mph traffic to access any of the parkland.

Even with the closure of the southbound lanes, the RMP has continued to operate well below its capacity. According to a Traffic Impact Assessment report prepared by GTS Consulting (Traffic Report, Appendix D), most of the RMP carries less than 250 vehicles in either direction during the morning and evening peak hours (8-9 a.m. and 4-5 p.m., respectively). All of the intersections within the study area (including Route 104 and Lockport Street) were shown to be operating with excess capacity as well. Using both modeling techniques and on-site travel runs, the Traffic Report finds that the average trip between Niagara Falls and Lewiston takes an average of 9-10 minutes along the RMP.

The majority of traffic using the RMP today consists of commuters travelling between downtown Niagara Falls and suburban communities to the north. The parkway is also used by a limited number of visitors, although I-190 accommodates more of the through-traffic bound directly for the Canadian border. As shown in the Existing Circulation Map in Appendix D, the RMP does provide access to the destination points along its route. However, such access is redundant, as most of these points are also served by routes other than the RMP, including Route 104, Portage Road, 11th Street/Highland Avenue, and Hyde Park Boulevard.

A. Full Removal

Since the reconfiguration of traffic and pedestrian lanes, various changes to the RMP have been proposed and debated, including full removal. Currently the debate revolves around the usefulness of the RMP in its current condition compared to an alternative and more fruitful use of the Niagara gorge rim. Central to this debate is the distribution of the vehicles that currently use the RMP. Fewer than 250 vehicles utilize the RMP in either direction during peak hours each day. Given the excess roadway capacity that exists along this and other adjacent corridors (such as Lewiston Road/Route 104, which essentially parallels the RMP for the entire six miles from Lewiston to Niagara Falls), the RMP has clearly outlived its usefulness as a vehicular thoroughfare (See Existing Circulation Map in Appendix D).

The following discussion focuses on the costs of removing the parkway compared to the benefits of restoring the gorge rim to its natural condition, and allowing residents and visitors to enjoy this unique natural resource.

Full removal of the RMP, as advocated by this Study and illustrated in the Restoration Concept (see Figure 3.0), would involve decommissioning the roadway from the Rainbow Bridge to Center Street in Lewiston. The decommissioning proposed for the RMP is essentially a two-step process. The first step is roadway removal, which involves removing and disposing of the pavement/hardscape. This effort will call for significant one-time costs and the redistribution of traffic currently using the parkway. However, the costs of removal must be considered in comparison to the costs associated with maintaining the RMP in its current condition as a limited access parkway. Redistribution of traffic currently using the RMP to alternative roadways also needs to be evaluated in terms of the volume of displaced traffic and the capacity of alternate routes to accommodate this traffic. The second step in decommissioning the RMP focuses on alternative uses of the land once the parkway is removed. This study strategically focuses on the restoration of the Niagara gorge rim, including the land formerly occupied by the RMP, to natural ecological communities that are available for public recreational use. Ecological restoration would involve restoring natural topography and drainage, restoring/improving soil conditions, developing a non-motorized recreational trail, and restoring/establishing native plant communities along the gorge rim.

A discussion of road removal costs compared to the long term cost of road maintenance is set forth below, followed by a discussion of the redistribution of RMP traffic. Case studies of other successful road closure/removal projects are presented, along with a summary of the benefits of alternate use of the gorge rim. Part III of this study includes a detailed discussion of the environmental and economic benefits of restoring the former road way to native ecological communities.

B. Removal Costs

A variety of studies have examined road removal costs within different contexts (Bagley, 1998; Switalski et al., 2004; Coffin, 2004; Hoornbeek and Schwarz, 2009; Preservation Institute, 2011). While overall cost figures may be found for previous highway removal projects, these figures provide only a very rough guide in estimating the potential cost of RMP demolition and removal. The costs surrounding each road removal project must be viewed in light of their unique circumstances, project setting, scope, and geographic extent. Total cost figures for road removal projects frequently include the cost of redevelopment initiatives, additional right-of-way purchases, and the redistribution of roadspace. They are also influenced by the local labor market, the nature and availability of various funding sources, and the extent of rehabilitation to both the built and natural environments. As a result, the range in project costs (from $25 million in

Milwaukee to $900 million in Seoul) provides only a general range as a guide for estimating the cost of RMP removal (Congress for the New Urbanism, 200; Park, 2007).

An examination of regional transportation construction data provides more useful information. The New York State Department of Transportation (NYSDOT) compiles annual contract values in their Regional Weighted Average Awarded Price Report (NYSDOT, 2010). This report details unit prices paid by the state over the previous year (which are detailed per line item), for each contract awarded through individual NYSDOT regions. The average prices paid by the state for several appropriate line items are used in Tables 1 and 2 below to estimate the potential cost of RMP removal and maintenance. It should be noted the cost of excavation and basic re-grading alone may not be as expensive as some might fear. In fact, the full removal of traffic would ease restrictions regarding excavation methods and equipment, and thus lower anticipated costs. The price of excavation would likely be further reduced without the need to manage traffic in the project area or keep the sub-base and right-of-way in drivable condition.

Table 1: Base Cost Estimates of Excavation and Fill

Lanes to be excavated	4	
Total excavated width per lane	13	feet
Pavement area per lane mile	68,640	sq. feet
Total pavement area	*1,647,360*	*sq. feet*
Assumed max. depth of excavation	24	inches
Estimated total excavation volume	121,905	cubic yards
Approx. unit price of excavation	$14.50	per cubic yard
Estimated excavation subtotal	*$1,767,617*	
Depth of embankment-in-place	18	inches
Approx. unit price of embankment	$8.00	per cubic yard
Estimated embankment subtotal	*$731,428*	
Depth of topsoil	5	inches
Approx. unit price of topsoil placement	$45.00	per cubic yard
Estimated topsoil placement subtotal	*$1,142,856*	
Depth of compost	1	inch
Approx. unit price of compost placement	$36.00	per cubic yard
Estimated topsoil placement subtotal	*$182,857*	
Excavation & fill total estimate	**$3,824,758**	

[a] **Based on NYS DOT (2010) figures.**

As shown in Table 1, based on NYSDOT figures, the estimated cost of excavation is $14.50 per cubic yard. At an excavation depth of 24 inches, replaced with embankment, topsoil, and composted materials at 18, 5, and 1 inches, respectively, the total cost for excavation and soil replacement along the 6-mile segment of the RMP proposed for removal would be approximately $3.8 million. This figure does not account for disposal costs associated with demolition debris, which would include concrete, asphalt, and steel. These disposal costs could be significantly reduced if debris were diverted from landfills to material reclamation facilities, where they may be recycled for use as aggregate, landscape materials, pipe bedding, or other end products.

To put removal costs in context, the construction and maintenance costs associated with the alternative of reconstructing the RMP to accommodate continued vehicular traffic must also be considered. The existing RMP corridor is slated for complete reconstruction within the coming years, as the roadbed and surface materials have reached the end of their functional lifespan. Therefore, any potential long-term maintenance estimates should be added to the near-term cost of roadway reconstruction, which could range substantially depending on the design chosen. The City of Niagara Falls has recently estimated the cost of roadway reconstruction from Main Street to Findlay Drive at approximately $28 million (City of Niagara Falls, 2009b). As that segment is roughly one-third the length of the RMP removal addressed in this study, it may be assumed that full reconstruction of this 6-mile segment could cost three times this amount. However, acknowledging the potential for economies of scale in construction, it may be

reasonable to assume a more conservative estimate of $55.5 million, twice the amount estimated for the smaller area examined by the City.

The maintenance responsibilities for a newly constructed roadway would also be substantial. The NYSDOT does not compile annual maintenance costs per roadway; regional roadway maintenance budgets are distributed on a "triage" basis (meaning that they are applied on an as-needed basis according to highest priority). However, regional NYSDOT budget estimates do provide an indication of the annual maintenance costs for typical asphalt-over-concrete facilities, as shown in Table 2 (NYSDOT, 2011).

The estimates shown in Table 2 assume the near-term replacement of the existing RMP with an asphalt-over-concrete roadway, as well as periodic maintenance projects (e.g. replacement of asphalt overlay), which are reasonably assumed to be required every 20 years. In addition, such a roadway would eventually require full replacement after approximately 50 years. Like the estimates for roadway removal, these costs also exclude some important components, such as sign and guiderail maintenance, public safety patrols, and periodic debris removal. In addition, the direct economic costs only tell part of the story: pesticide and herbicide application, habitat fragmentation, damage to roadside flora and fauna from road salt, and the nonpoint-source pollution associated with runoff from impervious surfaces also represent substantial costs to the community, both economically and ecologically. Those costs notwithstanding, the estimates presented here serve to highlight some of the major economic elements of RMP maintenance.

As shown in Table 2, full roadway reconstruction from Main Street in Niagara Falls to Center Street in Lewiston is estimated to cost $55.5 million. The estimated annual cost of mowing the shoulders and median along the 6-mile span of the RMP proposed for removal is $18,000. Likewise, the estimated annual costs of salting, plowing, and patching that portion of the RMP currently used for vehicular travel are $18,000, $15,000, and $2,040, respectively. These maintenance responsibilities total $53,040 per year, or more than $2.1 million over a 40 year time frame (considered to be a reasonable planning period). In

Table 2: Base Cost Estimates of Maintenance and Repair

Task category	Task	Annual expenditures		One-time expenditures	40-year estimate
		cost per lane mile	cost for 2-lane, 6-mile segment		
Reconstruction[a]	Full roadway reconstruction			$55,500,000	
	Reconstruction subtotal				*$55,500,000*
Maintenance[b]	Road salt application	$1,500	$18,000		$720,000
	Plowing[c]	$1,250	$15,000		$600,000
	Pothole patching	$170	$2,040		$81,600
	Mowing[d]	$1,000	$18,000		$720,000
	Maintenance subtotal				*$2,121,600*
Repair[b]	First overlay			$1,350,000	
	Second overlay			$1,350,000	
	Repair subtotal				*$2,700,000*
Total reconstruction, maintenance & repair cost estimate:					**$60,321,600**

[a]Estimate taken from City of Niagara Falls, 2009b.
[b]Based on maintenance and repair figures in NYSDOT (2011) estimates.
[c]Average cost per lane mile between state personnel and contracted personnel.
[d]Mowing cost assumes two shoulders and one grassed median.

addition, two overlay replacements (at an estimated $1.53 million each) within the next 40 years would bring the total maintenance and replacement costs for this portion of the RMP to approximately $4.8 million.

These figures do not account for inflation or the "time value" of money. Because of these factors and other uncertainties (such as long-term volatility in the cost of materials), it is very difficult to estimate full structural replacement costs so far in advance; however, it is safe to presume that the costs presented above represent a reasonable minimum estimate.

Based on the assumptions described above, the one-time cost of removal compares favorably to the cost of RMP reconstruction, maintenance and repair over the next 40 years. Although additional financial obligations related to the ecological restoration of the roadspace must also be considered, the ancillary economic benefits of such restoration lend additional support to this proposal. These benefits are discussed in further detail in Part III.

C. Redistribution of Traffic

1. Impact on Local Transportation Network and Adjoining Neighborhoods

Closure of the RMP will necessarily cause north/south traffic currently using the parkway to be diverted to alternative routes. As mentioned previously, there are several alternative north/south roadways that run parallel to the parkway that offer suitable alternative routes for vehicular traffic. The closest and more direct routes, which are available to all vehicles (commercial and noncommercial), are Whirlpool Drive and Route 104/Lewiston Road. Hyde Park Boulevard and Highland Avenue may also accommodate the diverted traffic (see Appendix D, Existing Circulation Map and Figure 2: Proposed Circulation Map). No matter the chosen route, the diversion of RMP traffic is not expected to generate unmanageable impacts on these roadways, due to a combination of low RMP traffic levels and excess capacity in the local roadway network. In fact, these two factors allowed for the permanent closure of two lanes of the parkway in 2001, as discussed previously. This portion of the RMP has been used in such a manor for the last 10 years, without a significant increase or disruption to traffic on adjacent routes.

Nonetheless, area residents may voice concern over the level of impact that full closure of the parkway could have on traffic levels in the adjacent neighborhoods. To assist in our assessment of potential traffic impacts, the Traffic Report prepared by GTS Consulting (Appendix D) examined the travel time, running time, delay time, running speed, and travel speed of vehicular traffic on the RMP. The Traffic Report also determined travel times and speeds on alternate routes if the RMP were to be closed. Based on the travel runs completed, the average trip between Niagara Falls and Lewiston was calculated to take about 9-10 minutes when traveling on the RMP. With the closure of this route, travel times would increase by approximately three minutes and take about 12-13 minutes in total, using Route 104 or alternative routes. Travel times between Irving Drive and Portage Road on the Route 104, Hyde Park Boulevard or Highland Avenue routes are all generally consistent, in the range of 7-8 minutes. It is estimated that the majority of the diverted traffic will use Route 104 for the entire trip between Lewiston and Niagara Falls, given that it is the shortest route in terms of both distance and travel time. Personal interpretation of travel speed and delay will also have some impact on the routes chosen. The higher travel speeds on Highland Avenue will draw some of the diverted trips since the increased distance does not significantly increase the overall travel time. Use of Hyde Park Boulevard to Lockport Street would be expected to be minimal given the poor road

conditions along Lockport Street, as well as the three consecutive stops signs at Niagara Avenue, Cleveland Avenue and South Avenue which create a feeling of longer travel time. Based on these conclusions, it is anticipated that approximately 70% of the Robert Moses Parkway traffic will divert to Route 104 and 30% will divert to Highland Avenue (see detailed discussion in Appendix D).

The Traffic Report concluded that even with the assumption that 70% of the diverted traffic would use Route 104, the closure of the parkway will not significantly increase traffic volumes on adjacent roadways in the area, and that the increases will generally not be noticeable to motorists currently using these alternate routes. This is due to the fact that the existing usage of the RMP is very low during both the morning and evening peak hours. During the morning peak hour, traffic volume increases on alternate routes are projected to be very low. With closure of the RMP, an additional 1-4 vehicles per minute are predicted in each direction in the southern and northern sections of Route 104 and approximately 12 vehicles per minute are predicted in each direction in the middle section of Route 104. During the evening peak hour, the volume increases are predicted to be in the range of 2-4 vehicles per direction per minute in the southern section of Route 104, and 2-3 vehicles per direction per minute in the middle and northern sections. On Highland Avenue, traffic volume increases are expected to be approximately one vehicle or less per minute per direction. The largest traffic increase will occur on Route 104 near Military Drive during the evening peak hour. Additional detail on the re-distributed traffic volumes expected in the area during the morning and evening peak hours is presented in Appendix D.

The Traffic Report also included a capacity analysis, to identify the potential impacts that the diverted traffic may have at various intersections on the existing roadway network. This analysis indicated that the traffic volume increases would generally have minimal impact on traffic operations in the area, with most intersection Levels of Service being maintained at the existing condition during both the morning and evening peak hours. Intersections in the City of Niagara Falls would continue to operate at overall Levels of Service B or better with all individual movements continuing to operate at Levels of Service C or better during both peak hours. The two northern intersections of Route 104 with Hyde Park Boulevard/ University Drive and Military Road would both continue to operate at Level of Service C or better during both peaks with all individual movements operating at Levels of Service D or better (see Appendix D for additional information on Levels of Service). In summary, given the low existing traffic volumes in the area on both the RMP and Route 104, there is excess capacity to easily accommodate the predicted increase in traffic volumes on adjacent roadways if the RMP is closed.

In addition to the redistribution of traffic, closure and removal of the parkway opens up opportunities for the local residential neighborhoods to reconnect with the Niagara gorge rim as a naturalized park. With removal of the RMP, fencing between the parkway and adjacent neighborhoods could be removed, and new vehicular and pedestrian circulation patterns and access points could be established. A proposed circulation plan is shown in Figure 2. As indicated in this figure, strategically located "soft entries" to the gorge rim (without parking) could provide access for adjacent residents. The creation of clearly identified visitor gateways (with designated parking) would allow tourists and other visitors to easily access the restored gorge rim. Instead of being an afterthought to a vehicle-oriented landscape, pedestrian access throughout the area would appear purposeful and welcoming. Both pedestrian and vehicular access to existing destination areas would be improved with greater clarity and separation between modes. New pedestrian access would be provided in the area of the Earl W. Brydges Artpark and the Niagara Escarpment, where none currently exists. Native planting features along key entry roads could be used to integrate an ecologically restored gorge rim with adjacent neighborhoods.

2. Case Studies- Highway removal

As with any traffic reconfiguration proposal, it is useful to examine previous efforts that involved removing segments of urban road networks, to consider the impacts that have been experienced elsewhere. In the decades following the mid-century expansion of urban freeways, there have been a number of notable urban highway removal projects throughout the United States and abroad. Each situation is unique; public opinion, project cost, and revitalization success stories are all influenced by the relative strength of regional economies, transportation networks, and local leadership. However, four of these projects provide valuable insight into the viability and potential benefits of the complete removal of the RMP, due to similarities in the setting, purpose, and/or existing infrastructural conditions of the projects.

Harbor Drive, Portland, Oregon- Until 1974, Harbor Drive was a high-traffic thoroughfare running along the length of the Willamette River in Portland, Oregon. The Annual Average Daily Traffic (AADT) on the road was estimated at 25,000 prior to removal, and the number of vehicles was projected to grow to 90,000 by 1990. Then-Governor Tom McCall proposed a removal plan to compete with three options for an increased roadway footprint. The removal plan was selected and implemented, removing six lanes from three miles of the waterfront, and opening up 37 acres for a waterfront park. Because commuters were given ample notice and adequate re-routing options, the widely anticipated gridlock never materialized. Traffic engineers for the city noted at the time that the removal project did not cause a single ripple in the City's transportation network. The waterfront acreage was dedicated to a riverfront park that became a catalyst project for the City's revitalization throughout the 1980s and 1990s (Preservation Institute, 2011).

Cheonggyecheon Highway, Seoul, South Korea- The elevated Cheonggyecheon Highway bisected a formerly bustling business district in Seoul, South Korea. The highway alignment followed what had been the Cheonggyecheon Stream, which was channelized and buried in the construction of the six-lane roadway. The project removed 3.6 miles of the highway, while daylighting and providing public access to the stream. A fraction of the highway's capacity was accommodated by two surface boulevards aligned along each bank of the exposed stream. The project was an enormous undertaking, but the reward has outweighed the risk; the improvement of the business district and the public use of a historically significant natural resource have revitalized an important piece of Seoul's cultural heritage. At an estimated traffic volume of 169,000 AADT, many people predicted that the removal of the highway would wreak havoc on the local transportation network. However, in summarizing the project for the World Federation of Engineering Organisations, project engineers noted that local traffic conditions actually got better. Traffic information systems were established, and a well-executed public information campaign helped to publicize transportation options. Adjacent routes accommodated the increased use in bus ridership, and traffic guides helped to direct drivers through nearby intersections. Despite some congestion at the outset of demolition, engineers noted that "the great traffic disaster that had been so widely feared never occurred… (in) several respects, the traffic flow system in the center of the city was improved." (Park, 2007)

Embarcadero Freeway, San Francisco, California- Having been badly damaged in the Loma Prieta earthquake of 1989, and highly unpopular since its construction, the Embarcadero Freeway was removed from San Francisco's waterfront in 1991. The project removed 1.5 miles of elevated freeway which separated a historic neighborhood from San Francisco Bay. The City replaced a portion of the freeway's capacity with a surface boulevard. Once again, claims of impending gridlock were not borne out in local roadway networks, despite an estimated 100,000 AADT. Investment in the public transportation system helped to carry the load, with transportation officials estimating an additional 30,000 transit passengers as a result of the project. In addition, adjacent waterfront properties have experienced significant revitalization as a result of their exposure. Historic structures have been improved, and there has been an increase in

commercial and residential investment. The area is now known as a hub for intermodal transportation, with improved vehicular, pedestrian, and light rail access (Preservation Institute, 2011).

Park East Freeway, Milwaukee, Wisconsin- Unlike the RMP, which runs parallel to a water feature, the Park East Freeway cut across the Milwaukee River. But like the RMP, the Park East Freeway also prevented the City of Milwaukee from a more productive and attractive engagement of its waterfront resources with adjacent neighborhoods. The elevated Park East occupied a city block's worth of right-of-way, bisecting a neighborhood that had become badly blighted since construction of the highway, and disrupting the efficient flow of the local road network at its access ramps. Whereas these access ramps concentrated traffic at just three intersections, the reconfigured urban grid efficiently dispersed this traffic over more than two dozen streets. The removal of the Park East Freeway allowed for the re-use of a mile-long strip of urban land, much of it with improved access to the water, and became an economic catalyst for the revitalization of Milwaukee's riverfront (Congress for the New Urbanism, 2011).

While each circumstance described above is unique, these projects share certain commonalities with the RMP proposal. Of particular relevance is the anticipation of traffic gridlock, an expectation shared in the case of the RMP, despite its comparatively small daily traffic volumes. As these case studies indicate, with appropriate planning and contingencies, highway capacity reductions (or outright removal) do not necessarily result in poorer levels of service or increased traffic on local roadways. This assertion is not merely anecdotal; engineers and researchers have noted the phenomenon of "disappearing traffic" in a series of capacity reduction projects both in the United States and abroad. The most comprehensive investigations of this phenomenon come from a group of British researchers, in their empirical study of 70 international cases of road capacity reduction, and a subsequent examination of public and professional perception of associated traffic impacts (Cairns et al., 1998, and Cairns et al., 2002, respectively). These researchers noted that:

"On balance, the data suggest that traffic reduction is a real phenomenon that occurs when roadspace for cars is reduced. Moreover, the scale of reduction can be quite substantial… in half the cases, over 11% of the vehicles which were previously using the road or the area where roadspace for general traffic was reduced, could not be found in the surrounding area afterwards. [There] may be a real reduction in capacity on the treated road or area, but this may be offset by adequate spare capacity on alternative routes or at other times of the day."

In summary, various researchers suggest that traffic gridlock may not occur (and, in fact, flow may improve) if travelers are given adequate preparation and alternate transportation options. In addition, experience elsewhere indicates that the surrounding areas may experience many ancillary benefits as a result of new options for land use that emerge following roadway removal. Among these ancillary benefits are the potential beneficial re-use of the land, economic development, and potential savings that could be achieved by reducing the demand for roadway maintenance and reconstruction.

3. Additional Infrastructural Elements

Four concepts were proposed by Wild Ones Niagara as possible ways to achieve specific desired improvements associated with the ecological restoration of the Niagara gorge rim. All of the proposed concepts are independent of the removal of the Parkway, but could enhance the overall experience of the visitor and/or success of the restoration effort. These concepts include the following:

- The development of a greenhouse and botanical education center over the lanes of the Robert Moses Parkway currently traversing the power plant. The intent behind this concept is to establish a greenhouse (and associated education center) for the propagation of native plant materials in or near the gorge rim, and to take advantage (directly or indirectly) of the energy generated by the power plant.
- The removal of blast and excavation debris left in the gorge as a result of the construction of NYPA's access road through Devil's Hole State Park, and the reuse of this debris for the construction of a pedestrian connector between the portions of the park bisected by this access road.
- The unplugging of drainage conduits in the Hyde Park Landfill outflow, for the purpose of recreating original hydrologic conditions within that section of the gorge rim and restoring a source of flora-sustaining water supply to Devil's Hole State Park.
- The construction of an external elevator to the rooftop of Wroble Towers. The intent of this concept is to provide visitors a grand vista of the Niagara River and gorge from the building's roof.

The feasibility of each proposed concept is discussed below, in light of the primary intent or goal behind the overall restoration concept. Alternative options are also presented, which may prove more efficient and/or effective given site constraints and development goals.

A. Greenhouse and Education Center

The ecosystem that has evolved along the rim has done so in a very particular context of climate tolerance, codependence with other flora and fauna, and adaptation among species. As such, a true restoration of the RMP corridor cannot be achieved through the simple importation of nominally similar species; all members of a single species may not have the specific characteristics required to thrive in this ecosystem. Restoration will require the support of professionals and volunteers dedicated to the propagation and stewardship of local ecotypes that have adapted to this particular environment.

The centerpiece of this support should take the form of a greenhouse and botanical education center located in or directly adjacent to the study area. The greenhouse would provide the conditions necessary for the propagation of native species. Within a protected environment, seedlings are protected from predation, incidental pollution, and competition for solar energy and hydration (especially important, given the abundance of non-native invasive species in the Study Area). Ideally, seedlings would be transferred from the greenhouse to an on-site nursery prior to their eventual transfer into appropriate ecological communities throughout the gorge rim. This would further ensure their viability in the particular ecological and climatic conditions of the surrounding area. Given such an opportunity to propagate, the native stock may do so in abundance, further supporting the restoration of the corridor.

Of course, such an operation cannot run itself. Initial staff resources may include (but are not limited to) botanists, field ecologists, and horticulturalists. As the facility grows and needs become more complex, outreach staff may be added to deliver educational initiatives to local schools and volunteers. Administrators would be required to assist professional staff, as would employees for transportation, maintenance, and the general labor required of such facilities. Financial support for the greenhouse, though not detailed herein,

could be generated from agencies including NYPA and OPRHP, both of whom may stand to gain from the potential for positive public relations.

There are several locations throughout Study Area that could be appropriate for the location of the greenhouse and its attendant facilities. A number of issues must be considered in weighing the advantages and disadvantages of each, including the following:

- Proximity to areas being restored
- Pedestrian and vehicular access
- Environmental health and safety
- Solar exposure
- Growth medium (within organic/topsoil/subsoil layers, ground-level raised beds, or on tabletops)
- Constructability

Given these theoretical constructs, three sites within or directly adjacent to the Study Area are considered for the feasibility of siting a greenhouse, outdoor nursery, and botanical education center: NYPA lands along the north shore of the forebay, the cleared portion of DeVeaux Woods State Park, and the existing portion of the RMP traversing the power plant.

NYPA forebay property:

The NYPA owns and manages approximately 400 acres adjacent to the power plant and forebay. Along the northern shore of the forebay, there are more than 30 acres of underutilized land that could accommodate the greenhouse facilities.

- Proximity: Though adjacent to the current Study Area, this land is not the most centralized site available. As shown in the Restoration Concept (Figure 3.0), the restored corridor is narrowest throughout the section of the RMP to the south of the dam, widening only briefly to the north of the dam along the I-190 interchange before becoming narrow again north of the Lewiston-Queenston Bridge. As such, the closest sections of the corridor would not be the sections requiring the most intensive restoration focus. This would increase transportation requirements between the greenhouse and individual portions of the restoration project, which is not ideal.
- Access: Closure of the RMP would not influence the suitability of this site in terms of vehicular access, as north-south access via Route 104/ Lewiston Road would be maintained. However, in terms of neighborhood connectivity and walkability, this site is not ideal. The lands surrounding this site are hemmed in by an interstate and a commuter route. The interior area features a limited number of residences and pedestrian facilities; it is among the least dense of any neighborhood from which the greenhouse could draw potential local visitors.
- Health and safety: The NYPA lands are directly in between a cemetery and the power plant's forebay. Human health is likely not threatened by soil vapors or other environmental health risk factors commonly found within the region, as the site is not identified as a source of contamination by state or federal authorities. However, public use of the forebay is strictly prohibited, a barrier which could render the site inconvenient at best, or unusable at worst, for such a facility. While public use of the water is certainly not a precondition of the greenhouse, local, state, and federal authorities would likely not authorize increased access along the adjacent land either, citing safety and security concerns.
- Exposure: Given the size of the site, it can be assumed that any number of solar orientations could be easily achieved by greenhouse structures. At this latitude, an east-west orientation would best

capture the greatest amount of solar energy along the southern face of the structure; however, certain site or growing conditions might make an alternative orientation more ideal.

- Growth medium: Pending soil tests for contamination, drainage, and other physical and chemical characteristics, this site is likely suitable for any growth medium.
- Constructability: The twin barriers of NYPA ownership and federal regulatory oversight of the forebay would likely render any construction proposals moot. Security concerns at this high-profile power facility are at extremely high levels in recent years. Assuming these barriers could be overcome, and that the authorities would allow a proposal such as this to gain traction, it is safe to assume that the approval process would be lengthy and cost-prohibitive.

DeVeaux Woods State Park:

The cleared areas within DeVeaux Woods State Park include mowed lawns and a number of existing structures which are either underutilized or abandoned. These areas are directly adjacent to Whirlpool State Park, one of the more prominent nodes along the corridor. As shown in the Restoration Concept (Figure 3.0), restoration of the RMP will connect the forested sections of these two parks, which feature some of the oldest tree species in the region.

- Proximity: This site is approximately halfway between the northern and southern termini of the Study Area. It features very direct access to one of the most spatially expansive sections of the restoration plan, at the confluence of the two parks. As one of the most likely candidates for the first phases of restoration, this site would also be free of deconstruction staging facilities sooner than most other sections of the parkway.
- Access: Vehicular access to this site would still be served by the existing Route 104/ Lewiston Road. The proposed realignment of vehicular access to Whirlpool State Park is directly to the south of this site at Findlay Drive. Pedestrian access is ideal, as the park boundary is surrounded by residential neighborhoods and walkable streets with sidewalks.
- Health and safety: This site does not present any immediately known health and safety concerns beyond the possible concern of generated traffic. As with any high-profile node within the restored gorge rim, it is expected (and indeed, hoped) that the restoration will bring with it an increased level of visitation. Still, it is assumed that any traffic generated specifically by the greenhouse facilities would be minimal and limited to standard business hours of operation.
- Exposure: Like the NYPA-owned lands to the north, this property is large enough to accommodate various solar orientations. The advantage of this site is the proximity to one of the largest "receiving" areas; any outdoor exposure experienced by the incubated species will feature the same microclimatic conditions as those found in the forests at Whirlpool and DeVeaux Woods State Parks.
- Growth medium: Also like the NYPA site, this site is likely suitable for any growth medium, pending standard soil tests. The cleared areas of the park offer many options for the placement of a nursery facility.
- Constructability: The DeVeaux Woods site offers the most ideal scenario of the three for general constructability. Like the NYPA property, there remains a barrier of public land ownership to overcome; however, unlike the NYPA property, one of the central mandates of state-owned parkland is to encourage public use. There is ample room for staging, some of which may have been used for roadway deconstruction, and roadways to the interior cleared sections are already in place. Perhaps the biggest advantage would appear to be the underutilized structures. While the greenhouse portion of the proposal will require new construction at all three sites, this site offers

ample existing infrastructure to house administrative offices, maintenance staff/equipment and the educational outreach facility. Indeed, some of the structures have served as school buildings in the past. With upgrades and retrofitting, an opportunity exists to take advantage of these structures for adaptive re-use.

Robert Moses Niagara Power Plant:

A third option would be to construct a greenhouse atop the Robert Moses Niagara Power Plant, in the path of the RMP right-of-way. The structure, including both the north and south approaches, is approximately a half mile in length. The top of the power plant stands almost 400 feet above the Niagara River below.

- Proximity: Like the adjacent NYPA property along the forebay, the power plant is not in the most central location along the corridor relative to the major restoration nodes. While some have suggested that a greenhouse atop the facility could capitalize on waste heat emissions, this potential is mitigated by the efficiency nature of hydroelectric power generation. As a non-thermal generation source, the hydropower facility does not generate a substantial amount of waste heat. Even if the facility's waste heat were able to keep the greenhouse supplied with warm air through the winter, the added construction costs associated with this site (addressed below) would likely offset any potential savings.
- Access: Of the three locations considered here, the power plant is the least convenient for vehicular and pedestrian access. Pedestrian access requirements could be met via the elevated walkway over Route 104/ Lewiston Road. However, as the productive capacity of the greenhouse increases, so will the need for access by service vehicles (for deliveries, construction, and maintenance), which will need to drive into the site, park, and turn around. While this may not generate much local traffic (as discussed above), it does translate into certain spatial demands that will be exceedingly difficult to meet given the narrow nature and dramatic topography of the site. While the parking lot along the south shore of the forebay may suffice for staff and visitors, it will not meet the needs of service vehicles.
- Health and safety: While the view is impressive, the power plant site comes with the most substantial safety and security concerns, to the extent that its consideration will likely be rendered moot by the regulating authorities. The Federal Energy Regulation Commission (FERC), which regulates the plant's security operations, considers increased public access to power facilities to pose higher security risks. FERC has increased the security requirements for relicensing critical infrastructure (including hydroelectric power plants) in recent years, citing elevated homeland security concerns. As the NYPA facility is the largest producer of electricity in New York State, it is extremely unlikely that NYPA and/or FERC would be willing to invest the resources necessary to fully mitigate the risks associated with increased levels of public foot traffic atop the power plant.
- Exposure: While the top of the power plant is certainly free from the obstruction of shade from trees, it would only accommodate a north-south greenhouse orientation. As discussed above, this exposure is not ideal, given the latitude of the facility.
- Growth medium: A greenhouse atop the power plant would only accommodate tabletop structures for plant propagation (or raised beds over concrete, functionally similar to the tabletop medium). With no soils below, drainage demands would require the use of a structural system. In addition, the power plant site offers no options for an on-site nursery.
- Constructability: The power plant is the least convenient site for greenhouse constructability. Assuming that the regulating authorities and ownership would allow for such plans to move forward, the approval process would likely be more cost-prohibitive for this site than any other

non-contaminated site in the region. The mobility of construction vehicles would be restricted by the narrow site dimensions as grade changes would preclude the ability of large vehicles to easily turn around on-site. Assuming that the concrete structure would serve as the greenhouse foundation, any boring or saw cuts into the concrete for the placement of columns or other structural members would be severely restricted.

B. Removal of Blast and Excavation Debris

Devil's Hole State Park was bisected when the access road was constructed for the Niagara Power Project, and the northern portion of the park has been inaccessible by foot ever since. The goal behind this concept is to restore pedestrian access to all parts of Devil's Hole State Park. This concept entails using the blast debris that was generated when the access road was constructed to build a new pedestrian connection over the road, thus allowing access to the northern portion of Devil's Hole State Park. However, rather than disturb existing conditions and incur the costs associated with harvesting blast debris and constructing a new pedestrian connection, it is recommended that the existing vehicular bridge over the access road be repurposed as a multi-use trail for pedestrians and bikers. This alternative option is less disruptive of the existing parklands, and less costly. With appropriate landscape treatment, the repurposed structure could be both attractive and highly unique. Greening or naturalizing the new pedestrian section of the RMP can occur immediately.

C. Hyde Park Landfill Outflow

Due to the long term and active remediation measures at the Hyde Park Landfill (which includes 11 wells, three groundwater flow zones, and an extensive monitoring system), unplugging the drainage conduits to restore flora-sustaining hydrological conditions within the gorge is highly unlikely in the near term. While the daylighting of streams and recreation of historic hydrologic patterns is an important long-term goal, the contamination at the Hyde Park facility are such that the unplugging of drainage conduits is not a development that could take place without extensive changes to the existing remediation measures.

D. Wroble Towers Elevator

The intent behind this concept is to provide a platform from which one could obtain a unique, elevated view of the Niagara River and gorge. Adjacent to the Robert Moses Parkway is Wroble Towers, a 13-story public housing complex. The roof of one of these structures could provide a spectacular viewing deck. An elevator lift on the exterior of the building could also provide an interesting viewing opportunity while transporting viewers to the roof. Unfortunately, this concept presents many complexities. Immediate constraints include probable construction and maintenance costs, safety issues and liability. In addition, this concept would require public access to a residential housing facility; even if limited to areas outside of the structure, this may be an unwelcome development for those living in the building. To alleviate these constraints, while still meeting the intent of this concept, the Restoration Concept described in Part III of this study proposes an elevated trail along the existing RMP bridge nearby (see Figure 3.0). This alternative would retain the elevated portion of the Robert Moses Parkway, discontinue its use as a roadway, and repurpose it as a multi-use pedestrian trail. Repurposing the elevated portion of the RMP would eliminate the costs associated with bridge demolition, as well as those associated with planning, designing and

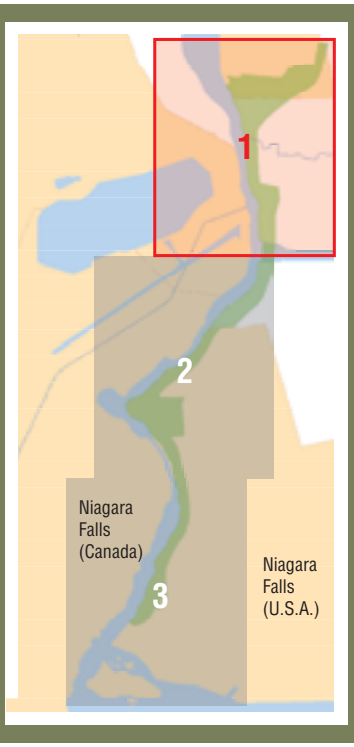
constructing an elevator and viewing deck at Wroble Towers. It would still provide visitors with an elevated vantage point from which to view one of the world's most unique natural settings. Although the elevated portion of the RMP is not as high as the roof of the Wroble Towers, the freedom to leisurely experience the grand vista, at no additional expense, while walking/biking along the elevated trail would add immense value to the overall experience. Thus, this concept of an elevated Niagara Rim Trail (see Figure 3.5) was proposed in the Restoration Concept.

4. Summary

Given the favorable comparison of removal versus reconstruction and maintenance costs, coupled with excess capacity in the local transportation network, it is rational to consider alternative uses for the land along the Niagara gorge rim. Today the RMP essentially separates neighborhoods from the spectacular natural resource that is the Niagara gorge, and runs through three state parks, all of which predate the RMP. It hinders, rather than accommodates, the ability of tourists to appreciate the Niagara gorge, and has a variety of adverse impacts on the gorge, a natural feature of international significance. In light of the of gorge rim's unique natural setting, the RMP's limited utility as a transportation corridor, and the opportunities for enhanced tourism and public appreciation of the Niagara gorge, the RMP should be fully removed to make way for a restored native ecosystem, a non-motorized recreational trail, and enhanced neighborhood connections.

Figure 2.1 Proposed Circulation Map

Sheet 1 of 3



Legend: Proposed Improvements

- Park Setting
- Urban Setting
- Robert Moses State Parkway Alternative
- Pedestrian Corridors
- Connective Corridors
- Proposed Hiking Trail
- Existing Hiking Trail
- Proposed Neighborhood Pedestrian Link
- Destination Points

NORTH

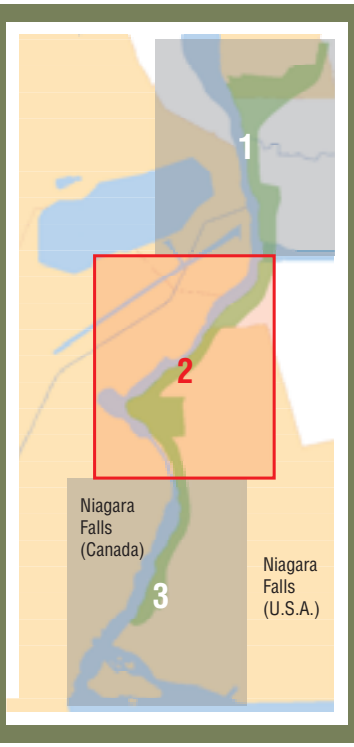
Figure 2.1

Regional Economic Growth Through Ecological Restoration of the Niagara Gorge Rim

Figure 2.2 Proposed Circulation Map

Sheet 2 of 3

edr COMPANIES



Legend: Proposed Improvements

- Park Setting
- Urban Setting
- Robert Moses State Parkway Alternative
- Pedestrian Corridors
- Connective Corridors
- Proposed Hiking Trail
- Existing Hiking Trail
- Proposed Neighborhood Pedestrian Link
- Destination Points

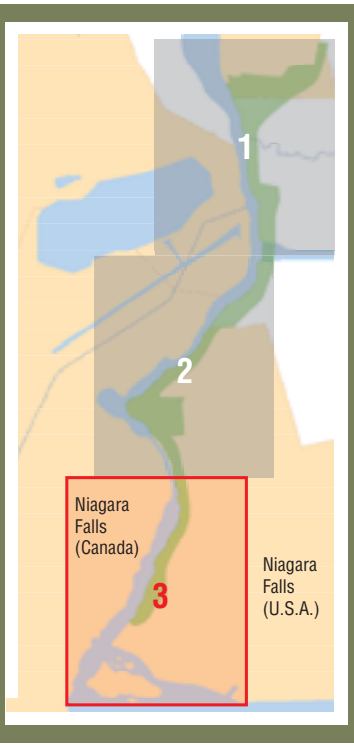
NORTH

Figure 2.2

Regional Economic Growth Through Ecological Restoration of the Niagara Gorge Rim

Figure 2.3 Proposed Circulation Map

Sheet 3 of 3



Legend: Proposed Improvements

- Park Setting
- Urban Setting
- Robert Moses State Parkway Alternative
- Pedestrian Corridors
- Connective Corridors
- Proposed Hiking Trail
- Existing Hiking Trail
- Proposed Neighborhood Pedestrian Link
- Destination Points

NORTH

Figure 2.3

Regional Economic Growth Through Ecological Restoration of the Niagara Gorge Rim

Part III: Restored Niagara Gorge Rim: Concept and Benefits

1. Niagara Gorge Rim Restoration Concept

The removal of the RMP would present opportunities for a more appropriate use of the land along the gorge rim. The option of keeping this area in the public domain, restoring its natural ecology and developing recreational trails and scenic overlooks is worthy of consideration from a natural, cultural and economic perspective. The primary goal for removing the RMP is to replace its "hardscape" with "greenscape", utilizing native vegetation to support a publicly-accessible naturalized corridor (including the adjacent gorge). This can be achieved in a way that brings added economic, cultural and environmental value to the greater Niagara community. Arguably, the added value from this new use should prove to be significant enough to offset the costs associated with restoration and management of a naturalized gorge rim.

A. Design Intent and Restoration Goals

The Niagara gorge rim Restoration Concept was developed to illustrate the alternative of ecological restoration and pedestrian use of the rim (see Figure 3.0: Restoration Concept). As illustrated by the Restoration Concept, this would involve restoration or establishment of plant communities that have been degraded or destroyed over time. The specific goals for the Restoration Concept include the following:

1. Remove man-made features that are under-used and/or interfering with natural ecological processes.
2. Restore natural topography and soil profiles to re-establish more natural surface water drainage and infiltration patterns.
3. Eliminate and/or control non-native invasive plant species that currently exist along the gorge rim.
4. Restore or re-create an appropriate suite of native ecological communities, including mixed deciduous forest, successional and wetland communities.
5. Establish and manage the restored ecological communities in a manner that promotes their use by native wildlife species including species that may be listed as endangered, threatened, or of special concern and that ensures ecosystem diversity, integrity, and long-term sustainability.
6. Enhance regional tourism opportunities and their associated economic benefits by improving the scenic and recreational opportunities provided by the Niagara gorge and rim.
7. Increase accessibility to the existing and enhanced trail system, reconnecting the community of Niagara Falls to the Niagara gorge, the defining natural feature of the region.
8. Contribute to the revitalization of surrounding communities through economic development, increased property values, unique ecotourism opportunities, and improved environmental quality.
9. Provide opportunities for public information and education regarding the natural and cultural history of the Niagara gorge and gorge rim, and the ecological restoration program being proposed.
10. Preserve the natural and cultural artifacts that support and enhance the story of the gorge rim's rebirth and renewal.

B. Ecological Improvements

Although the existing gorge rim contains isolated elements of native ecosystems, some unique botanical species, and a degree of indigenous wildlife, from an ecological perspective, it is highly degraded. The overarching intent of the Restoration Concept is to fully re-establish native plant species that will contribute

to a more natural forest-meadows community mix, complete with a diverse overstory, understory, and ground plain vegetation. Whereas the existing corridor is characterized by abundant non-native species, the Restoration Concept proposes the removal of invasives and the planting of native tree saplings, shrubs, and herbaceous species. Within this restored ecological setting, the native botanical species and indigenous wildlife that currently exist within the gorge and rim will be given an opportunity to thrive and multiply.

The native ecological communities along the Niagara gorge rim would ideally have the following species composition and characteristics, as described by Edinger et al. (2002). However, given the degree to which these communities have been altered or eliminated, the extent of soil disturbance, and the abundance of non-native invasive species, it is realistic to assume these restored ecosystems will only resemble the native communities described by Edinger et al. (2002). Although the forest restoration will be accomplished primarily through control of invasives and guided succession, all bare grounded areas will require revegetation. Sodded portions will be minimal. Native seedings will be the first step to new old field/ meadow, shrub transitions, and added forests.

Rich Mesophytic Forest- Very little mature forestland is present within the Study Area. However, the species present in forested communities within Artpark and DeVeaux Woods State Parks most closely represent a rich mesophytic forest, as defined by Edinger et al. (2002) and, therefore, a mixed deciduous forest with a species composition similar to this type of forest community is proposed to be restored. Canopy co-dominants should include five or more of the following species: red oak, red maple, white ash, American beech, sugar maple, black cherry, cucumber tree, and black birch. Other overstory species could include tulip tree, white oak, white pine, basswood, bitternut hickory, black oak, Eastern hop hornbeam, and striped maple. The shrub layer may consist of musclewood, arrow-wood, witch hazel, pinkster, red-berried elderberry, American fly-honeysuckle, roundleaved dogwood, alternate-leaved dogwood, smooth service-berry, and blueberry. The herbaceous layer includes species such as interrupted fern, yellow mandarin, white baneberry, jack-in-the pulpit, early meadow rue, princess pine, partridge berry, roundleaf violet, black cohosh, stoneroot, black snakeroot, large-leaf aster, blue-stem goldenrod, and tall rattlesnake root. Given the disturbed nature of the site, it may be challenging to restore the full diversity of this community. Priority should be given to species present within the existing mature forested areas within the Study Area. Within the canopy, these species include white oak, red oak, sugar maple, beech, black cherry, basswood, black walnut, and shagbark hickory. The understory includes saplings of overstory trees, along with shrub species such as spicebush, witch hazel, alternate-leaved dogwood, chokecherry, red elderberry, and maple-leave viburnum. Herbaceous species include jack-in-the-pulpit, false Solomon's seal, Virginia waterleaf, zigzag goldenrod, enchanter's nightshade, and squawroot.

Once established, habitat elements associated with this community will benefit a variety of wildlife species. Mature oaks, hickories, walnuts and beech produce large quantities of nuts, which are eaten by squirrels, deer, wild turkey, songbirds and small mammals. Rough barked trees such as black locust, shagbark hickory, and oaks, provide foraging sites for bark-probing birds (e.g. brown creeper, nuthatches, black and white warblers), and food storage sites for species such as tufted titmouse and black-capped chickadee. Diversity in foliage height and structural complexity are desirable characteristics that contribute to bird species diversity. Another important habitat feature of mature forested areas is the presence of deadwood. Dead trees, branches and logs provide food and cover for a variety of wildlife species. The main function provided by fallen deadwood is as cover and as a site for feeding and reproduction. Branches provide escape cover for birds and rabbits, while logs provide hiding cover and feeding site for small mammals, reptiles and amphibians. Hollow logs are used as cover and food storage sites by species such as gray squirrel, red squirrel, chipmunk and raccoon. Fallen deadwood also harbors numerous insects and crustaceans which birds feed on. By trapping suspended sediments, adding organic material, and increasing water-

holding capacity, fallen deadwood improves soil quality and thus also benefits wildlife indirectly. Standing deadwood is also an important habitat component. It provides foraging sites for insectivorous birds such as woodpeckers, nuthatches, brown creeper, and black-and-white warbler. In addition, numerous species of North American birds nest and/or roost in cavities in dead or deteriorating trees. Mammals such as gray squirrel, flying squirrel and raccoon use cavities for shelter and reproduction, utilizing both live and dead trees, and migratory bats roost under loose bark.

Successional Old Field- The Restoration Concept proposes that small areas of this community be established throughout the gorge rim. This community is defined by Edinger et al. (2002) as "a meadow dominated by forbs and grasses that occurs on sites that have been cleared (for farming or development), and then abandoned." Although this community may not be representative of the original ecological state of the Study Area, it will support the ecological and cultural goals of this restoration project by enhancing habitat diversity and increasing opportunities for wildlife observation by the public. Dominant species in this community should include a variety of native forbs and grasses.

This community could provide habitat for bird species such as eastern meadowlark, bobolink, killdeer, horned lark, and several species of sparrow (vesper, savannah, grasshopper and Henslow's) and provides food (seeds) and nesting cover for many of these species. These open areas would also harbor abundant insect populations, creating important foraging sites for many breeding birds. Old field communities also provide habitat for eastern cottontail, woodchuck and numerous species of small mammal. These species provide a prey base for predators such as hawks, owls and fox.

Successional Shrubland- Although not explicitly called out in the Restoration Concept, transitional areas of successional shrubland will occur along the edges between forested and old field communities. Edinger et al. (2002) describes successional shrubland as a community that has at least 50 percent cover of shrubs, occurring on sites that have been cleared or otherwise disturbed. Characteristic shrub species can include gray dogwood, eastern red cedar, raspberries, serviceberries, choke-cherry, sumac, nanny-berry, and arrowwood (Edinger et al., 2002).

Once established, this community will provide nesting and escape cover for a number of bird species such as cuckoos, gray catbird, brown thrasher, eastern kingbird, yellow breasted chat, rufous-sided towhee, American goldfinch, indigo bunting, common yellowthroat, and blue-winged warbler. Berry-producing shrubs will provide a source of food for the mammals such as raccoon, skunk and opossum and birds such as robin, flicker, cardinal, blue jay, and cedar waxwing. The fruit also attracts insects, which in turn provide food for a variety of insectivorous birds such as flycatchers, vireos and wood warblers. Shrubland will also provide food and cover for mammals such as white-tailed deer, red fox and eastern cottontail.

Shrub Swamp and Shallow Emergent Marsh- It does not appear that large wetland complexes historically occurred along the gorge rim, however, small wetland communities were likely found in areas that collected/retained stormwater prior to alteration of the site. With topography restored on-site, low-lying depressional areas will once again collect water and support wetland communities such as shrub swamps and shallow emergent marshes. Shrub swamps are a broadly defined, common type of wetland dominated by one or more shrub species. Characteristic shrubs should include species such as alder, red osier dogwood, silky dogwood, willows, buttonbush, meadow-sweet, steeple-bush, gray dogwood, swamp azalea, highbush blueberry, spicebush, wild raisin, and arrowwood (Edinger et al., 2002). Shallow emergent marsh communities are dominated by herbaceous plants such as bluejoint grass, cattails, sedges, marsh fern, manna grasses, spikerushes, bulrushes, three-way sedge, sweetflag, tall meadow-rue, marsh St. John's wort, arrowhead, goldenrods, eupatoriums, smartweeds, marsh bedstraw, jewelweed, and loosestrifes (Edinger et al., 2002).

Wetland communities on the restored gorge rim would likely be fairly small and although species diversity is desirable, some of these wetland areas may simply consist of a small pocket of silky dogwood or cattails. These wetland communities could provide cover and nesting/ spawning areas for songbirds, frogs and turtles.

C. Cultural Improvements

The Restoration Concept envisions visitors being able to walk or bike through the restored ecosystem via a network of non-motorized multi-use trails. Where appropriate, trailheads are proposed at periodic intervals to increase public access to the gorge rim. Many of these are proposed to be "soft" trailheads, meant to accommodate local neighborhood access only. They are not designed to include visitor parking or large signs, but should instead feature a small clearing and pedestrian-scale trail entrance, with appropriately scaled directional signage. Larger trailheads would be provided at key locations and should have the ability to accommodate parking and pedestrian facilities such as bike racks and benches. Any necessary signage at trailheads or along the trail should be sensitive to the context of a restored, natural area; it should be unobtrusive, while providing clear guidance to all visitors.

The primary multi-use pedestrian trail, referred to as the Niagara Rim Trail, is proposed to run the length of the restored gorge rim, generally following the route of the former RMP. This trail would provide barrier-free access and passive recreation opportunities throughout the restored forests and meadows. As range of trail routing and surfacing options are available, but it is currently envisioned that the trail be constructed of compacted stone dust or similar low-maintenance materials, and not be any wider than is necessary to accommodate a single walking or biking lane in both directions. Native grasses and shrubs should be planted directly alongside the trail, and planted tree species should be close enough such that the canopies of mature trees provide a measure of cover over the trail. It is very important that the pedestrian trails do not act as a barrier to wildlife within the gorge and rim; the intent of the trail is to complement the restored ecological communities and provide public access to them, not to bisect them in the same manner as the existing roadway. Specific guidelines for the design and layout of the trail system are not provided within this study, as they should be determined based on future site survey, grading, and planting plans, along with input from both the community and restoration professionals. However, in general the trail should be compatible with best management practices regarding distance from sensitive ecological communities, intensity of maintenance, and preventing the transport of invasive species.

A more detailed description of the Restoration Concept is provided on the following pages. The Restoration Concept is divided into six sheets and each written description below corresponds with each sheet of Figure 3.0.

1. Lewiston Plateau/Earl W. Brydges Artpark and the Niagara Escarpment (Figure 3.1)

The northern end of the Study Area includes the portion of the RMP that runs along the Niagara Escarpment, and the Earl W. Brydges Artpark and Plateau Park, both of which are located on the Lewiston Plateau. The Restoration Concept proposes reforestation of the Niagara Escarpment and undeveloped areas in the Artpark and Plateau Park. Existing forested areas along the northern perimeter of the Artpark and Plateau Park will be expanded to serve as a green buffer between the adjacent residential and commercial areas to the north and the newly restored ecological communities to the south. Additional trails connecting the Niagara Escarpment to the Lewiston Plateau will facilitate pedestrian access to/from

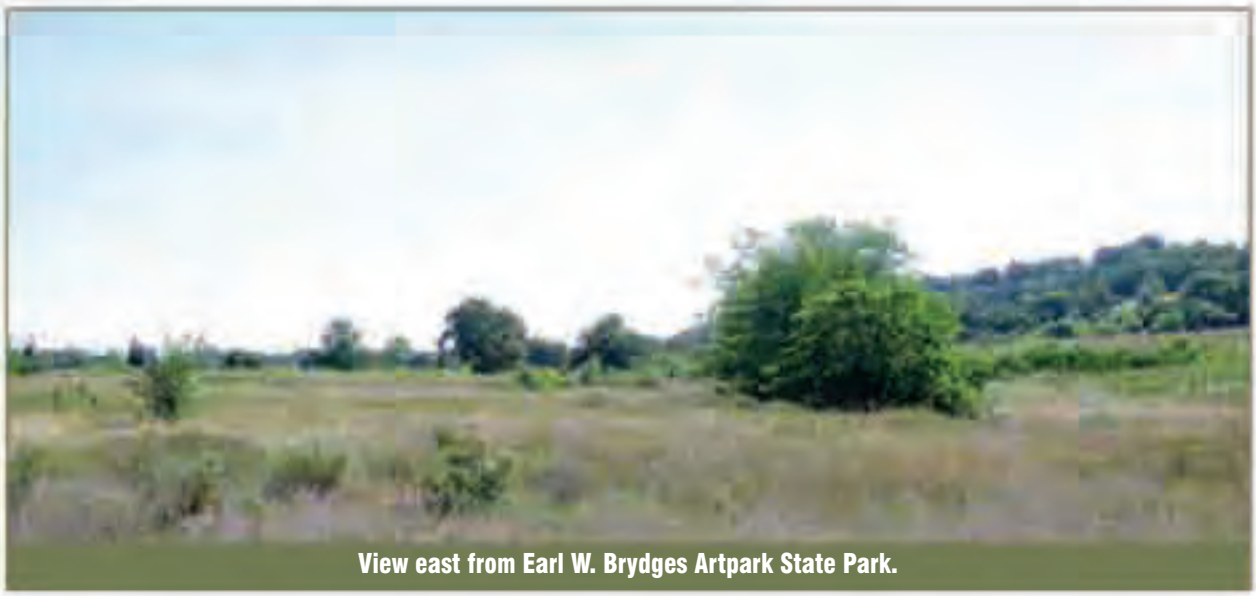
the area, including connections with the Artpark trail system. Connection with the Artpark will offer visitors to that destination additional recreational opportunities on the gorge rim, thus providing the opportunity for an extended and more diverse visitor experience. A community trailhead is proposed at the corner of Fourth and Tuscarora Streets. This new trail will provide easy public access to areas within the Artpark that provide a unique view over the Niagara River (and, on a clear day, Lake Ontario). This multiuse recreational trail will provide a safe, accessible and continuous path along the Niagara gorge rim, linking the Village of Lewiston to the City of Niagara Falls (and Niagara Falls itself). This experience will include connections to scenic overlooks, existing trails, parks, and other areas of cultural and ecological significance, and could encourage the development of bike rental concessions, guided tours, and other tourism-related businesses in the adjacent communities.

Improved ecology: Successional old field/meadow will be maintained throughout much of Plateau Park, as well as parts of the southern portion of the Artpark and along Route 104/Lewiston Road. Limited areas of mowed lawn will be maintained between existing buildings along park access roads. A mixed deciduous forest will be restored/expanded along the Escarpment and throughout the undeveloped portions of the Artpark.

Improved pedestrian circulation: The Niagara Rim Trail proceeds along the gorge rim from a trailhead off Center Street in Lewiston. The existing trails in the Artpark and Plateau Park will be connected with new trails that provide access between the Escarpment, Lewiston Plateau and the Niagara gorge.

Reduced vehicular circulation: The RMP will be removed. The Artpark will keep its vehicular access roads. No additional roadways are proposed.

Improved neighborhood connection: Local neighborhood connections to the trail system will be provided at the intersection of 8th Street and Seneca Street and along Center Street near the southbound ramp for Route 104/Lewiston Road. The streetscape along 4th Street, at its intersection with the Artpark and three blocks north to Center Street in the Village of Lewiston, will be enhanced with native vegetation similar to what is found in the Artpark. The southbound Route 104/Lewiston Road access ramp will be treated similarly.



View east from Earl W. Brydges Artpark State Park.

2. Niagara Escarpment – Niagara Falls Country Club to Robert Moses Niagara Power Plant (Figure 3.2)

Between the Niagara Falls Country Club and the Robert Moses Niagara Power Plant, there are some striking views available along the Niagara Escarpment. These views provide a one-of-a-kind scenic resource which belongs to the greater community and should be accessible to all visitors. The Niagara Rim Trail will provide access to scenic overlooks where users can take in these views. Although narrow, the section of the Study Area north of the Lewiston-Queenston Bridge is still wide enough to accommodate side trails off of the main Niagara Rim Trail. Soft trailheads are proposed to be located at the end of each residential street to provide easy, safe access for local residents. Though heavily influenced by the nearby I-190 interchange and Niagara Falls Country Club, reforestation of this area will provide needed screening of the I-190 interchange and the Country Club. A renewed and healthy forest will be an ideal complement to the unique geological footprint of the former Fish Creek. The day-lighting of Fish Creek is not currently proposed due to concerns relating to potential contamination and remediation issues. However, this option should be explored and implemented if found to be feasible. Restoration of a natural stream channel in this area would have ecological as well as aesthetic benefits. The Niagara Rim Trail continues through this section of the corridor, providing users with views of the exposed Niagara Escarpment, calcareous cliff communities in the gorge, and a sense of the power of the hydrologic patterns that gave shape to the land.

Improved ecology: The forest along this section will be encouraged to mature into a mixed deciduous forest, with the densest section south of the Lewiston-Queenston Bridge. The feasibility of day-lighting Fish Creek should be explored. All of the soft trailheads will be characterized by small meadows.

Improved pedestrian circulation: The Niagara Rim Trail will continue along the rim mostly parallel to the existing walking trail.

Reduced vehicular circulation: The RMP will be removed and no additional vehicular circulation is recommended in this section of the gorge rim.

View north from the NYPA Power Vista at the Robert Moses Niagara Power Plant.

Illustration of future Fish Creek overlook looking south along the Niagara River (see Figure 3.2 for location of illustrative view).

Improved neighborhood connection: Soft trailheads will be located at each end of Fort Gray Drive. Reforestation of this area will provide a buffer between the residential neighborhood and the Niagara Rim trail.

3. Devil's Hole State Park/Power Vista (Figure 3.3)

This section of the Study Area includes all of Devil's Hole State Park and the NYPA Power Vista, both of which are local tourist destinations. Portions of Devil's Hole State Park bisected by the RMP will be reconnected. Reforestation of the Niagara gorge rim will continue south of the Power Vista and into Devil's Hole State Park. With the removal of the RMP and inclusion of the new Niagara Rim Trail, all of Devil's Hole State Park will now be accessible to pedestrians. Implementation of the Restoration Concept will enhance both the Park and the Power Vista as regional tourism destinations by simplifying vehicular access to the Park, improving the pedestrian experience between the two attractions, and creating a more unique view from atop the nearby pedestrian overpass.

In an effort to reduce hardscape and to eliminate conflict points between vehicles and pedestrians, the two existing parking areas, which currently straddle the RMP, should be combined into one parking lot east of the proposed Niagara Rim Trail. This will reduce the impact of vehicles on the gorge rim ecosystem, provide easier vehicular access to the park from Route 104/Lewiston Road, and improve pedestrian safety and connectivity. From this parking area motorists can easily access alternative routes south to Niagara Falls including Highland Avenue and Hyde Park Boulevard. The existing pedestrian overpass above the parkway will be adapted to serve as an attraction for visitors to view the restored gorge rim from within the tree canopy (see illustration). Retaining the pedestrian bridge also provides a "historical bridge" from the era of transportation-focused land uses to the ecologically-centered uses proposed along the restored gorge rim. Similarly, the vehicular bridge over the NYPA's service drive will be transformed into a "green trail" carrying the landscape across the gap, reconnecting the currently fragmented ecosystem, and offering

View north from existing pedestrian overpass in Devil's Hole State Park.

Illustration of future view north from the pedestrian overpass (see Figure 3.3 for location of illustrative view).

a glimpse down into the gorge via the rock cut that accommodates the service drive.

The park will include restored forest land and meadows, as well as small areas of maintained parkland along the north edge of the pedestrian trail, to provide visitors with amenities for relaxation and passive recreation in a setting with dramatic scenic views. The Niagara Rim Trail will be accessible from the adjacent neighborhood and will be connected to existing trails that access the gorge.

Improved ecology: Small successional old field/meadow communities will be located at the soft trailhead near Lafayette Avenue. A mixed deciduous forest will be restored alongside the multi-use trail and at

Devil's Hole State Park. Within the park a small area of mowed lawn will be maintained near the edge of the gorge rim to accommodate picnics and informal recreational use. Native herbaceous species typical of old field/meadow ecological communities will be established on the bridge over the NYPA service drive.

Improved pedestrian circulation: The Niagara Rim Trail will continue through this section connecting with the popular trails that lead down the gorge to the river. The new trail will connect with the pedestrian overpass, allowing for a canopy experience, and providing access to that portion of Devil's Hole State Park located near the Power Vista. The parking lot will be strategically connected to Lewiston Road offering easy access and parking for visitors traveling by car without interrupting or interfering with the Niagara Rim Trail. This will facilitate visitation by tourists and eliminate existing conflicts between pedestrian and vehicular circulation.

Reduced vehicular circulation: The RMP will be removed. The two existing parking lots will be combined into one, which will be directly accessible from Route 104/Lewiston Road.

Improved neighborhood connection: Access to the Niagara Rim Trail is proposed to be provided to local residents in the adjacent neighborhood with a soft trailhead at Lafayette Avenue.

4. Whirlpool/DeVeaux Woods State Parks (Figure 3.4)

Whirlpool State Park and DeVeaux Woods are separate but adjacent parks within the Study Area. With removal of the RMP (and associated vehicular traffic) and with proper reforestation and restoration, these two parks would be joined, and could become a significant woodland and destination node within the Study Area. A portion of the cleared areas within DeVeaux Woods State Park (including existing mowed lawns and under-utilized buildings) could be an ideal location for a greenhouse/nursery for rearing plants to be used during restoration. This area offers ample existing infrastructure to house potential educational outreach facilities. Prior to construction of the RMP, the forests in both parks were a connected ecosystem, which was bisected by the RMP. This led to the slow decline of this forested ecosystem. Ecological restoration within this area will focus on restoring a natural species composition and structure to the forest, including a healthy understory, and will reconnect the two forests, creating a larger contiguous stand.

With the removal of RMP, pedestrians will no longer need to cross two lanes of 45 mph traffic to get to Whirlpool State Park. Vehicular access to Whirlpool State Park will be provided by a new scenic gateway from Findlay Drive. Improvement and identification of this entrance will enhance visitation by tourists visiting the area, and provide a connection with the surrounding community for users of the Niagara Rim Trail. Although the trail and driveway will intersect, the intersection will be designed to indicate trail users receive the right of way and all vehicles need to stop for trail users. Entranceways to both Whirlpool State Park and DeVeaux Woods State Park will be landscaped to invite visitation and blend with the surrounding naturalized area.

Pedestrian connectivity to the trail system from adjacent residential neighborhoods will be enhanced with five soft trailheads, four located north and the fifth located south of DeVeaux Woods. Whirlpool Drive will terminate at Chestnut Avenue and will be enhanced as the local connector along the west side of Niagara Falls, providing an attractive interface between the renewed gorge rim and adjacent neighborhoods. Suggested Whirlpool streetscape enhancements may include native street tree plantings, sidewalks, crosswalks, neighborhood trail head connections, wayfinding signage, on-street parking, and/or bicycle lanes. Such improvements will strengthen the interface between the park and adjacent neighborhoods, and set the stage for the ancillary benefits of public space beautification to migrate outward from these spaces.

View along Findlay Drive at intersection with Robert Moses Parkway.

Illustration of future view along the Findlay Drive gateway toward Whirlpool State Park (see Figure 3.4 for location of illustrative view).

Improved ecology: A mixed deciduous forest will be nurtured and expanded throughout much of Whirlpool State Park and DeVeaux Woods State Park, with some meadows and small areas of mowed lawn at Whirlpool State Park.

Improved pedestrian circulation: The Niagara Rim Trail will continue through the restored forest, connecting with existing gorge trials to the river and the pedestrian walkway from DeVeaux Woods. Sidewalks will be provided along the Findlay Drive gateway to Whirlpool State Park. Soft trailheads will be provided at certain neighborhood streets adjacent to the Study Area.

View along Robert Moses Parkway at Whirlpool State Park Driveway.

Illustration of future intersection of the Niagara Rim Trail with the proposed Findlay Drive gateway to Whirlpool State Park (see Figure 3.4 for location of illustrative view).

Reduced vehicular circulation: The RMP will be removed. Whirlpool State Park access driveway will be rerouted to directly connect with Findlay Drive, thus maintaining easy access to this destination for residents and tourists. Whirlpool Street will terminate at Chestnut Avenue.

Improved neighborhood connection: Soft trailheads will be located at Harrison, James, Maple, Vanderbilt, and Chestnut Avenues.

5. Elevated Niagara Rim Trail (Figure 3.5)

The point where the RMP meets the Whirlpool Bridge is a transportation crossroads with historic significance. Today there are two bridges over the Niagara gorge, one for cars and one for the railroad. The RMP overpass currently crosses over both of these bridges. As part of the Restoration Concept, this elevated section of roadway is proposed to be retained to create a distinctive landscaped pedestrian amenity, repurposing the roadway infrastructure as an elevated "green corridor" with a one-of-a-kind bird's-eye view of the Niagara gorge and Canada. With the appropriate techniques (similar to those employed to create "green roofs") the overpass will become a naturalized corridor and scenic overlook, providing recreationalists and tourists with a rare vantage point from which to view the natural wonder of the Niagara gorge. This repurposed infrastructure will be a unique showpiece for walkers, hikers, runners and bicyclists along the Niagara Rim Trail. The elevated trail has exceptional potential to draw visitors from throughout the bi-national region, especially in light of transit improvements currently underway at the site of the former Customs building on Whirlpool Street.

View south toward elevated portion of Robert Moses Parkway.

Illustration of conceptual Niagara Rim Trail viewing south toward elevated trail (see Figure 3.5 for location of illustrative view).

At strategic neighborhood streets, pedestrian connections will be enhanced to facilitate connectivity from the City's urban core to the proposed pedestrian trail system. Suggested streetscape enhancements may include planting native trees along the streets, improving sidewalks, designating crosswalks, providing trailhead connections, and installing way-finding signage. These improvements will work to reconnect urban neighborhoods with the adjacent parks and restored ecosystems along the gorge rim, and the visitors using this area.

Improved ecology: Native meadow species will be planted on the "pedestrianized" overpass, with meadows serving as gateways at each trailhead. Appropriately hardy native tree and shrub species will be located along improved streetscapes.

Improved Pedestrian circulation: The Niagara Rim Trail will continue through this section and will include the pedestrianized overpass. The trial will connect to existing walking trails down the gorge to the river. Safe and easy access to the trail will be provided at the end of designated neighborhood streets.

Reduced Vehicular circulation: The RMP will be removed, with the exception of the elevated overpass, which will be converted for non-motorized uses.

View of the Robert Moses Parkway. Automobile access is limited to the original northbound lanes in the foreground, with pedestrian access granted to the original southbound lanes at left.

Illustration of conceptual Niagara Rim Trail viewing north near elevated trail (see Figure 3.5 for location of illustrative view).

Neighborhood connection: The pedestrianized overpass will establish a new community landmark, while the enhanced streetscape along Ontario and Willow Avenue will provide deeper connections with adjacent residential and commercial areas. More frequent trailheads will improve access to the Niagara Rim Trail at Bellevue, Ontario, Willow, Ashland, and Willow Avenues, and the improved streetscape along Whirlpool Street will provide a buffer and help define pedestrian access.

6. Proposed Niagara Gorge Discovery Center (Figure 3.6)

The southern end of the Study Area has been addressed in the City of Niagara Falls' comprehensive plan (City of Niagara Falls, 2009a). The intent is to have the Niagara Rim Trial connect to this area, thus providing a seamless experience for Discovery Center visitors and trail users. Restored ecological communities will be carried along the rim up to and within the redesigned Niagara Gorge Discovery Center and Aquarium area. This area will be redesigned and configured as recommended in the City's comprehensive plan. The removal of the RMP and the creation of a "Cultural District" will help strengthen and link existing natural and cultural attractions into a world class park setting.

According to the 2009 comprehensive plan, attractions would include the Niagara Gorge Discovery Center, gorge overlooks, trails, recreation and festival areas, the expanded aquarium, shared surface and subsurface parking facilities, an outdoor performance amphitheater, a summer pond and winter skating rink, and a stormwater management area. The streetscape for Whirlpool Street will be enhanced with design details similar to those used to enhance the strategic east-west neighborhood corridors (such as Pine Street and Cedar Street) to facilitate pedestrian movement between the city's urban mixed-use corridor along Main Street and the new Cultural District.

This is an ideal location for elements of the City and its parks to interrelate with one another. In the words of urban designer Kevin Lynch, such nodes are strengthened by the presence of landmarks, and "provide a setting which almost guarantees attention for any such mark" (Lynch, 1960). Throughout this portion of the gorge rim, the Niagara Rim Trail will be not only a path, but a landmark in its own right. It will be enhanced by the presence of other destinations and attractions along its length, and could lend further support to ancillary economic opportunities such as bicycle rentals or concessions. The Niagara Rim Trail

View of the existing Niagara Gorge Discovery Center.

will be used to connect the built and natural environments, and to draw people into the restored landscape.

Improved ecology: A mixed deciduous forest will be nurtured along the western and southern portion of the rim, with meadows and shrubland scattered throughout the central and northern portion of the proposed Cultural District. The stormwater management area is proposed to be developed and maintained as a shallow emergent marsh.

Improved pedestrian circulation: The Niagara Rim Trial will continue through and connect with the pedestrian systems within the Niagara Discovery Center complex.

Reduced vehicular circulation: The RMP will be removed. Whirlpool Street will be removed from Cedar Avenue to Route 104/ Main Street. Vehicular parking is proposed within the Discovery Center complex.

Improved neighborhood connection: Formalized park entranceways are proposed to be located at or near existing/proposed structures. Pedestrian connections between the Discovery Center, the restored gorge rim, and residential and commercial areas will be improved through streetscape enhancements along Route 104/Main Street, Whirlpool Street, Pine Street, and Cedar Avenue.

2. Restoration Benefits

As discussed in Part II of this study, removal of the RMP will create a one-time cost and temporary inconvenience. However, these must be measured against the costs and benefits of either reconstructing and maintaining the RMP, or removing the roadway restoring the gorge rim. The essential question is what benefits could come from removing the RMP and restoring the Niagara gorge rim to a healthy, natural setting with a recreational trail? In addition, will these potential benefits outweigh the costs (and perceived inconveniences) of removing the RMP? Full removal and restoration would take significant financial resources, physical effort, and community dedication. Before such resources are committed, there should be a confident understanding of the benefits that will be derived from restoring this area. How would the proposed restoration of the gorge rim impact the community from an environmental, economic and cultural perspective? With the intent of addressing this question, the potential environmental and socio-economic benefits of the proposed ecological restoration concept are discussed below.

A. Environmental Benefits

1. General Environmental Benefits

Ecological restoration of the Niagara Rim will result in a variety of ecological/environmental benefits, including the following:

- Improved soil quality
- Improved water quality
- Improved quality and quantity of stormwater run-off
- Improved plant species diversity
- Improved local air quality and microclimate
- Improved wildlife habitat
- Reduced noise
- Improved scenery/aesthetics
- Improved open space and recreational opportunities

The question is to what degree will the environmental benefits be realized and can they be quantified? Implementation of the proposed Restoration Concept will replace 350 acres of disturbed/developed land (including 38 acres of pavement) with native ecological communities, and restore the health and vitality of the remaining communities within the Study Area. The removal of pavement, decompaction/restoration of a natural soil profile, and replacement of mowed lawn with native vegetation will undoubtedly improve water infiltration thus reducing stormwater run-off (Holman-Dodds et al., 2003). This in turn will reduce the transport of pollutants and sediments to receiving waters (Niagara River), facilitate water up-take by on-site vegetation, and provide additional groundwater recharge (Barnes et al., 2009; Brauman et al., 2007). The removal of vehicles and pavement, and the establishment of native vegetation will also provide local air quality and microclimate benefits through the reduction of vehicle emissions, increased shading, increased carbon dioxide up-take, and filtering/absorption of air-borne pollutants (McPherson & Rowntree, 1993; Peters & McFadden, 2010; Rowntree & Nowak, 1991; Tyrvainen et al., 2005).

Once established in the Study Area, restored plant communities will create additional habitat for area wildlife. The native plants will provide an increased diversity of food sources and cover types, and provide

a natural buffer between the Niagara gorge and adjacent developed areas. As discussed previously, open meadows and shrubland will provide nesting and foraging habitat for birds and mammals that prefer grasslands and early successional habitat. Enlarged forest areas will increase the size and contiguity of existing woodlands, and provide connections/travel corridors between isolated forest remnants (e.g., DeVeaux Woods) and forest vegetation in the Niagara gorge. Natural forest habitat features anticipated to develop over time, such as standing and fallen dead wood, increased foliage height diversity, tree cavities, and leaf litter, will all enhance habitat quality and diversity, and allow the gorge and rim to accommodate a wider variety of wildlife species that prefer forest and forest edge conditions. Removal of the RMP will also eliminate a potential source of road kill and provide safe movement of wildlife using the gorge rim.

In addition to the ecological benefits described above, restoration of the Study Area will also have environmental/quality-of-life benefits for area residents and visitors. Removal of vehicular traffic from the rim will reduce noise, improve safety, and allow unhindered pedestrian access to and along the Niagara gorge rim. Removal of the paved roadway and establishment of restored native ecosystems will provide enhanced open space, wildlife viewing opportunities, improved aesthetics, and enhanced property values along the Niagara gorge rim. Improved pedestrian access to a multi-use pedestrian trail (free of cars) will also enhance recreational opportunities for residents and provide a new and different destination for tourists visiting the area.

2. Ecosystem Services

As humans we benefit from a number of processes and resources that are supported by natural ecosystems. These benefits are referred to as ecosystem services and include clean water, clean air and any number of other benefits that people receive from the ecosystems that surround and sustain them (Millennium Ecosystem Assessment, 2005). Ecosystem services can be divided into four general categories:

Provisioning services: These are the benefits experienced through harvesting or consuming ecological resources, such as food and fiber.

Regulating services: These benefits arise from the interaction of a particular resource with other environmental forces or factors, such as flood control, waste processing, or climate control.

Cultural services: These are the products of non-consumptive human interaction with the environment, such as our spiritual connection with, or aesthetic enjoyment of, the landscape.

Supporting services: These are the core biological "outputs" stemming from the interaction of flora and fauna with their respective energy "inputs", such as photosynthesis and soil formation.

Measuring benefits from improved ecosystems has evolved from a general discussion of observed benefits to establishing an economic value for these benefits. Many ecosystem services (such as supporting services) are difficult to measure. These include many of the aesthetic and spiritual benefits that often accompany human interaction with the environment. However, many of the regulating services can be objectively measured and can help to quantify the overall public benefits of ecological restoration. Among these regulating services are the important functions that trees serve with regard to the regulation of microclimate and mitigation of air pollution. Trees help to moderate hot and cold air temperatures, which partially alleviates the need for increased energy production, preventing the release of additional emissions into the atmosphere. In addition, trees absorb pollutants from the soil, water, and air, through phytoremediation.

As the study of ecosystem services has evolved, several models have been introduced to measure the

economic values associated with regulating services in particular (Nelson & Daily, 2010; Holdren et al., 2011; The Nature Conservancy, 2011). One approach in developing these economic valuation models is to examine consumers' willingness to pay for the services rendered by ecological functions. This is the approach taken in the U.S. Forest Service's Northeast Community Tree Guide: Benefits, Costs, and Strategic Planning (McPherson et al., 2007). Since federal air quality standards require the mitigation of certain pollutants, and since their removal comes at a substantial cost to the public, it is possible for the Forest Service to quantify the economic value of the regulating services of forests. In the Northeast Community Tree Guide, the Forest Service has examined the abilities of representative tree species to mitigate hot and cool weather, wind, and common air pollutants, as well as their ability to intercept rainfall from entering water treatment facilities, and measured these services for their potential impact on utility customers. The Forest Service estimates a single small deciduous tree provides enough air temperature mitigation over the course of a year to avoid the production of 17 kWh of electricity and 806 cubic feet of natural gas. The subsequent savings attributable to 1,000 such trees over 40 years is more than $132,000 for electricity and $393,000 for natural gas. In other words, the more trees in an area, the less money spent on electricity or natural gas to mitigate the hot or cool weather.

That same tree will also remove pollutants from the air, both directly and indirectly. The Forest Service estimates that a small deciduous tree can remove 0.15 lbs of sulfur dioxide from the air each year, through a combination of avoided energy production and pollutant uptake. The public pays $3.48 for each pound of sulfur dioxide it removes from the atmosphere through other mitigation strategies (McPherson et al., 2007). After 40 years, the same small tree will save the public $20.88, and thus 1,000 such trees will result in $20,880 in savings.

Similarly, trees intercept a portion of rainfall, holding it on leaves and branches, thus reducing runoff entering the municipal sewer system. As trees absorb groundwater through their root systems, they also support the infiltration capacity of soil, which diverts more rainfall from the system. The Forest Service estimates that each intercepted and absorbed gallon of stormwater saves the public $0.008, and that a single small deciduous tree intercepts and absorbs 358 gallons per year. The amount of intercepted and absorbed stormwater from 1,000 small deciduous trees over a 40-year span thus saves more than $114,000.

Table 3 examines one method of estimating the economic impact of ecosystem services that would be provided by planting 21,000 trees throughout the RMP corridor, based on research performed by the Forest Service. For the purposes of this exercise, some assumptions must be made regarding the coverage of trees throughout the restored gorge rim:

- Table 3 assumes that 60% (210) of the 350 total acres of disturbed/developed and mowed lawn/ornamental ecological communities noted in Part I will be restored to a mixed deciduous forest condition.
- The tree density of restored forest within the Study Area (100 trees/acre) is assumed to be consistent with average characteristics for similar established forests as described in Martin (1992).
- Of the 21,000 modeled trees, 40% (8,400) are assumed to be large deciduous trees, and the rest are assumed to be evenly split (20% each, or 4,200) between small deciduous, medium deciduous, and a representative conifer species.
- It is further assumed that the understory, herbaceous layer, and all other flora and fauna will be associated with additional ecosystem services and maintenance obligations; however, those services and costs are not examined here.

Actual costs and benefits per tree per year may vary from published averages. For example, Forest Service

Table 3: Estimation of Ecosystem Services Resulting from Restoration of the Gorge Rim

Estimated Ecological and Economic Benefits of Reforestation over 40 Years^

		Small deciduous[a]		Medium deciduous[a]		Large deciduous[a]		Conifers[a]		Total reforestation		
		Count:	4,200	Count:	4,200	Count:	8,400	Count:	4,200	Total count:		21,000
Energy & environmental benefits	**Price**	**Resource Units**	**Total Value**	**Resource Units**	**Total Value**	**Resource Units**	**Total Value**	**Resource Units**	**Total Value**		**Total value**	**Share of total benefits**
	Dollars	RU / tree / year	Dollars	RU / tree / year	Dollars	RU / tree / year	Dollars	RU / tree / year	Dollars	Dollars / tree / year	Dollars	Percent
Electricity (kWh)[b]	0.1955	17	$558,348	39	$1,280,916	88	$5,780,544	25	$821,100	$10.05	$8,440,908	19.1
Natural gas (kcf)[c]	12.22	0.806	$1,653,941	1.523	$3,126,326	2.831	$11,623,465	1.503	$3,086,422	$23.20	$19,490,154	44.0
Net carbon dioxide (lb)	0.0033	144	$79,834	250	$138,600	485	$537,768	218	$120,859	$1.04	$877,061	2.0
Ozone (lb)	4.59	0.14	$107,957	0.29	$223,625	0.54	$832,810	0.28	$215,914	$1.64	$1,380,305	3.1
Nitrogen dioxide (lb)	4.59	0.18	$138,802	0.37	$285,314	0.7	$1,079,568	0.34	$262,181	$2.10	$1,765,865	4.0
Sulfur dioxide (lb)	3.48	0.15	$87,696	0.40	$233,856	0.85	$993,888	0.23	$134,467	$1.73	$1,449,907	3.3
Small particulate matter (lb)	8.31	0.13	$181,490	0.33	$460,706	0.45	$1,256,472	0.37	$516,550	$2.88	$2,415,218	5.5
Volatile organic compounds (lb)	2.31	0.01	$3,881	0.03	$11,642	0.06	$46,570	0.02	$7,762	$0.08	$69,854	0.2
Hydrology (gal)	0.008	358	$481,152	1,156	$1,553,664	1909	$5,131,392	909	$1,221,696	$9.99	$8,387,904	18.9
Total environmental benefits			*$3,293,100*		*$7,314,650*		*$27,282,477*		*$6,386,950*		*$44,277,176*	*100.0*
Installation & maintenance costs	**Per tree**	**Total Value**	**Per tree**	**Total Value**	**Per tree**	**Total Value**	**Per tree**	**Total Value**	**Per tree**	**Total Value**	**Share of costs**	
	Dollars / tree / year	Dollars	Dollars / tree / year	Dollars	Dollars / tree / year	Dollars	Dollars / tree / year	Dollars	Dollars / tree / year	Dollars	Percent	
Tree and planting[d]	$5.93	$995,400	$6.00	$1,008,000	$7.45	$2,503,200	$5.00	$840,000	$254.60	$5,346,600	26.8	
Pruning	$3.26	$547,680	$7.96	$1,337,280	$11.60	$3,897,600	$6.40	$1,075,200	$326.56	$6,857,760	34.4	
Remove and dispose	$1.28	$215,040	$1.62	$272,160	$2.06	$692,160	$1.47	$246,960	$67.92	$1,426,320	7.2	
Pest and disease	$0.09	$15,120	$0.13	$21,840	$0.17	$57,120	$0.11	$18,480	$5.36	$112,560	0.6	
Infrastructure repair	$1.13	$189,840	$1.55	$260,400	$2.06	$692,160	$1.37	$230,160	$65.36	$1,372,560	6.9	
Cleanup	$0.26	$43,680	$0.35	$58,800	$0.46	$154,560	$0.31	$52,080	$14.72	$309,120	1.5	
Administration / inspection/ other	$3.96	$665,280	$5.42	$910,560	$7.21	$2,422,560	$3.10	$520,800	$215.20	$4,519,200	22.7	
Total installation & maintenance costs		*$2,672,040*		*$3,869,040*		*$10,419,360*		*$2,983,680*		*$19,944,120*	*100.0*	
Net benefit		**$621,060**		**$3,445,610**		**$16,863,117**		**$3,403,270**		**$24,333,056**		

^Based on values as calculated by McPherson et al (2007), unless noted otherwise. Annual values incorporate effects of tree loss through mortality.

[a]Resource units as calculated by McPherson et al (2007) for public (street and park) trees only. Public trees are not assumed to provide direct shade onto adjacent buildings.

[b]Price source: US Energy Information Administration, July 2010 NYS avg. residential retail price (http://www.eia.gov/electricity/data.cfm#sales

[c]Price source: US Energy Information Administration, Feb 2011 NYS avg. residential retail price (http://www.eia.gov/dnav/ng/ng_pri_sum_dcu_SNY_m.htm); US Forest Service values converted from kBtu to kcf.

[d]Price source: NYS DOT Regional and Statewide Weighted Average Awarded Prices, July 2009-June 2010.

figures may reflect the cost of a more active forest management regime than would likely be implemented by NYSOPRHP, which employs a more "passive management" approach to its undeveloped forestlands (Ash, 2009). As a consequence, the maintenance costs shown in Table 3 may be higher than those NYSOPRHP would incur. However, a well-designed, diligent, and comprehensive restoration effort may justify such higher estimates as those provided by the Forest Service.

Altogether the 21,000 trees established through implementation of the Restoration Concept would result in more than $44 million in total savings from utility costs and pollution mitigation over the course of 40 years. Estimated costs for installation and maintenance of these trees are also provided in Table 3.

Long-term maintenance costs are based on estimates developed by the Forest Service (adjusted to local conditions as noted), for activities such as removal, disease control, infrastructure repair, cleanup, and inspection (although all of these may not be necessary for the gorge rim restoration). Based on these estimates the total cost of installation and maintenance for the 21,000 trees described here would total around $20 million over the forty year span, resulting in a net benefit of more than $24 million.

B. Cultural Benefits

Just as certain environmental benefits are objectively assigned economic value, so too can one quantify some of the economic and cultural benefits conservation lands, parks, trails and open space have on adjacent properties and communities. Some of the economic and cultural benefits associated with the removal of the RMP and ecological restoration of the gorge rim include the following:

1. Regional employment opportunities
2. Increased property values
3. Increased tourism/ecotourism
4. Increased park use
5. Health value
6. Quality of life
7. Traffic-related benefits

Two of these factors provide a revenue source to local government; 1) property tax revenue from the added value of lands in proximity to parks, and 2) sales tax revenue due to increased spending by tourists who visit the region primarily because of its parks. Together these factors can increase the overall "wealth" in a community and give critically needed financial resources to government to support public services and investments.

Three other factors provide direct savings to residents. The first is the value of residents' free use of the park for enjoyment and recreation. The second is the health benefits (savings in medical costs) resulting from activity and exercise that occurs in the parks. The third factor is community cohesion, which is the result of people working together to collectively save or improve a park. This type of community effort can result in a stronger sense of community stewardship and can reduce antisocial behavior.

As part of this study, a preliminary economic analysis was performed by HB Solutions to examine the potential direct and indirect impacts of roadway removal on regional business and development prospects (Appendix C). While it is difficult to precisely quantify the actual economic benefits that will result from a restored gorge rim, this study examines the current economic context of the region and suggests ways in which those benefits could be realized throughout the area, based on reasonable assumptions and observed impacts experienced elsewhere.

1. Regional Employment Opportunities

According to this analysis, removal of the RMP offers the City of Niagara Falls the opportunity to leverage a slight increase in local traffic (if it increases at all) into improved exposure of economically productive areas, such as business districts and recreational nodes. It is expected that full removal will support investment and

revitalization initiatives throughout the Main Street and Downtown business districts of the city, as well as improved pedestrian connections throughout adjacent residential areas.

As discussed in greater detail in Appendix C, the removal of the RMP will generate both direct and indirect economic benefits in various sectors. In the near-term, the phased removal of the RMP and restoration of the gorge rim may also represent a direct (and potentially substantial) opportunity for regional businesses. Direct employment related to roadway removal will involve workers in the engineering, construction/ demolition, transportation, and waste management industries. The design and implementation of the restoration concept presented in this study will require professionals in these industries and more, including professionals in the fields of ecology and resource protection, botany, horticulture/plant propagation, landscape architecture, as well as assorted technicians in each field. Increases in each of these employment

Table 4: Selected Niagara County Industrial Sub-sectors, 2009

Sub-sector description (NAICS*)	Paid employees for pay period including 3/12/09^	First-quarter payroll($1,000)	Annual payroll($1,000)	Total establishments	Number of establishments by employment-size class					
					1 - 4	5 - 9	10 - 19	20 - 49	50 - 99	100 or more
Highway, street, and bridge construction	26	281	2,387	8	6	1	1	0	0	0
Other heavy and civil engineering construction	[0-19]	D	D	1	1	0	0	0	0	0
Site preparation contractors	151	1,629	10,640	24	19	1	1	3	0	0
All other specialty trade contractors	145	990	7,394	39	34	2	1	2	0	0
General freight trucking, local	44	279	1,408	10	7	0	3	0	0	0
Specialized local freight trucking (except used goods)	[20-99]	417	2,238	21	15	4	2	0	0	0
Scenic and sightseeing transportation, land	52	248	2,031	4	1	1	0	2	0	0
Landscape architectural services	[0-19]	49	208	5	5	0	0	0	0	0
Engineering services	445	7,658	28,683	23	13	3	2	3	1	1
Environmental consulting services	74	1,675	6,028	10	6	2	1	1	0	0
Other scientific and technical consulting services	[0-19]	83	237	4	4	0	0	0	0	0
Other physical and biological research	[0-19]	D	D	2	1	1	0	0	0	0
Landscaping services	200	1,067	7,291	101	91	6	3	1	0	0
Remediation services	[500-999]	D	D	8	3	1	1	1	1	1
Materials recovery facilities	[20-99]	D	D	2	1	0	0	1	0	0
Environment, conservation and wildlife organizations	[0-19]	D	D	1	0	0	1	0	0	0

Source: U.S. Census Bureau, County Business Patterns 2009
***North American Industrial Classification System**
^ Values in brackets [] indicate ranges, used to maintain anonymity of individual companies
D=with held to avoid disclosing data for individual companies

sectors are known to have "ripple effects" throughout a regional economy by virtue of their positive impacts on personal income and potential for increased spending (USDC, 1997).

Long-term management of the restored ecosystem, trails, and adjacent parkland will likely be the responsibility of the NYSOPRHP, and may require increases in that agency's staffing and budgetary resources. NYSOPRHP expenditures in the Niagara Frontier region during fiscal year 2008-9 totaled $30.4 million; these expenditures have been estimated to support 454 jobs within the region, with a total employee income of $24.2 million (Heintz et al., 2009). Increases in operational and capital expenditures related to parks are known to have positive impacts on local economies. These impacts can be greatest when the responsible agency is a non-local government entity (such as the NYSOPRHP), and when that agency focuses on local procurement of goods and services (Nadel, 2005).

An ecologically restored Niagara gorge rim could potentially influence economic growth throughout Niagara County. When viewed from that regional perspective, the restoration of the Niagara gorge rim looks like a healthier economic option. Table 4 highlights the employment context for the relevant sub-sectors within Niagara County as of 2009. While it is yet not possible to estimate the full impact ecological restoration of the Niagara gorge rim may have on the regional labor market, these employment figures may provide insight into the industry sub-sectors that currently exist within the county that could be utilized in the implementation phases.

It is also worth noting what industry sub-sectors are not currently represented within the county, as any necessary services within those fields would require the creation or expansion of new businesses in the area, or the associated employment benefits accruing outside the region. These include, but are not limited to: nursery and tree production; forest nurseries; forestry support services; and geophysical surveying and mapping services. Many of these employment opportunities (such as environmental consulting, forestry support services, etc.) will extend well beyond the removal and restoration phases, as periodic maintenance will be performed on the restored ecosystem.

Additionally, the overall employment impact of the ecological restoration will extend into other employment opportunities, such as travel and tourism. The New York State Department of Labor estimates that the travel and tourism "cluster" directly employs 5,110 positions in Niagara County (NYSDOL, 2011). This cluster is comprised of a percentage of employment in the accommodations, culture/recreation/amusements, food service, passenger transportation, and travel retail sub-sectors. These positions represent indirect employment opportunities related to the restoration of the gorge rim. Table 5 illustrates the employment portrait of the travel and tourism cluster within Niagara County in 2009. Employment opportunities in the travel and tourism cluster represent only some of the potential economic benefits of increased tourism. Additional economic impacts related to travel and tourism are discussed in further detail in subsection

Table 5: Niagara County's Travel & Tourism Cluster, 2009

Travel & Tourism: All Industry Groups					Accommodations		Culture, Recreation and Amusements		Food Service		Passenger Transportation		Travel Retail	
Jobs	"Total Wages ($ mn)"	"Average Wage"	"% Share of Total Jobs in County"	"% Share of Wages in County"	Jobs	"Total Wages ($ mn)"	Jobs	"Total Wages ($ mn)"	Jobs	"Total Wages ($ mn)"	Jobs	"Total Wages ($ mn)"	Jobs	"Total Wages ($ mn)"
5,110	$126.2	$24,700	7.3	5.1	740	$12.8	2,640	$78.6	1,010	$12.2	440	$15.9	280	$6.6

Source: NYSDOL, 2011 (preliminary data)

B(3), below.

2. Increased Property Values

According to TPL, two key factors influence how the values of residential land change due to their proximity to open space and parkland: 1) the distance or "nearness" to the space and how well they are physically connected, and 2) the quality of the open space, including how well it is maintained. Anecdotal evidence from metropolitan Dallas supports the notion of valuable connectivity; builders there noted a 25% premium on projects adjacent to the Katy Trail system (RTC, 2007). The value of nearness was experienced in the City of Denver, where TPL's research concluded that the value of residential properties within 500 feet from a park increased by 5%. In Denver's case, this added $724 million to the city's tax base and generated $4.08 million in additional property tax revenue (TPL, 2010). A TPL study in Philadelphia documented the same effect, and estimated a total increase of $688.8 million in property values due to the presence of nearby parks. This generated $18.1 million in additional property taxes (Gies, 2009). In another study in Washington DC, using the same 5% impact figure, $6,953,377 of additional property tax revenue was attributed to the increased value of residential property located within 500 feet of parks (Harnik and Belle, 2009).

A research study evaluating the impacts of a 50-acre "natural park" area on adjacent properties concluded that the increased value of residential properties could be 5% to 20% depending on their proximity. Here, based on home values of $210,000 to $240,000 and a property tax rate of 2% of the homes' values, nearby parkland generated an aggregate incremental property tax payment of $196,000 from 140 homes (TPL, 2010).

For commercial properties, the effects are similar. For example, commercial land along the Rose Kennedy Greenway abutting Boston's Big Dig project showed a value increase of 79% between 1988 and 2003. This was about double the increase in value of all assessed commercial properties in the city during the same period (Gies, 2009).

Although it is difficult to draw direct corollaries to the experiences of larger cities, these cases can serve as illustrative examples of the potential impact of ecological restoration on properties adjacent to the RMP. Because several state parks already exist within the RMP study area, the situation may not be completely analogous. However, considering the condition of some of those parks, and their fragmentation from one another and the community caused by the RMP, it is rational to assume that improvements associated with full removal and ecological restoration would have a similarly positive impact on adjacent property values. As of 2010, the full assessment value of residential properties within 500 feet of the RMP was approximately $46.6 million. A conservative 3% increase in residential property value as a result of their proximity to a restored, reconnected, and revitalized gorge rim would add an additional $1.4 million to the local tax bases of Niagara Falls and Lewiston. A full 5% increase in residential property values, consistent with the documented experiences of other cities as described above, would add an additional $2.3 million to the local tax base.

3. Increased Tourism/Ecotourism

As discussed in Part I, the tourism industry is one of the primary contributors to the regional economy, and the restoration of the gorge rim would present an opportunity for growth in the ecotourism sub-sector. As previously stated, ecotourism includes nature-oriented travel experiences and activities such as

birding, photography, hiking, kayaking, climbing, and biking. Although typically associated with tourism operations in developing countries, this opportunity could represent a new model for sustainable, nature-based ecotourism in an urban context. Ecotourism in the Niagara region may begin with the use of public parks or other natural areas, but its overall impact may be experienced in many different parts of the economy.

To illustrate this point, a TPL study looking at new spending from out-of-town visitors to Denver found that, of the 13.5 million out-of-town visitors in 2008, approximately 5.25% came because of the City's parks. A certain percentage of these stayed overnight at hotels, and others with friends and families. Using average spending figures from lodging, food, and incidentals, the study estimated that overnight visitors spent $33.08 million, visitors staying with friends and family spent $11.98 million, and day visitors spent $6.345 million. Using local sales and lodging tax figures, the study concluded that park-based tourism generated $3,048,860 in revenue for the City of Denver (TPL, 2010).

A similar study of the economic value of San Diego's parks was conducted in 2006. The San Diego Convention and Visitors Bureau estimated that 20% of tourists visited a park and that 22% of these visitors came to San Diego primarily because of its parks. It concluded that just under 5% of San Diego tourism was attributable to the city's parks, which were visited by 835,000 overnighters and 522,000 day visitors. Based on sales, meal and lodging taxes, the study concluded that these park visitors generated $8,579,000 in revenue to the city (Harnik and Belle, 2009).

The local and regional economic impact of parks and trails tourism is positive and well-established. Within the Niagara Frontier region, non-local visitors to state parks were estimated to have supported between 2,000 and 4,200 jobs from 2007 to 2008 alone. These positions generated between $75 and $154 million in employment income (Heintz et al., 2009). The positive impact of parks and trails tourism is evident in case studies from around the country:

- The development of the Mineral Belt Trail in Leadville (CO) contributed to a 19% increase in local sales tax revenues. Many business owners within the Town of Leadville noted that many of their customers were drawn to the area specifically because of the Mineral Belt Trail (Nadel, 2005).
- The Allegheny Trail in Allegheny County (PA) was credited with the development of ten new businesses in two towns along the length of the trail. Within the first five years following the creation of the trail, visitors from outside of the area were estimated to have spent an additional $3.2 million in the local economy as a direct result of the trail (Nadel, 2005).
- The Burlington Bikeway and Island Trail along the shoreline of Burlington (VT) was estimated to bring between $1 and $2.5 million into the local economy from non-local trail users in just five months of operation, from May to September, 2008 (Zhang et al., 2010).
- The total economic impact of tourists' expenditures related to use of the Virginia Creeper Trail in southwest Virginia has been estimated at approximately $1.6 million annually (Gill, 2001).
- Non-local users of parks, trails, and open space lands in Jefferson County (WI) have been estimated to spend approximately $15 million per year in the local economy. This spending supports approximately 420 jobs throughout the county, with an estimated total employee income of $6.2 million (Carleyolsen et al., 2005).
- Prior to its renovation, the Walkway Over the Hudson, a repurposed, pedestrianized railroad bridge in Poughkeepsie (NY) was anticipated to attract 267,000 total annual visitors (including 110,000 non-local visitors), and to generate $14.6 million in direct spending. In its first year of

operation, total visitation was estimated at 780,000, nearly three times the anticipated volume (Walkway Over the Hudson, 2011).

Recent overall visitation to Niagara Falls has been estimated at approximately 12 million travelers per year (NTCC, 2011). A previous analysis found that 9% of visitors to the Greater Niagara area participated in activities at public parks, and 6% participated in activities focused on nature (ERA, 2004). Using the estimated per person daily expenditures of $83.50 (ERA, 2004), if just 5% of the tourists visiting public parks were to extend their stay by one night as a result of the amenities offered by the restored Niagara gorge rim, the resulting additional trip expenditures would be $4.5 million. If 10% of these tourists extended their stay, the additional trip expenditures would be slightly more than $9 million. These revenues may be distributed through a number of economic channels, including hospitality services, retail businesses, and transportation services (Nadel, 2005).

Tourism industry studies show that ecotourists prefer multi-activity travel experiences, with a strong stated preference for walking, hiking, backpacking, and water-related activities (Wight, 1996b). Restoration of the Niagara gorge rim would open ecotourism-related opportunities for businesses and organizations to cater to these preferences, such as guide services, nature interpretation centers, or bicycle rental/sales/service providers. In addition, it would strengthen opportunities for programmatic connections with other ecotourism outlets throughout the region, as well as the many scenic and cultural parks located nearby. These include, but are not limited to:

- Tonawanda Wildlife Management Area
- Iroquois National Wildlife Refuge
- Tifft Nature Preserve
- Buckhorn Island Bird Conservation Area
- East River Marsh
- Gulf Wilderness Park
- Hyde Park
- Old Fort Niagara
- Erie Canalway Trail

Programmatic connections between these operations could include such cooperative ventures as joint marketing efforts or special event planning. Other local opportunities could be available in the nascent sustainable hospitality sub-sector, including LEED-certified bed and breakfasts or hotels, locally-sourced dining options, etc. (Levy and Duverger, 2010).

4. Increased Park Use

A study conducted for TPL in 2008 looked at how attendance numbers in city parks changed after eliminating automobile traffic. It concluded that, in many case, closing parks to vehicles dramatically increased park usage. As noted by the authors, "while automobiles bring people to parks, they also push them away." A study of Golden Gate Park in San Francisco in 2006 showed a 116% increase in park visitors on Sundays when the John F. Kennedy Drive is closed to cars, as compared to visitation on Saturdays when the road is open. This same study looked at San Antonio and the effect of banning cars on a one mile stretch of roadway in Brackenridge Park. The San Antonio Parks and Recreation Department indicated it saw a dramatic increase in usage when vehicular use was eliminated (Harnik and Belle, 2008).

While it is difficult to draw a direct corollary to attendance at Whirlpool and Devil's Hole State Parks, one can assume that attendance is negatively influenced to some degree by the presence of two lanes of traffic travelling at 45 miles per hour through or directly adjacent to the parks. NYSOPRHP estimated that a total of 352,764 people visited these two parks in 2010 (NYSOPRHP, 2011); even a modest annual increase of 10% would bring more than 35,000 additional visitors to use these parks. In addition, although the Restoration Concept proposed in this study would greatly reduce the overall footprint of cars throughout the park area, it would still allow for vehicular access to Whirlpool and Devil's Hole State Parks, so that current users would not be inconvenienced.

This increased visitation would have direct and tangible benefits to the local economy. When users of the Schuylkill River Trail in southeastern Pennsylvania were asked how the trail had influenced their personal spending, 78% of respondents indicated that they had purchased "hard goods" (such as bicycles, accessories, or clothing) because of their use of the trail. The average expenditure on these goods was valued at approximately $400. In addition, 50% of users indicated that they had spent an average of $9 per park visit on "soft goods" (such as food and drinks) (RTC, 2009).

5. Health Value

Some of TPL's work tried to quantify the health value of parks. In these studies, it is assumed that greater physical exercise will increase health and reduce certain medical problems (e.g. heart disease and diabetes) and their attendant costs. Using a "health benefits calculator," assigned cost differentials were calculated for those who exercise regularly and for those who do not, by age; these differentials were estimated at $351 for persons under 65 years old and $701 for persons over 65. In Denver, one study estimated that 171,363 persons exercised actively enough in parks to reduce their health costs. Using these assumptions, it concluded that a combined health savings of $64,955,500 was attributed to park use (TPL, 2010).

6. Quality of Life

In the competitive world of economic development, a community's amenities, such as parks and conservation areas, can be powerful tools to attract and retain businesses and quality employees. Richard Florida's book, *The Rise of the Creative Class* (2002), indicates that today's business leaders recognize that a good environment is ranked as the most important amenity in successfully attracting high technology workers. Many communities have recognized the importance of their quality greenspace in developing revitalization strategies to attract and retain businesses. According to a publication of the American Planning Association, "knowledge" workers are attracted to cities such as Seattle, Portland, San Francisco, Denver, and Austin which have quality open space and associated amenities, such as accessible outdoor recreation, hiking and biking trails, etc. (APA, 2002).

7. Traffic Benefits

As discussed in Part II of this study, with full closure of the RMP, the potential inconvenience to motorists who use this road would be a few extra minutes in travel time. There are several north/south roadways with excess capacity, which can be used as alternatives to the RMP. Because motorists have several choices, they will not all be drawn to a single roadway by default. Additionally, due to the very nature of RMP as a limited-access parkway which legally only accommodates noncommercial traffic, commercial traffic is already using routes other than the RMP. Therefore, closure of the parkway will not divert larger

commercial vehicles onto roadways through residential neighborhoods. Traffic from the RMP is anticipated to be dispersed across the existing road network, including Route 104/Lewiston Road, Highland Avenue, and Hyde Park Avenue. The percentage of distribution of vehicles onto each roadway would be difficult to predict. However, even if 100% of vehicles elect to use Route 104/Lewiston, the actual number of cars that may use this roadway would be relatively low and would not cause traffic on Route 104 to exceed capacity (see Appendix D).

While closure of the RMP would result in little, if any, noticeable impact on commuting times or traffic congestion, it will, on the other hand, remove vehicular activity from the gorge rim, thus enhancing safe public access to and appreciation of the Niagara gorge and rim. The traffic that becomes redirected through the City of Niagara Falls, although limited, would present potential customers and possible economic benefits to local businesses. In addition, the Restoration Concept includes streetscape improvements along local streets throughout the area, including Third Street, Pine Avenue, Cedar Avenue, Whirlpool Street, Willow Avenue, and Ontario Avenue in Niagara Falls, and South Fourth Street in Lewiston. Such improvements at key junctures along the park/urban interface will further enhance local property values, serve as important elements of local wayfinding, and strengthen adjacent neighborhoods' sense of place.

3. Restoration Concept Summary

There is no question that the Niagara gorge rim once served the region as an important, and at times critical, transportation route. Indeed, the history of the rim and the settlements that arose along its length provides ample evidence that the growth and prosperity of Niagara Falls have, at one time, benefited from such a use. However, the examination presented in this study should compel residents and regional decision-makers to reconsider whether these historic benefits remain valuable in a contemporary setting, where economic, environmental, and cultural patterns are dramatically different than they were when the RMP was constructed. While the RMP may still provide easy (albeit redundant) access between Lewiston and downtown Niagara Falls, this benefit is only experienced by the few drivers that actually utilize the roadway. In contrast, the disadvantages of a degraded environment, foregone economic opportunities, and a disconnected waterfront are experienced by the entire region.

As the community and its elected decision-makers weigh the merits of options for resolving those disadvantages, the option of full roadway removal and ecological restoration, as described in this Restoration Concept, should be considered as that which offers the most valuable benefits to every constituent within the region. This concept presents the greatest potential for substantial and quantifiable public benefits to the regional economy and environment. It will contribute to the revitalization of the area in a way that no roadway can, by improving the quality of the air and water, contributing to regional biodiversity, and inviting residents to reconnect with their waterfront, all while opening opportunities for economic development.

The Restoration Concept is graphically described throughout the illustrations that follow (Figure 3). The Index Sheet (Figure 3.0) provides an overview of the Restoration Concept throughout the entire Study Area. The subsequent figure sheets (Figures 3.1-3.6 from north to south, respectively) each describe a portion of the concept in further detail, demonstrating the potential location of the Niagara Rim Trail, cultural uses, restored meadows and woodlands, and streetscape enhancements. Landmarks are identified for the purpose of orientation.

2
Niagara Escarpment-Country Club to Robert Moses Niagara Power Plant

3
Devil's Hole State Park/Power Vista

4
Whirlpool/DeVeaux Woods State Parks

5
Elevated Niagara Rim Trail

Lewiston Pla
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Sheet 1 of 6

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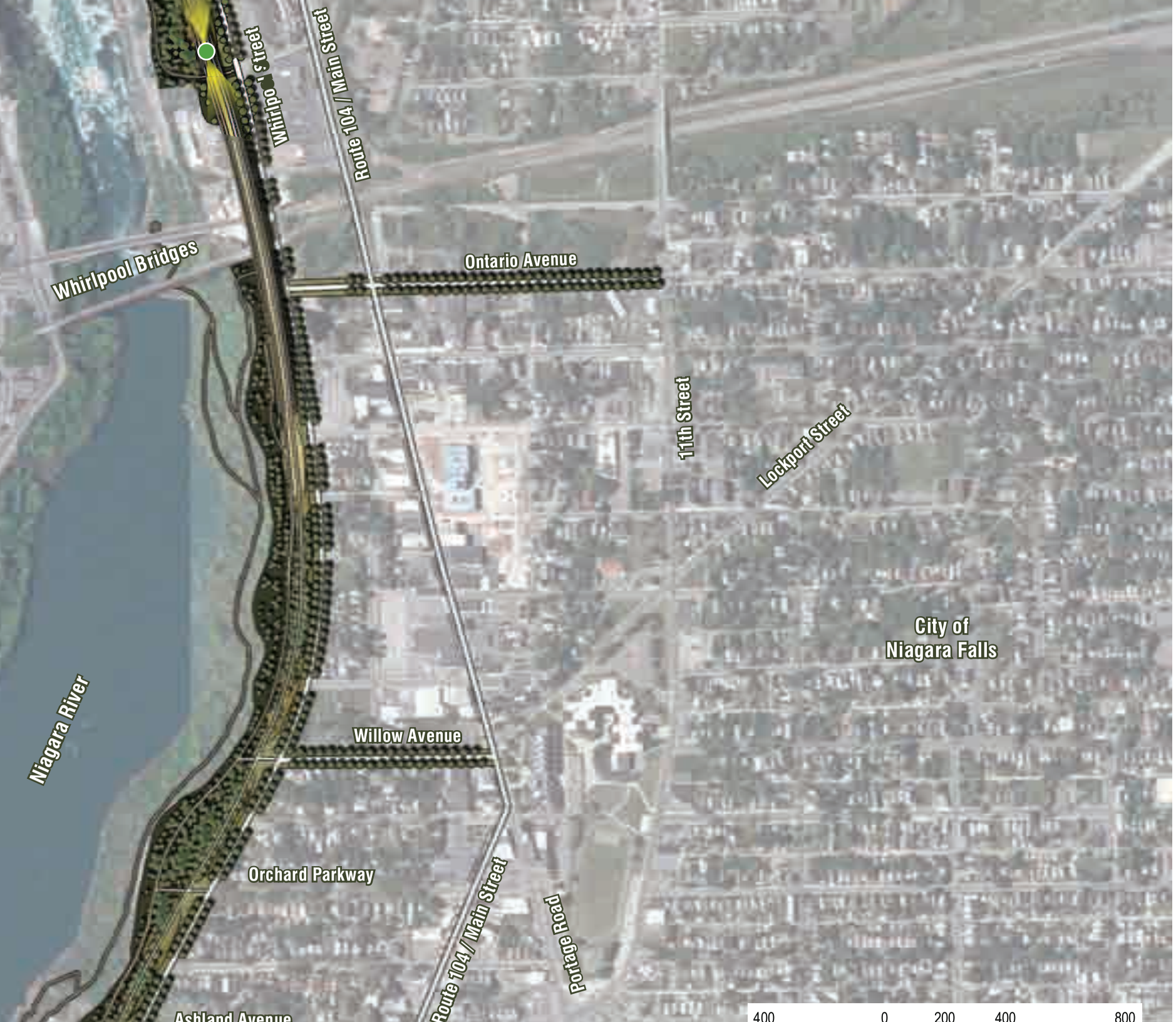

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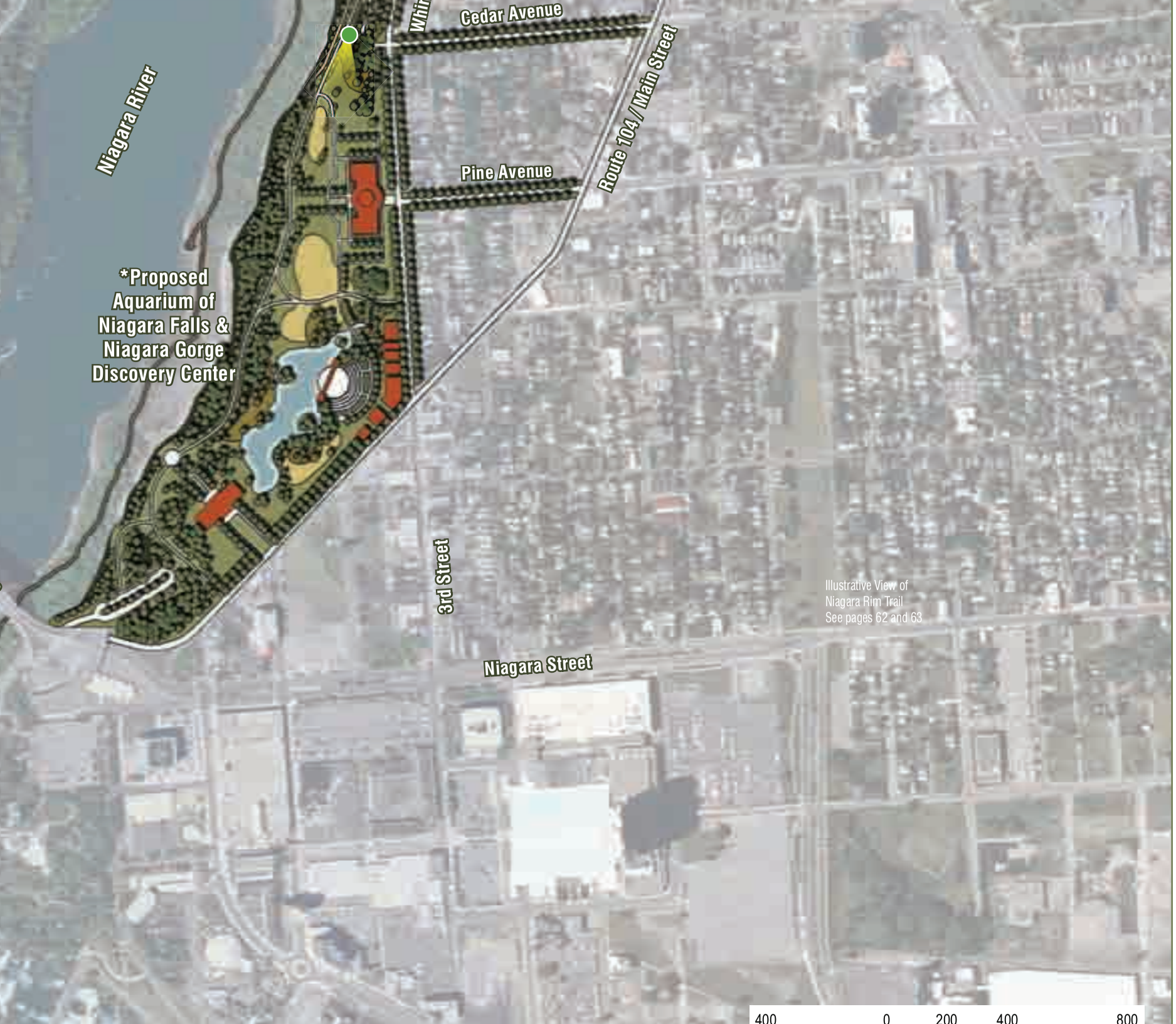

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Part IV: Implementation and Management: How It Can Happen

1. Implementation Approach

As illustrated in the Restoration Concept (see Part III), the desired future condition of the Niagara gorge rim is a native forest community, with small areas of successional communities and wetlands. The goal is to establish a restored natural ecosystem that supports a diversity of native plant and wildlife species. Eradication/control of non-native invasive species, and provision of opportunities for public access to, and appreciation of, the restored gorge rim and adjacent gorge are also important goals of the restoration effort. A study commissioned by NYPA acknowledged that small-scale (pilot-level) restoration efforts are likely to succeed within the gorge and rim, while at the same time concluding that large-scale community-level restoration is not likely feasible (TRC & Riveredge, 2008). However, this conclusion focused on the restoration of rare plant species and communities within the gorge, rather than the more common communities that are proposed for restoration on the gorge rim.

Although ambitious, the goals of community-level restoration on the gorge rim are not unrealistic or without precedent. A wide variety of disturbed/developed areas around the world have been restored to functional natural ecosystems. These sites include reclaimed mines, closed landfills and abandoned industrial properties (Barnhisel & Hower, 1997; Brenner et al., 1984; Nelson, 1995; Winterhalden, 1996). These precedents provide ample evidence that such restoration can occur in more severely degraded landscapes than what is found in the Study Area. Several examples of seemingly less challenging (though no less impressive) projects may also provide guidance with respect toward establishing and following long-term, iterative, and creative restoration protocols (Allison, 2002; FPLC, 2008; Ahern et al., 1992).

In any of these settings, the first step in the restoration process is to understand current and historic conditions and define, as specifically as possible, the communities that are to be re-established. Existing conditions on the gorge rim are described in Parts I and II of this study while the overall vision of the restored rim is presented in Part III. This section of the study describes a general approach to the restoration effort, followed by a description of proposed pilot projects and general guidance on how restored communities would need to be monitored and managed in the future.

Preliminary Steps

Prior to initiating ecological restoration on the gorge rim, an extensive amount of advocacy, funding support, data collection, and planning will be necessary to support the work going forward. These preliminary steps may include, but are not limited to the following:

1. Establish a "friends group" or similar advocacy organization that could work with local agencies, municipalities and funding sources to advance the project. Ideally this group could hire a restoration ecologist to oversee and guide progress of the project during all phases of planning, design, construction and management. This individual (or other support staff) could also pursue grants, participate in public outreach, and work with other stakeholders to build a broad coalition of support for the project.
2. Work with the NYSDOT and OPRHP to achieve consensus on RMP removal, get the project into the NYSDOT "pipeline" of future projects, and establish a time frame for further study, design and construction (i.e. demolition and removal).
3. Research funding opportunities (see below) and apply for specific grants/awards to initiate detailed planning and design work (including specific pilot projects).
4. Survey agency officials, local professionals, and volunteer stewards involved in the restoration of other appropriate sites along the gorge or gorge rim to collect the best available local knowledge regarding such projects (e.g. Niagara Parks' [Ontario] Paradise Grove oak savannah restoration).

5. Conduct a detailed site suitability analysis to determine opportunities and constraints on ecological restoration and pedestrian circulation as envisioned in the Restoration Concept included in this study.
6. Define specific pilot projects (see Section 3, below) to evaluate the feasibility of various restoration techniques. Identify specific locations for the projects and develop detailed designs and cost estimates.
7. Complete State Environmental Quality Review Act (SEQRA) review concurrent with design and implementation of RMP removal by the NYSDOT.
8. Establish baseline economic and demographic conditions for use in subsequent examinations of socioeconomic impacts of full ecological restoration and/or pilot projects.

Many of these substantive responsibilities would be identified and initiated as individual phases of work are defined and implemented.

Phasing of Restoration

Full removal and restoration of the RMP all at once would likely be impractical. Closing the entire parkway, physically removing it, and managing the restoration of extensive ecological systems all at once would be complicated, and require a major capital investment. A more practical and rational approach would be to phase the removal by segmenting the RMP into four phases to be removed sequentially over a five to 10 year time period. Consideration has to be given to the remaining segments of the RMP, ensuring that they remain functional until removed. Once the designated section of the RMP is removed, restoration of that area and construction of the recreational trail can take place in accordance with this Restoration Concept and implementation strategies set forth in Part IV of this Study. The following phasing plan for removal of the RMP is recommended:

- Phase 1: Remove the RMP from Findlay Drive north to where northbound vehicles have an option to exit onto Lewiston Road. This interchange will need to be reconfigured to allow full access to the remaining northern portion of the RMP.
- Phase 2: Remove the RMP from the Rainbow Bridge north to Findlay Drive. If the Discovery Center has not been improved according to the City's Comprehensive Plan, the northern point of John B. Daily Boulevard should end with a turnabout.
- Phase 3: Remove the RMP from the new interchange with Lewiston Road north to Interstate 190. The remaining segment of the RMP will allow for convenient transportation from Interstate 190 to points north along the RMP.
- Phase 4: Remove the RMP from Interstate 190 north to Center Street in Lewiston.

Potential Funding Sources

Like any other improvements to our aging, obsolete infrastructure, the restoration of the RMP will require funding sources over both the short and long terms. The context of fiscal responsibility within the Study Area is complex; it includes areas owned by agencies and authorities at different levels of government, and various agreements between those administrative bodies determine which body is responsible for any particular action. Given current pressures on public-sector budgets and the continued threat of further cuts, it is unlikely that a single dedicated, long-term funding source for full ecological restoration will be

identified in the very near future, either through general or program funds.

However, this should not deter efforts to implement the vision presented within this study. Instead, the complex network of land ownership and maintenance/stewardship responsibilities could present an opportunity for leveraged funds from a number of public and private sources. As the benefits are widely distributed across the local public and private economies, the funding sources used to achieve them should be equally as diverse. Incrementally, each source may only be sufficient to cover a portion of project costs; cumulatively, especially if dedicated to a central fund, they could have a greater impact. In addition, public agencies may be able to dedicate program funds for pilot projects as needed, or continuous funds based on the economic benefits each would receive. For example:

- City of Niagara Falls- In anticipation of increased property tax receipts, it may be possible for the City of Niagara Falls to issue tax increment financing bonds for small streetscape improvements at the locations of trailheads.
- Utility companies- As the project would have measurable economic benefits regarding stormwater treatment and demand for natural gas and electricity, local utilities could subsidize project costs in proportion to their avoided expenditures.
- Federal and state- In the event that a regulatory framework for ecosystem services markets (e.g. a carbon cap-and-trade system) were ever to be implemented at the state or federal level, the sequestration and air filtration mechanisms of the restored gorge rim may be an attractive option for industrial air pollution offsets.

The following regional, state and federal programs could also be used by state or local agencies for funding assistance:

- New York State Department of Transportation (NYSDOT): Transportation Enhancement Program
- Niagara River Greenway Commission
- United States Fish and Wildlife Service (USFWS): Partners for Fish and Wildlife
- National Park Service (NPS): National Heritage Area Program
- Clean Air Act, Section 103 and 105 grant programs (EPA)
- Clean Water Act, Section 319 Nonpoint Source Management Program grants (EPA)
- Clean Water State Revolving Fund (EPA)
- Endangered Species Act, Section 6 Cooperative Endangered Species Conservation Fund (Fish & Wildlife Service [FWS])
- Community Action for a Renewed Environment (CARE) grants (EPA)
- Great Lakes Restoration Initiative (EPA)
- Healthy Watershed Initiative (EPA)
- Migratory Bird Conservation Fund (FWS)
- Partnership for Sustainable Communities' open grant program (Housing & Urban Development [HUD], Department of Transportation [DOT], and EPA)
- Performance Partnership Grant program (EPA)
- Recreational Trails Program (Federal Highway Administration [FHWA])

- Targeted Watersheds Grant program (EPA)
- Urban and Community Forestry program (Department of Agriculture, Forest Service)

  Note: as of the time of this study's publication, the Urban and Community Forestry program and other cooperative forestry programs are being reorganized by the Forest Service.

The following private programs may also be of assistance in planning or implementing restoration initiatives, either to public agencies, non-profit organizations, or public-private partnerships:

- Parks & Trails of New York
- Alcoa Foundation Partnership for Trees
- The Conservation Alliance grant programs
- The Fund for Wild Nature
- iTreeBank (administered by TreeLink, and sponsored by the US Forest Service)
- The Kendall Foundation
- Kodak American Greenways Program (administered by The Conservation Fund)
- The Charles Stewart Mott Foundation's Freshwater Ecosystems program
- The Surdna Foundation's Sustainable Environments program
- National Association of Regional Councils' Green Infrastructure Initiative grants
- The Trust for Public Land's Conservation Campaign program

2. General Sequence of Restoration Activities

The following section outlines the general sequence of restoration events that would be anticipated during restoration of the gorge rim. Specific actions and guidelines to be followed during each of these events are listed in the approximate order they would be anticipated to occur. These events and specific actions describe what would need to be done for full restoration of the gorge rim, or for restoration of any discrete area along the rim. In general, restoration of native ecological communities along the Niagara gorge rim would be initiated by a detailed site evaluation that examines existing soil, drainage and vegetative conditions in the area to be restored. Results of the site evaluation would then be used to develop an actual restoration plan for the specific area under consideration. This plan and oversight of the actual restoration effort should be developed by a qualified restoration ecologist. In general, it is anticipated that this plan would outline the following sequence of events:

1. Removal of unnecessary pavement and "hardscape".
2. Restoration of natural topography and surface drainage conditions.
3. Restoration/improvement of soil conditions.
4. Eradication/control of non-native invasive species.
5. Establishment of native ecological communities.
6. Provide improved means of pedestrian access.

Specific actions that would be necessary for implementation of each of these restoration activities are presented below:

1. Removal of Pavement/Hardscape

- Achieve consensus on where pavement and other hardscape should be removed based on Restoration Concept Plan recommendations regarding access and circulation and the approval of State Parks and other stakeholders.
- Develop a demolition and removal plan for built facilities to be removed. It is anticipated that this plan would specifically identify where built features are to be removed, and specific excavation/demolition/removal techniques and specifications.
- Utilize appropriate heavy equipment to break up, excavate, and transport pavement and other hardscape debris to be removed. It is anticipated that backhoes with jackhammer attachments, bucket loaders, and dump trucks would be required to accomplish this work.
- Utilize a bulldozer with a deep ripping attachment to decompact soils as necessary in areas where pavement has been removed.
- Determine where removed material would be disposed. It is anticipated that most of this material would either be transported to an appropriate off-site location for disposal (e.g., a construction and demolition land fill), or used as millings or clean fill for other construction projects in the region. Some material may also be used as fill to reestablish natural contour/topography or achieve desired drainage conditions within the RMP corridor. Granular material used as road base could also be recycled for use as trail surfacing.

2. Restoration of Natural Topography and Drainage

- Prepare a topographic survey showing existing contours at one-foot contour intervals.

- Prepare a grading plan and specifications for the gorge rim that reestablish more natural contours and obliterate evidence of former road corridors and other paved areas. Use evidence of cut and fill along the edge of the gorge rim to provide guidance regarding the proposed grading. Use historic reports, drawings, and photos to identify former drainage courses and depressions that could be recreated to capture surface water runoff and create wetland conditions. Investigate the potential for daylighting original drainage courses that have since become contaminated.
- Develop a stormwater pollution prevention plan (SWPPP) as part of the State Pollution Discharge Elimination System (SPDES) general permit that would be required for this activity, since it would disturb greater than one acre of land.
- Utilize heavy equipment to excavate and fill as necessary to achieve the proposed grades indicated on the grading plan. Where adequate topsoil exists such soil should be removed and stockpiled for later use before establishing desired subgrade elevations.
- Amend topsoil as necessary (see next set of actions).
- Redistribute stockpiled topsoil, and bring in additional topsoil from off-site as necessary to reestablish final grades. All topsoil (from both on-site and off-site sources) should be free of seeds and rootstock from non-native invasive species.
- Implement the SWPPP. Install, maintain, and monitor all necessary sediment and erosion control measures in accordance with the requirements of the SWPPP. Installation of temporary stabilization/sediment and erosion control devices in any areas where grading is used to concentrate surface water runoff.

3. Restore/Improve Soil Conditions

- Collect soil samples from all areas to be restored and send out for laboratory analysis. Use results of this analysis to identify soil amendment needs.
- Decompact soils in all areas where pavement has been removed or where off-pavement pedestrian or vehicular traffic has resulted in soil compaction (as evidence by worn paths/lack of vegetation, or as indicated by penetrometer testing).
- Amend soil as necessary to achieve appropriate levels of organic matter and nutrients necessary to support native vegetation. Any organic soil amendments should be sterilized or otherwise guaranteed to be free of any seeds or root stock from non-native invasive species.
- Redistribute topsoil over regraded subgrade. A minimum of 6 inches of topsoil would be required in all locations where restoration activities are proposed, except under overstory trees that are being left in place.
- Install sediment and erosion control measures in accordance with the SWPPP.

4. Eradication/Control of Non-native Invasive Species

- Prior to initiation of restoration in any given area, conduct an inventory of non-native invasive species in the area. Determine which species are present, where they are located, their size and density.
- Based on the results of the non-native invasive species inventory, identify appropriate species-specific eradication/control measures. Mechanical, chemical, and/or biological control techniques

should all be considered.

- If chemical control measures (herbicides) are to be used, prepare specifications for chemical selection and application technique. Chemical selection should be based on its efficacy for the species in question and other considerations, including effect on non-target plant species, movement within the environment, and potential impacts on fish and wildlife. Choice of application technique should be based on the size/density of plants to be treated and the potential for impacts to non-target species. In general, the most selective technique should be used. For trees, this would typically involve direct application of herbicides to the exposed cambium (e.g., frilled bark or cut stump). For larger shrubs, a basal stem treatment might be appropriate, while for small shrubs, seedlings, and herbaceous species, a foliar application would generally be the best approach. In all cases, any herbicides used to eradicate or control non-native invasive species should be applied by NYSDEC – certified applicators in accordance with all label restrictions.
- Mechanical removal (cutting, girdling, grubbing, etc.) will often be the best approach for removing large trees or extensive stands of shrubs. However, a combination of mechanical and chemical treatment may be required to prevent resprouting/reseeding. A combination of girdling and application of herbicide to the frilled bark of standing trees can be used to kill these trees without necessarily removing them. Standing deadwood is an important element of forest habitat that can be created in this way. Similarly it may be desirable to cut trees, chemically treat the cut stump to prevent resprouting, and leave fallen deadwood in place. Fallen deadwood is also an important habitat component of mature forest ecosystems.
- Biological controls are limited in their applicability, especially for the species in question along the Niagara gorge rim. Use of the Galerucella beetle could be appropriate to control stands of purple loosestrife that may develop in wetlands and drainage corridors during restoration of the gorge rim.

5. Establishment of Native Ecological Communities

- Develop planting plans and specifications for the establishment of native plant communities. These plans should be developed by a landscape architect and/or restoration ecologist, experienced in the establishment of native plant communities.
- For forest communities these plans would generally involve planting whips or small container-grown saplings at irregular spacing throughout the area to be restored. In general the larger the trees that are planted, the higher the survival rate and the greater the cost. Plants should be obtained from the most local source available to assure that the genetic makeup of the plants is appropriate to the location. If local sources are not available, consider growing nursery stock utilizing on-site seed sources. Another possible option is the New York State Tree Nursery, which sells tree and shrub seedlings grown from New York seed sources. Species that make up the composition of the desired overstory community should be planted in the appropriate percentages. Specific placement should be guided by species-specific sunshine and moisture preferences (e.g., plant oaks and cherries on drier, sunnier sites, while maples and basswood prefer more moisture and shadier sites). Once the desired overstory tree species have successfully established, understory shrubs and herbaceous plants would be planted to create a multi-story forest.
- For successional communities, reestablishment of native species would typically involve application of a native seed mix. Standard native seed mixes are available from commercial nurseries, and can be used to develop upland meadows and shrubland, as well as wet meadows and scrub shrub

swamps. In addition, custom mixtures can be prepared using seeds available from commercial nurseries. Again, the most local source available is the most desirable.

- Tree and shrub planting specifications should include details on planting pit preparation, staking and watering. Trees and shrubs should be warrantied by the installer for at least one year (i.e., any dying during the first year would be replaced at no cost).

6. Provide Improved Means of Pedestrian Access

- Map all existing paved and unpaved pedestrian walks/trails and evaluate their condition. Compliance with standard trail recommendations for maximum grade, cross slope, surface material, and compliance with the Americans with Disabilities Act (ADA) should be part of this evaluation.
- Map all existing fences and railings and document their materials, condition, and the need for their occurrence in the locations where they have been installed. Compliance with ADA requirements should also be noted.
- In routing the proposed multi-use trail, give maximum consideration to the principal goals of restoration. Trails should not encroach on highly sensitive habitats. Trail redundancy and interference with restored hydrologic regimes should be minimized.
- Develop a set of trail and fence specifications for the proposed pedestrian access system along the Niagara gorge rim. These specifications should address maximum grades, cross slopes, appropriate materials, and construction/installation techniques. Preference should be given to materials that are durable, sustainable/low-maintenance, and consistent in aesthetic character with the natural communities being restored along the gorge rim. Compacted stone dust should be the preferred trail surface in most instances, while railings and fencing should generally be made of wood or recycled plastic material resembling wood.

3. Pilot (Demonstration) Projects

Due to the technical and financial challenges of undertaking ecological restoration on the entire gorge rim at one time, it is anticipated that this work would be initiated in phases. However, initiation of the first phase should be preceded by pilot projects designed to test the feasibility of various restoration and management techniques before implementing them on a large scale basis. Because of its central location within the study area and its status as an easily accessed tourist destination, Whirlpool State Park has been identified as an appropriate location for these pilot restoration projects. Whirlpool State Park is envisioned in the Restoration Concept as having direct vehicle access from Route 104 (via Findlay Drive) with visitor parking and pedestrian access to the proposed trail system. This area also has the added advantage of being accessible to adjacent neighborhoods to the west, and of having the existing DeVeaux Woods as a core area of primarily native vegetation that the restoration can build off of, and be compared to as a reference community.

Three specific types of pilot projects are recommended. These would include the following:

1. Management of existing woodlands,
2. Restoration of disturbed/developed areas to natural communities, and
3. Establishment of vegetation on paved surfaces.

Details regarding these proposed projects are presented below.

1. Management of Existing Woodlands

As mentioned in Part I of this study, DeVeaux Woods has some of the attributes of native old growth forest, but lacks, or is deficient in, certain features that would be expected in undisturbed native forest. Restoration and maintenance of a functional forest ecosystem is a major objective of the overall Restoration Concept for the gorge rim. To evaluate potential means of enhancing the ecological condition of forest stands on the rim, it is recommended that a pilot project be undertaken to evaluate the existing seed bank which could hold potential of seedling recruitment as volunteers and cost effectiveness of various forest management techniques. It is proposed that a discrete area of DeVeaux Woods, perhaps 0.5 acre in size, be managed to recreate more natural forest conditions. This project would involve removal of non-native species from the overstory and understory, improvement of foliage height diversity and structural complexity, and increasing the presence of standing and fallen deadwood. The preferred approach would be to accomplish several of these goals through the identification of non-native or unhealthy trees in the overstory and selectively killing or removing these trees to create small openings in the overstory canopy. Girdling these trees would create standing deadwood, while felling the trees would increase the fallen deadwood component of the forest. The increased penetration of sunlight that results from either treatment would enhance the growth of understory trees and shrubs. This would increase the foliage height diversity and structural complexity of the forest, thus enhancing its wildlife habitat value. It would also facilitate natural regeneration of trees and maintenance of a healthy understory in the forest.

If the selected area for the pilot project is either lacking understory vegetation, or has an understory dominated by non-native species, planting of native understory shrubs and saplings could also be included in the project. Understory planting should occur after the creation of openings in the overstory and/or removal of non-native species from the understory. As mentioned previously, planted vegetation should be exclusively native species obtained from local sources.

The effectiveness of the forest management techniques applied to the pilot area should be monitored over time. Different means of creating openings in the canopy (girdling vs. felling) and different approaches

to the eradication of non-native species (physical removal vs. chemical control) should be evaluated to determine their relative costs and benefits. Changes in plant species dominance, diversity, and density should also be measured, along with changes in the diversity or abundance of wildlife within the pilot area.

2. Restoration of Disturbed/Developed Areas

Restoration of the majority of the study area will involve conversion of disturbed and developed land into natural communities. The disturbed/developed areas to be restored include open mowed lawn, lawn areas under trees, and areas where pavement (primarily the RMP) has been removed. In most of these areas, the restored community is proposed to be mixed deciduous forest, although some areas of meadow, successional shrubland, and wetland are also anticipated. To evaluate the feasibility of restoring various disturbed/developed areas to natural communities, it is recommended that an area between Whirlpool State Park and DeVeaux Woods (where the RMP and the DeVeaux Woods trail intersect) be identified that includes the three disturbed conditions described above. The pilot project in this area (perhaps an acre in size) would involve removal of pavement, soil restoration, and planting with native species, as described in the previous section. In the area where pavement is removed, the primary effort to be evaluated would be the creation of soil and drainage conditions suitable for growth and development of native plant communities. Different types and amounts of topsoil and subsoil/base material should be evaluated, along with different site preparation techniques (decompaction, etc.). In other areas, less significant soil amendment, aeration, and/or top dressing may be effective in restoring more natural soil conditions and facilitating plant growth. Once soils have been restored, a variety of ? and grasses should be seeded across all bare soils that are not sodded. A combination of seeding, planting of bare-root seedlings, and planting of larger container-grown stock should be used to evaluate differential costs and rates of survival and growth. Again, preference should be given to locally-grown native species, consistent with the species composition of the desired forest community. The same general approach should be taken in reestablishing non-forested native communities, except the trees would be replaced with native shrubs and/or herbaceous plant species.

The replanted communities would be monitored to determine which soil restoration/improvement techniques are most effective in promoting healthy plant growth. Monitoring would also determine which plant species and planting technique results in the best rates of survival and growth over time. This effort would also indicate where replanting and/or control of non-native species is required. The effectiveness of various techniques for the control or eradication of non-native species from the restored areas should also be evaluated as part of the monitoring effort.

3. Establishment of Vegetation on Paved Surfaces

As indicated in Part III of this study, the restored gorge rim is anticipated to include an elevated portion of the RMP to allow views of the Niagara River and gorge, provide a dynamic pedestrian experience, and avoid the expense and logistical difficulties associated with removal of the elevated highway and restoration of the developed areas beneath it (several of which are anticipated to remain in operation over the long term). The Restoration Concept envisions the conversion of the elevated portion of the RMP into a vegetated corridor featuring a pedestrian walkway surrounded by native herbaceous and shrub species. To establish this vegetation on top of the existing infrastructure, techniques similar to those used to create "green roofs" would be utilized.

To test the feasibility of this restoration technique on site, it is proposed that a pilot project be undertaken

on an area of currently unused or under-used pavement, either a parking lot of a portion of the closed lanes of the RMP that runs between Whirlpool and DeVeaux Woods State Parks. The pilot project would involve conversion of a relatively small area of pavement (perhaps 0.25 acre) to natural meadow and shrub vegetation. The vegetation would be established in a layer of soil, placed over drainage and waterproof layers. A minimum of 6-12 inches of local topsoil would be placed on top of a drainage course, which depending on the slope of the area, could consist of troughs, porous mats, or coarse materials such as gravel, pumice, or shale. The drainage layer would be placed on a waterproof layer to protect the existing pavement from water damage and root penetration (as would be required on elevated sections of the RMP where existing developed areas would remain underneath). The topsoil would then be seeded with a native seed mix featuring species that prefer full sunlight, and are tolerant of shallow soils and drought conditions. Test plantings of different native shrubs could also be included in the pilot plot. After planting, seed germination and plant growth will be dependent on scheduled watering and natural precipitation. Consequently, seeding should be conducted during favorable planting seasons, such as early spring and fall when cooler temperatures and regular rainfall facilitate seed germination and plant establishment.

Once established, the pilot area should be monitored to evaluate the successful germination, survival, and growth of different plant species, and to document invasion by non-native species. Should non-native species begin to dominate, various means of controlling or eradicating these species should be evaluated as part of the monitoring effort.

4. Management Recommendations

It is important to understand that after initiating restoration of natural communities on the gorge rim, long-term monitoring and active management of these communities will be required. The basic approach to short-term monitoring was outlined in the discussion of pilot projects in the previous section. However, long-term monitoring will also be required to evaluate development of these communities over time. Given the anticipated use of the area, the plant communities that exist in the adjacent gorge and residential neighborhoods, and the results of restoration efforts elsewhere, it is anticipated that this monitoring will indicate the need for on-going management/human intervention to assure the establishment and persistence of these communities. This section outlines anticipated future management activities in the following categories:

- Forest Management
- Maintenance of Successional Shrubland
- Maintenance of Meadows/Grasslands
- Management of Wetlands
- Trail Maintenance
- Management of Public Use Areas

Examples of management recommendations in each of these categories are presented below.

1. Forest Management

- Gradually remove all large non-native trees (such as Norway maple) from forest stands. The increased light and growing space provided by tree removal will stimulate the growth of thick understory vegetation and will encourage fruit and seed production. Along with improving structural diversity and wildlife food and cover availability, thick understory vegetation will also discourage off-trail travel. Overstory removal can be accomplished by cutting or girdling selected trees. The latter may be preferable in that it increases the snag component in these areas.
- Do not remove trees with active wildlife dens, nests, or cavities.
- Only remove standing deadwood (trees and branches) in areas where it is necessary from the standpoint of safety.
- Protect and manage exceptionally large trees. Such trees typically produce large quantities of seed and have abundant deadwood and cavities, all of which benefit wildlife. Selective removal of adjacent vegetation will reduce competition and increase vigor, while at the same time providing improved views of these impressive trees.
- Protect and maintain an adequate supply of snags and den trees. In general, within mature forested areas there should be a minimum of two living trees with cavities suitable for use by wildlife, and an equal number of large snags per acre. Girdling can be used to create snags where adequate numbers are lacking. Girdled trees should be at least 20 feet tall and have a minimum diameter of 8 inches. Only common or non-native species should be girdled, and an attempt should be made to select unhealthy or over-crowded individuals. The snags should be uniformly distributed to assure maximum use, as many cavity nesters have strict territorially requirements. Snag management should be given preference over the provision of artificial nest boxes.
- Monitor forested areas adjacent to private yards to document evidence of encroachment or dumping of yard waste on public land.

2. Maintenance of Successional Shrubland

- Establish and maintain brushy edges around open meadows and forested stands. This can be accomplished through the encouragement of native shrubs and by planting. Mowing should be used to create an undulating irregular edge rather than an abrupt border.
- Maintain successional shrub communities by mowing with a brush hog once every 5-10 years. Mowing should be done in the late fall, after the nesting season and fall migration.

3. Maintenance of Meadows and Grasslands

- Monitor meadow areas for invasion by non-native species and/or woody vegetation, and control the proliferation of these species through various control mechanisms, including physical removal and selective chemical control.
- Maintain a dominance of herbaceous species by mowing meadows once every 1-2 years. Mowing should be conducted during the late summer or fall to avoid impacting nesting grassland birds and juvenile mammals.
- Monitor the use of open areas by uncommon bird species such as Henslow's sparrow, grasshopper sparrow and eastern bluebird.
- Maintain scattered clumps of shrubs and standing trees (both alive and dead) along meadow edges to provide singing and foraging perches for birds and to improve bird watching opportunities.
- Active recreation (ball playing, Frisbee throwing, etc.) should not be allowed in restored meadow areas, unless this use occurs exclusively in winter (e.g., cross country skiing) when damage to native plants and disturbance of wildlife can be avoided.
- In selected open field/meadow areas, consider planting and/or encouraging herbaceous species that are attractive to butterflies. Common milkweed, Joe-Pye weed, butterflyweed, field thistle, and wild geranium provide food and cover for butterflies and/or caterpillars.
- Plant and/or preserve small patches of native conifers in the corners of along the edges of open fields and shrub thickets. If thinned to a 10 by 10 foot spacing, lower branches will live longer and herbaceous vegetation will grow between the trees. This will provide good wildlife cover.

4. Management of Wetlands

- Monitor existing and restored wetland communities on a regular basis to confirm the establishment and maintenance of wetland hydrology and a dominance of native hydrophytic plant species. Document the presence of invasive non-native plant species such as European buckthorn, honeysuckles, common reed, purple loosestrife, and reed canary grass.
- To the extent that wetland hydrology requires enhancement, identify potential new sources of surface water run-off and means of directing this water to the wetlands and holding it there.
- If invasive non-native species are documented in the wetlands, immediately implement various control measures to discourage the growth of these species.
- Encourage a buffer of trees and shrubs to develop along wetland edges to minimize human disturbance and provide foraging and nesting cover for songbirds.

5. Trail Maintenance

- Provide a trail map and marking system that allows users to easily navigate the gorge rim and access trails that lead into the gorge and down to the Niagara River.
- Provide signage at trail heads that describes allowable and prohibited trail uses.
- Maintain surface condition and drainage on the main multi-use trail to assure safe passage by all user groups.
- Spurs (secondary trails) off the main train should be surfaced with natural materials (stone dust or shredded bark) that prevent soil erosion and facilitate use during all seasons.
- Monitor the trail system for evidence of unauthorized (e.g., motorized vehicle) use.
- Use plantings or felled trees to block access to gorge trails that are highly eroded, unsafe, or located in ecologically sensitive areas.
- Provide wildlife viewing opportunities by maintaining scattered small openings along the trails.

6. Management of Public Use Areas

- Provide signature signage for way finding purposes. Describe access and connections to trails in the gorge and inform visitors of safe activities.
- Regular mowing (to maintain lawn) should be restricted to the margins of access driveway, parking areas, shoulders of the Niagara Rim Trail, and trail heads.
- Develop and maintain interpretive signage highlighting the restoration efforts that have been undertaken, and the goals of such practices. Interpretive displays should be placed at appropriate locations along various trails and public use areas along the rim.
- Except for the selective use of herbicides to control invasive non-native species, refrain from the use of pesticides, as these chemicals may be toxic to fish and wildlife, or indirectly harmful through the elimination or contamination of insects and other invertebrates that serve as pollinators and/or a food source for other wildlife species.
- Refrain from using chemical fertilizers, as these could elevate nutrient input to adjacent wetlands and the Niagara River.
- Any landscape plantings in public use areas should utilize only native trees and shrubs. Ideally, these plantings should enhance vegetative diversity and provide wildlife food and cover.
- Any picnic facilities or seating areas should be conveniently located near trailheads and selected overlook areas along the multi-use trail.

Following the management recommendations outlined above would allow the restored gorge rim to develop and persist as a sustainable natural ecosystem. If monitoring indicates that this management is effective, the required level of active management should decrease over time. However, because of the significant past disturbance this area has received, along with the existing plant communities and adjacent land uses that occur in the area, it is anticipated that some level of active management/intervention will be required over the long-term. While this represents a significant commitment of financial and human resources, the results have the potential to more than off-set this commitment and provide tangible, long-term environmental and economic benefits to the Niagara region.

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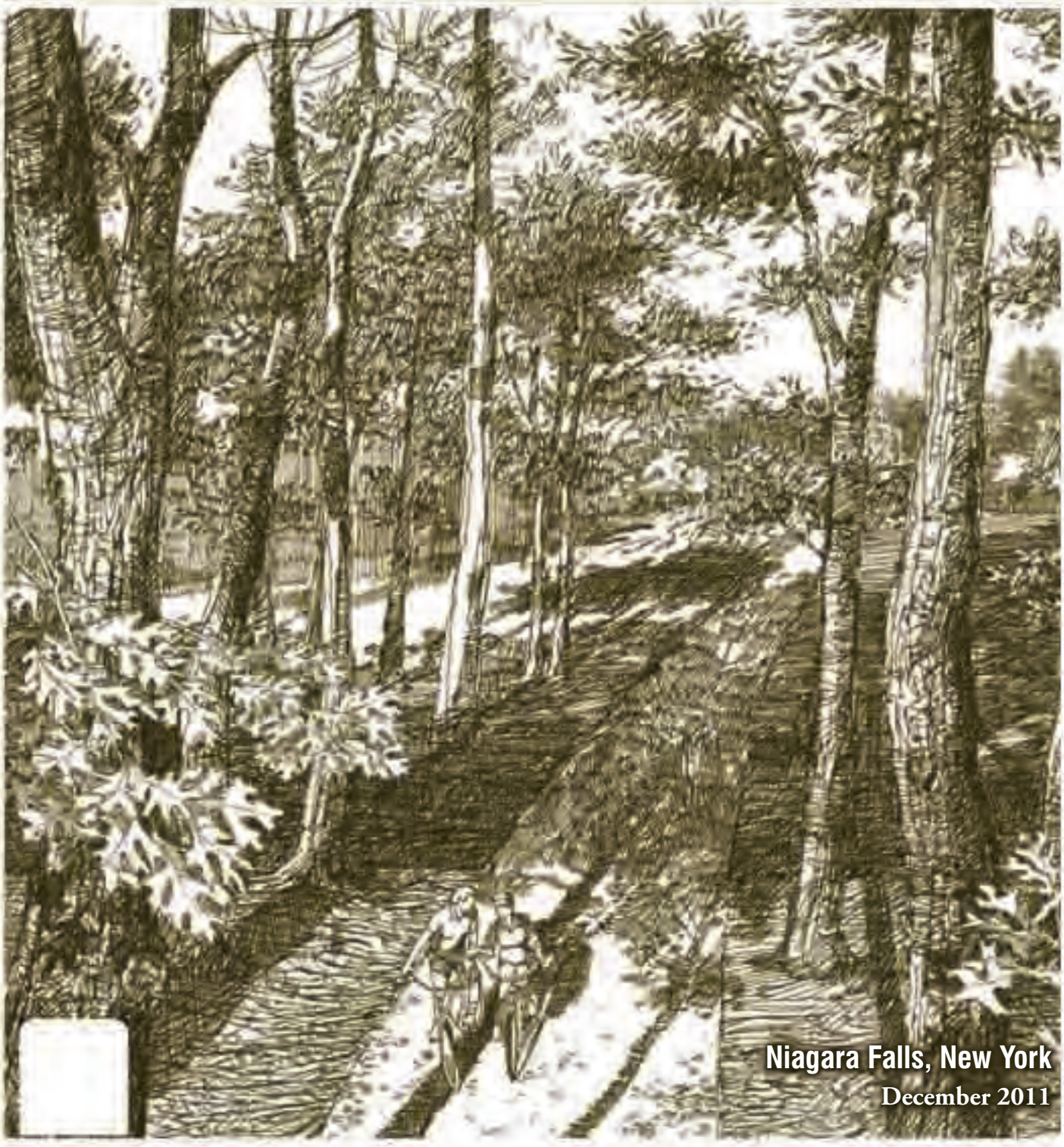
Regional Economic Growth Through Ecological Restoration of the Niagara Gorge Rim



Niagara Falls, New York

December 2011

Appendices

Appendix A: Soil Characteristics

Appendix A: Soil Series Within the Study Area.

Soil Series (Map Symbol)	Main Characteristics
Cayuga and Cazenovia silt loams (CcB)	• Moderately drained to well drained • Seasonal water table at depth of 1½ -2 feet • Underlain by loamy calcareous glacial till at a depth of 20-36 inches • 2% to 6% slopes • Approximately 14 acres in Study Area, found on rim in the Artpark
Collamer silt loam (CnA and CnB)	• Moderately well drained • Seasonal water table at depth of 1½ -2 feet • Formed in neutral to calcareous lacustrine deposits • 0% to 6% slopes • Approximately 49 acres in Study Area, on rim in the Artpark and along the Robert Moses Parkway
Cut and fill land (Cu)	• Result from construction operations • Original soil has been stripped and removed, or covered with fill materials to a depth of 3 feet or more • A mixture of soil materials with no profile development • Require onsite investigation if changes in land use are contemplated • Common within Study Area (approximately 175 acres), both along rim and in gorge

Soil Series (Map Symbol)	Main Characteristics
Dunkirk and Arkport soils (DvD3)	• Well drained • Seasonal high water table generally at a depth >3 feet • Formed in sandy deltaic and limy lacustrine deposits • 12% to 20% slopes, eroded • Uncommon in Study Area, found on rim in the Artpark
Hudson soils (HuF3)	• Rapid runoff and slow permeability • Found in long, narrow strips along streambanks • 20% to 45% slopes, eroded • Uncommon in Study Area, found in gorge within the Artpark
Made land (Me)	• Areas that have been filled with stones, masonry materials, bricks, and other waste • Thin mantle of soil material, but no profile development • Require onsite investigation to determine suitability for other uses • Approximately 27 acres in Study Area, both in gorge and on rim, immediately south of the Niagara Power Project
Otisville gravelly sandy loam (OsB)	• Excessively drained • Seasonal high water table generally at a depth >5 feet • Formed in sand and gravel glacial beach deposits • 3% to 8% slopes • Approximately 25 acres in Study Area, found on rim in the Artpark
Quarries (Qu)	• Uncommon in Study Area, found on rim in the Artpark

Soil Series (Map Symbol)	Main Characteristics
Rhinebeck silt loam (RbA)	• Somewhat poorly drained • Seasonal high water table at depth of ½ to 1 foot • Formed in calcareous lacustrine deposits • 0% to 2% slopes • Uncommon in Study Area, found on rim in the Artpark
Rock land, steep (RoF)	• Slopes exceed 15% • Approximately 46 acres in Study Area, primarily in gorge, but also on rim in the Artpark

Source: USDA Soil Conservation Service, 1972.

Appendix B: Ecological Inventory of Niagara Gorge and Rim

ECOLOGICAL INVENTORY
OF THE
NIAGARA RIVER GORGE AND RIM

Prepared For: Wild Ones: Native Plants, Natural Landscapes
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August 2010

TABLE OF CONTENTS

FIGURES

APPENDICES

1.0 INTRODUCTION

Environmental Design & Research, Landscape Architecture, Planning, Environmental Services, Engineering and Surveying, P.C. (EDR) was retained by Wild Ones Niagara to prepare an ecological inventory of the Niagara River Gorge and Rim Study Area (Study Area). The Study Area consists of approximately 702 acres, and is located in the City of Niagara Falls, the Town of Lewiston, and the Village of Lewiston in Niagara County, New York (see Figure 1). This report describes the existing ecological resources within the Study Area, both in the gorge and along the rim.

1.1 OBJECTIVES

The purpose of this reconnaissance-level ecological investigation is to consolidate and verify ecological data obtained from existing sources. Information is presented on the physiographic setting, vegetation, wildlife, and aquatic resources of the Study Area.

1.2 STUDY AREA DESCRIPTION

The Study Area encompasses the Niagara River gorge and rim from the Rainbow Bridge in the City of Niagara Falls to the northern edge of the Earl W. Brydges Artpark State Park in the Village of Lewiston (see Figure 2). The western limit of the Study Area is the eastern edge of the Niagara River, while the eastern limit of the Study Area is the urbanized neighborhoods immediately adjacent to the Robert Moses Parkway, within the boundaries of the City of Niagara Falls and the Town of Lewiston. The Study Area includes the Earl W. Brydges Artpark State Park (Artpark), Devil's Hole State Park, Whirlpool State Park, DeVeaux Woods State Park, and the northern portion of Niagara Falls State Park. The Study Area also includes the tailrace of the Niagara Power Plant, operated by the New York Power Authority (NYPA).

1.3 METHODS

Information presented in this report is based upon literature and database reviews, agency consultation (Appendix A), and reconnaissance-level field surveys.

Existing sources of information consulted include the New York Natural Heritage Program (NYNHP) database and conservation guides, New York State Department of State Significant Coastal Fish and Wildlife Habitat data, New York State Breeding Bird Atlas data, Audubon Christmas Bird Count data, New York State Reptile and Amphibian Atlas data, National Wetland Inventory (NWI) and New York State Department of Environmental Conservation (NYSDEC) Freshwater Wetland Maps, the Niagara County Soil Survey, USGS topographic maps and digital terrain models, New York State

Museum (Geologic Survey) maps and files, historic and current aerial photography, Audubon Important Bird Area (IBA) data, NatureServe Explorer data, New York Power Authority (NYPA) documents, and Patricia Eckel's Niagara Gorge studies.

Reconnaissance-level field surveys of the Study Area were conducted by EDR botanist Sara Stebbins on May 12-13 and June 9, 2010, and by EDR wildlife biologist Bill Trembath on June 9, 2010. Vegetative communities within the Study Area were mapped based on review of existing data sources (Evans et al., 2001; ASA & E/PRO, 2005; TRC & Riveredge, 2008), interpretation of aerial photography, and field verification. Community boundaries were then digitized using a Geographic Information System (GIS). Plant species were determined through visual observation, collection, and identification using field guides and dichotomous keys (Newcomb, 1977; Gleason & Cronquist, 1991; Flora of North America, 1993+; Holmgren, 1998). Mammal species within the Study Area were identified during field review based on direct observation of individuals or sign (tracks, bones, scat, etc.). Bird species were identified through both visual and auditory observation in early June, during the peak of the breeding (singing) season for most avian species. The presence of reptiles and amphibians was documented through searches of wooded areas, seeps, and streams.

2.0 PHYSIOGRAPHIC SETTING

The Study Area is located within the Great Lakes Plain Ecozone, which is a large, low terrain area covering 7,206 square miles in New York State, adjacent to Lakes Erie and Ontario. Except for the drumlins between Syracuse and Rochester, the plain has little local relief, and is dominated by an erosional topography of glacial till modified by moraines, shoreline deposits, and drumlins. The Great Lakes Plain Ecozone is divided into four subzones: the Erie-Ontario Plain, Drumlin, Oswego Lowlands, and Eastern Ontario Plain. The Erie-Ontario Plain sub-zone extends along the shores of Lakes Erie and Ontario in western New York, and includes the Study Area. Elevation within this sub-zone ranges from approximately 245 feet to about 800 feet above mean sea level (AMSL). Much of the area is farmland or developed; woodland comprises approximately 15% of the Erie-Ontario Plain sub-zone (Andrle & Carroll, 1988; NYSDEC, 1996; Edinger et al., 2002).

2.1 TOPOGRAPHY

Elevation in the Study Area ranges from approximately 260 feet AMSL along the Niagara River in the Artpark, up to approximately 600 feet AMSL on the rim in DeVeaux Woods State Park. Topography within the gorge consists of steep cliffs. Along the rim, topography is more level, but generally slopes upward towards the eastern edge of the Study Area (USGS, undated). Gorge depth averages 209 feet from the surface of the river (Eckel, 2004).

2.2 GEOLOGY

Prominent within the Study Area, the Niagara Escarpment is an ancient geological formation that runs generally east-west through the Great Lakes region from New York through Ontario and Michigan west to Wisconsin. The escarpment originated approximately 430-450 million years ago, as marine sediment deposits at the edge of a shallow, warm sea. The “capstone,” or surface rocks in the escarpment, is comprised of weather-resistant dolostone. Differential erosion of adjacent softer rock such as shale and sandstone eventually exposed the cliffs of escarpment (NEC, 2010).

The formation of Niagara Falls is an ongoing process that began with the retreat of the Wisconsin glacier approximately 12,000 years ago. Melting ice from the glacier drained into what is now the Niagara River, and plunged over the edge of the Niagara Escarpment near Lewiston. Gradual erosion through the force of the river water, annual freezing/thawing cycles, and rockfall have resulted in the falls moving upstream to their current location (DNC, 2010).

Surfical geology in the central and southern portions of the Study Area is comprised of variably textured glacial till, during and shortly after the last ice age. Bedrock of the Lockport dolomitic limestone formation is exposed at the surface at the escarpment, with lacustrine beach deposits found to the north in the Artpark, and a terminal moraine paralleling the escarpment to the south (NYS Geological Survey, 1999; USDA Soil Conservation Service, 1972). Soils in the Study Area formed in these glacial materials. Glacial till consists of the rocks and soil materials that were picked up and deposited by the glacier as it moved slowly southward. As the ice began retreating north again, coarse materials were deposited in the form of outwash, while melting waters carried fine soil materials into water bodies, which settled out to form lacustrine deposits (USDA Soil Conservation Service, 1972).

2.3 SOILS

When conducting the Niagara County Soil Survey, soils scientists conducted detailed and/or reconnaissance-level soil surveys, depending on location. The reconnaissance-level soil surveys generated soil association maps, while the detailed soil surveys generated more specific mapping units. Due to early human settlement of the area, detailed soil mapping was not conducted throughout much of the City of Niagara Falls, including the southern portion of the Study Area. There are two soil associations mapped within the Study Area, the Rhineback-Ovid-Madalin association and the Odessa-Lakemont-Ovid association (USDA Soil Conservation Service, 1972). Each of these are described in greater detail below:

Rhineback-Ovid-Madalin Association – This soils association occurs in the Study Area north of the limestone escarpment. These soils are deep, somewhat poorly drained to very poorly drained soils having a fine textured or moderately fine textured subsoil that is predominantly brown or olive in color. The surface layers are usually comprised of silt loam or dark silt loam, with silty clay or silty clay loam subsoils. Underlying materials are varved silt and clay, or loamy glacial till (USDA Soil Conservation Service, 1972).

Odessa-Lakemont-Ovid Association -- This soils association occurs in the Study Area south of the limestone escarpment. These soils are deep, somewhat poorly drained to very poorly drained soils having a fine textured or moderately fine textured subsoil that is predominantly reddish in color. The surface layers are usually comprised of silty clay loam or silt loam, with silty clay or silty clay loam subsoils. Underlying materials are clay and silt, or loamy glacial till (USDA Soil Conservation Service, 1972).

As described above, detailed soil mapping was only conducted in the northern portion of the Study Area (see Figure 3). In the Soil Survey of Niagara County, regions not subject to detailed examination were mapped as Ua, or Unsurveyed area. Such areas comprise approximately 353 acres, or 50% of the Study Area. The table below summarizes the characteristics of the soil series mapped within the Study Area.

Soil Series Within the Study Area.

Soil Series (Map Symbol)	Main Characteristics
Cayuga and Cazenovia silt loams (CcB)	• Moderately drained to well drained • Seasonal water table at depth of 1½ -2 feet • Underlain by loamy calcareous glacial till at a depth of 20-36 inches • 2% to 6% slopes • Approximately 14 acres in Study Area, found on rim in the Artpark
Collamer silt loam (CnA and CnB)	• Moderately well drained • Seasonal water table at depth of 1½ -2 feet • Formed in neutral to calcareous lacustrine deposits • 0% to 6% slopes • Approximately 49 acres in Study Area, on rim in the Artpark and along the Robert Moses Parkway
Cut and fill land (Cu)	• Result from construction operations • Original soil has been stripped and removed, or covered with fill materials to a depth of 3 feet or more • A mixture of soil materials with no profile development • Require onsite investigation if changes in land use are contemplated • Common within Study Area (approximately 175 acres), both along rim and in gorge
Dunkirk and Arkport soils (DvD3)	• Well drained • Seasonal high water table generally at a depth >3 feet • Formed in sandy deltaic and limy lacustrine deposits • 12% to 20% slopes, eroded • Uncommon in Study Area, found on rim in the Artpark
Hudson soils (HuF3)	• Rapid runoff and slow permeability • Found in long, narrow strips along streambanks • 20% to 45% slopes, eroded • Uncommon in Study Area, found in gorge within the Artpark
Made land (Me)	• Areas that have been filled with stones, masonry materials, bricks, and other waste • Thin mantle of soil material, but no profile development • Require onsite investigation to determine suitability for other uses • Approximately 27 acres in Study Area, both in gorge and on rim, immediately south of the Niagara Power Project

Soil Series (Map Symbol)	Main Characteristics
Otisville gravelly sandy loam (OsB)	• Excessively drained • Seasonal high water table generally at a depth >5 feet • Formed in sand and gravel glacial beach deposits • 3% to 8% slopes • Approximately 25 acres in Study Area, found on rim in the Artpark
Quarries (Qu)	• Uncommon in Study Area, found on rim in the Artpark
Rhinebeck silt loam (RbA)	• Somewhat poorly drained • Seasonal high water table at depth of ½ to 1 foot • Formed in calcareous lacustrine deposits • 0% to 2% slopes • Uncommon in Study Area, found on rim in the Artpark
Rock land, steep (RoF)	• Slopes exceed 15% • Approximately 46 acres in Study Area, primarily in gorge, but also on rim in the Artpark

Source: USDA Soil Conservation Service, 1972.

Detailed soil surveys have been conducted in approximately half of the Study Area. Of the mapped portions of the Study Area, approximately 26% are comprised of silt loams and gravelly sandy loam (CcB, CnA, CnB, DvD3, HuF3, OsB, and RbA); 13% by steep rockland (RoF); and 61% are comprised of map units that are very disturbed and lack soil profile development (Cu, Me, and Qu). The latter, disturbed map units are concentrated along the rim, and are generally the result of construction operations (e.g., Robert Moses Parkway, the tailrace of the Niagara Power Plant, and adjacent areas). The original soil in these areas has been either stripped away and removed, or compacted and covered with fill materials to a depth of 3 feet or more. According to the USDA Soil Conservation Service (1972), these areas require detailed on-site investigations of the specific soil conditions "if changes in land use are contemplated" in order "to determine suitability for other uses."

2.4 HYDROLOGY

The hydrology of the Niagara River between the intakes and tailraces is largely controlled by the diversion of water for both U.S. and Canadian hydroelectric projects, although natural features such as cross sectional area, sinuosity, and gradient also play a less significant role. There are two regulatory constraints on water level fluctuations and flow: the 1950 ***Treaty Between Canada and the United States of America Concerning the Diversion of the Niagara River*** (Treaty), and the 1993 ***Directive of the International Niagara Board of Control*** (Directive). The Treaty establishes a seven-month tourist season from April through October, during which a minimum flow of 100,000 cubic feet per second (cfs) is required during hours of peak visitation. A minimum flow of 50,000 cfs is required during non-peak hours within the tourist season, and during the non-tourist season from November

through March. The Directive requires that the International Niagara Control Structure be operated within certain water level restrictions, as monitored at the Material Dock Gauge in the Chippewa-Grass Island Pool (ASA & E/PRO, 2005).

Water resources are somewhat limited within the Study Area, aside from the Niagara River at the western edge. Surface water features include Fish Creek and Bloody Run, which drain into the Niagara River in the Earl W. Brydges and Devil's Hole State Parks, respectively. Groundwater in the Study Area is contained within the Lockport Group, a fractured bedrock aquifer (URS & GSE, 2005). Discharge features on-site include seeps and springs. Many of the seeps along the cliff face discharge onto "shelves" in the calcareous cliff community, and support small patches of common reed. Numerous stormwater runoff drainage structures also occur within the gorge (ASA & E/PRO, 2005). The NWI maps one small, forested wetland within the Artpark, near the northern edge of the Study Area. There are no mapped NYSDEC freshwater wetlands within the Study Area.

3.0 VEGETATION

The Niagara Gorge is an area of unusually rich plant diversity that has long been the subject of botanical interest. Eckel (2001) maintains a bibliographic and specimen database of plants documented within the Niagara Gorge and its vicinity, based on both personal research within the gorge and extensive historical records. This area includes both the Canadian and American sides of the gorge, from one mile south of the cataracts in Niagara Falls north to Lewiston, including the many islands within the river (e.g., Goat, Dufferin, Three Sisters, Luna, Cayuga, and Cedar Islands). In compiling the catalogue of species, Eckel (2001, 2002) reviewed published literature and archival sources, and examined in excess of 25,000 voucher specimens in the collections of the Clinton Herbarium, at Buffalo Museum of Science in Buffalo, New York; the Queen Victoria Park School of Horticulture, in Ontario, Canada; and the New York State Herbarium, in Albany, New York.

The Vascular Flora of the Vicinity of the Falls of Niagara (Eckel, 2001) contains records of 1,272 species within an area estimated at less than 2 square miles. The total of 1,272 species is not an indication of the total number of species currently occurring within the gorge, but rather the total number of species reported over a century of exploration. To provide a measure of the plant diversity contained within the Niagara Gorge and vicinity, Eckel (2004) compared this tally to the recorded flora within the entire Niagara Frontier Region (approximately 7,850 square miles) and all of Cattaraugus County (approximately 1,313 square miles). The 1,272 species recorded within the gorge database represent approximately 80% of the 1,597 species recorded within the Niagara Frontier Region, and are roughly equivalent to the 1,280 species recorded within Cattaraugus County (Eckel, 2004).

Given that the boundaries of the Study Area described herein are different, and exclude the Niagara River islands and Canadian side of the gorge, the number of species occurring within the Study Area is likely significantly less than the cumulative total Eckel describes for the larger gorge and falls vicinity. However, Eckel's studies provide invaluable information about the floristic diversity within the Niagara River gorge.

Plant species and communities found within the Study Area were identified and characterized by EDR during reconnaissance-level field investigations conducted during the spring and early summer of 2010. A total of 238 unique plant species were documented within the Study Area during these surveys, 138 within the gorge, and 189 along the rim. A complete list of these species, including scientific names, is included in Appendix B. Nomenclature follows the New York Flora Atlas (Weldy

& Werrier, 2010). Other resources consulted to characterize vegetation within the Study Area include existing reports, agency correspondence, and aerial photography.

3.1 ECOLOGICAL COMMUNITIES

Vegetative communities within the Study Area include calcareous cliff community, calcareous talus slope woodland, disturbed/developed, mowed lawn/ornamental plantings, shallow emergent marsh, successional old field, successional forest, and northern hardwoods. Calcareous cliff community and calcareous talus slope woodland are the dominant communities within the gorge; both are tracked as significant natural communities by the NYNHP. A larger variety of generally more disturbed communities occur along the rim. The location of the various communities within the Study Area is illustrated on Figure 4, while representative photographs are presented in Appendix D. Each ecological community within the Study Area is described below:

Calcareous Cliff Community – As defined by the Draft Ecological Communities of New York State (Edinger et al., 2002), this community occurs "on vertical exposures of resistant, calcareous bedrock (such as limestone or dolomite) or consolidated material; these cliffs often include ledges and small areas of talus. There is minimal soil development, and vegetation is sparse." This community occurs in a narrow band throughout much of the Study Area, in the gorge immediately below the rim. The cliff averages about 25 meters (82 feet) in height and is largely unvegetated; where present, vegetation consists of herbs and a few stunted trees (Evans et al., 2001). Tree species include northern white cedars, while herbaceous species include wild columbine, bulbet fern, and herb-robert. Despite their diminutive stature, the stunted cedars found along many sections of the Niagara Escarpment have been documented to exceed 1,000 years in age (Larson et al., 2000). Although there are several hundred occurrences statewide, the calcareous cliff community is ranked S3 (vulnerable), because it is limited in distribution to calcareous regions of the state, and because of threats including mineral extraction, adjacent upslope development and run-off, recreational overuse, and invasive species (NYNHP, 2009a).

Calcareous Talus Slope Woodland – As defined by the Draft Ecological Communities of New York State (Edinger et al., 2002), this community consists of "an open or closed canopy community that occurs on talus slopes composed of calcareous bedrock such as limestone or dolomite." Talus derived from cliff rockfall or landslides with slopes of 20-45 degrees makes up at least 50% of the substrate, and is typically at least partially moss-covered. Soils are usually moist and loamy (NYNHP, 2009b). This community is common throughout the gorge, occurring immediately below the cliffs, and is present in two broad forms: as mature forest and as

successional forestland dominated by shrubs (Evans et al., 2001). Dominant or co-dominant tree species observed in mature calcareous talus slope woodlands in the Study Area include sugar maple, basswood, white ash, eastern hophornbeam, paper birch, Norway maple, and American beech. Other less common tree species include black cherry, bird cherry, box elder, butternut, northern white cedar, hemlock, and yellow birch. The shrub layer ranges in density, depending on canopy coverage, and includes saplings of the overstory trees, along with red elderberry, chokecherry, flowering raspberry, mountain maple, shrubby honeysuckles, buckthorn, alternate-leaved dogwood, and round-leaf dogwood. Common herbaceous species include zigzag goldenrod, herb robert, small-flowered leafcup, marginal woodfern, garlic mustard, white baneberry, sarsaparilla, and false solomon's-seal. Despite several hundred occurrences statewide, this community is ranked S3, because it is limited in distribution to calcareous regions of the state, and because of threats including development, forest fragmentation, invasive species, recreational overuse, and over-browsing by deer (NYNHP, 2009b).

Disturbed/Developed – This community consists of a combination of several "cultural communities" as defined in the Draft Ecological Communities of New York State (Edinger et al., 2002), including paved road/path and urban structure exterior. Disturbed/developed lands occur throughout the Study Area, particularly along the rim, and are characterized by the presence of buildings, parking lots, roadways, sidewalks, and staircases. Vegetation in these areas is generally either lacking or highly managed (i.e., landscape plantings seeded along roadsides for erosion control). Volunteer vegetation at the edges of these areas is generally sparse, and comprised of early successional, often non-native, herbaceous species such as bull thistle, dandelion, curly dock, mullein, yellow rocket, and orchard grass.

Mowed Lawn/Ornamental Plantings – This community consists of a combination of several "cultural communities" as defined in the Draft Ecological Communities of New York State (Edinger et al., 2002), including mowed lawn, mowed lawn with trees, mowed roadside/pathway, and flower/herb garden. Mowed lawn and ornamental plantings occur throughout the Study Area along the rim. Ornamental species planted along roadsides and in parks include honeysuckles, hawthorns, barberries, lilac, privet, honey locust, horse chestnut, red pine, and Scots pine. Lawns typically include bluegrass, dandelion, clovers, and hawkweeds. Components of native flora occur amongst the mowed lawn and ornamental plantings in some locations, particularly at Whirlpool State Park, where the lawn flora includes bluets, wild strawberry, wild columbine, hairy beard-tongue, pussy toes, and Pennsylvania sedge. This community also includes areas along the parkway that have recently been designated as

"natural regeneration areas." Although such areas are not currently being mowed, active landscaping (in the form of planting non-native shrub species) continues in these areas, and signs indicate the non-mowing management techniques are "being tested." Should mowing be permanently abandoned, these areas would transition to successional old fields (and then to successional shrubland, and eventually to successional forests).

Shallow Emergent Marsh – As defined by the Draft Ecological Communities of New York State (Edinger et al., 2002), a shallow emergent marsh consists of "a marsh meadow community that occurs on mineral soil or deep muck soils (rather than true peat) that are permanently saturated and seasonally flooded." A small community fitting this description occurs on the rim near the northern end of the Study Area, within the wildlife restoration area in the Artpark. Common herbaceous species include sedges, common cattail, manna grass, green bulrush, wool grass, Joe-pye weed, soft rush, and boneset. Though not dominant, willow shrubs and silky dogwood are scattered throughout the marsh.

Successional Old Field – As defined by the Draft Ecological Communities of New York State (Edinger et al., 2002), a successional old field consists of "a meadow dominated by forbs and grasses that occurs on sites that have been cleared" and then abandoned. This community occurs on the rim near the northern end of the Study Area, in the Artpark. Common species include orchard grass, goldenrods, asters, old field cinquefoil, cow vetch, teasel, white and red clover, dandelion, thistles, and wild strawberry.

Successional Forest – This community is common along the rim on sites that have been cleared and are re-growing, typically adjacent to trails or other disturbed/developed areas. Trees are mostly immature and of relatively low height. Co-dominant trees in these areas consist of black locust, Norway maple, bird cherry, box elder, aspens, ashes, and staghorn sumac. Shrub growth is often thick, and dominated by honeysuckles, buckthorn, privet, and chokecherry. Vines are abundant, with common species including Virginia creeper, poison ivy, and wild grape. Common herbaceous species include orchard grass, zigzag goldenrod, cleavers, deadly nightshade, weed orchid, and Canada thistle.

Mixed Northern Hardwoods – This community occurs along the rim within both the Artpark and DeVeaux Woods State Parks. Dominant or co-dominant tree species include white oak, red oak, sugar maple, and Norway maple. Other common tree species include beech, black cherry, basswood, black locust, black walnut, shagbark hickory, and horse chestnut. The understory is variable, ranging from open to dense, and includes saplings of overstory trees, along with shrub

species such as spicebush, witch hazel, alternate-leaved dogwood, chokecherry, honeysuckle, buckthorn, red elderberry, and maple-leave viburnum. Herbaceous vegetation is similarly variable, sparse in places and very thick in others, and includes native species such as jack-in-the-pulpit, false Solomon's seal, Virginia waterleaf, zigzag goldenrod, enchanter's nightshade, and squawroot, along with adventives such as garlic mustard, weed orchid, cleavers, fig buttercup, and nipplewort.

In a survey of old growth and potential old growth in Western New York, Kershner (1995) defined old-growth forests as "original forest which has existed since before European settlement times," and that "have a large proportion of their trees exceeding 150 years in age." After evaluating DeVeaux Woods, and counting the rings on five fallen oaks that had ages ranging from 150 to 250 years, Kershner (1995) identified the mature forest at DeVeaux Woods as old-growth forest. The site has also been assessed by Eckel (1986, 2008), who described 2-3 acres of old growth forest at the site, and by the NYNHP in 2000. The NYNHP survey found "many very old trees," but also documented that the small size and isolation of the forest makes it vulnerable to wind damage and other edge effects, such as encroachment by invasive species. Evans et al. (2001) concluded, "Although it is recognized that the DeVeaux Woods supports some very old tree, many other characteristics of old growth are lacking, such as fallen logs in various stages of decomposition, standing dead trees, both large and small canopy gaps, an undulating forest floor where trees have fallen over and decomposed, undisturbed soils, and a prevailing lack of human disturbance."

3.2 RARE PLANT SPECIES/SIGNIFICANT NATURAL COMMUNITIES

The United States Fish and Wildlife Service (USFWS) hosts a website designed to assist in determining the possible occurrence of federally-listed, proposed, and candidate species by county. The provided lists include all such species known to occur in a given county, as well as those considered likely to occur therein. This online consultation procedure was conducted on June 15, 2010 (Appendix A). The only plant species listed for Niagara County is the threatened eastern prairie fringed orchid (***Platanthera leucophea***), which is considered a historic occurrence by the USFWS. While once considered a likely component of the native flora in six New York counties (Genesee, Niagara, Onondaga, Orleans, Oswego, and Wayne), the NYNHP also considers this species to be historical statewide (Young, 2010). However, this rare wildflower is still state-listed as endangered in New York. Since correspondence from the NYNHP (Appendix A) did not indicate the presence of any historical eastern prairie fringed orchid populations in the vicinity of the Study Area, the population tracked by the USFWS likely occurred elsewhere in Niagara County.

A written request for information regarding state-listed threatened and endangered plant species and unique or significant natural communities was sent to the NYNHP on May 4, 2010. According to the response received from the NYNHP (Appendix A), two significant natural communities occur within the Study Area: calcareous talus slope woodland and calcareous cliff community. The NYNHP considers the occurrences of these communities to be significant from a statewide perspective, and to have high ecological and conservation value. Each of these communities is described above. In addition, the NYNHP database indicates current records for six state-listed plant species in the vicinity of the Study Area: elk sedge (***Carex garberi***), lesser fringed gentian (***Gentianopsis virgata***), slender blazing-star (***Liatris cylindracea***), Ohio goldenrod (***Oligoneuron ohioense***), smooth cliff brake (***Pellaea glabella***), and sky-blue aster (***Symphyotrichum oolentangiense***). Each of these species is described below:

Elk Sedge – This tufted perennial is has white fruits, unlike most sedge species. Rangewide, elk sedge occurs across Canada and the northern United States, becoming rare at the southern extent of the range. Elk sedge is ranked as an endangered species in New York, and the state heritage rank is S1, indicating that the species is critically imperiled. There are only two known populations of this rare sedge within New York State, both in the Niagara River Basin. Elk sedge occurs on calcareous rocks and soils near edges of large rivers, on limestone pavements, and in fens (NYNHP, 2009c). Within the Study Area, this species has been documented in the gorge at the base of the calcareous cliff community (Evans et al., 2001). Both New York populations are threatened by habitat alteration, from invasive species, natural erosion, and scraping of cliffs due to safety concerns (NYNHP, 2009c).

Lesser Fringed Gentian – Rangewide, lesser fringed gentian occurs in north-central North America, from Quebec west to Manitoba, and south to South Dakota, Illinois, and New York. This rare wildflower is considered a “probable” component of the flora in Erie and Monroe Counties, but has only been confirmed within the last 30 years in Niagara and St. Lawrence Counties (Young, 2010). Lesser fringed gentian is ranked as an endangered species in New York, and the state heritage rank is S1, indicating that the species is critically imperiled. Species with the rank of S1 typically have five or fewer occurrences statewide, making them highly vulnerable to extirpation. Lesser fringed gentian grows in bogs and meadows, and along wet shores, especially in calcareous regions (Gleason & Cronquist, 1991). Within the Study Area, this species occurs scattered along the cliff face within the gorge (Evans et al., 2001).

Slender Blazing Star – Slender blazing star is ranked as an endangered species in New York, and the state heritage rank is S1, indicating that the species is critically imperiled. Rangewide, this species is found throughout central North America, from Ontario south to Arkansas and Alabama. In New York, which is on the northeast edge of its range, this species is only known from Niagara County (Young, 2010). Slender blazing star grows in dry, open places (Gleason & Cronquist, 1991), prairies, limestone and sandstone outcrops, bluffs, barrens, glades, marl, dunes, and roadsides (Flora of North America, 1993+). Within the Study Area, this species occurs on dry calcareous talus within the gorge (Evans et al., 2001). Threats include recreational overuse and land management practices (Eckel, 2008).

Ohio Goldenrod – This rare goldenrod has a limited distribution, primarily in the Great Lakes region, occurring from Ontario south to Illinois and Ohio and east to New York. Eleven extant populations are known statewide, primarily in western and central New York. Ohio goldenrod is ranked as a threatened species in New York, and the state heritage rank is S2, indicating that the species is imperiled. This species predominately grows in very rich fens, including sloping and marl fens. It also occasionally occurs in rich peat swamps, calcareous dripping cliffs, and along the banks of large rivers. Threats to the New York populations include mining, invasive species, trampling, erosion, and beaver activities (NYNHP, 2009d).

Smooth Cliff Brake – Rangewide, smooth cliff brake is found throughout much of northeastern and central North America, from Quebec west to Manitoba, and south to Virginia and Texas. In New York, this rare fern is known from 12 extant populations, mostly along the limestone escarpment running east to west from Niagara Falls to Albany. Although it most often occurs on calcareous cliffs, often with eroding or crumbly white limestone, in a few locations, this fern occurs on cliff faces composed of sandstone. Smooth cliff brake is ranked as a threatened species in New York, and the state heritage rank is S2, indicating that the species is imperiled. Due to the inaccessibility of the habitat, there are no immediate threats to this species in New York (NYNHP, 2009e). Within the Study Area, smooth cliff brake occurs at two locations in the gorge (Evans et al., 2001). EDR observed both of these populations in May 2010 (see Photo 16 in Appendix D).

Sky-Blue Aster – Rangewide, this species is found throughout central North America, from Ontario south to Texas. Sky-blue aster is ranked as an endangered species in New York, and the state heritage rank is S1, indicating that the species is critically imperiled. Although this rare wildflower is considered a “probable” component of the flora in Erie, Cattaraugus, Oneida, Oswego, and Monroe Counties, but has only been confirmed within the last 30 years in Niagara

and Livingston Counties (Young, 2010). Sky-blue aster is reported from prairies and dry woods (Gleason & Cronquist, 1991), alvars, glades, bluffs, dunes, oak and/or pine savannas, barrens, open deciduous woods (Flora of North America, 1993+). Within the Study Area, sky blue aster has been documented in dry shallow limey soils both along the rim and within the gorge (Evans et al., 2001). Threats to Niagara County populations include invasive species and land management practices such as mowing (Eckel, 2008).

The NYNHP database includes records of three additional state-listed plant species in the vicinity of the Study Area: puttyroot (***Aplectrum hyemale***), basil-balm (***Monarda clinopodia***), and northern pondweed (***Potamogeton alpinus***). However, none of these populations have been re-located since the 1800s, despite extensive botanical work in the area by Eckel (1986; 2001, 2002, 2003a, 2003b, 2004, 2008) and others (Evans et al., 2001; TRC & Riveredge, 2008). While it is possible that these species could occur undetected within the Study Area, such occurrence is unlikely, and they are considered "historical" in the vicinity of the Study Area by the NYNHP (Appendix A).

In addition to those historical records identified in NYNHP correspondence, a report prepared by NYNHP for the New York State Office of Parks, Recreation and Historic Preservation (Evans et al., 2001) contains records for several more state-listed plants in the vicinity of the Study Area: yellow giant-hyssop (***Agastache nepetoides***), Drummond's rock cress (***Boechera stricta***), calamint (***Calamintha arkansana***), scarlet Indian-paintbrush (***Castileja coccinea***), rough-leaved dogwood (***Cornus drummondii***), rock-cress (***Draba aranisans***), Kalm's St.John's-wort (***Hypericum kalmianum***), long-awn hairgrass (***Muhlenbergia capillaris***), downy phlox (***Phlox pilosa*** ssp. ***pilosa***), pink milkwort (***Polygala incarnata***), giant pine-drops (***Pterospora andromeda***), swamp oats (***Sphenopholis pensylvanica***), and marsh arrow-grass (***Triglochin palustre***). According to Evans et al. (2001), these species "are known from historical record only; they have not been observed in the last 20 years and were not found during this study." It is also important to note that the report included Goat Island and other areas of the Niagara Reservation beyond the boundaries of the Study Area.

Finally, a variety of ninebark (***Physocarpus opulifolius*** var. ***intermedius***) that was formerly state-listed as endangered has been documented within the Study Area (Evans et al., 2001; Eckel, 2001, 2004, 2008; TRC & Riveredge, 2008). However, as described in Evans et al. (2001) the characteristics distinguishing the two varieties of ninebark, var. ***intermedius*** and var. ***opulifolius***, occur along an east to west gradient, with no clear separation point. Gleason and Cronquist (1991) treat the difference as a forma, and other botanical manuals also fail to support varietal recognition (Fernald, 1970; Voss, 1985). Therefore, ninebark is no longer state-listed as endangered or threatened in New York State, and is no longer tracked by the NYNHP (Young, 2010).

3.3 NON-NATIVE INVASIVE SPECIES

According to the ***Final Report of the New York State Invasive Species Task Force***, approximately one-third of the plant species in the State are native to places other than New York. Many of these species cause no significant harm and in fact provide benefits as agricultural crops, landscaping, or garden plants. However, introduced species often lack the predators and pathogens found in their native ecosystems, and can therefore thrive and in some cases, become extremely aggressive, outcompeting native species. Up to 15% of introduced species eventually become invasive. An invasive species is an organism that has been purposefully or accidentally introduced outside its original geographic range, and is able to proliferate and aggressively alter its new environment, potentially causing harm to the economy, environment, or human health (NYS ISTF, 2005).

The New York State Invasive Species Council (2010) recently finalized a report that recommends a regulatory system for preventing the importation and/or release of non-native species. Under this system, non-native species will be classified into one of three lists: prohibited, regulated, and unregulated. This process will create the first official lists of invasive species for New York State. For use during development of the official lists, the NYSDEC has released an interim list of invasive plant species to assist with incorporating invasive species management into funding, regulatory and other activities, such as planning and priority-setting, prevention, early detection, monitoring, rapid response, control and eradication, restoration, research, and public education. While the interim list does not include all plant species that are invasive in New York State, it does identify those thought to pose the greatest threat (NYSDEC, 2010a).

Non-native plant species represent a significant portion of the current flora within the Study Area, particularly along the rim, but in the gorge as well. Of the 238 species observed by EDR during reconnaissance-level surveys, 105 species (44%) are not native to the western New York region. The plant species list in Appendix B identifies non-native species with an asterisk preceding the scientific name, and indicates whether each species was observed in the gorge or along the rim. Twenty-one species included on the NYSDEC interim list of invasive plant species were documented within the Study Area: Japanese knotweed, purple loosestrife, common reed, garlic mustard, mugwort, spotted knapweed, Canada thistle, bull thistle, crown vetch, Fuller's teasel, oriental bittersweet, Norway maple, tree of heaven, Japanese barberry, autumn olive, glossy buckthorn, Amur honeysuckle, shrub honeysuckles, common buckthorn, black locust, and multiflora rose. Most of the invasive species present within the Study Area are both common and widespread outside the Study Area as well.

Non-native invasive species, both in the gorge and along the rim, present a grave threat to the rare plant populations and natural communities within the Study Area (Evans et al., 2001; Eckel 2002, 2003a). According to Evans et al. (2001), protection of the calcareous cliff faces and talus slopes throughout the Niagara River gorge is key to the long-term viability of the majority of the rare plants found within. Nationwide, 46% of plants and animals federally-listed as endangered or threatened are at risk because of invasive species (NYS ISTF, 2005). Each of the invasive species identified within the Study Area has the ability to spread rapidly and crowd out native plants, changing the vegetative structure of natural areas. Invasive species within the Study Area have typically been planted along the rim or in adjacent communities, or established populations there through inadvertent introduction during construction, road building, and various other earth moving activities. Once established along the rim, these populations of invasive species serve as a source of seeds for expanding populations, often within the gorge (Evans et al., 2001; Eckel 2002).

4.0 WILDLIFE

Wildlife species and habitat found within the Study Area were identified and characterized by EDR during reconnaissance-level field investigations conducted during June of 2010. A total of 81 wildlife species were documented within the Study Area during these surveys. However, based on existing data, species range, and habitat conditions, a total of more than 300 wildlife species are likely to occur in or immediately adjacent to the Study Area. These species are generally common throughout New York State. A complete list of these species, including scientific names, is included in Appendix C. Other resources consulted to characterize wildlife within the Study Area include existing publications, agency correspondence, and aerial photography.

Additional discussion of wildlife resources within the Study Area is provided below, including wildlife habitat, birds, mammals, reptiles and amphibians, and rare wildlife species.

4.1 WILDLIFE HABITAT

A basic principle of wildlife ecology is that the distribution and abundance of any wildlife species is directly dependent upon the quality and quantity of available habitat. Habitat is defined as the sum total of environmental factors (including food, cover, and water) that a given species of animal needs to survive and reproduce in a given area (Trefethen, 1964). Each habitat type within the Study Area has particular elements that make it valuable to different species of wildlife.

Forested communities on-site include several habitat elements important to wildlife. Mature oaks, hickories, beech, and walnuts in these areas produce nut mast, which is eaten by squirrels, deer, wild turkey, songbirds, and small mammals. Rough barked trees (e.g., maples, hickories, and oaks) provide foraging sites for bark-probing birds (e.g., brown creeper, black-capped chickadee), and food storage sites for species such as tufted titmouse and white-breasted nuthatch. Another important feature of the mature forested communities on-site is the occurrence of dead trees, which can be found in varying stages of decay. Standing dead trees (snags) are used by a variety of wildlife species for foraging and cover. Bats use the dead and loose bark of snags for roost trees (i.e., nesting cover). Primary cavity-dwellers, such as woodpeckers and chickadees, excavate shelter in the deadwood of snags. Secondary cavity-dwellers, such as owls, nuthatches, titmice, wrens, and squirrels, subsequently occupy these shelters. Fallen deadwood provides cover for other wildlife species, along with a site for feeding and reproduction. Fallen branches provide escape cover for birds and rabbits, while logs provide cover and feeding sites for small mammals, reptiles, and amphibians. Hollow logs are used as cover and food storage sites by species such as gray squirrel, red squirrel, eastern chipmunk, and raccoon. Nurse trees, which are fallen deadwood

in advanced stages of decay, provide additional benefits to the ecology of forested communities. Nurse trees provide important habitat to some species of salamander, while insects such as beetles and ants spend all, or a portion of, their life cycles living in and feeding on deadwood. In addition, many species of plants flourish in the nutrient rich soils provided by decaying trees, and can often be found rooting directly on nurse trees.

Areas with thick shrubs, such as the successional shrubland and forests found throughout the Study Area, are essential to sustain songbird populations. Certain species, such as gray catbird, American goldfinch, indigo bunting, common yellowthroat, and yellow warbler, require low bushy vegetation for nesting and escape cover. Other species such as American robin, blue jay, northern cardinal, and brown-headed cowbird will utilize a variety of habitats, but also prefer brushy edge habitat. The berries produced by woody vegetation in successional communities are highly palatable to these birds, as well as mammals such as raccoon, skunk, and opossum. Shrubs and successional forests also provide food and cover for mammals such as white-tailed deer, red fox, and eastern cottontail, and provide singing and hunting perches by songbirds and raptors.

Old-field communities, such as those found in the Artpark, are used as hunting areas by raptors such as red-tailed hawk. The lack of overstory vegetation also allows these areas to serve as singing grounds for breeding woodcock and foraging areas for aerial insectivores such as bats, swallows, and flycatchers. The herbaceous vegetation supports abundant insect populations, which serve as an important food source for nesting songbirds, and the vegetation itself provides forage in the form of seeds and foliage, which is utilized by sparrows, finches, small mammals, woodchuck, and cottontail rabbit. These species provide a prey base for predators such as hawks, owls, and fox. Tall grass and weeds are also used as escape cover by rabbits and as bedding and fawning grounds by deer.

The calcareous cliff community within the gorge provides potential habitat for wildlife species that require rock faces and/or loose rock for nesting, roosting, or escape cover. These species include cliff swallow, small-footed bat, and a variety of snakes, salamanders, and small mammals. The latter species may also use loose rock at the base of the cliffs as thermal cover/hibernacula during the winter. In addition, cliffs provide important nesting and perching sites for a broad range of raptors, including peregrine falcon (Larson et al., 2000), a state-listed endangered species.

Disturbed/developed areas and mowed lawn/ornamental plantings provide some degree of generally low quality wildlife habitat. Mowed lawn and patches of un-mowed vegetation within these areas are used for foraging by certain birds and mammals (e.g., European starling, eastern cottontail rabbit,

meadow vole, woodchuck, etc.), while man-made debris and other material can provide cover for small mammals, snakes, and salamanders. In addition, some bird species have adapted to ever-increasing human disturbances and are able to forage in the non-vegetated portions of developed areas (i.e., for trash). These birds include American crow, various gulls, house sparrow, and European starling. However, the overall habitat value of these areas is relatively low due to high levels of human activity and a lack of adequate food, cover, and water. These areas typically receive regular use by only a limited number of wildlife species.

4.2 BIRDS

Cliff habitats contribute to species richness in various ecosystems around the globe, and the calcareous cliff community found within the Study Area is no exception. Larson et al. (2000) reported that ecosystems along the Niagara Escarpment in Ontario support greater number of bird species than forested ecosystems of similar size. A total of 54 avian species were observed by EDR within the Study Area during reconnaissance-level field investigations conducted during June of 2010. A complete list of these species, including scientific names, is included in Appendix C. In addition, published data from the New York State Breeding Bird Atlas and Audubon Christmas Bird Count were reviewed to more fully characterize avian activity within the Study Area. Data from each of these sources are summarized below.

Breeding Birds

The BBA is a comprehensive, statewide survey that indicates the distribution of breeding birds in New York State. Surveys were conducted from 2000-2005. Each survey block covers an area of approximately 3 square miles. The Study Area occurs within survey blocks 1677A, 1678B, 1678C, and 1678D. The species totals for these blocks range from 46 to 73 species, for a combined total of 86 individual species. Most of the species recorded were common birds of forest, forest edge, woodland, successional old field, and wetland habitats. However, following state-listed avian species were also documented: peregrine falcon (endangered); pied-bill grebe (threatened); and American bittern, sharp-shinned hawk, Cooper's hawk, and common nighthawk (special concern). No federally listed threatened or endangered species were recorded (NYSDEC, 2007a).

Wintering Birds

Use of the Study Area by wildlife during the winter months is likely limited due to severe winter weather. Food for most birds, especially woodland birds, is likely to be scarce at this time, and therefore, a low diversity and density of wintering birds would be expected in and around the Study Area. Those bird species that can be expected to consistently occur within the Study Area (i.e.,

occur during most winters), such as dark-eyed juncos, are generally common and abundant both on a regional and continental scale. Irruptive species, such as snowy owls, generally have smaller populations, and their presence in the area is likely inconsistent and often brief.

Data from the Audubon's Christmas Bird Count provides an overview of the birds that inhabit the region during early winter. Counts take place on a single day during a three-week period around Christmas, when dozens of birdwatchers comb a 15-mile (24 km) diameter circle in order to tally up bird species and individuals observed. The entire Study Area falls within the Niagara Falls, Ontario count circle. Over the last ten years, annual species counts on this route ranged from 90 to 100 species, for a combined total of 140 individual species. The most common wintering bird species observed were Canada goose, mallard, common merganser, long-tailed duck, Bonaparte's gull, ring-billed gull, herring gull, rock dove, mourning dove, blue jay, American crow, black-capped chickadee, European starling, American tree sparrow, dark-eyed junco, house finch, and house sparrow. The following state-listed avian species were also documented: peregrine falcon and short-eared owl (endangered); pied-billed grebe and northern harrier (threatened); and sharp-shinned hawk, Cooper's hawk, northern goshawk, red-shouldered hawk, red-headed woodpecker, and horned lark (special concern). No federally-listed endangered or threatened species were recorded (National Audubon Society, 2010a).

4.3 MAMMALS

Reconnaissance-level surveys conducted by EDR in June 2010 confirmed the presence of 16 mammal species within the Study Area. Mammals observed within the gorge included white-tailed deer, chipmunk, gray squirrel, and red squirrel, while species observed along the rim included woodchuck, red fox, and several small mammals (mice and moles). Additional species not observed, but likely to occur in the area include various shrews and bats. All of these species are common and widely distributed throughout New York State. A complete list of mammalian species observed or considered likely to occur within the Study Area, including scientific names, is included in Appendix C.

4.4 REPTILES AND AMPHIBIANS

Reptile and amphibian presence within the Study Area was determined through reconnaissance-level field surveys and review of the New York State Amphibian and Reptile Atlas (Herp Atlas). The Herp Atlas was a ten-year survey (1990 through 1999) designed to document the geographic distribution of the state's herptofauna. Atlas data was collected and organized according to USGS 7.5-minute quadrangles. Based on this data, along with documented species ranges and existing

habitat conditions, it is estimated that approximately 30 reptile and amphibian species could occur in the vicinity of the Study Area (NYSDEC, 2007b; NatureServe, 2009).

Reconnaissance-level surveys conducted by EDR in June 2010 confirmed the presence of eight amphibian species and three reptile species within the Study Area. All 11 of these species occurred in the gorge, either along the riverbank, in seeps, or in damp leaf litter on the gorge slopes. Reptile and amphibian presence along the rim is more limited: American toad and garter snake were observed, and spring peeper and western chorus frog were heard singing. A complete list of species observed or considered likely to occur within the Study Area, including scientific names, is included in Appendix C. Although no federally- or state-listed endangered or threatened species were observed onsite, the Herp Atlas indicates the presence of blue-spotted salamander in the general area (i.e., in the Niagara Falls quadrangle), which is listed as species of special concern in New York State.

4.5 RARE WILDLIFE SPECIES/SIGNIFICANT WILDLIFE HABITATS

Correspondence from the NYNHP (Appendix A) indicated the presence of three sensitive aquatic species in the vicinity of the Study Area: lake sturgeon, hickorynut (a freshwater mussel), and rainbow shell. See Section 5.3 for descriptions of each of these species. No rare terrestrial wildlife or avian species were reported. However, NYNHP correspondence indicated the presence of two significant wildlife habitat features in the vicinity of the Study Area, a waterfowl winter concentration area and a gull colony. In addition, the entire Study Area falls within the Niagara River Corridor Important Bird Area as designated by the National Audubon Society, and the Lower Niagara River Rapids is designated as a Significant Coastal Fish and Wildlife Habitat by the Department of State, Division of Coastal Resources. Each of these significant wildlife habitats is described below:

Waterfowl Winter Concentration Area – According to NYNHP correspondence, this area overlaps only the very northern end of the Study Area, in Lewiston where the Niagara River abruptly broadens from narrow and fast-flowing, to a very large, deep, riverine habitat comparable to open water areas in Lake Ontario. Bank height in this section ranges from 20-70 feet (National Audubon Society, 2010b). Evans et al. (2001) indicate that additional areas of the Niagara River sections also serves as important waterfowl winter concentration areas, including sections adjacent to the Niagara Reservation, Whirlpool, and Devil's Hole State Parks. Due to the persistent open water, these river sections attract large numbers of ducks and geese during the winter, when many other waters are frozen. The NYNHP ranks this occurrence of wildlife habitat

as S3S4, or vulnerable. This significant wildlife habitat is restricted to the Niagara River, immediately adjacent to the Study Area gorge.

Gull Colony – Located on Goat Island, this colony of nesting ring-billed gulls is south of the Study Area. According to NYNHP correspondence, the nests are found in an open rocky area, on cliff edges and talus slope. The talus area below the cliff has sections of trees, shrubs, and grass. TRC and Riveredge (2008) report that this colony has grown rapidly in recent years, with nest counts increasing from 4,669 nests in 2003 to 7,786 nests in 2007. In addition to the gulls, 176 double-crested cormorant nests were counted within the colony in 2007, mostly in trees. This significant wildlife habitat occurs outside the Study Area.

Significant Coastal Fish and Wildlife Area – Located between the Whirlpool Rapids Bridge and the Lewiston Village line, this 4.5-mile section of the Niagara River is narrow, deep, and fast-flowing. Although the habitat conditions are unusual in New York State, the importance of this area to fish and wildlife is somewhat constrained by both the natural physical environment and the effects of human activities. This area supports a productive coldwater fishery, focusing heavily on spawning runs of steelhead. See Section 5.2 for additional information about fish in the Study Area. One of the largest winter concentrations of gulls in western New York is associated with the hydroelectric stations in this section of the gorge, with numbers exceeding 10,000 in some years. Many live, dead, or injured fish are brought to the surface by turbulent water currents and discharge water from the hydroelectric plants, and the gulls are apparently attracted to this readily available food source. While a variety of waterfowl species, particularly diving ducks, feed in the Lower Niagara River Rapids during migration periods and in winter, a lack of nesting areas limit concentrations (NYSDOS, 2010). This significant wildlife habitat is restricted to the Niagara River, immediately adjacent to the Study Area gorge.

Important Bird Area – The Important Bird Areas (IBA) program is an international bird conservation initiative with the goal of identifying and conserving the most important habitats for birds. IBAs may include public or private lands, and they may be protected or unprotected. The Niagara River Corridor IBA is a 155-square mile area along the U.S. side of the Niagara River in the 32-mile section between Lake Erie and Lake Ontario. According to the National Audubon Society (2010b), the Niagara River supports one of the world's most spectacular concentrations of gulls, with 19 species recorded and one-day counts of over 100,000 individuals. The river also hosts a remarkable diversity and abundance of waterfowl, and supports breeding colonies of double-crested cormorants, great blue herons, great egrets, black-crowned night-herons, ring-billed gulls, herring gulls, and common terns. Marshes along the river have supported breeding

populations of state-listed species including least bittern, northern harrier, pied-billed grebe, and sedge wren. Finally, habitats along the edge of the river support an exceptional diversity of migratory songbirds during spring and fall migrations (National Audubon Society, 2010b). It should be noted that not all of the ornithological significance associated with this IBA occur within the Study Area. However, the entire Study Area falls within the IBA, and significant avian habitat features occur both within the Gorge, and to a lesser extent along the rim, particularly in the forested communities at Earl W. Brydges Artpark and DeVeaux Woods State Parks.

As described above, the USFWS hosts a website designed to assist in determining the possible occurrence of federally-listed, proposed, and candidate species by county. This online consultation procedure was conducted on June 15, 2010. The only animal species listed for Niagara County is the bald eagle (***Haliaeetus leucocephalus***), which was officially de-listed on August 8, 2007. Although no longer protected under the Endangered Species Act, the bald eagle continues to receive protection under the Bald and Golden Eagle Protection Act. Furthermore, the bald eagle is still state-listed as threatened in New York. Since correspondence from the NYNHP (Appendix A) did not indicate the presence of bald eagle in the vicinity of the Study Area, the breeding population tracked by the USFWS likely occurs elsewhere in Niagara County. However, bald eagles could utilize the gorge as foraging habitat, perching in shoreline trees and hunting for fish, particularly in the winter when the river water remains open. No animals currently listed or proposed for listing by the USFWS as endangered, threatened, or candidate species are currently tracked in Niagara County (Appendix A).

5.0 AQUATIC RESOURCES

This section describes the water quality, fish, and rare aquatic species found in the Study Area, and in the Niagara River, which forms the western boundary of the Study Area.

5.1 WATER QUALITY

The NYSDEC classifies all waters in the state based on the existing or expected best use of that waterway. The Niagara River is designated as Class A-S, which is considered a protected stream class subject to the provisions of the Protection of Waters regulations. The Class A designation indicates that the best usage is as a source of drinking water, and for fishing, swimming and other recreation. Tributaries within the Study Area, including Fish Creek, Bloody Run, and various unnamed waterways, are designated as Class C. This class is unprotected, and indicates that the best usage is for fishing (NYSDEC, 2010b).

The Niagara River and gorge have been subject to various pollutants, both historical and ongoing. The Hooker-Hyde Park landfill, active from 1953 to 1975, was used to dispose of approximately 80,000 tons of waste, including hazardous materials such as volatile organic compounds and dioxin. Contaminants from the landfill entered both the groundwater and Bloody Run, which flowed down the gorge face into the Niagara River. As part of the remediation plan, Bloody Run was excavated to remove contaminated water and sediment, and extraction wells were constructed to maintain an inward groundwater hydraulic regime. Current seeps in the Bloody Run area of the gorge are surface runoff rather than groundwater discharge, and indicate that the extraction wells have been effective at controlling groundwater migration from the landfill into the gorge (USEPA, 2008). Although these remediation activities have successfully removed contaminates from Bloody Run, the altered hydrology in this part of the gorge has result in drier conditions in the calcareous cliff communities and calcareous talus slope woodlands in the vicinity of Devil's Hole. Eckel (2003b) indicated that the Bloody Run remediation and resultant habitat desiccation has likely decreased the floristic diversity in the area, putting particular stress on mosses, liverworts, and ferns.

Runoff from city streets and parking lots along the rim drains into the gorge through channelization and through stormwater drainage structures evident along the face of the cliff, introducing a variety of pollutants (e.g., saltwater and petroleum products) to the natural communities at the base of the cliff, and ultimately to the Niagara River. This runoff represents an ongoing threat to the calcareous talus slope woodlands located below the cliffs. According to Evans et al. (2001), "the introduction of chemicals and fuels into these natural systems could have profound effects on their overall integrity."

Due to concerns about adverse health effects from chemical contamination, the New York State Department of Health has issued fish consumption advisories for waters throughout the State, including the Niagara River. Specific contaminants of concern include polychlorinated biphenyls (PCBs), mirex, and dioxins. Children under 15 years and women under 50 years are advised not to eat any fish from the Niagara River downstream of the falls. Men and women beyond their childbearing years are also advised not to eat channel catfish, carp, lake trout over 25 inches, brown trout over 20 inches, and white perch; and are advised to eat no more than one meal per month of Chinook salmon, rainbow trout, smallmouth bass, white sucker, smaller lake trout, smaller brown trout, coho salmon over 25 inches, and carp (NYSDOH, 2010).

5.2 FISH

Immediately adjacent to the Study Area, the Lower Niagara River Rapids support a productive coldwater fishery. Concentrations of steelhead are among the highest in the state. These spawning runs start in September and October, and may continue sporadically throughout the winter, peaking in March and April. Substantial numbers of coho salmon, chinook salmon, and brown trout also occur in the area during spring and fall spawning periods. However, these populations are the result of an ongoing effort by the NYSDEC to establish a salmonid fishery in the Great Lakes through stocking; no successful reproduction by salmonids has been documented in the Lower Niagara River Rapids (NYSDOS, 2010). Steelheads were observed spawning in 2003 in a small gravel deposit in the vicinity of Devil's Hole, near the downstream end of Foster Rapids. However, this area is partial dewatered by low flows, and it is unlikely that this spawning was successful (ASA & E/PRO, 2005).

Other fish species found in the lower rapids include smallmouth bass, walleye, white bass, yellow perch, lake trout, smelt (NYSDOS, 2010), rock bass, freshwater drum, and round goby (Stantec, 2005). It is unlikely that the section of the Niagara River adjacent to the Study Area is used for fish spawning or nursery activities by any of these species to any significant extent, due to the strong turbulent currents, a lack of shallow water littoral areas, and the lack of tributaries (NYSDOS, 2010).

5.3 RARE AQUATIC SPECIES

Correspondence from the NYNHP (Appendix A) indicated the presence of three sensitive aquatic species in the vicinity of the Study Area: lake sturgeon (***Acipenser fulvescens***), hickorynut (***Obovaria olivaria***), and rainbow shell (***Villosa iris***). Each of these species is described below:

Lake Sturgeon – This primitive bottomfeeder is one of New York's largest freshwater fish. Primary habitat is the bottoms of large, clean, freshwater rivers and lakes, although the species

rarely occurs in the brackish water (e.g., of the lower St. Lawrence River). Lake sturgeon is found most often at depths of 5-10 meters. Preferred substrates include firm sand, gravel, or rock. This rare fish has a large, but discontinuous range throughout eastern and central North America, from Quebec and Vermont west to Alberta and Minnesota and south the Alabama and Arkansas; it is vulnerable throughout its entire range. In New York, lake sturgeon have been collected in St. Lawrence River, Niagara River, Oswegatchie River, Grasse River, Lake Ontario, Lake Erie, Lake Champlain, Cayuga Lake, and in the Seneca and Cayuga canals. Lake sturgeon is ranked as a threatened species in New York, and the state heritage rank is S1S2, indicating that the species is critically imperiled. Threats to the species include historical overfishing, dams, habitat loss and degradation, invasive species, and poaching (NatureServe, 2009; NYSDEC, 2010c).

Hickorynut – This yellowish-brown or greenish mussel is oval shaped, and can reach up to 4 inches in length (Badra, 2004). This species is typically found in deep water with a good current, on sand or gravel substrates; water depths usually exceed 6-8 feet. Known or reported fish host species include the shovelnose sturgeon, lake drum, and lake sturgeon. Rangewide, this species occurs throughout the Mississippi and St. Lawrence River basins, from Quebec and Ontario south to Arkansas (Badra, 2004; NatureServe, 2009). In New York, this rare mussel has been documented from the Niagara River in both Erie and Niagara Counties, with populations in the vicinity of the Study Area found near Goat and Buckhorn Islands. While recent surveys have documented spent shells of hickorynut, no living or recently dead animals have been found since 1970 (Riveredge, 2005). The state heritage rank is SH, indicating that the species is considered historical in New York State. According to correspondence from the NYNHP (Appendix A), the extirpation of Niagara River populations of hickorynut and most related unionids was likely caused by the zebra mussel outbreak of the mid-1990s.

Rainbow Shell – This oval-shaped mussel is yellowish-tan with green rays, with a maximum length of approximately 3 inches (Badra, 2007). Rainbow shell lives in riffles along the edges of emerging vegetation, in gravel and sand in moderate to strong current. It is most numerous in clean, well-oxygenated stretches at depths of less than three feet. This species is found throughout the Tennessee, Cumberland, and Ohio River basins, the upper Mississippi River, and the St. Lawrence River system from Lake Huron to Lake Ontario including their tributaries. Although this species remains stable in the central part of its range (i.e., Ohio, Kentucky, Tennessee), it is declining at the edges of its range, particularly in the Great Lakes region, largely due to the impacts of invasive zebra mussels. In New York, rainbow shell has been documented in Chautauqua, Erie, Genesee, Monroe, Niagara, and Orleans Counties

(NatureServe, 2009). In the Niagara River, this rare mussel is reported from near Goat Island, just south of the Study Area. The state heritage rank is S2S3, indicating that the species is imperiled in New York State.

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Title

Ecological Inventory of the Niagara River Gorge and Rim

City of Niagara Falls, Town of Lewiston and Village of Lewiston
Niagara County, New York

Figure 1: Study Area Location Map

Map Scale & Orientation

N
W E
S

0 5 10 20 30
Miles

Legend

Study Area

Notes

Map created July 2010.

Base Map:
ESRI StreetMap North America, 2008.

Author

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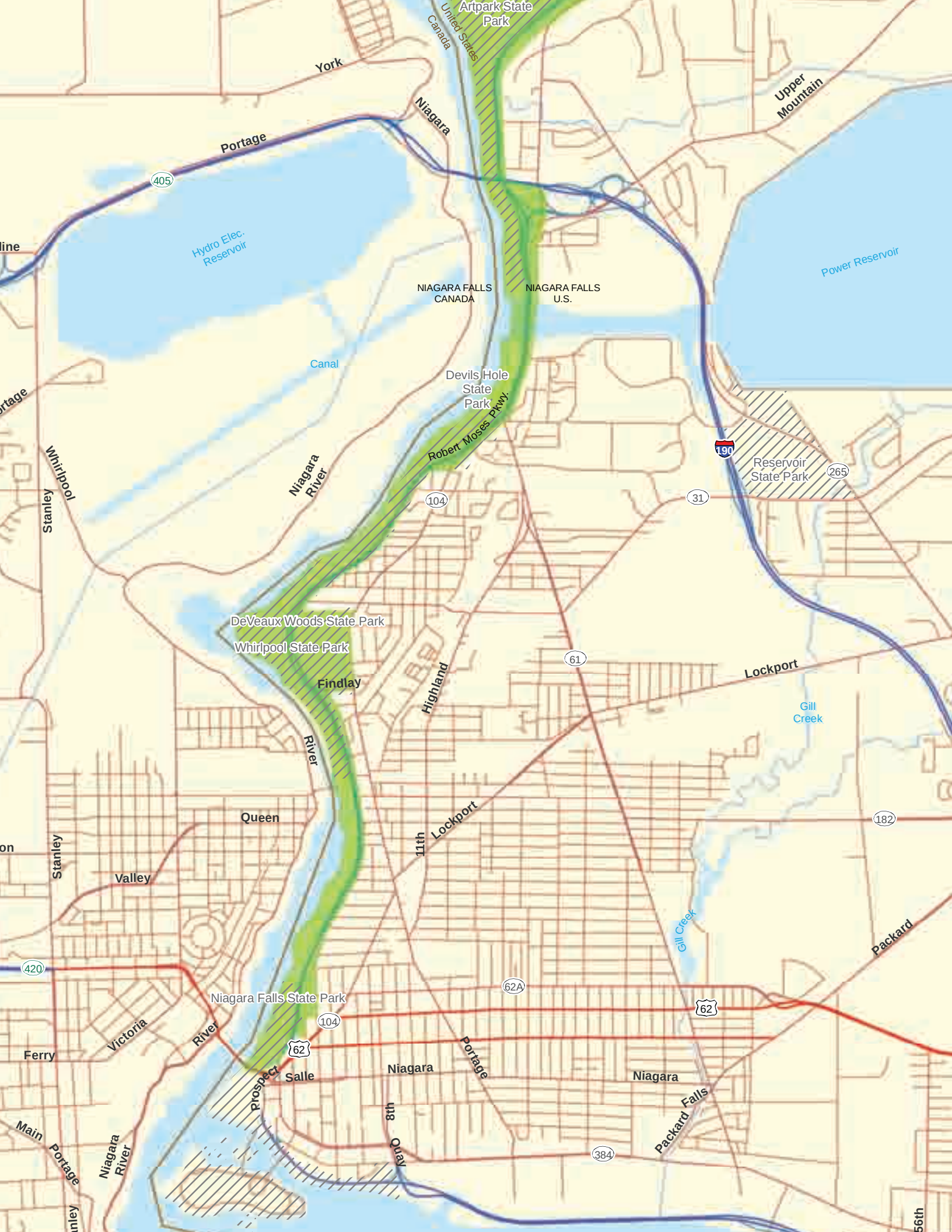
F: 315.471.1061
www.edrpc.com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Canal
Devils Hole State Park
Robert Moses Pkwy.
Whirlpool
Stanley
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Reservoir State Park
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DeVeaux Woods State Park
Whirlpool State Park
Findlay
Highland
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Lockport
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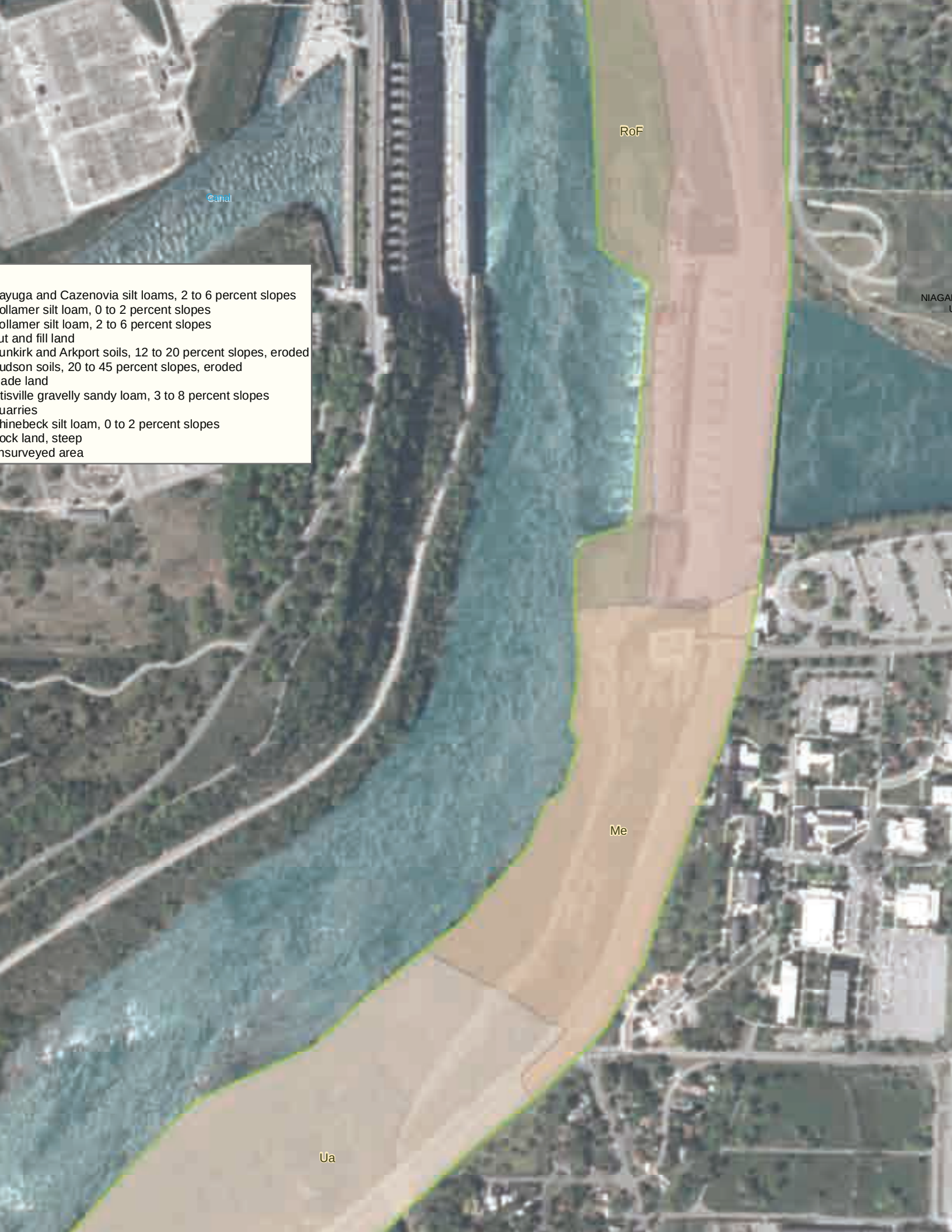
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Portage
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Homestead
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Fort Gray
Hewitt
Kenneth
Barton
405
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Niagara
Niagara River
Robert Moses Pkwy
104
Power Auth Service
Old Lewiston
Riverdale
George
William
Irving
Spring
Power Vista
Freshman
Senior
Junior
Campus
Campus
Penrose


Riverview
Mckinley
Garfield
Thorndale
Penn
Lafayette
University
Lafayette
Terrace
Rankine Road
104
Rankine
Meadowbrook
Patricia
Robert Moses Pkwy
Wyoming
Mckinley
Norwood
Crescent
Harrison
Hudson
Garrett
Rapids
James
Crescent
Morley
Roselle
Maple
Washington
Mckoon
Bell
Hudson
Deveaux
Highland
Vanderbilt
Macklem


Vanderbilt
College Avenue
College
Van Rensse
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Robert Moses Pkwy
Clifton
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Findlay
River
Chestnut
Leader
Glenview
Stanton
Chasm
Whirlpool
Gillette
Spring
Terrace
Elgin
Stanton
Hickson
May
Buttrey


Bridge
Ontario
182
Cataract
Park
Whirlpool
Niagara
American Legion
Queen
Cleveland
10th
Avpl
Zimmerman
Lincoln
South
Division
Michigan
Lockport
104
Linwood
8th
Robert Moses Pkwy
Willow
Pierce
Oxford
Orchard
Chilton
Portage
Ashland
Elmwood
Spruce
Armory


Ryerson
Palmer
Ontario
Eastwood
River
Elmwood
Spruce
Cedar
Cedar
3rd
Whirlpool
Robert Moses Pkwy
River
Philip
John
Falls
Park
Pine
Walnut
104
62
Rainbow Bridge
62
3rd
4th
5th
62
62
2nd
Niagara
Salle
384
384
Prospect
Mayor Michael
Plaza

APPENDIX A

Agency Correspondence

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
Division of Fish, Wildlife & Marine Resources
New York Natural Heritage Program
625 Broadway, 5th Floor, Albany, New York 12233-4757
Phone: (518) 402-8935 • **Fax:** (518) 402-8925
Website: www.dec.ny.gov

Alexander B. Grannis
Commissioner

May 24, 2010

Sara R. Stebbins
Environmental Design & Research
217 Montgomery Street, Suite 1000
Syracuse, NY 13202

Dear Ms. Stebbins:

In response to your recent request, we have reviewed the New York Natural Heritage Program database with respect to an Environmental Assessment for the proposed Niagara Gorge Ecological Inventory, Project # 09065, area as indicated on the map you provided, located in Town of Lewiston and the City of Niagara Falls, Niagara County.

Enclosed is a report of rare or state-listed animals and plants, significant natural communities, and other significant habitats, which our databases indicate occur, or may occur, on your site or in the immediate vicinity of your site. For most sites, comprehensive field surveys have not been conducted; the enclosed report only includes records from our databases. We cannot provide a definitive statement as to the presence or absence of all rare or state-listed species or natural communities. This information should not be substituted for on-site surveys that may be required for environmental impact assessment.
PLEASE NOTE: This Project is within several New York State Parks:
DeVeaux Woods, Devils Hole, Earl Brydges Artpark, Niagara Falls, and the Whirlpool State Park.

The enclosed report may be included in documents that will be available to the public. However, any enclosed maps displaying locations of rare species are considered sensitive information, and are intended only for the internal use of the recipient; they should not be included in any document that will be made available to the public, without permission from the New York Natural Heritage Program.

The presence of the plants and animals identified in the enclosed report may result in this project requiring additional review or permit conditions. For further guidance, and for information regarding other permits that may be required under state law for regulated areas or activities (e.g. regulated wetlands), please contact the appropriate NYS DEC Regional Office, Division of Environmental Permits, as listed at www.dec.ny.gov/about/39381.html.

523

This project location is adjacent to a designated Significant Coastal Fish and Wildlife Habitat. This habitat is part of New York State's Coastal Management Program (CMP), which is administered by the NYS Department of State (DOS). Projects which may impact the habitat are reviewed by DOS for consistency with the CMP. For more information regarding this designated habitat and applicable consistency review requirements, please contact:

Jeff Zappieri - (518) 474-6000
NYS Department of State
Office Coastal, Local Government and Community Sustainability
1 Commerce Plaza, 99 Washington Avenue,
Albany, NY 12231

Our databases are continually growing as records are added and updated. If this proposed project is still under development one year from now, we recommend that you contact us again so that we may update this response with the most current information.

Sincerely,

Tara Salerno

Tara Salerno, Information Services
New York Natural Heritage Program

Enc.

cc: Reg. 9, Wildlife Mgr.
Reg. 9, Fisheries Mgr.
Tom Lyons, NYS OPRHP, Empire State Pl, Bldg #1, 17th Floor, Albany, 12238
Shaun Keeler, Bureau of Fisheries, Albany

523

Natural Heritage Report on Rare Species and Ecological Communities

NY Natural Heritage Program, NYS DEC, 625 Broadway, 5th Floor, Albany, NY
12233-4757
(518) 402-8935

-The information in this report includes only records entered into the NY Natural Heritage databases as of the date of the report. This report is not a definitive statement on the presence or absence of all rare species or significant natural communities at or in the vicinity of this site.
-Refer to the User's Guide for explanations of codes, ranks and fields.
-Location maps for certain species and communities may not be provided 1) if the species is vulnerable to disturbance, 2) if the location and/or extent is not precisely known, 3) if the location and/or extent is too large to display, and/or 4) if the animal is listed as Endangered or Threatened by New York State.

Natural Heritage Report on Rare Species and Ecological Communities

COMMUNITIES

Calcareous talus slope woodland

This occurrence of Calcareous Talus Slope Woodland is considered significant from a statewide perspective by the NY Natural Heritage Program. It is either an occurrence of a community type that is rare in the state or a high quality example of a more common community type. By meeting specific, documented significance criteria, the NY Natural Heritage Program considers this occurrence to have high ecological and conservation value.

Office Use

NY Legal Status:	Unlisted	**NYS Rank:**	S3	5498
Federal Listing:		**Global Rank:**	G3G4	
Last Report:	2000-09-14	**EO Rank:**		
County:	Niagara			
Town:	Lewiston, Niagara Falls - City			
Location:	Niagara Gorge Whirlpool Woods			

General Quality and Habitat: The community is of moderate size, but within a largely developed landscape. A number of exotic species can be found in communities directly adjacent to the cliff face, but generally not at high densities directly on the cliff face. Restoring areas of the cliff to a more natural state and eliminating some activities could potentially raise the overall rank of this community. A sparsely vegetated to completely forested calcareous talus slope community lying below an extensive limestone cliff and above the Niagara River. As currently documented, the community extends the length of the Niagara Gorge from Niagara Falls downstream roughly 8000 meters to a large dam operated by the New York Power Authority. The plateau above the rim of the gorge is developed for recreation and sightseeing with several picnic grounds, tourists facilities, parking lots and roads. The landscape surrounding the community is rural to the north consisting of primarily abandoned farm fields and scattered hamlets and urban and heavily populated to the east, west and south.

Calcareous cliff community

This occurrence of Calcareous Cliff Community is considered significant from a statewide perspective by the NY Natural Heritage Program. It is either an occurrence of a community type that is rare in the state or a high quality example of a more common community type. By meeting specific, documented significance criteria, the NY Natural Heritage Program considers this occurrence to have high ecological and conservation value.

Office Use

NY Legal Status:	Unlisted	**NYS Rank:**	S3	10512
Federal Listing:		**Global Rank:**	G4	
Last Report:	2000-09-14	**EO Rank:**		
County:	Niagara			
Town:	Lewiston, Niagara Falls - City			
Location:	Niagara Gorge Whirlpool Woods			

General Quality and Habitat: The community is of moderate size, but within a largely developed landscape. A number of exotic species can be found in communities directly adjacent to the cliff face, but generally not at high densities directly on the cliff face. Restoring areas of the cliff to a more natural state and eliminating some activities could potentially raise the overall rank. Sparsely vegetated limestone cliffs along the east rim of the Niagara Gorge from Niagara Falls downstream roughly 8000 meters. The cliff grades into a calcareous talus slope woodland below the cliff. The plateau above the rim of the gorge is developed for recreation and sightseeing with several picnic grounds, tourists facilities, parking lots and roads. The landscape surrounding the community is rural to the north consisting of primarily abandoned farm fields and scattered hamlets and urban and heavily populated to the east, west and south.

FISH

Acipenser fulvescens

Office Use 8630

Lake Sturgeon

NY Legal Status: Threatened
Federal Listing:
Last Report: **
NYS Rank: S1S2 - Critically Imperiled
Global Rank: G3G4 - Vulnerable
EO Rank: **
BOF

County: Niagara
Town: Lewiston
Location: At, or in the vicinity of, the project site.

General Quality and Habitat: **For information on the population at this location and management considerations, please contact the NYS DEC Regional Wildlife Manager for the Region where the project is located.

FRESHWATER MUSSELS

Obovaria olivaria

Office Use 11306

Hickorynut

NY Legal Status: Unlisted
Federal Listing:
Last Report: 1997-06-10
NYS Rank: SH - Historical
Global Rank: G4 - Apparently secure
EO Rank: Possibly Extant

County: Erie, Niagara
Town: Grand Island, Niagara Falls - City
Location: Niagara River Buckhorn Island and Goat Island

General Quality and Habitat: David Strayer (2003) indicated that Obovaria olivaria probably existed in small numbers in the Niagara River in the early 1990s before the zebra mussel outbreak in the mid-1990s. It appears that zebra mussels have killed most of the unionids as only old, chalky shells were found. However, Strayer also indicated that additional surveys are needed to determine if this species as well as other unionids are truly extirpated from this site. Buckhorn Island: The mussels were found on a sand bar of firm sand under 0.25-1 meter of water fringing a deep channel. There are patches of macrophytes (Scirpus, Potamogeton) and the water is clear. Goat Island: The mussels were found near Goat Island.The water current is fast as it leads to Niagara Falls.

Villosa iris

Office Use 8707

Rainbow

NY Legal Status: Unlisted
Federal Listing:
Last Report: 1997-06-10
NYS Rank: S2S3 - Imperiled
Global Rank: G5Q - Secure
EO Rank: Extant

County: Erie, Niagara
Town: Grand Island, Niagara Falls - City
Location: Niagara River Buckhorn Island and Goat Island

General Quality and Habitat: While no live mussels were found in 1997 it is still assumed the population is extant because valves were found. Buckhorn Island: The mussels were found on a sand bar of firm sand under 0.25-1 meter of water fringing a deep channel. There are patches of macrophytes such as Scirpus, Potamogeton and the water is clear. Goat Island: The mussels were found near Goat Island. The water current is fast as it leads to Niagara Falls.

OTHER

Waterfowl Winter Concentration Area

Office Use 7656

NY Legal Status: Unlisted
Federal Listing:
Last Report: 1994-01-25
NYS Rank: S3S4 - Vulnerable
Global Rank: GNR - Not ranked
EO Rank: Extant

County: Niagara
Town: Lewiston, Porter
Location: Lower Niagara River

General Quality and Habitat: A very large, deep riverine habitat that is comparable to open water areas in Lake Ontario. Here the river abruptly broadens from the very narrow, deep, fast flowing stretch of the gorge at the generating stations. A variety of waterfowl species also feed in the lower Niagara River rapids (upstream from the Niagara Escarpment), but concentrations are limited due to lack of resting areas. The lower rapids do not freeze over in winter providing some suitable habitat in any given year.

Gull Colony

Office Use

NY Legal Status:	Unlisted	**NYS Rank:**	SNR - Rank not assigned	9260
Federal Listing:		**Global Rank:**	GNR - Not ranked	
Last Report:	1998-05-25	**EO Rank:**	Extant	
County:	Niagara			S
Town:	Niagara Falls - City			
Location:	Goat Island			
General Quality and Habitat:	Although a full survey (count) was conducted a rank of "E" was assigned because there are no global rank specifications for this type of occurrence. The nests are in open rocky areas on cliff ledges and talus slope. The slope below the cliff has sections of trees, shrubs and grass.			

VASCULAR PLANTS

Carex garberi

Elk Sedge

Office Use

NY Legal Status:	Endangered	**NYS Rank:**	S1 - Critically imperiled	9751
Federal Listing:		**Global Rank:**	G5 - Secure	
Last Report:	1990-06-16	**EO Rank:**	Good	
County:	Niagara			S
Town:	Niagara Falls - City			
Location:	Niagara Gorge Whirlpool Woods			
General Quality and Habitat:	The population and habitat are in good shape, but some exotics are present. Deep river gorge with calcareous cliff community of sparse vegetation and large areas of talus. Soils well drained, loose, shaky. With Crataegus sp., Campanula rotundifolia, Thuja occidentalis, Muhlenbergia racemosa, Toxicodendron radicans.			

Gentianopsis virgata

Lesser Fringed Gentian

Office Use

NY Legal Status:	Endangered	**NYS Rank:**	S1 - Critically imperiled	10448
Federal Listing:		**Global Rank:**	G5 - Secure	
Last Report:	1990-10-06	**EO Rank:**	Fair	
County:	Niagara			
Town:	Niagara Falls - City			
Location:	Niagara Gorge Whirlpool Woods			
General Quality and Habitat:	This is a small population in good habitat. Deep river gorge with calcareous cliff community of sparse vegetation and large areas of talus. Soils well drained. With Aster laterifiorus, Agrostis stolonifera, Leucanthemum vulgare. Remains of an old railroad bed are evident.			

Liatris cylindracea

Slender Blazing-star

Office Use

NY Legal Status:	Endangered	**NYS Rank:**	S1 - Critically imperiled	5818
Federal Listing:		**Global Rank:**	G5 - Secure	
Last Report:	2000-09-27	**EO Rank:**	Fair	
County:	Niagara			
Town:	Niagara Falls - City			
Location:	Niagara Gorge Whirlpool Woods			
General Quality and Habitat:	A total of 77 stems from 19 genets and 6 distinct groups within a well-protected gorge system. These plants need high light levels, thus they are found in openings, talus, and disturbed areas. This plant is found on and around a large boulder within the deep gorge of the Niagara River. Additional plants may be found within the talus slope near this large boulder. A trail that parallels that swift-moving rapids of the Niagara River is located approximately 4 meters from the boulder and plants are located directly along the edge of this trail. The plants are growing within the calcareous talus and within cracks of larger dolomite boulders and bedrock.			

Oligoneuron ohioense

Office Use 12318

Ohio Goldenrod

NY Legal Status: Threatened
Federal Listing:
Last Report:
County: Niagara
Town: Lewiston
Location:
General Quality and Habitat:

NYS Rank: S2 - Imperiled
Global Rank: G4 - Apparently secure
EO Rank: Unassigned

Pellaea glabella ssp. glabella

Office Use 7406

Smooth Cliff Brake

NY Legal Status: Threatened
Federal Listing:
Last Report: 2000-09-27
County: Niagara
Town: Niagara Falls - City
Location: Niagara Gorge Whirlpool Woods
General Quality and Habitat: Over two hundred plants scattered within a protected gorge system. This plant is scattered within the deep river gorge carved out by the Niagara River just below Niagara Falls. The plants are found within a calcareous cliff community and calcareous talus slope woodland. The vegetation is sparse in many areas and the soils are well drained. The remains of an old railroad bed are evident within this gorge system. The "giant rock population" is found on a two-plus story tall dolomitic boulder that fell from the Lockport formation cliffs located above. One side of this rock is directly adjacent to the trail the traverses the entire lower gorge and the other side of this rock rests near the edge of the Niagara River. The plants are mostly found on the south side in partial to full sunlight.

NYS Rank: S2 - Imperiled
Global Rank: G5T5 - Secure
EO Rank: Good

Symphyotrichum oolentangiense

Office Use 9142

Sky-blue Aster

NY Legal Status: Endangered
Federal Listing:
Last Report: 2006-09-20
County: Niagara
Town: Niagara Falls - City
Location: Niagara Gorge Whirlpool Woods
General Quality and Habitat: There are possibly 100 or more plants plants in two distinct groups within a well-protected, but unstable system. The plants are found in two distinct areas. Group 1: The plants are located at the top rim of a deep river gorge, just above a high calcareous cliff community. This group is located in a small remnant grassland squeezed between a parking lot and the topsim of the gorge. From this vantage point, there is a great view of the Niagara River gorge and Canada. Group 2: The plants are located within the calcareous talus slope and on the dolomotic limestone flats at the base of the gorge. The soils are well drained and normally quite dry. Within the gorge, there is the remains of an old railroad bed. This portion of the gorge is used most by fisherman trying to gain access to the Niagara River.

NYS Rank: S1 - Critically imperiled
Global Rank: G5 - Secure
EO Rank: Fair

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13 Records Processed

More detailed information about many of the rare and listed animals and plants in New York, including biology, identification, habitat, conservation, and management, are available online in Natural Heritage's Conservation Guides at www.acris.nynhp.org, from NatureServe Explorer at http://www.natureserve.org/explorer, from NYSDEC at http://www.dec.ny.gov/animals/7494.html (for animals), and from USDA's Plants Database at http://plants.usda.gov/index.html (for plants).

More detailed information about many of the natural community types in New York, including identification, dominant and characteristic vegetation, distribution, conservation, and management, is available online in Natural Heritage's Conservation Guides at www.acris.nynhp.org. For descriptions of all community types, go to http://www.dec.ny.gov/animals/29384.html and click on Draft Ecological Communities of New York State

NY Natural Heritage Program, NYS DEC, 625 Broadway, 5th Floor
Albany, NY 12233-4757
(518) 402-8935

HISTORICAL RECORDS

The following plants and animals were documented in the vicinity of the project site at one time, but have not been documented there since 1979 or earlier.
There is no recent information on these plants and animals in the vicinity of the project site and their current status there is unknown. In most cases the precise location of the plant or animal in this vicinity at the time it was last documented is also unknown and therefore location maps are generally not provided.
If appropriate habitat for these plants or animals is present in the vicinity of the project site, it is possible that they may still occur there.

Natural Heritage Report on Rare Species and Ecological Communities

VASCULAR PLANTS

Aplectrum hyemale

Puttyroot

Office Use 6115

NY Legal Status: Endangered
Federal Listing:
Last Report: 1885-06-05

NYS Rank: S1 - Critically imperiled
Global Rank: G5 - Secure
EO Rank: Historical, no recent information

County: Niagara
Town: Niagara Falls - City
Location: Whirlpool Woods
Directions: Specimen label: Whirlpool [Whirlpool Woods].
General Quality and Habitat: Specimen label: Woods.

Gentianopsis virgata

Lesser Fringed Gentian

Office Use 2548

NY Legal Status: Endangered
Federal Listing:
Last Report: 1933-09

NYS Rank: S1 - Critically imperiled
Global Rank: G5 - Secure
EO Rank: Historical, no recent information

M

County: Niagara
Town: Lewiston
Location: Lewiston
Directions: Lewiston.
General Quality and Habitat:

Monarda clinopodia

Office Use 5287

Basil-balm

NY Legal Status: Endangered
Federal Listing:
Last Report: 1887-08

NYS Rank: S1S2 - Critically imperiled
Global Rank: G5 - Secure
EO Rank: Historical, no recent information

County: Niagara
Town: Niagara Falls - City
Location: Goat Island
Directions: Goat Island, Niagara Falls.
General Quality and Habitat: An island in the Niagara River.

Potamogeton alpinus

Office Use 6996

Northern Pondweed

NY Legal Status: Threatened
Federal Listing:
Last Report: 1996-08-21

NYS Rank: S2 - Imperiled
Global Rank: G5 - Secure
EO Rank: Historical, no recent information

County: Niagara
Town: Niagara Falls - City
Location: Niagara Falls
Directions: The plants were collected 0.6 mile above Niagara Falls.
General Quality and Habitat: In a river.

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a Records Processed

More detailed information about many of the rare and listed animals and plants in New York, including biology, identification, habitat, conservation, and management, are available online in Natural Heritage's Conservation Guides at www.acris.nynhp.org, from NatureServe Explorer at http://www.natureserve.org/explorer, from NYSDEC at http://www.dec.ny.gov/animals/7494.html (for animals), and from USDA's Plants Database at http://plants.usda.gov/index.html (for plants).

USERS GUIDE TO NY NATURAL HERITAGE DATA

New York Natural Heritage Program, 625 Broadway, 5th Floor, Albany, NY 12233-4757 phone: (518) 402-8935

NATURAL HERITAGE PROGRAM: The NY Natural Heritage Program is a partnership between the NYS Department of Environmental Conservation (NYS DEC) and The Nature Conservancy. Our Mission is to facilitate the conservation of New York's biodiversity by providing comprehensive information and scientific expertise on rare species and natural ecosystems to resource managers and other conservation partners. We accomplish this mission by combining thorough field inventories, scientific analyses, expert interpretation, and the most comprehensive database on New York's distinctive biodiversity to deliver the highest quality information for natural resource planning, protection, and management.

DATA SENSITIVITY: The data provided in the report are ecologically sensitive and should be treated in a sensitive manner. The report is for your in-house use and should not be released, distributed or incorporated in a public document without prior permission from the Natural Heritage Program.

EO RANK: A letter code for the quality of the occurrence of the rare species or significant natural community, based on population size or area, condition, and landscape context.

A-E = Extant: A=Excellent, B=Good, C=Fair, D=Poor, E=Extant but with insufficient data to assign a rank of A-D.
F = Failed to find. Did not locate species during a limited search, but habitat is still there and further field work is justified.
H = Historical. Historical occurrence without any recent field information.
X = Extirpated. Field/other data indicates element/habitat is destroyed and the element no longer exists at this location.
U = Extant/Historical status uncertain.
Blank = Not assigned.

LAST REPORT: The date that the rare species or significant natural community was last observed at this location, as documented in the Natural Heritage databases. The format is most often YYYY-MM-DD.

NY LEGAL STATUS – Animals:

Categories of Endangered and Threatened species are defined in New York State Environmental Conservation Law section 11-0535. Animals listed as Endangered, Threatened, or Special Concern are protected against taking, importation, transportation, possession, or sale without a permit. Endangered, Threatened, and Special Concern species are listed in regulation 6NYCRR 182.5.

E - Endangered Species: any species which meet one of the following criteria:
- Any native species in imminent danger of extirpation or extinction in New York.
- Any species listed as endangered by the United States Department of the Interior, as enumerated in the Code of Federal Regulations 50 CFR 17.11.

T - Threatened Species: any species which meet one of the following criteria:
- Any native species likely to become an endangered species within the foreseeable future in NY.
- Any species listed as threatened by the U.S. Department of the Interior, as enumerated in the Code of the Federal Regulations 50 CFR 17.11.

SC - Special Concern Species: those species which are not yet recognized as endangered or threatened, but for which documented concern exists for their continued welfare in New York.

P - Protected Wildlife (defined in Environmental Conservation Law section 11-0103): wild game, protected wild birds, and endangered species of wildlife.

U - Unprotected (defined in Environmental Conservation Law section 11-0103): the species may be taken at any time without limit; however a license to take may be required.

G - Game (defined in Environmental Conservation Law section 11-0103): any of a variety of big game or small game species as stated in the Environmental Conservation Law; many normally have an open season for at least part of the year, and are protected at other times.

NY LEGAL STATUS – Plants:

The following categories are defined in regulation 6NYCRR part 193.3 and apply to NYS Environmental Conservation Law section 9-1503.

E - Endangered Species: listed species are those with:
- 5 or fewer extant sites, or
- fewer than 1,000 individuals, or
- restricted to fewer than 4 U.S.G.S. 7 ½ minute topographical maps, or
- species listed as endangered by U.S. Dept. of Interior, as enumerated in Code of Federal Regulations 50 CFR 17.11

T - Threatened: listed species are those with:
- 6 to fewer than 20 extant sites, or
- 1,000 to fewer than 3,000 individuals, or
- restricted to not less than 4 or more than 7 U.S.G.S. 7 and ½ minute topographical maps, or
- listed as threatened by U.S. Department of Interior, as enumerated in Code of Federal Regulations 50 CFR 17.11

R - Rare: listed species have:
- 20 to 35 extant sites, or
- 3,000 to 5,000 individuals statewide.

V - Exploitably vulnerable: listed species are likely to become threatened in the near future throughout all or a significant portion of their range within the state if causal factors continue unchecked.

U - Unprotected; no state status.

FEDERAL STATUS (PLANTS and ANIMALS): The categories of federal status are defined by the United States Department of the Interior as part of the 1974 Endangered Species Act (see Code of Federal Regulations 50 CFR 17). The species listed under this law are enumerated in the Federal Register vol. 50, no. 188, pp. 39526 - 39527. The codes below without parentheses are those used in the Federal Register. The codes below in parentheses are created by Heritage to deal with species which have different listings in different parts of their range, and/or different listings for different subspecies or varieties.

(blank) = No Federal Endangered Species Act status.
LE = Formally listed as endangered.
LT = Formally listed as threatened.
C = Candidate for listing.
LE,LT = Formally listed as endangered in part of its range, and as threatened in the other part; or, one or more subspecies or varieties is listed as endangered, and the others are listed as threatened.
LT,PDL = Populations of the species in New York are formally listed as threatened, and proposed for delisting.

GLOBAL AND STATE RANKS (animals, plants, ecological communities and others): Each element has a global and state rank as determined by the *NY Natural Heritage Program*. These ranks carry no legal weight. The global rank reflects the rarity of the element throughout the world and the state rank reflects the rarity within New York State. Intraspecific taxa are also assigned a taxon rank to reflect the infraspecific taxon's rank throughout the world. ? = Indicates that the state or global rank is uncertain and more information is needed. Range ranks, e.g. S1S2, indicate not enough information is available to distinguish between two ranks.

GLOBAL RANK:

G1 - Critically imperiled globally because of extreme rarity (5 or fewer occurrences) or very few remaining acres, or miles of stream) or especially vulnerable to extinction because of some factor of its biology.
G2 - Imperiled globally because of rarity (6 - 20 occurrences, or few remaining acres, or miles of stream) or very vulnerable to extinction throughout its range because of other factors.
G3 - Vulnerable: Either rare and local throughout its range (21 to 100 occurrences), or found locally (even abundantly at some of its locations) in a restricted range (e.g. a physiographic region), or vulnerable to extinction throughout its range because of other factors.
G4 - Apparently secure globally, though it may be quite rare in parts of its range, especially at the periphery.
G5 - Demonstrably secure globally, though it may be quite rare in parts of its range, especially at the periphery.
GH - Historically known, with the expectation that it might be rediscovered.
GX - Species believed to be extinct.
GU - Lack of information or substantial conflicting information about status or trends makes ranking infeasible at this time.

NYS RANK:

S1 - Critically imperiled: Typically 5 or fewer occurrences, very few remaining individuals, acres, or miles of stream, or some factor of its biology making it especially vulnerable in New York State.
S2 - Imperiled: Typically 6 to 20 occurrences, few remaining individuals, acres, or miles of stream, or factors demonstrably making it very vulnerable in New York State.
S3 - Vulnerable: Typically 21 to 100 occurrences, limited acreage, or miles of stream in New York State.
S4 - Apparently secure in New York State.
S5 - Demonstrably secure in New York State.
SH - Historically known from New York State, but not seen in the past 20 years.
SX - Apparently extirpated from New York State.
SU - Lack of information or substantial conflicting information about status or trends makes ranking infeasible at this time.

SxB and SxN, where Sx is one of the codes above, are used for migratory animals, and refer to the rarity within New York State of the breeding (B)populations and the non-breeding populations (N), respectively, of the species.

TAXON (T) RANK: The T ranks (T1 - T5) are defined the same way as the Global ranks (G1 - G5), but the T-rank refers only to the rarity of the subspecific taxon.
T1 through T5 - See Global Rank definitions above.
Q - Indicates a question exists whether or not the taxon is a good taxonomic entity.

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
Division of Fish, Wildlife & Marine Resources
Habitat Inventory Unit
625 Broadway, 5th Floor, Albany, New York 12233-4757
Phone: (518) 402-8935 • **Fax:** (518) 402-8925
Website: www.dec.ny.gov

Joe Martens
Commissioner

September 13, 2011

Melissa McCarthy
EDR Companies
217 Montgomery St.
Suite 1000
Syracuse, NY 13202

Dear Ms McCarthy:

In response to your recent request, we have reviewed the New York Natural Heritage Program Database with respect to an Environmental Assessment for the Niagara Gorge Ecological Inventory # 09065, as indicated in the shapefile you provided, located within the town of Lewiston and the City of Niagara Falls, Niagara County.

Enclosed is a report of rare or state-listed animals and plants, significant natural communities and other significant habitats, which our databases indicate occur, or may occur, on your site or in the immediate vicinity of your site. For most sites, comprehensive field surveys have not been conducted; the enclosed report only includes records from our databases. We cannot provide a definitive statement as to the presence or absence of all rare or state-listed species or natural communities. This information should not be substituted for on-site surveys that may be required for environmental impact assessment.

The enclosed report may be included in documents that will be available to the public. However, any enclosed maps displaying locations of rare species are considered sensitive information and are intended only for the internal use of the recipient; they should not be included in any document that will be made available to the public, without permission from the New York Natural Heritage Program.

The presence of the plants and animals identified in the enclosed report may result in this project requiring additional review or permit conditions. For further guidance, and for information regarding other permits that may be required under state law for regulated areas or activities, (e.g., regulated wetlands), please contact the appropriate NYS DEC Regional Office, Division of Environmental Permits, as listed at www.dec.ny.gov/about39381.html.

Our databases are continually growing as records are added and updated. If this proposed project is still under development one year from now, we recommend that you contact us again so that we may update this response with the most current information.

Sincerely,

Katherine F. Barnes

Katherine F. Barnes, GISP
Cartographic Technician 3
Habitat Inventory Unit

Natural Heritage Report on Rare Species and Ecological Communities

NY Natural Heritage Program, NYS DEC, 625 Broadway, 5th Floor,
Albany, NY 12233-4757
(518) 402-8935

-The information in this report includes only records entered into the NY Natural Heritage databases as of the date of the report. This report is not a definitive statement on the presence or absence of all rare species or significant natural communities at or in the vicinity of the site.
-Refer to the User's Guide for explanations of codes, ranks and fields.
-Location maps for certain species and communities may not be provided 1) if the species is vulnerable to disturbance, 2) if the location and/or extent is not precisely known, 3) if the location and/or extent is too large to display, and/or 4) if the animal is listed as Endangered or Threatened by New York State.

Natural Heritage Report on Rare Species and Ecological Communities

COMMUNITIES

Calcareous talus slope woodland

This occurrence of Calcareous Talus Slope Woodland is considered significant from a statewide perspective by the NY Natural Heritage Program. It is either an occurrence of a community type that is rare in the state or a high quality example of a more common community type. By meeting specific, documented significance criteria, the NY Natural Heritage Program considers this occurrence to have high ecological and conservation value.

Office Use

NY Legal Status:	Unlisted	**NYS Rank:**	S3	5499
Federal Listing:		**Global Rank:**	G3G4	
Last Report:	2000-09-14	**EO Rank:**		
County:	Niagara			
Town:	Lewiston, Niagara Falls - City			
Location:	Niagara Gorge Whirlpool Woods			

General Quality and Habitat: The community is of moderate size, but within a largely developed landscape. A number of exotic species can be found in communities directly adjacent to the cliff face, but generally not at high densities directly on the cliff face. Restoring areas of the cliff to a more natural state and eliminating some activities could potentially raise the overall rank of this community. A sparsely vegetated to completely forested calcareous talus slope community lying below an extensive limestone cliff and above the Niagara River. As currently documented, the community extends the length of the Niagara Gorge from Niagara Falls downstream roughly 8000 meters to a large dam operated by the New York Power Authority. The plateau above the rim of the gorge is developed for recreation and sightseeing with several picnic grounds, tourists facilities, parking lots and roads. The landscape surrounding the community is rural to the north consisting of primarily abandoned farm fields and scattered hamlets and urban and heavily populated to the east, west and south.

Calcareous cliff community

This occurrence of Calcareous Cliff Community is considered significant from a statewide perspective by the NY Natural Heritage Program. It is either an occurrence of a community type that is rare in the state or a high quality example of a more common community type. By meeting specific, documented significance criteria, the NY Natural Heritage Program considers this occurrence to have high ecological and conservation value.

Office Use

NY Legal Status:	Unlisted	**NYS Rank:**	S3	10512
Federal Listing:		**Global Rank:**	G4	
Last Report:	2000-09-14	**EO Rank:**		
County:	Niagara			
Town:	Lewiston, Niagara Falls - City			
Location:	Niagara Gorge Whirlpool Woods			

General Quality and Habitat: The community is of moderate size, but within a largely developed landscape. A number of exotic species can be found in communities directly adjacent to the cliff face, but generally not at high densities directly on the cliff face. Restoring areas of the cliff to a more natural state and eliminating some activities could potentially raise the overall rank. Sparsely vegetated limestone cliffs along the east rim of the Niagara Gorge from Niagara Falls downstream roughly 8000 meters. The cliff grades into a calcareous talus slope woodland below the cliff. The plateau above the rim of the gorge is developed for recreation and sightseeing with several picnic grounds, tourists facilities, parking lots and roads. The landscape surrounding the community is rural to the north consisting of primarily abandoned farm fields and scattered hamlets and urban and heavily populated to the east, west and south.

FISH

Acipenser fulvescens

Lake Sturgeon — Office Use 8830

NY Legal Status: Threatened | NYS Rank: S1S2 - Critically imperiled
Federal Listing: | Global Rank: G3G4 - Vulnerable — BOF
Last Report: ** | EO Rank: **
County: Niagara
Town: Lewiston
Location: At, or in the vicinity of, the project site
General Quality and Habitat: **For information on the population at this location and management considerations, please contact the NYS DEC Regional Wildlife Manager for the Region where the project is located

FRESHWATER MUSSELS

Obovaria olivaria

Hickorynut — Office Use 11306

NY Legal Status: Unlisted | NYS Rank: S1 - Critically imperiled
Federal Listing: | Global Rank: G4 - Apparently secure
Last Report: 1997-06-10 | EO Rank: Possibly Extant
County: Erie, Niagara
Town: Grand Island, Niagara Falls - City
Location: Niagara River Buckhorn Island and Goat Island
General Quality and Habitat: David Strayer (2003) indicated that Obovaria olivaria probably existed in small numbers in the Niagara River in the early 1990s before the zebra mussel outbreak in the mid-1990s. It appears that zebra mussels have killed most of the unionids as only old, chalky shells were found. However, Strayer also indicated that additional surveys are needed to determine if this species as well as other unionids are truly extirpated from this site. Buckhorn Island: The mussels were found on a sand bar of firm sand under 0.25-1 meter of water fringing a deep channel. There are patches of macrophytes (Scirpus, Potamogeton) and the water is clear. Goat Island: The mussels were found near Goat Island.The water current is fast as it leads to Niagara Falls.

Villosa iris

Rainbow — Office Use 8707

NY Legal Status: Unlisted | NYS Rank: S2S3 - Imperiled
Federal Listing: | Global Rank: G5Q - Secure
Last Report: 1997-06-10 | EO Rank: Extant
County: Erie, Niagara
Town: Grand Island, Niagara Falls - City
Location: Niagara River Buckhorn Island and Goat Island
General Quality and Habitat: While no live mussels were found in 1997 it is still assumed the population is extant because valves were found. Buckhorn Island: The mussels were found on a sand bar of firm sand under 0.25-1 meter of water fringing a deep channel. There are patches of macrophytes such as Scirpus, Potamogeton and the water is clear. Goat Island: The mussels were found near Goat Island. The water current is fast as it leads to Niagara Falls.

OTHER

Waterfowl Winter Concentration Area

Office Use 7656

NY Legal Status: Unlisted | NYS Rank: S3S4 - Vulnerable
Federal Listing: | Global Rank: GNR - Not ranked
Last Report: 1994-01-25 | EO Rank: Extant
County: Niagara — S
Town: Lewiston, Porter
Location: Lower Niagara River
General Quality and Habitat: A very large, deep riverine habitat that is comparable to open water areas in Lake Ontario. Here the river abruptly broadens from the very narrow, deep, fast flowing stretch of the gorge at the generating stations. A variety of waterfowl species also feed in the lower Niagara River rapids (upstream from the Niagara Escarpment), but concentrations are limited due to lack of resting areas. The lower rapids do not freeze over in winter providing some suitable habitat in any given year.

Gull Colony

Office Use

NY Legal Status: Unlisted | NYS Rank: SNR - Rank not assigned | 9250
Federal Listing: | Global Rank: GNR - Not ranked
Last Report: 1996-05-25 | EO Rank: Extant
County: Niagara | 5
Town: Niagara Falls - City
Location: Goat Island
General Quality and Habitat: Although a full survey (count) was conducted a rank of "E" was assigned because there are no global rank specifications for this type of occurrence. The nests are in open rocky areas on cliff ledges and talus slope. The slope below the cliff has sections of trees, shrubs and grass.

VASCULAR PLANTS

Carex garberi

Elk Sedge

Office Use

NY Legal Status: Endangered | NYS Rank: S1 - Critically Imperiled | 9751
Federal Listing: | Global Rank: G5 - Secure
Last Report: 1900-00-16 | EO Rank: Good
County: Niagara | 6
Town: Niagara Falls - City
Location: Niagara Gorge Whirlpool Woods
General Quality and Habitat: The population and habitat are in good shape, but some exotics are present. Deep river gorge with calcareous cliff community of sparse vegetation and large areas of talus. Soils well drained, loose, shaky. With Crataegus sp., Campanula rotundifolia, Thuja occidentalis, Muhlenbergia racemosa, Toxicodendron radicans

Gentianopsis virgata

Lesser Fringed Gentian

Office Use

NY Legal Status: Endangered | NYS Rank: S1 - Critically Imperiled | 10445
Federal Listing: | Global Rank: G5 - Secure
Last Report: 1900-10-00 | EO Rank: Fair
County: Niagara | 5
Town: Niagara Falls - City
Location: Niagara Gorge Whirlpool Woods
General Quality and Habitat: This is a small population in good habitat. Deep river gorge with calcareous cliff community of sparse vegetation and large areas of talus. Soils well drained. With Aster tataricus, Agrostis stolonifera, Leucanthemum vulgare. Remains of an old railroad bed are evident.

Liatris cylindracea

Slender Blazing-star

Office Use

NY Legal Status: Endangered | NYS Rank: S1 - Critically Imperiled | 9918
Federal Listing: | Global Rank: G5 - Secure
Last Report: 2000-09-27 | EO Rank: Fair
County: Niagara
Town: Niagara Falls - City
Location: Niagara Gorge Whirlpool Woods
General Quality and Habitat: A total of 77 stems from 19 genets and 6 distinct groups within a well-protected gorge system. These plants need high light levels, thus they are found in openings, talus, and disturbed areas. This plant is found on and around a large boulder within the deep gorge of the Niagara River. Additional plants may be found within the talus slope near this large boulder. A trail that parallels that swift-moving rapids of the Niagara River is located approximately 4 meters from this boulder and plants are located directly along the edge of this trail. The plants are growing within the calcareous talus and within cracks of larger dolomite boulders and bedrock.

Liatris cylindracea

Office Use 5818

Slender Blazing-star | NY Legal Status: Endangered | NYS Rank: S1 - Critically imperiled
Federal Listing: | Global Rank: G5 - Secure
Last Report: 2000-09-27 | EO Rank: Fair
County: Niagara
Town: Niagara Falls - City
Location: Niagara Gorge Whirlpool Woods

General Quality and Habitat: A total of 77 stems from 10 genets and 6 distinct groups within a well-protected gorge system. These plants need high light levels, thus they are found in openings, talus, and disturbed areas. This plant is found on and around a large boulder within the deep gorge of the Niagara River. Additional plants may be found within the talus slope near this large boulder. A trail that parallels that swift moving rapids of the Niagara River is located approximately 4 meters from this boulder and plants are located directly along the edge of this trail. The plants are growing within the calcareous talus and within cracks of larger dolomite boulders and bedrock.

Oligoneuron ohioense

Office Use 12318

Ohio Goldenrod | NY Legal Status: Threatened | NYS Rank: S2 - Imperiled
Federal Listing: | Global Rank: G4 - Apparently secure
Last Report: 2001-09-18 | EO Rank: Fair
County: Niagara
Town: Lewiston
Location: Lewiston Riverbank

General Quality and Habitat: This is a small population in good habitat in a heavily disturbed landscape. The site consists of a steep (about 50 degree slope), west-facing embankment of compacted clay, perhaps with interlayered alluvium, about two stories high. There is an abandoned staircase structure upslope of the plants, and a steel pier on the two meter wide beach. The bank is saturated throughout with calcareous seepage. The bank is open to the sun and covered with grasses and forbs, with some shrubs. There are some trees planted at the top of the slope. The plants occur near the base of the bank, in clay soil, above a sandy and cobbly beach. There are massive tufa deposits at the base of the bank from mosses, including Didymodon tophaceus, and mats of Cratoneuron filicinum in the calcareous seeps.

Pellaea glabella ssp. glabella

Office Use 7400

Smooth Cliff Brake | NY Legal Status: Threatened | NYS Rank: S2 - Imperiled
Federal Listing: | Global Rank: G5T5 - Secure
Last Report: 2000-09-27 | EO Rank: Good
County: Niagara
Town: Niagara Falls - City
Location: Niagara Gorge Whirlpool Woods

General Quality and Habitat: Over two hundred plants scattered within a protected gorge system. This plant is scattered within the deep river gorge carved out by the Niagara River just below Niagara Falls. The plants are found within a calcareous cliff community and calcareous talus slope woodland. The vegetation is sparse in many areas and the soils are well drained. The remains of an old railroad bed are evident within this gorge system. The "plant rock population" is found on a two-plus story tall dolomitic boulder that fell from the Lockport formation cliffs located above. One side of this rock is directly adjacent to the trail the traverses the entire lower gorge and the other side of this rock rests near the edge of the Niagara River. The plants are mostly found on the south side in partial to full sunlight. The "Whirlpool Point population"

Pellaea glabella ssp. glabella

Smooth Cliff Brake

Office Use 7408

NY Legal Status: Threatened
Federal Listing:
Last Report: 2000-09-27
County: Niagara
Town: Niagara Falls - City
Location: Niagara Gorge Whirlpool Woods
NYS Rank: S2 - Imperiled
Global Rank: G5T5 - Secure
EO Rank: Good

General Quality and Habitat: Over two hundred plants scattered within a protected gorge system. This plant is scattered within the deep river gorge carved out by the Niagara River just below Niagara Falls. The plants are found within a calcareous cliff community and calcareous talus slope woodland. The vegetation is sparse in many areas and the soils are well drained. The remains of an old railroad bed are evident within this gorge system. The "giant rock population" is found on a two-plus story tall dolomitic boulder that fell from the Lockport formation cliffs located above. One side of this rock is directly adjacent to the trail the traverses the entire lower gorge and the other side of this rock rests near the edge of the Niagara River. The plants are mostly found on the south side in partial to full sunlight. The "Whirlpool Point population"

Pellaea glabella ssp. glabella

Smooth Cliff Brake

Office Use 7408

NY Legal Status: Threatened
Federal Listing:
Last Report: 2000-09-27
County: Niagara
Town: Niagara Falls - City
Location: Niagara Gorge Whirlpool Woods
NYS Rank: S2 - Imperiled
Global Rank: G5T5 - Secure
EO Rank: Good

General Quality and Habitat: Over two hundred plants scattered within a protected gorge system. This plant is scattered within the deep river gorge carved out by the Niagara River just below Niagara Falls. The plants are found within a calcareous cliff community and calcareous talus slope woodland. The vegetation is sparse in many areas and the soils are well drained. The remains of an old railroad bed are evident within this gorge system. The "giant rock population" is found on a two-plus story tall dolomitic boulder that fell from the Lockport formation cliffs located above. One side of this rock is directly adjacent to the trail the traverses the entire lower gorge and the other side of this rock rests near the edge of the Niagara River. The plants are mostly found on the south side in partial to full sunlight. The "Whirlpool Point population"

Symphyotrichum oolentangiense

Sky-blue Aster

Office Use 9142

NY Legal Status: Endangered
Federal Listing:
Last Report: 2000-09-20
County: Niagara
Town: Niagara Falls - City
Location: Niagara Gorge Whirlpool Woods
NYS Rank: S1 - Critically imperiled
Global Rank: G5 - Secure
EO Rank: Fair

General Quality and Habitat: There are possibly 100 or more plants plants in two distinct groups within a well-protected, but unstable system. The plants are found in two distinct areas. Group 1: The plants are located at the top rim of a deep river gorge, just above a high calcareous cliff community. This group is located in a small remnant grassland squeezed between a parking lot and the top rim of the gorge. From this vantage point, there is a great view of the Niagara River gorge and Canada. Group 2: The plants are located within the calcareous talus slope and on the dolomitic limestone flats at the base of the gorge. The soils are well drained and normally quite dry. Within the gorge, there is the remains of an old railroad bed. This portion of the gorge is used most by fisherman trying to gain access to the Niagara River

10 Records Processed

More detailed information about many of the rare and listed animals and plants in New York, including biology, identification, habitat, conservation, and management, are available online in Natural Heritage's Conservation Guides at www.acris.nynhp.org, from NatureServe Explorer at http://www.natureserve.org/explorer, from NYSDEC at http://www.dec.ny.gov/animals/7494.html (for animals), and from USDA's Plants Database at http://plants.usda.gov/index.html (for plants).

More detailed information about many of the natural community types in New York, including identification, dominant and characteristic vegetation, distribution, conservation, and management, is available online in Natural Heritage's Conservation Guides at www.acris.nynhp.org. For descriptions of all community types, go to http://www.dec.ny.gov/animals/29384.html and click on Draft Ecological Communities of New York State.

NY Natural Heritage Program, NYS DEC, 625 Broadway, 5th Floor
Albany, NY 12233-4757
(518) 402-8935

HISTORICAL RECORDS

The following plants and animals were documented in the vicinity of the project site at one time, but have not been documented there since 1979 or earlier, or there is uncertainty regarding their continued presence.
There is no recent information on these plants and animals in the vicinity of the project site and their current status there is unknown. In most cases the precise location of the plant or animal in this vicinity at the time it was last documented is also unknown and therefore location maps are generally not provided.
If appropriate habitat for these plants or animals is present in the vicinity of the project site, it is possible that they may still occur there.

Natural Heritage Report on Rare Species and Ecological Communities

VASCULAR PLANTS

Aplectrum hyemale

Puttyroot

NY Legal Status: Endangered
Federal Listing:
Last Report: 1985-06-05

NYS Rank: S1 - Critically imperiled
Global Rank: G5 - Secure
EO Rank: Historical, no recent information

Office Use 6115

County: Niagara
Town: Niagara Falls - City
Location: Whirlpool Woods
Directions: Specimen label: Whirlpool (Whirlpool Woods).
General Quality and Habitat: Specimen label: Woods.

Gentianopsis virgata

Lesser Fringed Gentian

NY Legal Status: Endangered
Federal Listing:
Last Report: 1833-09

NYS Rank: S1 - Critically imperiled
Global Rank: G5 - Secure
EO Rank: Historical, no recent information

Office Use 2548

M

County: Niagara
Town: Lewiston
Location: Lewiston
Directions: Lewiston
General Quality and Habitat:

Potamogeton alpinus

Office Use 6906

Northern Pondweed

NY Legal Status: Threatened
Federal Listing:
Last Report: 1886-08-21

NYS Rank: S2 - Imperiled
Global Rank: G5 - Secure
EO Rank: Historical, no recent information

County: Niagara
Town: Niagara Falls - City
Location: Niagara Falls
Directions: The plants were collected 0.5 mile above Niagara Falls.
General Quality and Habitat: In a river.

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3 Records Processed

More detailed information about many of the rare and listed animals and plants in New York, including biology, identification, habitat, conservation, and management, are available online in Natural Heritage's Conservation Guides at www.acris.nynhp.org, from NatureServe Explorer at http://www.natureserve.org/explorer, from NYSDEC at http://www.dec.ny.gov/animals/7494.html (for animals), and from USDA's Plants Database at http://plants.usda.gov/index.html (for plants).

United States Department of the Interior

FISH AND WILDLIFE SERVICE

New York Field Office
3817 Luker Road, Cortland, NY 13045
Phone: (607) 753-9334
Fax: (607) 753-9699

Long Island Field Office
3 Old Barto Rd., Brookhaven, NY 11719
Phone: (631) 776-1401
Fax: (631) 776-1405

Endangered Species Act List Request Response Cover Sheet

This cover sheet is provided in response to a search of our website* for information regarding the potential presence of species under jurisdiction of the U.S. Fish and Wildlife Service (Service) within a proposed project area.

Attached is a copy of the New York State County List of Threatened, Endangered, and Candidate Species for the appropriate county(ies). The database that we use to respond to list requests was developed primarily to assist Federal agencies that are consulting with us under Section 7(a)(2) of the Endangered Species Act (ESA) (87 Stat. 884, as amended; 16 U.S.C. 1531 ***et seq***.). Our lists include all Federally-listed, proposed, and candidate species known to occur, as well as those likely to occur, in specific counties.

The attached information is designed to assist project sponsors or applicants through the process of determining whether a Federally-listed, proposed, or candidate species and/or "critical habitat" may occur within their proposed project area and when it is appropriate to contact our offices for additional coordination or consultation. You may be aware that our offices have provided much of this information in the past in project-specific letters. However, due to increasing project review workloads and decreasing staff, we are now providing as much information as possible through our website. We encourage anyone requesting species list information to print out all materials used in any analyses of effects on listed, proposed, or candidate species.

The Service routinely updates this database as species are proposed, listed, and delisted, or as we obtain new biological information or specific presence/absence information for listed species. If project proponents coordinate with the Service to address proposed and candidate species in early stages of planning, this should not be a problem if these species are eventually listed. However, we recommend that both project proponents and reviewing agencies retrieve from our online database an ***updated*** list every 90 days to append to this document to ensure that listed species presence/absence information for the proposed project is ***current.***

Reminder: Section 9 of the ESA prohibits unauthorized taking** of listed species and applies to Federal and non-Federal activities. For projects not authorized, funded, or carried out by a Federal agency, consultation with the Service pursuant to Section 7(a)(2) of the ESA is not required. However, no person is authorized to "take**" any listed species without appropriate authorizations from the Service. Therefore, we provide technical assistance to individuals and agencies to assist with project planning to avoid the potential for "take**," or when appropriate, to provide assistance with their application for an incidental take permit pursuant to Section 10(a)(1)(B) of the ESA.

Additionally, endangered species and their habitats are protected by Section 7(a)(2) of the ESA, which requires Federal agencies, in consultation with the Service, to ensure that any action it authorizes, funds, or carries out is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat. An assessment of the potential direct, indirect, and cumulative impacts is required for all Federal actions that may affect listed species.

For instance, work in certain waters of the United States, including wetlands and streams, may require a permit from the U.S. Army Corps of Engineers (Corps). If a permit is required, in reviewing the application pursuant to the Fish and Wildlife Coordination Act (48 Stat. 401, as amended;16 U.S.C. 661 ***et seq.***), the Service may concur, with or without recommending additional permit conditions, or recommend denial of the permit depending upon potential adverse impacts on fish and wildlife resources associated with project construction or implementation. The need for a Corps permit may be determined by contacting the appropriate Corps office(s).*

For additional information on fish and wildlife resources or State-listed species, we suggest contacting the appropriate New York State Department of Environmental Conservation regional office(s) and the New York Natural Heritage Program Information Services.*

Since wetlands, ponds, streams, or open or sheltered coastal waters may be present in the project area, it may be helpful to utilize the National Wetlands Inventory (NWI) maps as an initial screening tool. However, they may or may not be available for the project area. Please note that while the NWI maps are reasonably accurate, they should not be used in lieu of field surveys for determining the presence of wetlands or delineating wetland boundaries for Federal regulatory purposes. Online information on the NWI program and digital data can be downloaded from Wetlands Mapper, http://wetlands.fws.gov/mapper_tool.htm.

Project construction or implementation should not commence until all requirements of the ESA have been fulfilled. After reviewing our website and following the steps outlined, we encourage both project proponents and reviewing agencies to contact our office to determine whether an accurate determination of species impacts has been made. If there are any questions about our county lists or agency or project proponent responsibilities under the ESA, please contact the New York or Long Island Field Office Endangered Species Program at the numbers listed above.

Attachment (county list of species)

*Additional information referred to above may be found on our website at: http://www.fws.gov/northeast/nyfo/es/section7.htm

** Under the Act and regulations, it is illegal for any person subject to the jurisdiction of the United States to ***take*** (includes harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect; or to attempt any of these), import or export, ship in interstate or foreign commerce in the course of commercial activity, or sell or offer for sale in interstate or foreign commerce any endangered fish or wildlife species and most threatened fish and wildlife species. It is also illegal to possess, sell, deliver, carry, transport, or ship any such wildlife that has been taken illegally. “Harm” includes any act which actually kills or injures fish or wildlife, and case law has clarified that such acts may include significant habitat modification or degradation that significantly impairs essential behavioral patterns of fish or wildlife.

Niagara County

Federally Listed Endangered and Threatened Species and Candidate Species

This list represents the best available information regarding known or likely County occurrences of Federally-listed and candidate species and is subject to change as new information becomes available.

Common Name	Scientific Name	Status
Bald eagle [1]	***Haliaeetus leucocephalus***	D
Eastern prairie fringed orchid ***(Historic)***	***Platanthera leucophea***	T

Status Codes: E=Endangered, T=Threatened, P=Proposed, C=Candidate, D=Delisted.

[1] The bald eagle was delisted on August 8, 2007. While there are no ESA requirements for bald eagles after this date, the eagles continue to receive protection under the Bald and Golden Eagle Protection Act (BGEPA). Please follow the Service's May 2007 Bald Eagle Management Guidelines to determine whether you can avoid impacts under the BGEPA for your projects. If you have any questions, please contact the endangered species branch in our office.

Information current as of: 6/15/110

Print Species List

APPENDIX B

Plant Species List

PLANT SPECIES INVENTORY
Observed On-Site During EDR Surveys, 2010

	Family	Genus	species	common name	Gorge	Rim
*	Aceraceae	***Acer***	***negundo***	box elder	x	x
	Aceraceae	***Acer***	***nigrum***	black maple	x	
*	Aceraceae	***Acer***	***platanoides***	Norway maple	x	x
*	Aceraceae	***Acer***	***pseudoplatanus***	sycamore maple		x
	Aceraceae	***Acer***	***rubrum***	red maple		x
	Aceraceae	***Acer***	***saccharum***	sugar maple	x	x
	Aceraceae	***Acer***	***spicatum***	mountain maple	x	
	Anacardiaceae	***Rhus***	***aromatica***	fragrant sumac	x	x
	Anacardiaceae	***Rhus***	***typhina***	staghorn sumac	x	x
	Anacardiaceae	***Toxicodendron***	***radicans***	poison ivy	x	x
*	Apiaceae	***Daucus***	***carota***	Queen Anne's lace	x	x
	Apocynaceae	***Apocynum***	***androsaemifolium***	spreading dogbane		x
*	Apocynaceae	***Vinca***	***minor***	periwinkle		x
	Aquifoliaceae	***Ilex***	***opaca***	American holly		x
	Araceae	***Arisaema***	***triphyllum***	jack-in-the-pulpit	x	x
	Araliaceae	***Aralia***	***nudicaulis***	sarsaparilla	x	
	Araliaceae	***Aralia***	***racemosa***	spikenard	x	
*	Araliaceae	***Hedera***	***helix***	English ivy		x
	Aristolochiaceae	***Asarum***	***canadense***	wild ginger	x	
	Asclepiadaceae	***Asclepias***	***incarnata***	swamp milkweed	x	
	Asclepiadaceae	***Asclepias***	***syriaca***	common milkweed	x	x
	Aspleniaceae	***Asplenium***	***trichomanes***	maidenhair spleenwort	x	
*	Asteraceae	***Achillea***	***millefolium***	common yarrow	x	x
	Asteraceae	***Ambrosia***	***artemisiifolia***	annual ragweed		x
	Asteraceae	***Antennaria***	***neglecta***	field pussytoes		x
*	Asteraceae	***Arctium***	sp.	burdock	x	x
*	Asteraceae	***Artemisia***	***vulgaris***	common mugwort		x
*	Asteraceae	***Bellis***	***perennis***	English daisy		x
*	Asteraceae	***Centaurea***	***stoebe***	spotted knapweed		x
*	Asteraceae	***Cichorium***	***intybus***	chicory		x
*	Asteraceae	***Cirsium***	***arvense***	Canada thistle		x
	Asteraceae	***Cirsium***	***muticum***	swamp thistle	x	
*	Asteraceae	***Cirsium***	***vulgare***	bull thistle		x
	Asteraceae	***Erigeron***	***annuus***	daisy fleabane		x
	Asteraceae	***Erigeron***	***philadelphicus***	Philadelphia fleabane		x
	Asteraceae	***Eupatorium***	***perfoliatum***	boneset		x
	Asteraceae	***Eurybia***	***macrophylla***	largeleaf aster	x	
	Asteraceae	***Eutrochium***	***maculatum***	spotted Joe-pye weed		x
*	Asteraceae	***Lapsana***	***communis***	nipplewort		x
*	Asteraceae	***Leucanthemum***	***vulgare***	ox-eye daisy	x	x
*	Asteraceae	***Pilosella***	***caespitosa***	meadow hawkweed		x
*	Asteraceae	***Pilosella***	***piloselloides***	king devil		x
	Asteraceae	***Polymnia***	***canadensis***	small-flowered leafcup	x	
	Asteraceae	***Prenanthes***	sp.	rattlesnake-root	x	x
	Asteraceae	***Solidago***	***flexicaulis***	zigzag goldenrod	x	x
	Asteraceae	***Solidago***	spp.	other goldenrods	x	x
*	Asteraceae	***Taraxacum***	***officinale***	dandelion	x	x
*	Asteraceae	***Tragopogon***	***porrifolius***	purple goat's-beard		x
*	Asteraceae	***Tragopogon***	***pratensis***	goat's-beard		x
*	Asteraceae	***Tussilago***	***farfara***	coltsfoot	x	x
	Balsaminaceae	***Impatiens***	***capensis***	spotted jewelweed	x	

PLANT SPECIES INVENTORY
Observed On-Site During EDR Surveys, 2010

	Family	Genus	species	common name	Gorge	Rim
	Balsaminaceae	***Impatiens***	***pallida***	pale jewelweed		x
*	Berberidaceae	***Berberis***	***thunbergii***	Japanese barberry	x	x
*	Berberidaceae	***Berberis***	***vulgaris***	common barberry	x	x
	Berberidaceae	***Podophyllum***	***peltatum***	may-apple		x
	Betulaceae	***Betula***	***alleghaniensis***	yellow birch	x	
*	Betulaceae	***Betula***	***nigra***	river birch		x
	Betulaceae	***Betula***	***papyrifera***	paper birch	x	x
	Betulaceae	***Betula***	***populifolia***	gray birch	x	x
*	Betulaceae	***Corylus***	***avellana***	European hazelnut		x
	Betulaceae	***Ostrya***	***virginiana***	eastern hophornbeam	x	x
*	Bignoniaceae	***Catalpa***	***speciosa***	catalpa		x
*	Boraginaceae	***Brunnera***	***macrophylla***	largeleaf brunnera		x
*	Brassicaceae	***Alliaria***	***petiolata***	garlic mustard	x	x
*	Brassicaceae	***Barbarea***	***vulgaris***	yellow rocket	x	x
	Brassicaceae	***Cardamine***	***diphylla***	two-leaf toothwort	x	
	Brassicaceae	***Cardamine***	***douglassii***	purple cress	x	
	Brassicaceae	***Cardamine***	***concatenata***	cutleaf toothwort		x
*	Brassicaceae	***Hesperis***	***matronalis***	dame's rocket	x	x
*	Brassicaceae	***Lepidium***	***campestre***	field pepperweed		x
*	Brassicaceae	***Lunaria***	***annua***	money plant	x	
*	Brassicaceae	***Sisymbrium***	***altissimum***	tall tumblemustard	x	
	Caprifoliaceae	***Diervilla***	***lonicera***	bush-honeysuckle	x	
*	Caprifoliaceae	***Lonicera***	***maackii***	Amur honeysuckle		x
*	Caprifoliaceae	***Lonicera***	***morrowii***	Morrow honeysuckle	x	x
*	Caprifoliaceae	***Lonicera***	***tartarica***	Tartarian honeysuckle	x	x
*	Caprifoliaceae	***Lonicera***	***x bella***	fly honeysuckle	x	x
	Caprifoliaceae	***Sambucus***	***racemosa***	red elderberry	x	x
	Caprifoliaceae	***Viburnum***	***acerifolium***	mapleleaf viburnum	x	x
*	Caprifoliaceae	***Viburnum***	***lantana***	wayfaring tree	x	
*	Caryophyllaceae	***Cerastium***	***fontanum***	mouse-ear chickweed		x
*	Celastraceae	***Celastrus***	***orbiculatus***	Oriental bittersweet	x	x
*	Chenopodiaceae	***Chenopodium***	***album***	pigweed		x
*	Clusiaceae	***Hypericum***	***perforatum***	common St.John's-wort	x	x
*	Convolvulaceae	***Convolvulus***	***arvensis***	field bindweed		x
	Cornaceae	***Cornus***	***alternifolia***	alternate-leaved dogwood	x	x
	Cornaceae	***Cornus***	***amomum***	silky dogwood	x	
	Cornaceae	***Cornus***	***racemosa***	grey dogwood	x	x
	Cornaceae	***Cornus***	***rugusa***	roundleaf dogwood	x	
	Cupressaceae	***Juniperus***	***virginiana***	red cedar	x	
	Cupressaceae	***Thuja***	***occidentalis***	white cedar	x	x
	Cyperaceae	***Carex***	***pensylvanica***	Pennsylvania sedge		x
	Cyperaceae	***Carex***	spp.	other sedges	x	x
	Cyperaceae	***Scirpus***	***atrovirens***	green bulrush		x
	Cyperaceae	***Scirpus***	***cyperinus***	wool grass		x
*	Dipsaceae	***Dipsacus***	***fullonum***	Fuller's teasel		x
	Dryopteridaceae	***Dryopteris***	***carthusiana***	spinulose woodfern		x
	Dryopteridaceae	***Dryopteris***	***marginalis***	marginal woodfern	x	
*	Elaeagnaceae	***Elaeagnus***	***umbellata***	autumn olive		x
	Equisetaceae	***Equisetum***	***arvense***	field horsetail	x	
*	Fabaceae	***Cercis***	***canadensis***	eastern redbud		x
*	Fabaceae	***Coronilla***	***varia***	crown vetch		x

PLANT SPECIES INVENTORY
Observed On-Site During EDR Surveys, 2010

	Family	Genus	species	common name	Gorge	Rim
	Fabaceae	***Desmodium***	***glutinosum***	large tick-trefoil		x
*	Fabaceae	***Gleditsia***	***triacanthos***	honey locust		x
*	Fabaceae	***Lotus***	***corniculatus***	bird's foot trefoil		x
*	Fabaceae	***Melilotus***	***officinalis***	yellow sweet clover		x
*	Fabaceae	***Robinia***	***pseudoacacia***	black locust	x	x
*	Fabaceae	***Trifolium***	***aureum***	hop-clover		x
*	Fabaceae	***Trifolium***	***repens***	white clover		x
*	Fabaceae	***Trifolium***	***pratense***	red clover		x
*	Fabaceae	***Vicia***	***cracca***	cow vetch		x
*	Fabaceae	***Wisteria***	***sinensis***	Chinese wisteria		x
	Fagaceae	***Fagus***	***grandifolia***	American beech	x	x
*	Fagaceae	***Fagus***	***sylvatica***	European beech		x
	Fagaceae	***Quercus***	***alba***	white oak		x
	Fagaceae	***Quercus***	***rubra***	red oak	x	x
	Geraniaceae	***Geranium***	***maculatum***	wild geranium		x
	Geraniaceae	***Geranium***	***robertianum***	herb-robert	x	x
	Grossulariaceae	***Ribes***	***americanum***	wild black currant	x	x
	Hamamelidaceae	***Hamamelis***	***virginiana***	witch-hazel		x
*	Hippocastanaceae	***Aesculus***	***hippocastanum***	horse chestnut	x	x
*	Hydrangeaceae	***Philadelphus***	***coronarius***	mock-orange		x
	Hydrophyllaceae	***Hydrophyllum***	***virginianum***	Virginia waterleaf		x
	Juglandaceae	***Carya***	***cordiformis***	bitternut hickory	x	x
	Juglandaceae	***Carya***	***ovata***	shagbark hickory		x
	Juglandaceae	***Juglans***	***cinerea***	butternut	x	
	Juglandaceae	***Juglans***	***nigra***	black walnut		x
	Juncaceae	***Juncus***	***effusus***	soft rush		x
	Juncaceae	***Juncus***	***tenuis***	path rush		x
*	Lamiaceae	***Glechoma***	***hederacea***	ground ivy		x
*	Lamiaceae	***Leonurus***	***cardiaca***	motherwort		x
*	Lamiaceae	***Nepeta***	***cataria***	catnip	x	x
*	Lamiaceae	***Prunella***	***vulgaris***	self-heal		x
	Lauraceae	***Lindera***	***benzoin***	spicebush		x
	Lauraceae	***Sassafras***	***albidum***	sassafras		x
	Liliaceae	***Erythronium***	***americanum***	trout lily	x	x
*	Liliaceae	***Hemerocallis***	***fulva***	orange daylily	x	x
	Liliaceae	***Maianthemum***	***racemosum***	false Solomon's-seal	x	x
	Liliaceae	***Maianthemum***	***stellatum***	starry Solomon's-seal	x	
	Liliaceae	***Polygonatum***	***biflorum***	giant Solomon's-seal		x
	Liliaceae	***Polygonatum***	***pubescens***	downy Solomon's-seal	x	
*	Lythraceae	***Lythrum***	***salicaria***	purple loosestrife	x	
	Magnoliaceae	***Liriodendron***	***tulipifera***	tulip tree		x
*	Malvaceae	***Malva***	***neglecta***	common mallow		x
*	Moraceae	***Morus***	***alba***	white mulberry		x
	Oleaceae	***Fraxinus***	***americana***	white ash	x	x
	Oleaceae	***Fraxinus***	***pennsylvanica***	green ash	x	x
*	Oleaceae	***Ligustrum***	***vulgare***	European privet	x	x
*	Oleaceae	***Syringa***	***vulgaris***	common lilac	x	x
	Onograceae	***Circaea***	***lutetiana***	enchanter's nightshade		x
	Onograceae	***Oenothera***	***biennis***	evening primrose		x
	Ophioglossaceae	***Botrychium***	***virginiana***	rattlesnake fern	x	
	Orchidaceae	***Cypripedium***	***parviflorum***	yellow lady's-slipper	x	

PLANT SPECIES INVENTORY
Observed On-Site During EDR Surveys, 2010

	Family	Genus	species	common name	Gorge	Rim
*	Orchidaceae	***Epipactis***	***helleborine***	weed orchid		x
	Orobanchaceae	***Conopholis***	***americana***	squaw-root		x
	Oxalidaceae	***Oxalis***	***stricta***	upright yellow wood sorrel	x	
*	Papaveraceae	***Chelidonium***	***majus***	greater celadine		x
	Papaveraceae	***Sanguinaria***	***canadensis***	bloodroot	x	
*	Pinaceae	***Picea***	***pungens***	blue spruce		x
	Pinaceae	***Pinus***	***resinosa***	red pine		x
	Pinaceae	***Pinus***	***strobus***	white pine		x
*	Pinaceae	***Pinus***	***sylvestris***	Scotch pine		x
	Pinaceae	***Tsuga***	***canadensis***	hemlock	x	
*	Plantaginaceae	***Plantago***	***lanceolata***	English plantain		x
*	Plantaginaceae	***Plantago***	***major***	common plantain	x	x
	Plantaginaceae	***Plantago***	***rugelii***	blackseed plantain	x	
	Platanaceae	***Platanus***	***occidentalis***	sycamore	x	x
*	Poaceae	***Alopecurus***	sp.	foxtail		x
*	Poaceae	***Bromus***	***inermis***	smooth brome		x
*	Poaceae	***Dactylis***	***glomerata***	orchard grass	x	x
	Poaceae	***Glyceria***	sp.	manna grass		x
*	Poaceae	***Phleum***	***pratense***	timothy		x
*	Poaceae	***Phragmites***	***australis***	common reed	x	x
*	Polygonaceae	***Fallopia***	***japonica***	Japanese knotweed		x
	Polygonaceae	***Persicaria***	***virginiana***	jumpseed		x
*	Polygonaceae	***Rumex***	***crispus***	curly dock	x	x
	Portulaceae	***Claytonia***	***virginica***	Virginia spring beauty		x
	Primulaceae	***Lysimachia***	***ciliata***	fringed loosestrife	x	
*	Primulaceae	***Lysimachia***	***nummularia***	creeping Jennie		x
	Pteridaceae	***Pellaea***	***glabella***	smoth cliff brake	x	
	Ranunculaceae	***Actaea***	***pachypoda***	white baneberry	x	
	Ranunculaceae	***Actaea***	***rubra***	red baneberry	x	
	Ranunculaceae	***Aquilegia***	***canadensis***	wild columbine	x	x
	Ranunculaceae	***Clematis***	***virginiana***	virgin's bower	x	x
	Ranunculaceae	***Ranunculus***	***abortivus***	small-flowered crowfoot	x	x
*	Ranunculaceae	***Ranunculus***	***acris***	tall buttercup	x	x
*	Ranunculaceae	***Ranunculus***	***ficaria***	fig buttercup		x
	Ranunculaceae	***Ranunculus***	***pensylvanicus***	bristly buttercup	x	
	Ranunculaceae	***Thalictrum***	***dioicum***	early meadow-rue	x	x
*	Rhamnaceae	***Frangula***	***alnus***	glossy buckthorn	x	
*	Rhamnaceae	***Rhamnus***	***cathartica***	buckthorn	x	x
	Rosaceae	***Amelanchier***	spp.	serviceberries	x	x
*	Rosaceae	***Crataegus***	***monogyna***	oneseed hawthorn		x
	Rosaceae	***Crataegus***	spp.	other hawthorns	x	x
*	Rosaceae	***Duchesnea***	***indica***	mock-strawberry		x
	Rosaceae	***Fragaria***	***virginiana***	wild strawberry	x	x
	Rosaceae	***Geum***	***canadense***	white avens		x
	Rosaceae	***Geum***	***aleppicum***	yellow avens		x
*	Rosaceae	***Malus***	sp.	apple	x	x
	Rosaceae	***Physocarpus***	***opulifolius***	eastern ninebark	x	
*	Rosaceae	***Potentilla***	***recta***	sulfur cinqufoil	x	x
	Rosaceae	***Potentilla***	***simplex***	old field cinquefoil	x	x
*	Rosaceae	***Prunus***	***avium***	bird cherry	x	x
*	Rosaceae	***Prunus***	***mahaleb***	Mahaleb cherry	x	

PLANT SPECIES INVENTORY
Observed On-Site During EDR Surveys, 2010

	Family	Genus	species	common name	Gorge	Rim
	Rosaceae	***Prunus***	***serotina***	black cherry	x	x
	Rosaceae	***Prunus***	***virginiana***	chokecherry	x	x
*	Rosaceae	***Rosa***	***multiflora***	multiflora rose	x	x
	Rosaceae	***Rubus***	***alleghaniensis***	blackberry		x
	Rosaceae	***Rubus***	***occidentalis***	black raspberry	x	x
	Rosaceae	***Rubus***	***odoratus***	flowering raspberry	x	x
*	Rosaceae	***Rubus***	***phoenicolasius***	wineberry	x	x
*	Rosaceae	***Sorbus***	***aucuparia***	European mountain-ash	x	x
*	Rubiaceae	***Galium***	***mollugo***	wild madder	x	x
	Rubiaceae	***Houstonia***	***longifolia***	longleaf bluet	x	x
	Salicaceae	***Populus***	***deltoides***	eastern cottonwood	x	x
	Salicaceae	***Populus***	***grandidentata***	bigtooth aspen	x	x
	Salicaceae	***Populus***	***tremuloides***	quaking aspen		x
	Salicaceae	***Salix***	spp.	willows	x	x
	Saxifragaceae	***Saxifraga***	***virginiensis***	early saxifrage	x	
*	Scrophulariaceae	***Linaria***	***vulgaris***	butter-and-eggs	x	
	Scrophulariaceae	***Penstemon***	***hirsutus***	hairy beard-tongue		x
*	Scrophulariaceae	***Verbascum***	***thapsus***	common mullein	x	x
*	Scrophulariaceae	***Veronica***	***officinalis***	common speedwell	x	x
*	Scrophulariaceae	***Veronica***	***serpyllifolia***	thyme-leaved speedwell		x
*	Simaroubaceae	***Ailantus***	***altissima***	tree-of-heaven	x	x
*	Solanaceae	***Solanum***	***dulcamara***	deadly nightshade	x	x
	Staphyleaceae	***Staphylea***	***trifolia***	American bladdernut	x	
	Taxaceae	***Taxus***	***canadensis***	Canada yew	x	
	Tiliaceae	***Tilia***	***americana***	American basswood	x	x
*	Tiliaceae	***Tilia***	***cordata***	littleleaf linden		x
	Typhaceae	***Typha***	***angustifolia***	narrow-leaved cattail	x	
	Typhaceae	***Typha***	***latifolia***	common cattail		x
	Ulmaceae	***Celtis***	***occidentalis***	hackberry		x
	Ulmaceae	***Ulmus***	***americana***	American elm	x	
	Violaceae	***Viola***	***sororia***	common violet	x	
	Vitaceae	***Parthenocissus***	***quinquefolia***	Virginia creeper	x	x
	Vitaceae	***Vitis***	***riparia***	riverbank grape	x	x
	Woodsiaceae	***Cystopteris***	***bulbifera***	bulbet fern	x	

Notes:
1. Nomenclature follows New York Flora Atlas (Weldy & Werrier, 2010).
2. Species preceded by an asterik are not native in western New York (Eckel, 2001; Weldy & Werrier, 2010).

APPENDIX C

Wildlife Species List

WILDLIFE SPECIES INVENTORY

Based on existing data, on-site surveys, and/or the availability of suitable habitat, the following species could occur in the Study Area at some time during the year:

	Common Name	*Scientific Name*
Bird Species		
	Loons	***Gaviidae***
4	common loon	***Gavia immer***
4	red-throated loon	***Gavia stellata***
	Grebes	***Pedicipedidae***
4	horned grebe	***Podiceps auritus***
4	red-necked grebe	***Podiceps grisegena***
3,4	pied-billed grebe	***Podilymbus podiceps***
	Herons, Bitterns	***Ardeidae***
1,3,4	**great blue heron**	***Ardea herodias***
3	American bittern	***Botaurus lentiginosus***
3	green heron	***Butorides virescens***
3,4	black-crowned night heron	***Nycticorax nycticorax***
1,3,4	**double crested cormorant**	***Phalacrocorax auritus***
	Waterfowl	***Anatidae***
3,4	wood duck	***Aix sponsa***
4	northern pintail	***Anas acuta***
4	American wigeon	***Anas americana***
4	northern shoveler	***Anas clypeata***
	green-winged teal	***Anas crecca***
3	blue-winged teal	***Anas discors***
1,3,4	**mallard**	***Anas platyrhynchos***
3,4	American black duck	***Anas rubripes***
4	gadwall	***Anas strepera***
4	greater white-fronted goose	***Anser albifrons***
4	lesser scaup	***Aythya affinis***
4	redhead	***Aythya americana***
4	ring-necked duck	***Aythya collaris***
4	greater scaup	***Aythya marila***
4	canvasback	***Aythya valisineria***
4	brant goose	***Branta bernicla***
1,3,4	**Canada goose**	***Branta canadensis***
4	bufflehead	***Bucephala albeola***
4	common goldeneye	***Bucephala clangula***
4	Barrow's goldeneye	***Bucephala islandica***
4	snow goose	***Chen caerulescens***
4	long-tailed duck	***Clangula hyemalis***
4	trumpeter swan	***Cygnus buccinator***
4	tundra swan	***Cygnus columbianus***
4	mute swan	***Cygnus olor***
4	hooded merganser	***Lophodytes cacullatus***
4	black scoter	***Melanitta americana***

WILDLIFE SPECIES INVENTORY

Based on existing data, on-site surveys, and/or the availability of suitable habitat, the following species could occur in the Study Area at some time during the year:

	Common Name	*Scientific Name*
[4]	white-winged scoter	***Melanitta deglandi***
[4]	surf scoter	***Melanitta perspicillata***
[1,3,4]	**common merganser**	***Mergus merganser***
[4]	red-breasted merganser	***Mergus serrator***
[4]	ruddy duck	***Oxyura jamaicensis***
[4]	king eider	***Somateria spectabilis***
	American Vultures	***Cathartidae***
[1,3]	**turkey vulture**	***Cathartes aura***
	black vulture	***Coragyps atratus***
	Hawks	***Accipitridae***
[3,4]	Cooper's hawk	***Accipiter cooperii***
[4]	northern goshawk	***Accipiter gentilis***
[3,4]	sharp-shinned hawk	***Accipiter striatus***
[1,3,4]	**red-tailed hawk**	***Buteo jamaicensis***
[4]	rough-legged hawk	***Buteo lagopus***
[4]	red-shouldered hawk	***Buteo lineatus***
	broad-winged hawk	***Buteo platypterus***
[4]	northern harrier	***Circus cyaneus***
[4]	merlin	***Falco columbarius***
[3,4]	American kestrel	***Falco sparverius***
[3,4]	peregrine falcon	***Falco peregrinus***
[4]	bald eagle	***Haliaeetus leucocephalus***
	osprey	***Pandion haliaetus***
	Pheasants	***Phasianidae***
[3,4]	ring-necked pheasant	***Phasianus colchicus***
	Grouse	***Tetraonidae***
	ruffed grouse	***Bonasa umbellus***
	Turkeys	***Meleagrididae***
[4]	wild turkey	***Meleagris gallopavo***
	Rails	***Rallidae***
[4]	American coot	***Fulica americana***
	common moorhen	***Gallinula chloropus***
	Plovers	***Charadriidae***
[1,3,4]	**killdeer**	***Charadrius vociferus***
	Sandpipers	***Scolopacidae***
[3]	spotted sandpiper	***Actitus macularia***
[3]	American woodcock	***Philohela minor***

WILDLIFE SPECIES INVENTORY

Based on existing data, on-site surveys, and/or the availability of suitable habitat, the following species could occur in the Study Area at some time during the year:

	Common Name	*Scientific Name*
	solitary sandpiper	***Tringa solitaria***
	Gulls, Terns	***Laridae***
4	black-headed gull	***Chroicocephalus ridibundus***
4	little gull	***Hydrocoloeus minutus***
1,3,4	**herring gull**	***Larus argentatus***
4	California gull	***Larus californicus***
4	mew gull	***Larus canus***
1,3,4	**ring-billed gull**	***Larus delawarensis***
4	lesser black-backed gull	***Larus fuscus***
4	Iceland gull	***Larus glaucoides***
4	glaucous gull	***Larus hyperboreus***
4	great black-backed gull	***Larus marinus***
1,4	**Bonaparte's gull**	***Larus philadelphia***
4	Thayer's gull	***Larus thayeri***
4	black-legged kittiwake	***Rissa tridactyla***
	Auks	***Alcidae***
4	razorbill	***Alca torda***
	Pigeons, Doves	***Columbidae***
1,3,4	**rock dove**	***Columba livia***
1,3,4	**mourning dove**	***Zenaida macroura***
	Cuckoos	***Cuculidae***
	yellow-billed cuckoo	***Coccyzus americanus***
	Typical Owls	***Strigidae***
4	northern saw-whet owl	***Aegolius acadicus***
4	short-eared owl	***Asio flammeus***
4	long-eared owl	***Asio otus***
4	snowy owl	***Bubo scandiacus***
3,4	great horned owl	***Bubo virginianus***
3,4	eastern screech owl	***Megascops asio***
4	barred owl	***Strix varia***
	Goat Suckers	***Caprimulgidae***
3	common nighthawk	***Chordeiles minor***
	Swifts	***Apodidae***
1,3	**chimney swift**	***Chaetura pelagica***
	Hummingbirds	***Trochilidae***
3	ruby-throated hummingbird	***Archilochus colubris***

WILDLIFE SPECIES INVENTORY

Based on existing data, on-site surveys, and/or the availability of suitable habitat, the following species could occur in the Study Area at some time during the year:

	Common Name	*Scientific Name*
	Kingfishers	***Alcedinidae***
1,3,4	**belted kingfisher**	***Ceryle alcyon***
	Woodpeckers	***Picidae***
1,3,4	**northern flicker**	***Colaptes auratus***
4	pileated woodpecker	***Dryocopus pileatus***
3,4	red-bellied woodpecker	***Melanerpes carolinus***
4	red-headed woodpecker	***Melanerpes erythrocephalus***
1,3,4	**downy woodpecker**	***Picoides pubescens***
3,4	hairy woodpecker	***Picoides villosus***
4	yellow-bellied sapsucker	***Sphyrapicus varius***
	Flycatchers	***Tyrannidae***
1,3	**eastern wood-pewee**	***Contopus virens***
	alder flycatcher	***Epidonax alnorum***
1,3	**least flycatcher**	***Epidonax minimus***
	willow flycatcher	***Epidonax traillii***
3	great crested flycatcher	***Myiarchus crinitus***
1,3,4	**eastern phoebe**	***Sayornis phoebe***
3	eastern kingbird	***Tyrannus tyrannus***
	Swallows	***Hirundinidae***
	cliff swallow	***Hirundo pyrrhonotta***
3	barn swallow	***Hirundo rustica***
3	purple martin	***Progue subis***
	bank swallow	***Riparia riparia***
3	northern rough-winged swallow	***Stelgidopteryx serripennis***
1,3	**tree swallow**	***Tachycineta bicolor***
	Shrikes	***Laniidae***
4	northern shrike	***Lanius excubitor***
	Jays, Crows	***Corvidae***
1,3,4	**American crow**	***Corvus brachyrhynchos***
1,3,4	**blue jay**	***Cyanocitta cristata***
	Titmice	***Paridae***
1,3,4	**black-capped chickadee**	***Parus atricapillus***
1,3,4	**tufted titmouse**	***Parus bicolor***
	Nuthatches	***Sittidae***
1,3,4	**red-breasted nuthatch**	***Sitta canadensis***
1,3,4	**white-breasted nuthatch**	***Sitta carolinensis***
	Creepers	***Certhiidae***
4	brown creeper	***Certhia americana***

WILDLIFE SPECIES INVENTORY

Based on existing data, on-site surveys, and/or the availability of suitable habitat, the following species could occur in the Study Area at some time during the year:

	Common Name	*Scientific Name*
	Wrens	***Troglodytidae***
3	marsh wren	***Cistothorus palustris***
3,4	Carolina wren	***Thryothorus ludovicianus***
1,3	**house wren**	***Troglodytes aedon***
3,4	winter wren	***Troglodytes troglodytes***
	Mimic Thrushes	***Mimidae***
1,3,4	**gray catbird**	***Dumetella carolinensis***
3,4	northern mockingbird	***Mimus polyglottos***
1,3,4	**brown thrasher**	***Toxostoma rufum***
	Thrushes	***Turdidae***
1	**veery**	***Catharus fuscescens***
4	hermit thrush	***Catharus guttatus***
1,3	**wood thrush**	***Hylocichla mustelina***
4	Townsend's solitaire	***Myadestes townsendi***
1,3,4	**eastern bluebird**	***Sialia sialis***
1,3,4	**American robin**	***Turdus migratorius***
	Kinglets	***Sylviidae***
	blue-gray gnatcatcher	***Polioptila caerulea***
4	ruby-crowned kinglet	***Regulus calendula***
4	golden-crowned kinglet	***Regulus satrapa***
	Pipits	***Motacillidae***
4	American pipit	***Anthus rubescens***
	Waxwings	***Bombycillidae***
1,3,4	**cedar waxwing**	***Bombycilla cedrorum***
4	bohemian waxwing	***Bombycilla garrulus***
	Starlings	***Sturnidae***
1,3,4	**European starling**	***Sturnus vulgaris***
	Vireos	***Vireonidae***
1,3	**warbling vireo**	***Vireo gilvus***
1,3	**red-eyed vireo**	***Vireo olivaceus***
	Wood Warblers	***Parulidae***
3,4	yellow-rumped warbler	***Dendroica coronata***
	blackburnian warbler	***Dendroica fusca***
	magnolia warbler	***Dendroica magnolia***
	chestnut-sided warbler	***Dendroica pensylvanica***
1,3	**yellow warbler**	***Dendroica petechia***
4	pine warbler	***Dendroica pinus***

WILDLIFE SPECIES INVENTORY

Based on existing data, on-site surveys, and/or the availability of suitable habitat, the following species could occur in the Study Area at some time during the year:

	Common Name	*Scientific Name*
	black-throated green warbler	***Dendroica virens***
1,3	**common yellowthroat**	***Geothlypis trichas***
	black and white warbler	***Mniotilta varia***
	mourning warbler	***Oporonis philadelphia***
1	**ovenbird**	***Seiurus aurocapillus***
	northern waterthrush	***Seiurus noveboracensis***
3	American redstart	***Setophaga ruticila***
	golden-winged warbler	***Vermivora chrysoptera***
	blue-winged warbler	***Vermivora pinus***
	Nashville warbler	***Vermivora ruficapilla***
	Canada warbler	***Wilsonia canadensis***
	hooded warbler	***Wilsonia citrina***
	Weaver Finches	***Ploceidae***
1,3,4	**house sparrow**	***Passer domesticus***
	Blackbirds	***Icteridae***
1,3,4	**red-winged blackbird**	***Agelaius phoeniceus***
1,3	**bobolink**	***Dolichonyx oryzivorus***
4	rusty blackbird	***Euphagus carolinus***
3	Baltimore oriole	***Icterus galbula***
	orchard oriole	***Icterus spurius***
1,3,4	**brown-headed cowbird**	***Molothrus ater***
1,3,4	**common grackle**	***Quiscalus quiscula***
1,3	**eastern meadowlark**	***Sturnella magna***
	Larks	***Alaudidae***
4	horned lark	***Eromophila alpestris***
	Cardinals	***Cardinalinae***
1,3,4	**northern cardinal**	***Cardinalis cardinalis***
1,3	**indigo bunting**	***Passerina cyanea***
1,3	**rose-breasted grosbeak**	***Pheucticus ludovicianus***
3	scarlet tanager	***Piranga olivacea***
	Sparrows	***Emberizidae***
	grasshopper sparrow	***Ammodramus savannarum***
4	Lapland longspur	***Calcarius lapponicus***
4	lark sparrow	***Chondestes grammacus***
4	dark-eyed junco	***Junco hyemalis***
3,4	swamp sparrow	***Melospiza georgiana***
	Lincoln's sparrow	***Melospiza lincolnii***
1,3,4	**song sparrow**	***Melospiza melodia***
4	fox sparrow	***Passerella iliaca***
4	snow bunting	***Plectrophenax nivalis***

WILDLIFE SPECIES INVENTORY

Based on existing data, on-site surveys, and/or the availability of suitable habitat, the following species could occur in the Study Area at some time during the year:

	Common Name	*Scientific Name*
	vesper sparrow	***Pooecetes gramineus***
4	white-throated sparrow	***Zonotrichia albicollis***
4	white-crowned sparrow	***Zonotrichia leucophrys***
4	Harris's sparrow	***Zonotrichia querula***
	True Finches	***Fringillidae***
4	common redpoll	***Carduelis flammea***
4	pine siskin	***Carduelis pinus***
1,3,4	**American goldfinch**	***Carduelis tristis***
1,3,4	**house finch**	***Carpodacus mexicanus***
4	purple finch	***Carpodacus purpureus***
4	evening grosbeak	***Coccothraustes vespertinus***
4	red crossbill	***Loxia curvirostra***
4	white-winged crossbill	***Loxia leucoptera***
3	savannah sparrow	***Passerculus sandwichensis***
4	pine grosbeak	***Pinicola enucleator***
	rufous-sided towhee	***Pipilo erythrophthalmus***
4	American tree sparrow	***Spizella arborea***
1,3,4	**chipping sparrow**	***Spizella passerina***
4	field sparrow	***Spizella pusilla***

Mammal Species

	Opossums	***Didelphiidae***
1	**opossum**	***Didelphis virginiana***
	Shrews	***Soricidae***
	shorttail shrew	***Blarina brevicauda***
	least shrew	***Cryptotis parva***
	masked shrew	***Sorex cinereus***
	smoky shrew	***Sorex fumeus***
	Moles	***Talpidae***
1	**starnose mole**	***Condylura cristata***
1	**hairytail mole**	***Parascalops breweri***
1	**eastern mole**	***Scalopus aquaticus***
	Plainnose Bats	***Vespertilionidae***
	big brown bat	***Eptesicus fuscus***
	silver-haired bat	***Lasionycteris noctivagans***
	red bat	***Lasiurus borealis***
	hoary bat	***Lasiurus cinereus***
	Keen myotis	***Myotis keenii***
1	**little brown myotis**	***Myotis lucifugus***
	tri-colored bat	***Perimyotis subflavus***

WILDLIFE SPECIES INVENTORY

Based on existing data, on-site surveys, and/or the availability of suitable habitat, the following species could occur in the Study Area at some time during the year:

	Common Name	*Scientific Name*
	Racoons	***Procyonidae***
1	**raccoon**	***Procyon lotor***
	Porcupines	***Erethizontidae***
	porcupine	***Erethizon dorsatum***
	Weasels	***Mustelidae***
1	**striped skunk**	***Mephitis mephitis***
	shorttail weasel	***Mustela erminea***
	longtail weasel	***Mustela frenata***
	mink	***Mustela vison***
	Dogs, Wolves, Foxes	***Canidae***
	coyote	***Canis latrans***
	gray fox	***Urocyon cinereoargenteus***
1	**red fox**	***Vulpes vulpes***
	Squirrels	***Sciuridae***
	northern flying squirrel	***Glaucomys sabrinus***
	southern flying squirrel	***Glaucomys volans***
1	**woodchuck**	***Marmota monax***
1	**eastern gray squirrel**	***Sciurus carolinensis***
1	**eastern chipmunk**	***Tamias striatus***
1	**red squirrel**	***Tamiasciurus hudsonicus***
	Beaver	***Castoridae***
	beaver	***Castor canadensis***
	Mice, Rats, Lemmings, Volves	***Cricetidae***
1	**meadow vole**	***Microtus pennsylvanicus***
	muskrat	***Ondatra zibethicus***
	white-footed mouse	***Peromyscus leucopus***
1	**deer mouse**	***Peromyscus maniculatus***
	Old World Rats & Mice	***Muridae***
	house mouse	***Mus musculus***
	Norway rat	***Rattus norvegicus***
	Jumping Mice	***Zapeoidae***
	woodland jumping mouse	***Napaeozapus insignis***
	meadow jumping mouse	***Zapus hudsonicus***
	Hares, Rabbits	***Leporidae***
1	**eastern cottontail**	***Sylvilagus floridanus***
	Deer	***Cervidae***
1	**whitetail deer**	***Odocoileus virginianus***

WILDLIFE SPECIES INVENTORY

Based on existing data, on-site surveys, and/or the availability of suitable habitat, the following species could occur in the Study Area at some time during the year:

	Common Name	*Scientific Name*
Reptile and Amphibian Species		
	Snapping Turtles	***Chelydridae***
[1,2]	**common snapping turtle**	***Chelydra serpentina***
	Box and Water Turtles	***Emydidae***
[2]	painted turtle	***Chrysemys picta***
[2]	red-eared slider	***Trachemys scripta***
	Colubrids	***Colubridae***
	ring necked snake	***Diadophis punctatus***
	black rat snake	***Elaphe obsoleta***
[2]	eastern milk snake	***Lampropeltis triangulum***
	smooth green snake	***Liochlorophis vernalis***
[1,2]	**northern water snake**	***Natrix sipedon***
	brown snake	***Storeria dekayi***
	red-bellied snake	***Storeria occipitomaculata***
	eastern ribbon snake	***Thamnophis sauritus***
[1,2]	**common garter snake**	***Thamnophis sirtalis***
	Mole Salamanders	***Ambystomatidae***
	Jefferson salamander	***Ambystoma jeffersonianum***
[2]	blue-spotted salamander	***Ambystoma laterale***
	spotted salamander	***Ambystoma maculatum***
	Aquatic Salamanders	***Proteidae***
[2]	mudpuppy	***Necturus maculosus***
	Newts	***Salamandridae***
	red-spotted newt	***Notophthalmus viridescens***
	Lungless Salamanders	***Plethodontidae***
	Allegheny mountain dusky salamander	***Desmognathus ochrophaeus***
	northern two-lined salamander	***Eurycea bislineata***
	spring salamander	***Gyrinophilus porphyriticus***
[1,2]	**northern red-backed salamander**	***Plethodon cinereus***
	slimy salamander	***Plethodon glutinosus***
	Toads	***Bufonidae***
[1,2]	**American toad**	***Bufo americanus***
	Tree Frogs	***Hylidae***
	gray treefrog	***Hyla versicolor***
[1,2]	**spring peeper**	***Pseudacris crucifer***
[1,2]	**western chorus frog**	***Pseudacris triseriata***

WILDLIFE SPECIES INVENTORY

Based on existing data, on-site surveys, and/or the availability of suitable habitat, the following species could occur in the Study Area at some time during the year:

	Common Name	*Scientific Name*
	True Frogs	***Ranidae***
1,2	**bull frog**	***Rana catesbeiana***
1,2	**green frog**	***Rana clamitans***
	pickeral frog	***Rana palustris***
1,2	**northern leopard frog**	***Rana pipiens***
1,2	**wood frog**	***Rana sylvatica***
	Fish Species	
	Pikes	***Esocidae***
5	northern pike	***Esox lucis***
	chain pickerel	***Esox niger***
	Sunfishes	***Centrarchidae***
5	rock bass	***Ambloplites rupestris***
	redbreast sunfish	***Lepomis auritus***
5	pumpkinseed	***Lepomis gibbosus***
5	bluegill	***Lepomis macrochirus***
5,6	smallmouth bass	***Micropterus dolomieui***
5	largemouth bass	***Micropterus salmoides***
	Temperate Bass	***Moronidae***
5	white perch	***Morone americana***
5,6	white bass	***Morone chrysops***
	Drums	***Sciaenidae***
5	freshwater drum	***Aplodinotus grunniens***
	Bullhead/Catfishes	***Ictaluridae***
5	brown bullhead	***Ameiurus nebulosus***
5	channel catfish	***Ictalurus punctatus***
	Suckers	***Catostomidae***
5	white sucker	***Catostomus commersoni***
	Gobies	***Gobiidae***
5	round goby	***Neogobius melanostomus***
	Perches	***Percidae***
	Johnnie darter	***Etheostoma nigrum***
	fantail darter	***Etheostoma flabellare***
	tessellated darter	***Etheostoma olmstedi***
5,6	yellow perch	***Perca flavescens***
	blackside darter	***Percina maculata***
	shield darter	***Percina peltata***
5,6	walleye	***Sander vitreus***

WILDLIFE SPECIES INVENTORY

Based on existing data, on-site surveys, and/or the availability of suitable habitat, the following species could occur in the Study Area at some time during the year:

	Common Name	***Scientific Name***
	Carps and Minnows	***Cyprinidae***
	redside dace	***Clinostomus elongatus***
	lake chub	***Couesius plumbeus***
5	carp	***Cyprinus carpio***
	satinfin shiner	***Cyrinella analostana***
	cutlips minnow	***Exoglossum maxillingua***
	common shiner	***Luxilus cornutus***
	river chub	***Nocomis micropogon***
	golden shiner	***Notemigonus crysoleucas***
	comely shiner	***Notropis amoenus***
5	spottail shiner	***Notropis hudsonicus***
	bluntnose minnow	***Pimephales notatus***
	blacknose dace	***Rhinicthys atratulus***
	longnose dace	***Rhinicthys cataractae***
	fall fish	***Semotilus corporalis***
5	creek chub	***Semotilus atromaculatus***
	Trout	***Salmonidae***
5,6	coho salmon	***Oncorhynchus kisutch***
5,6	rainbow trout	***Oncorhynchus mykiss***
5,6	chinook salmon	***Oncorhynchus tshawuytscha***
5,6	brown trout	***Salmo trutta***
5,6	lake trout	***Salvelinus namaycush***

Notes: Bold denotes those species actually observed on site.

1 ***Species identified during on-site ecological surveys conducted by EDR in June 2010.***

2 ***Species identified in the NYS Amphibian & Reptile Atlas Project (Lewiston & Niagara Falls Quads).***

3 ***Species identified in the NYS Breeding Bird Atlas (Blocks 1677A, 1678B, 1678C, and 1678D).***

4 ***Species identified in the Audubon Christmas Bird Count (Niagara Falls Count).***

5 ***Species identified in the Stantec's 2005 Recreational Fishing Survey of the Lower Niagara River.***

6 ***Species identified in the NYS Department of State Coastal Fish & Wildlife Habitat Rating Form.***

APPENDIX D

Representative Photographs

Photo 1
Calcareous Cliff Community

Photo 2
Calcareous Cliff Community

Photo 3
Calcareous Talus Slope Woodland

Photo 4
Calcareous Talus Slope Woodland

Photo 5

Disturbed/Developed

Photo 6

Disturbed/Developed

Photo 7

Mowed Lawn/Ornamental Plantings

Photo 8

Mowed Lawn/Ornamental Plantings

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