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PROJECT NARRATIVE

1. In a brief paragraph, describe the project and its purpose, how and when it will be accomplished, and why it is important.

Brief Narrative

The Buffalo Museum of Science is requesting consistency review with the Niagara River Greenway Plan from the Niagara River Greenway Commission for the *Vernal Pool Enhancement at Tiff Nature Preserve* project. If deemed consistent, the proposal will be submitted to the Greenway Ecological Standing Committee requesting \$68,000 in funding for a two-year project running from summer 2017 through 2018.

Vernal pools are small, seasonally flooded ephemeral wetlands occurring in forested ecosystems. These depressions are flooded in spring, and usually dry completely by late summer. Vernal pools are critical breeding environments for some amphibians including the Blue-spotted salamander which is listed as a species of “Special Concern” and a “High Priority Species of Greatest Conservation Need” in New York and occurs within and adjacent to the project area at Tiff Nature Preserve. Vernal pools also can support large populations of invertebrates which are major food sources for many species of migratory songbirds that are also of significant conservation value and occur at Tiff Nature Preserve. This project will directly benefit amphibians, birds, and invertebrates, and promote the ongoing restoration of an urban brownfield into quality wildlife habitat and accessible green space for the public in Western New York. It will also be interpreted to our visitors and used to expand the environmental education offered at the preserve. The project has two major components.

1. Upland habitat enhancement – Amphibians require both aquatic breeding sites and upland habitat to complete their life cycle. A buffer of upland forest habitat surrounding wetland depressions will be enhanced by controlling non-native invasive species. Following invasive species control, native trees will be planted in this buffer to maintain a forest ecosystem as upland habitat. Besides amphibians, the planting of native trees will enhancement stop-over habitat for many species of migratory songbirds that occur at Tiff Nature Preserve.

2. Wetland depression enhancement – Seasonally flooded wetlands are critical for obligate vernal pool species of amphibians and invertebrates. It is important that these depressions hold water long enough for the species’ life histories before they dry up. The hydroperiod of the wetland depressions at Tiff Nature Preserve is currently too short. This project will not only control invasive species with three depressions (see Figure 1), but will add synthetic liners to areas within the depression basin to extend the hydroperiod so they hold water long enough to be suitable habitat for these species.

Detailed Narrative

Project Need & Benefits

Vernal pools are small, seasonally flooded ephemeral wetlands occurring in forested ecosystems (see Figure 2). These unique environments are threatened by habitat loss, fragmentation, pollution, altered hydrological regimes, and climate change. Several pool-breeding amphibians depend on vernal pools for reproduction and larval development; however these animals spend the majority of their lives in the surrounding terrestrial forested habitat. This project is designed to enhance the habitat for at least one vernal pool obligate species, the Blue-spotted salamander which is listed as a species of “Special Concern” and a “High Priority Species of Greatest Conservation Need” in New York and occurs at Tiff Nature Preserve. This project will enhance both vernal pool breeding habitat as well as forested upland habitat.

In addition to the Blue-spotted salamander and other amphibian species that occur at Tiff Nature Preserve, this project will benefit invertebrate species that utilize seasonal wetlands. In addition to many invertebrate species having significant conservation value on their own, invertebrate populations in general create the base of the food web in forest ecosystems and are an especially important food source for migrating songbirds. Tiff Nature Preserve is a recognized Important Bird Area (IBA) by Audubon New York for its important habitat for migratory songbirds which includes many species of birds identified in the New York State Wildlife Action Plan as Species of Greatest Conservation Need (SGCN) such as the Bay-breasted warbler, Canada warbler, Cape May warbler, Prothonotary warbler, Red-headed woodpecker and the Cerulean Warbler which is also listed as “Special Concern” in New York State.

Both vernal pool amphibians and many species of migratory songbirds are dependent of forest ecosystems. The current forest canopy at Tiff Nature Preserve, dominated by eastern cottonwood trees, is already starting to decline with little regeneration of canopy tree species in the understory (see Figure 3). This project will help maintain the important forest ecosystem at Tiff Nature Preserve by controlling non-native invasive species that compete with native tree species and by directly planting native tree species.

In addition to the forest restoration and wildlife habitat benefits of this project, it will also add to the public enjoyment and environmental education offerings at Tiff Nature Preserve. The project will be highly visible and interpreted from preserve trails through signage and facilitated programs. Also, many community volunteers will be directly engaged in the implementation of this project through invasive species control, seasonal wetland enhancements, and native tree planting.

Habitat Enhancement Components

1. Upland habitat enhancement – A buffer of upland forest habitat surrounding wetland depressions will be enhanced by controlling non-native invasive species. The dominant invasive species is common buckthorn (*Rhamnus cathartica*) which forms dense thickets preventing the regeneration of native tree species (see Figure 3). Buckthorn degrades upland habitat for pool-breeding amphibians and the berries provide little nutritional value to birds and other wildlife. Buckthorn and other non-native shrub and tree species (*Lonicera* spp., *Frangula alba*, *Alanthus altissima*) will be controlled in a minimum of four acres within the six acre project area creating 50-foot or greater buffers of upland habitat around each vernal pool. Invasive species will be controlled by mechanical cutting of small stems and trunks followed by a cut-stump herbicide application to prevent resprouting.

Following invasive species control, approximately 300 native trees will be planted in this buffer to maintain a forest ecosystem as upland habitat (see Table 1). Every tree planted will be protected with a shelter or fencing to protect it from deer damage and browsing. This protection will be maintained until the trees reach a size where they are not vulnerable to deer. This type of protection has worked well for over 2,000 native trees previously planted at Tifft Nature Preserve.

Table 1: Possible Native Tree Species*

Common Name	Scientific Name
Cottonwoods	<i>Populus deltoids</i>
American Basswood	<i>Tilia americana</i>
Red Maple	<i>Acer rubrum</i>
Silver Maple	<i>Acer saccharinum</i>
Black Willow	<i>Salix nigra</i>
Swamp White Oak	<i>Quercus bicolor</i>
Pin Oak	<i>Quercus palustris</i>
American Sycamore	<i>Platanus occidentalis</i>
Tulip Poplar	<i>Lirodendron tulipifera</i>

* This list is not meant to be comprehensive, but representative of the native tree species that could be planted at Tifft Nature Preserve. The species list was compiled from species lists in the NYS DEC publication "Ecological Communities of New York State, 2nd Edition" (2014).

2. Wetland depression enhancement – Seasonally flooded wetlands are critical for obligate vernal pool species, but it is important that the hydroperiod is long enough for the species' life histories and currently the wetland depressions at Tifft Nature Preserve dry up too soon in most years. In addition to controlling any non-native invasive species

within the wetland depression, this project will include techniques to extended the hydroperiod of three vernal pools within the six acre project area. This will involve manually removing coarse woody debris and the top 4-12 inches of leaf litter, organic matter, and soil in each depression which will be stock piled. Then a synthetic liner of PVC or other similar material will be laid down within all or some of the depression to create a more impervious basin that will hold water later into the season. After installation of the basin liner, the stockpiled coarse woody debris, leaf litter, organic matter and soil will be replaced on top of the synthetic liner.

Project Timeline

Year One – 2017	Year Two – 2018
Invasive Species Control – Summer & Fall	Install Pond Liners – Summer
	Native Tree Planting – Fall
Volunteer Opportunities – Summer & Fall	Volunteer Opportunities – Summer & Fall
Interpretation – Throughout & Ongoing	Interpretation – Throughout & Ongoing

Project Monitoring

The enhanced vernal pools will be monitored once every spring and once every summer for water depths, the presence of adult or juvenile amphibians, amphibian egg masses, and invertebrate populations. Repeat photo monitoring sites at each vernal pool will be established with pictures take once each spring and summer annually.

The survival of all trees planted for this project will be monitored annually using uniquely numbered tags on each tree. This method has been successful for monitoring of previously planted trees and will increase the number of monitored trees at Tift Nature Preserve to over 2,000. The shelters protecting each tree will also be monitored and repaired as needed until the trees reach a size where they are not vulnerable to deer. Finally, the effectiveness of invasive species control will be visually monitored each year and follow-up control will be conducted as needed.

2. Referring to the Niagara River Greenway Plan, clearly document and describe how the proposed project will advance the Niagara River Greenway vision including the principles, goals, and criteria that define that vision.

Principles – Excellence, Sustainability, Accessibility, Ecological Integrity, Public Well-Being, Connectivity, Restoration, Authenticity, Celebration, Partnerships, Community Based

Excellence – Tifft Nature Preserve is positioned at the south end of the Niagara River Greenway which is a world renowned bird migration corridor. This project will enhance this outstanding natural resource and add to its national reputation. The proposed work will build upon the over 150 year history of research and science education at the Buffalo Museum of Science.

Sustainability – The Vernal Pool Enhancement project improves the sustainability of wildlife habitat and plant communities as Tifft Nature Preserve.

Ecological Integrity – Tifft Nature Preserve is a tremendous natural asset within the Niagara River Greenway with its natural communities and diverse wildlife fauna. This project will improve the natural communities on the preserve and enhance habitat for wildlife.

Public Well-Being – Tifft Nature Preserve provides a location for students and the public to expand their knowledge and understanding of their environment, as well as a place to relax and unwind on a peaceful walk in a natural setting.

Connectivity – The native tree planting component of the Vernal Pool Enhancement project will provide important habitat for migrating birds and create connections with other migrating bird stop-over sites all along the Niagara River Greenway.

Restoration – Enhancing vernal pools, planting native trees and controlling invasive species at Tifft Nature Preserve will continue the restoration process of a recovering brownfield. This project will enhance the natural plant communities as well as wildlife habitat on the preserve.

Authenticity/Celebration – A major mission of Tifft Nature Preserve is to promote the environment and natural resources of the Niagara River Greenway and to create a ‘green place’ within the area. At the same time, we interpret the rich industrial history of the area and make connections between environments of the past and present.

Partnerships – The feasibility of this project was assessed through partnership with SUNY-Buffalo State College (see Appendix B) and volunteer partnerships with local colleges and universities, community groups, and area businesses will occur.

Community Based – Tiff Nature Preserve serves the entire community of the Niagara River Greenway including: school children, youth groups, families, bird watchers, seniors, and nature lovers of all types. Also, this project will incorporate community volunteers in implementing the project.

Goals – Improve Access, Make Connections, Protect and Restore Environmental Systems, Spark Revitalization and Renewal, Promote Long Term Sustainability, Extend the Legacy of Frederick Law Olmsted, Celebrate History and Heritage

Access – Tiff Nature Preserve is open to the public at no charge seven days a week during daylight hours. There are five miles of trails, two wetland boardwalks, and three wildlife viewing blinds at the preserve. This project will be highly visible and interpreted from trails on the preserve.

Make Connections – Tiff Nature Preserve provides a valuable site to connect students and the public with the environment and natural resources of the Niagara River Greenway. This project will further expand and develop those connections, as well as connect community volunteers with hands-on conservation.

Protect and Restore Environmental Systems – Tiff Nature Preserve is a recovering brownfield and this project is designed to continue the restoration process by restoring native communities and enhancing wildlife habitat. This project will also inform and educate students and the public about value and importance of the Niagara River Greenway's natural habitats and resources.

Celebrate History and Heritage – Tiff Nature Preserve has a rich history as a commercial and industrial site. How this history and past land used affect the current environment and management of the site is communicated to students and the public.

Spark Revitalization and Renewal – Tiff Nature Preserve provides valuable natural and recreational amenities that add greatly to the quality of life of area residents, as well as attracting tourists and new investment to the area. This project will maintain and improve the natural and aesthetic qualities of the area.

Promote Long Term Sustainability – Enhancing vernal pools, planting native trees and controlling invasive species at Tiff Nature Preserve is part of a long-term goal to maintain and enhance the aesthetics and wildlife habitat on the preserve for decades into the future.

Criteria – Consistency with the NRG Principles, Priority Status, Focus Area, Environmental Soundness, Implementable, Economic Viability, Availability of Local Sponsors or Partners, Ability to Match or Leverage Funds, Consideration of Other Planning Efforts, Clear Benefits

Consistency with the Principles – The Vernal Pool Enhancement project is consistent with all of the principles of the Niagara River Greenway and makes significant contributions in Ecological Integrity, Public Well-Being, and Restoration.

Priority Status – The Vernal Pool Enhancement project includes several priorities identified in the Niagara River Greenway Plan: providing access to water front resources, restoration of Niagara River Ecosystem, and interpretation and education about the region’s cultural, natural and historic resources.

Focus Area – Tifft Nature Preserve is within the focus area delineated in the Niagara River Greenway Plan where it functions as the southern gateway to the Niagara River Greenway.

Environmental Soundness – The very purpose of the Vernal Pool Enhancement project is to improve the environment on the preserve by increasing the numbers and species of trees, controlling invasive species, and managing wildlife to restore and enhance natural communities and habitat.

Implementable – The Vernal Pool Enhancement project is implementable and feasible as outlined in this proposal. Further details on the overall management of the preserve are covered in the Tifft Nature Preserve Management Plan, which is available at <http://www.tifft.org/tifft/scienceandresearch/>.

Availability of Local Sponsor or Partners – The Buffalo Museum of Science has worked collaboratively with the City of Buffalo to managed and operated Tifft Nature Preserve since 1982 as a high quality natural, educational, and educational resource for the region.

Ability to Match or Leverage Funds – The budget for this project includes over \$18,000 in additional project value from the funds requested from the Niagara River Greenway. These additional funds comprise over over 20% of the total project value.

Considerations of Other Planning Efforts – The Vernal Pool Enhancement project would help achieve the vision and goals of many other planning efforts including: City of Buffalo Comprehensive Plan, Local Waterfront Revitalization Plan, New York State Open Space Conservation Plan, New York State Wildlife Action Plan, and South Buffalo Brownfield Opportunity Area (BOA) Plan.

Clear Benefits – The The Vernal Pool Enhancement project would provide many benefits within the Niagara River Greenway. Major benefits include: enhancement of natural communities and wildlife habitat, providing environmental education in context, improving the aesthetics of a popular natural recreation area, and providing scientific information on management on an urban natural areas.

3. Define the budget for the proposed project and include costs for the following:

Planning	\$ _____
Construction	\$ <u>61,850.00</u>
Acquisition	\$ _____
Administration	\$ <u>6,150.00</u>
Operation and Maintenance/Year	\$ _____
TOTAL PROJECT COST	\$ <u>68,000.00</u>

An itemized budget for each year of the two year grant is included as Appendix A.

Project Match

In addition to the funding requested through the Niagara River Greenway, additional valued will be added to this project by the Buffalo Museum of Science totaling 21.5% of the project value.

Staff Time	\$ <u>12,400.00</u>
Supplies & Materials	\$ <u>1,825.00</u>
Volunteer Time	\$ <u>4,365.00</u>
TOTAL PROJECT MATCH	\$ <u>18,590.00</u>

Long-term Maintenance

Benefits of this project will be long-lasting such as enhancing natural communities, preserving a tree canopy, environmental education, and an increase in environmental awareness of visitors to the preserve. These benefits and physical project components will be maintained into the future by Buffalo Museum of Science staff at Tiff Nature Preserve.

4. Describe the measures taken at the local level to gain community and government support for this project (hearings, petitions, public surveys, resolutions of support, or other methods).

In early 2008, the Buffalo Museum of Science undertook the task of natural resource planning for Tiff Nature Preserve which had not occurred since the preserve's establishment in the 1970s. This effort led to the creation of the Tiff Nature Preserve Management Plan which was completed in 2009. During the planning process stakeholder and public input was sought and incorporated into the final plan through private and public meetings. Prior to release of the final version of the plan, a draft version and request for comments was sent to external reviewers representing local government, state and federal natural resources agencies, college and university professors, environmental consulting firms, members of the local environmental community, and other interested parties. The Management Plan for Tiff Nature Preserve identifies several projects for protection and enhancement of the preserve's natural resources including controlling invasive species, enhancement of vernal pools, and maintaining the tree canopy which are all included in this project. See the Tiff Nature Preserve Management Plan at <http://www.tiff.org/tiff/scienceandresearch/>.

If this project has been cited or described in a local planning document or some equivalent thereof, attach copies of that documentation highlighting the sections that are relevant to the proposed project.

In addition to this project being identified in the Management Plan for Tiff Nature Preserve (see <http://www.tiff.org/tiff/scienceandresearch/>), the general framework of the project is part of the Niagara River Greenway Plan. The Greenway Implementation Concept of Protecting, Preserving, and Restoring Important Ecological Resources states that removal of invasive species and replacement with native species is a priority (p. 87), and identifies Tiff Nature Preserve as an important upland area within the Niagara River ecosystem (p. 87-88), as well as an impaired habitat and brownfield in need of restoration due to invasive species and past land uses (p. 91). Habitat Improvements at Tiff Nature Preserve was also suggested as a project by Buffalo Niagara Riverkeepers (Fig. 45) while gathering stakeholder input for the Niagara River Greenway Plan. This project would address all of these points and improve Tiff Nature Preserve and the Niagara River Greenway.

Tiff Nature Preserve is also mentioned and highlighted in the following local and statewide documents:

- City of Buffalo Comprehensive Plan (2006) – Tiff Nature Preserve is cited as part of the city's "Green Infrastructure" (Fig. 32) and as a "Destination Park" (Fig. 35), a distinction given to only 16 of Buffalo's 120 parks.

- Local Waterfront Revitalization Plan (2007) – In this plan Tifft Nature Preserve is highlighted for its Public Access and Recreation (Map 2-8, p. II-44), but more importantly for its wildlife habitat and states, “Wildlife frequents wooded and open space areas around wetlands and vacant areas in Sub-Area 4, particularly in the Tifft Nature Preserve” (p. II-81). The plan also lists Tifft Nature Preserve and adjacent lands as a “Conservation/Habitat Restoration Area” on Map 4-1D.
- South Buffalo Brownfield Opportunity Area (BOA) Plan (2009) – The South Buffalo BOA plan highlights the importance of Tifft Nature Preserve as an asset to the region and an integral piece of the revitalization of South Buffalo.
- New York State Open Space Conservation Plan (2014) – Tifft Nature Preserve is listed as a valuable urban wetland (p. 144) for providing wildlife habitat. The project will enhance existing seasonal wetlands at Tifft Nature Preserve.
- New York State Significant Coastal Fish & Wildlife Habitat – Tifft Nature Preserve was designated in 1987 by the Department of State as a Significant Coastal Fish & Wildlife Habitat with an extremely high significance score of 84 points (the highest in Western New York). This high rating is due to natural features such as the largest remnant wetland in the Lake Erie coastal region and the presence of a diverse wildlife, including rare species. However, the rating form also states that the preserve “...is the most heavily used environmental education center in the region.” This project will enhance the value of the preserve for wildlife and continue the providing quality environmental education to a large segment of the population. Rating form available at <http://www.nyswaterfronts.com/index.asp>.
- Important Bird Area (IBA) of New York – Due to the important stop-over habitat for migratory songbirds, nesting habitat for marsh birds and waterfowl, winter habitat for resident birds and total of 265 species document, Tifft Nature Preserve is designated an IBA by Audubon New York.
- New York State Wildlife Action Plan (2015) – Tifft Nature Preserve provides habitat for many species of wildlife identified in the New York State Wildlife Action Plan as Species of Greatest Conservation Need (SGCN). This includes the Blue-spotted salamander (Special Concern & High Priority SGCN), Bay-breasted warbler (High Priority SGCN), Canada warbler (High Priority SGCN), Cape May warbler (High Priority SGCN), Prothonotary warbler (High Priority SGCN), Red-headed woodpecker (High Priority SGCN) and many more. The plan is available at <http://www.dec.ny.gov/animals/7179.htm>.

Describe the role of municipal agencies, stakeholder groups, consultants, volunteers, or others who will be involved in the proposed project.

Buffalo Museum of Science staff will take leading roles in implementing all aspects of the Vernal Pool Enhancement project with the assistance of volunteers. Key museum staff roles and responsibilities are below.

David Spiering – Tifft Nature Preserve Ecologist

David will be the project manager and oversee all aspects of implementation including invasive species control, hiring contractors, purchasing supplies, tree planting, coordinating volunteers and project monitoring. David received a BS in Zoology and Conservation Biology from the UW-Madison, a MS in Ecology from Colorado State University, and has over ten years of professional experience as a biologist.

Meghan Dye – Tifft Nature Preserve Experience Manager

Meghan oversees development of all educational content at Tifft Nature Preserve and provides leadership and direction pertaining to all of the experiences at Tifft Nature Preserve. This includes important relationship building with all school and public audiences, and operational concerns relating to the delivery of programs. Meghan received a BS SUNY-College of Environmental Science and Forestry.

Buffalo Museum of Science Facilitators of Learning

Museum Facilitators of Learning will assist with development and presentation of educational content to students and the public. All Facilitators of Learning have at least bachelor degrees in science or education and experience teaching environmental programming to audiences of all ages.

Karen Wallace – Deputy Director, Buffalo Museum of Science

Karen Wallace directs the Department of Learning & Interpretation that focuses on inquiry-based learning and teaching techniques. She supervises staff at Tifft Nature Preserve and will provide input on the educational components of this project, as well as assistance with budgeting and administration. Karen received a BA in Biology and a M.Ed. of Science Education from SUNY at Buffalo.

Volunteers

There will be many opportunities for individuals to volunteer in a number of ways such as tree planting, invasive species control, educational programming, and citizen science projects, among others. Volunteers will be a diverse mix of people including scout groups, families, college students, and retired citizens from area schools, community groups and businesses. A minimum of 450 hours of volunteer service, with a value of over \$4,000 is included in this project.

5. Describe and document the environmental setting and existing conditions at the proposed site.

Tifft Nature Preserve is a 264-acre urban nature preserve, operated by the Buffalo Museum of Science (see map below). Located in South Buffalo, the area was formerly used as a transshipment facility and dump until a group of concerned citizens successfully petitioned the city to create a nature preserve on the property in the early 1970s. Despite the industrial history of the site, this brownfield provides valuable wildlife habitat and needed greenspace within the City of Buffalo. Major habitats on the preserve include: a 75-acre remnant cattail marsh, woodlands, grasslands, and three ponds. The cattail marsh, which is the largest remnant wetland in Erie County, provides nesting habitat for rare marsh birds and the woodlands are an important stop-over site for migrating birds. Due this important bird habitat, Tifft Nature Preserve is designated as an Important Bird Area (IBA) by New York State Audubon. The Buffalo Museum of Science is committed to protecting the significant natural resources on the preserve and achieving the full potential of Tifft Nature Preserve as a destination for environmental education, outdoor recreation, and scientific research in western New York.

The proposed project area is located in the northern end of the preserve and is approximately six acres of woods containing at least three distinct depressions creating vernal pools. The woods is dominated with a canopy of eastern cottonwood trees (*Populus deltoides*) with a an understory dominated by the non-native invasive shrub common buckthorn (*Rhamnus cathartica*). The thicket of buckthorn reduces wildlife habitat and prevents the regeneration of trees that will grow to replace the existing canopy of aging cottonwood trees. Also, due to the course fill material that underlies much of Tifft Nature Preserve, the vernal pools dry up too early in the season most years to be quality habitat for wildlife dependent on season wetlands such as the blue-spotted salamander (*Ambystoma laterale*) which occurs on the preserve and is listed as threatened in New York State.

More information on the preserve and details on topics such as invasive species control, native tree planting and vernal pool enhancement can be found in the Tifft Nature Preserve Management Plan (<http://www.tifft.org/tifft/scienceandresearch/>).

Provide photographs, conceptual plans, and drawings that show the site as it presently exists and how the site will change with the addition of the proposed project.

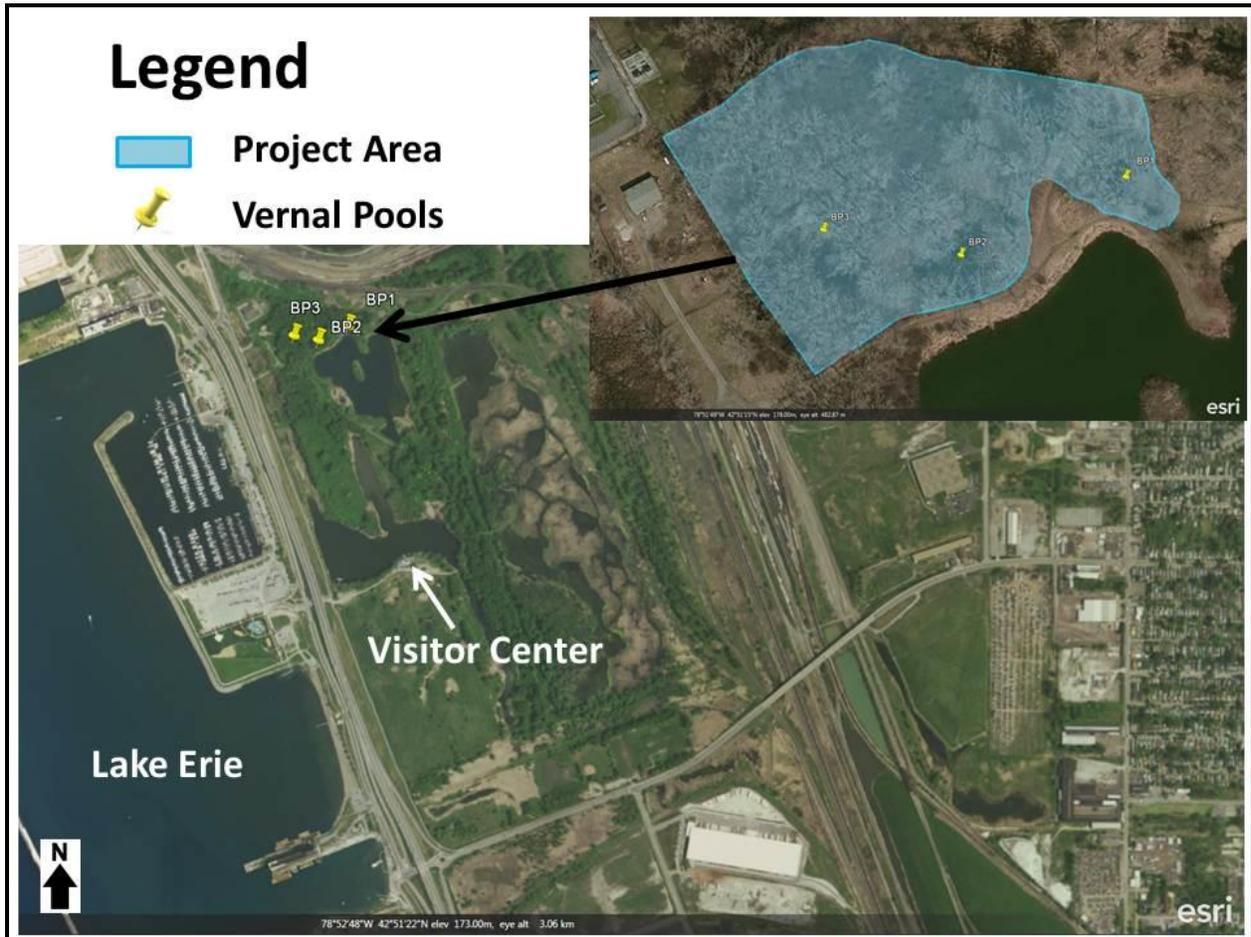


Figure 1: Aerial photo of Tiff Nature Preserve showing location of vernal pools and project area (inset).



Figure 2: Vernal pool holding water in the spring of 2014



Figure 3: Vernal pool surrounded by dense thicket of buckthorn in spring of 2014, notice the canopy gaps

Describe how your project will comply with the State Environmental Quality Review Act (SEQRA). The existence of wetlands, significant upland and aquatic habitats, and plant or animal species that are classified as rare, threatened, or endangered should be noted. Explain how such natural resources will be protected and/or enhanced.

The aspects of this project where the State Environmental Quality Review Act (SEQRA) or other environmental regulation would apply are addressed below.

Regulated Wetland

This project involves no work within the delineated boundary of the regulated wetland (BU-15) or 100-foot buffer surrounding a regulated wetland that are protected under Article 24 of the New York State Environmental Conservation Law.

Herbicides

An Environmental Impact Statement (EIS) was created through the SEQRA process for all pesticides that are registered for use in New York State. Only herbicides registered for use in New York State will be used for invasive species control. All herbicides used will be labelled for use on target species, and will be applied only by certified pesticide applicators following all label instructions and herbicide regulations. David Spiering, the Tifft Nature Preserve Ecologist, is a certified pesticide applicator in New York State and will oversee or perform all herbicide applications.

Rare, Threatened & Endangered Species

Tifft Nature Preserve provides habitat for several state listed wildlife species including: Blue-spotted salamander (Special Concern), Golden-wing Warbler (Special Concern), and Cerulean Warbler (Special Concern). This project would not negatively impact those species and is designed for improve habitat for salamanders and migratory songbirds.

Cite any relevant project related studies.

See Appendix B for a for a feasibility assessment of enhancing vernal pools at Tifft Nature Preserve prepared in partnership with SUNY-Buffalo State College.

See the Literature Cited section in the Tifft Nature Preserve Management Plan (<http://www.tifft.org/tifft/scienceandresearch/>) for an extensive list of references on Tifft Nature Preserve, natural community restoration, invasive species control, and other relevant topics.

APPENDIX A:

Itemized Project Budget & Vendor List

Itemized Budget for Two-Year Project

Expense Category ¹	Year One (FY17)	Year Two (FY18)	Total
Invasive Species Control			
Contracted Crew	\$10,000.00	-	\$10,000.00
Herbicide	\$350.00	-	\$350.00
Equipment	\$350.00	\$350.00	\$700.00
Basin Liners	-	\$10,000.00	\$10,000.00
Tree Planting			
Tree Stock	-	\$7,300.00	\$7,300.00
Shelters	-	\$3,600.00	\$3,600.00
Supplies	-	\$100.00	\$100.00
Staff Time			
Tifft NP Ecologist	\$6,200.00	\$6,200.00	\$12,400.00
Ecology Technician	\$8,700.00	\$8,700.00	\$17,400.00
Administration	\$2,400.00	\$3,750.00	\$6,150.00
Total Project Expenses	\$28,000.00	\$40,000.00	\$68,000.00
Project Match			
Invasive Species Control			
Volunteers	\$2,182.50	\$2,182.50	\$4,365.00
Tree Planting			
Fencing	-	\$625.00	\$625.00
Rebar	-	\$1,200.00	\$1,200.00
Staff Time			
Tifft NP Ecologist	\$6,200.00	\$6,200.00	\$12,400.00
Total Project Match	\$8,382.50	\$10,207.50	\$18,590.00
Total Project Value	\$36,382.50	\$50,207.50	\$86,590.00

¹Documentation for all costs, including vendor quotes and catalog prices, is available upon request. See following table for list of possible project vendors from which budget numbers were calculated.

Possible Vendor List

Vendor	Items	Vendor	Items
Plant Material		Equipment & Supplies	
Russell’s Tree & Shrub Farm, East Amherst, NY	tree stock	Forestry Suppliers Jackson, MS	herbicide, tools, planting supplies
Turnbull Nursery, North Collins, NY	tree stock	Ben Meadows Janesville, WI	herbicide, tools, planting supplies
Schichtel’s Nursery, Springville, NY	tree stock	Home Depot Buffalo, NY	herbicide, tools, planting supplies
		Tractor Supply Company Buffalo, NY	herbicide, tools, planting supplies
Contractors			
WF Tree Care, Inc. Cheektowaga, NY	invasive spp. control	EcoDepot, LLC Gambrills, MD	tree shelters
Premium Services Inc. Buffalo, NY	invasive spp. control	Pinelands Nursery & Supply Columbus, NJ	tree shelters
Applied Ecological Services, Waterloo, NY	invasive spp. control	Saville’s Outdoor Power Equip. Orchard Park, NY	equipment supplies and service
		Noble Saw Tonawanda, NY	equipment supplies and service
Vernal Pools			
Pondliners.com Shawnee, OK	basin liner		
Just Liners Bogata, TN	basin liner		
Western Environmental Liner, Romulus, NY	basin liner		

APPENDIX B:

**Feasibility Assessment for the Enhancement of
Vernal Pool Habitats at Tiff Nature Preserve**

Feasibility Assessment for the Enhancement of Vernal Pool Habitats at Tifft Nature Preserve

Prepared by Zachary A. Cava
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January 2016

Project Advisors:
Dr. Amy M. McMillan, Associate Professor
Biology Department, SUNY Buffalo State
&
David Spiering
Ecologist at Tifft Nature Preserve, Buffalo Museum of Science

Introduction

Vernal pools (aka “seasonal pools,” “ephemeral wetlands,” “temporary pools,” etc.) are small, seasonally flooded ephemeral wetlands, typically isolated from permanent surface water flows (Calhoun et al. 2005). In the northeastern United States, vernal pools occur as shallow depressions in forested landscapes (NYSDEC 2016a). These depressions are filled by precipitation, snowmelt, and rising groundwater, attain maximum depths in spring, and usually dry completely by late summer (Calhoun et al. 2005). As a consequence of this wet-dry cycle, fish (and other predators that tend to associate with more permanent aquatic habitats) are largely excluded from temporary wetlands, creating critical breeding environments for some amphibians and invertebrates that cannot tolerate fish predators (Kenney and Burne 2009).

Species that rely primarily or exclusively on ephemeral wetlands are referred to as vernal pool “obligates” (Kenney and Burne 2009). In Western New York, these include mole salamanders (*Ambystoma* spp.), wood frogs (*Lithobates sylvaticus*), and fairy shrimp (Order Anostraca) (Table 1; Gibbs et al. 2007; NYSDEC 2016b). Organisms that use vernal pools along with other wetland habitats are termed “facultative” vernal pool species, and include other amphibians (e.g. spring peepers, American toads, red-spotted newts, four-toed salamanders), reptiles (e.g. spotted turtles, Blanding’s turtles, wood turtles), birds (e.g. wood ducks), and invertebrates (e.g. insects, crustaceans, bivalves) (Kenney and Burne 2009; Gibbs et al. 2007; NYSDEC 2016b). In addition to providing habitat for a variety of wildlife, vernal pools also perform important hydrologic and ecosystem services, including the storage and filtration of surface water, and energy exchange between aquatic and terrestrial environments (Lichko and Calhoun 2003).

Ephemeral wetlands do not receive specific protection in New York State, or at the federal level (NYSDEC 2016a). These unique environments are threatened by habitat loss, fragmentation, pollution, altered hydrological regimes, and climate change, and fact that vernal pools are generally small and isolated makes these habitats especially vulnerable (NYNHP 2015a). Furthermore, although several pool-breeding amphibians depend on vernal pools for reproduction and larval development, these animals spend the majority of their lives in surrounding terrestrial habitat. Because pool-breeding amphibians often migrate several hundred meters between breeding sites and upland habitats, persistence of pool-dependent amphibians depends on the availability of forested uplands *in addition to* seasonal breeding pools (Mitchell et al. 2006). Even when suitable wetland and terrestrial habitats co-occur, migration barriers, such as roads, can have profound impacts on dispersal and population stability (Calhoun et al. 2005).

In light of the threats facing seasonal wetlands, and the lack of protection these environments are afforded in New York State, local conservation efforts play a critical role in the future of these habitats and the wildlife they sustain. Although protection of intact habitat is ideal, this is often impossible or impractical (Windmiller and Calhoun 2008). To address this issue, in recent years many scientists and natural resource managers have made progress with constructing artificial vernal pools, and enhancing degraded vernal pool habitats. The purpose of this assessment is to explore the feasibility of enhancing and/or creating vernal pool habitat at Tiff Nature Preserve.

History

The fact that the area where Tiff Nature Preserve is situated did not historically support ephemeral wetlands should not preclude consideration for the management of this habitat type there. Indeed, the degree of habitat alteration this area has undergone as a consequence of local industry makes “restoration” to a pre-colonial state (i.e. freshwater marsh) largely impractical. The relatively recent emergence of woodland habitat at Tiff offers a unique opportunity to offset some of the profound losses incurred by native forest ecosystems following the development of the Buffalo metropolitan area. Establishing vernal pools at Tiff has the potential to increase local biodiversity, while simultaneously providing opportunities for education and community involvement.

Existing Habitat

Several seasonal pools have been documented at Tiff Nature Preserve, four of which were photographed during the summer of 2014 (Fig. 1-5). When fully inundated, the estimated area of individual pools ranges from 120 to 3,000+ m². Water depth among pools was between approximately 12 to 31 cm when photographed on 23 May 2014, and all pools had dried by 25 June 2014. The surrounding woodland habitat is represented by a tree canopy of cottonwoods (*Populus deltoides*) and willow (*Salix* spp.), a shrub layer dominated by buckthorn (*Rhamnus* spp.) and honeysuckle

(*Lonicera* spp.), and a mixed layer of mesic herbaceous plants (e.g. white snakeroot [*Ageratina altissima*] and stinging nettle [*Urtica dioica*]). As a consequence of Tifft's industrial heritage, the substrate throughout the preserve is characterized by a shallow organic layer overtop a deep mixture of construction fill.

Based on these conditions, it is unlikely that existing pools are filling the roles of natural seasonal wetlands. Most importantly, the observed hydroperiod does not align with the phenology of target vernal pool species (Table 1). With the exception of fairy shrimp, vernal pool obligates require pools to be inundated until July–August, when metamorphosis takes place. However, in 2014 all photodocumented pools had dried by June, suggesting the current hydroperiod is too brief for amphibians to complete development. Although data were only collected for one season, precipitation records indicate the region experienced near-average rainfall during this time (Table 2).

Of the indicator species (i.e. vernal pool obligates) listed in Table 1, only one species—the blue-spotted salamander (*Ambystoma laterale*) is known to occur at Tifft Nature Preserve. In New York State, blue-spotted salamanders are designated both as a species of “Special Concern” and as a “Species of Greatest Conservation Need” (SGCN). Presumably, *A. laterale* has colonized the preserve fairly recently by dispersing from peripheral habitats. Although evidence of reproduction has not yet been reported at Tifft, these salamanders are commonly observed near the cattail marsh, suggesting this habitat is being utilized for breeding (David Spiering, pers. comm.). Blue-spotted salamanders are known to occasionally reproduce in permanent wetlands, however such habitats represent suboptimal breeding environments due to increased predation risk. Thus, blue-spotted salamanders would likely benefit from the creation of vernal pools at Tifft. Furthermore, the existence of *A. laterale* at Tifft serves as a promising indicator for the preserve's capacity to support other vernal pool fauna.

Habitat Enhancement

Site Selection

When designing an artificial wetland, hydrology is perhaps the most critical aspect to consider (Lichko and Calhoun 2003). Although existing pools do not appear to be filling the role of natural seasonal wetlands, habitat modification resulting in an extended hydroperiod could allow these environments to regain much of the functionality of natural vernal pools. Existing depressions at Tifft Nature Preserve represent ideal sites for managing vernal pool habitat because these areas already exhibit some crucial features associated with natural ephemeral wetlands—namely the retention of water for part of year. By choosing sites in accordance with existing topography/hydrology, landscape disturbance can be minimized.

Pre-Construction Inventory & Monitoring

Pre-construction environmental surveys, including species inventories and habitat characterization, should be completed at sites under consideration for habitat enhancement. These surveys would 1) verify that target species do not already occur at Tifft Nature Preserve, and accordingly, that extant wetlands are not already functioning as natural vernal ponds; and 2) provide data on pre-construction conditions to be used for measuring the long-term efficacy of management actions.

Techniques for detecting the presence/absence of indicator species *within pool depressions* include dipnet surveys, eggmass counts, and visual encounters. Although survey efforts should be focused on the breeding season to maximize detection probability, collecting substrate samples from dry depressions may be helpful, particularly for identifying invertebrate signs (e.g. shells, cases, eggs). Because blue-spotted salamanders are known to occur at Tifft, sampling upland habitats could provide insight into the distribution, habitat use, and demography of this species. Survey methods for detecting ambystomatid salamanders in terrestrial habitats include coverboard arrays and drift fences with pitfall traps. Frog call surveys could also be employed during the breeding season to detect wood frogs and other anuran species. For detailed guidelines on the inventory and monitoring of amphibians, see Graeter et al. (2008). The U.S. Fish and Wildlife Service provides survey guidelines for listed fairy shrimp in the western U.S. (USFWS 2015), and a similar methodology may be adopted for sampling local wetlands. It must be emphasized that all documented species, regardless of status as vernal pool indicators, should be identified to taxa and compiled in an inventory for the preserve.

The boundaries of pool depressions should be delineated using GPS, and topography may be surveyed. Pools should be photographed from different perspectives, revisited at various times throughout the year, and photographed from approximately the same positions (including landmarks to help). Maximum water depth, period of inundation, and area of inundation should be documented (a measuring stick may be secured at the deepest point in a pool). Water quality parameters, such as pH, temperature, conductivity, and turbidity should be recorded, and water samples can be analyzed for the presence of heavy metals, fertilizers, and pesticides. Dominant vegetation in and around pool depressions should be documented (e.g. >20% relative cover; De Weese 1998), and canopy cover estimated. Soil properties are highly variable throughout the preserve, thus excavating test holes at potential wetland enhancement sites would yield valuable information on local soil characteristics (e.g. substrate size, heterogeneity, composition, pH).

All of the environmental parameters assessed at Tifft Nature Preserve should be compared with conditions at natural reference pools within the region (Lichko and Calhoun 2003). These paired comparisons would help guide management efforts by revealing major differences between natural wetlands and existing habitats, and by providing a range of “target” conditions that may be required for constructed pools to approximate the functions of their natural counterparts. For additional information

regarding the monitoring and evaluation of constructed vernal pools, see De Weese (1998).

Pool Construction

A variety of factors can influence a vernal pool's hydroperiod, including water depth, annual precipitation, soil permeability, the contribution of groundwater and surface water flow, sun exposure, and transpiration (Biebighauser 2003). Although all of these factors should be considered when selecting a construction plan, water depth and soil permeability are the characteristics land managers have most control over. Below is a summary of different techniques involving the manipulation of pool depth and permeability that may be utilized for the enhancement vernal pool habitat at Tifft Nature Preserve. For detailed guidance on pool construction, see Biebighauser (2011).

1. *Excavation* – In areas with high water tables, excavation alone may suffice in creating depressions that will be inundated for a desired period. Investigations by MacDonald et al. (2015) indicate Tifft has a high water table, with depth to groundwater estimated at 1–2 meters throughout the preserve (David Spiering, pers. comm.). Consequently, existing seasonal pools may have a strong groundwater component. If so, deepening these depressions (either by hand, or with the aid of heavy machinery) could effectively extend the hydroperiod.

Water levels at prospective sites should be monitored to ensure there is adequate seasonal fluctuation in groundwater supplies to allow pools of a given depth to dry completely (Tom Biebighauser pers. comm.). There are three permanent wells at Tifft Nature Preserve, two of which are in close proximity to potential vernal pool enhancement sites BP1-3 (Fig. 1; MacDonald et al. 2015). Water depth could be measured at these wells at various intervals throughout the year to determine if groundwater depth fluctuates enough to subject constructed pools to annual wet-dry cycles typical of natural ephemeral wetlands. If the results are promising, a small test hole can be excavated at a prospective site to verify depth to groundwater and investigate the substratum. If conditions still appear suitable, this method probably represents the easiest and most economical approach to vernal pool enhancement at Tifft. However, if the water table is too low, too stable, or if this technique proves objectionable for other reasons (e.g. leaching of contaminants from soil), refer to options 2 and 3 below.

2. *Synthetic Liner* – The use of synthetic liners represents a reliable option for enhancing vernal pool habitat at Tifft Nature Preserve where depressions are inundated by surface flows. When placed within a shallow depression, a liner creates an impermeable layer, regardless of the surrounding soil type. For this reason, liners are ideal for sites like Tifft, where substrate is dominated by highly permeable construction fill. Another benefit of using synthetic liners is that a desired hydroperiod may be achieved with minimal disturbance to the surrounding habitat, compared to the aforementioned methods. Drawbacks of using liners include cost,

and size limitations. Because liners are difficult to maneuver, wetland size would be limited to 30 x 40'. **This method is not recommended in areas already inundated by groundwater, as rising water can cause the liner to float. If a liner must be used at a site with high groundwater input, a drainpipe can be placed beneath the liner to prevent groundwater from displacing the liner.*

3. *Excavation & Compaction* – At sites with fine textured soils (silt, loam, clay), a combination of excavation and compaction (using a bulldozer) can be used to create artificial pools. This method is probably inappropriate for use at Tiff Nature Preserve due to the shallow soil profile and presence of highly permeable construction fill throughout the preserve. Although the addition of clay to constructed wetlands may improve water-holding capacity in certain situations, this method is expensive, involves extensive habitat disturbance, and is prone to failure (e.g. crayfish and other animals can burrow through clay causing the wetland to drain).

Pool Design

The dimensions of artificial vernal pools should be informed by referencing natural seasonal wetlands in the region. These “reference pools” will later serve as valuable benchmarks for assessing the functionality of constructed pools. In general, pool depth should be within 10 to 100 cm—the range at which most temperate amphibians deposit egg masses (Richter 1997). Pools that are too deep may not dry completely in summer. Efforts should be made to create wetlands with varied microtopography of the pool floor, and irregularly shaped, gradually sloping edges. Once inundated, these pools will not only appear more natural, but also provide a greater array of microhabitats, thus promoting increased species diversity.

It may take several years for a constructed pool to “mature” and appear as part of the natural landscape. This process may be expedited by planting native vegetation on exposed soils soon after construction. Establishing native plants early also helps to prevent erosion, and reduces opportunities for invasive species to take hold. Aside from encouraging the growth of native flora, placing sticks/branches in recently constructed pools can benefit pool-breeding amphibians by providing valuable oviposition sites.

Just as artificial pools can benefit from being seeded with native plants, the introduction of other organisms to artificial pools may be warranted in certain situations. Constructed wetlands can represent viable habitat for a variety of species, yet only a few of these potential species may possess dispersal traits that allow them to colonize these new habitats. For example, highly mobile, wide-ranging fauna, such as dragonflies and other insects, are expected to utilize constructed pools quickly. Similarly, wildlife already found at Tiff Nature Preserve, such as blue-spotted salamanders, may naturally colonize created wetlands, whereas other organisms, including spotted salamanders, wood frogs, and fairy shrimp, have likely become spatially isolated from the preserve due to increasing urbanization and habitat fragmentation.

In situations where suitable habitat is not readily accessible to target species, “human-facilitated dispersal” may be a viable option. Species introductions would require consultation with the NYSDEC, but might be accomplished fairly easily (e.g. by transplanting sediment, water, and/or egg masses from nearby donor pools). Important factors to consider before introducing wildlife to Tiff Nature Preserve include the risk of disease transmission, the genetic diversity of the donor stock, and the outcome of introductions on existing community dynamics. Despite Tiff’s extensive history of disturbance, along with the preserve’s isolated setting within an urban landscape, the practice of biological introductions is often controversial. For this reason, it may be prudent to monitor constructed pools for several years before considering species introductions.

Upland Habitat

Pool-breeding amphibians spend 11 months of the year in surrounding upland habitat; thus if constructed pools are to support target fauna, it is imperative to maintain suitable terrestrial habitat in addition to aquatic breeding habitat. Based on the movement patterns of pool-breeding amphibians, land managers should aim to conserve 150-300 m of upland habitat surrounding pool boundaries (Windmiller and Calhoun 2008). Some authors define separate “management zones,” with each zone having specific management goals. For example, Calhoun et al. (2005) describe: 1) the pool depression, 2) the pool envelope (extending 30 m from pool edge), and 3) critical terrestrial habitat (30-230 m from pool edge). For the pool depression, goals include sustaining a desired hydroperiod, ensuring a depression doesn’t fill with sediment, maintaining suitable water quality, providing oviposition sites (e.g. vegetation, branches), and cultivating native vegetation along pool margins. The pool envelope provides “nursery habitat” for amphibian metamorphs, which are especially vulnerable to desiccation. Accordingly, cool, moist conditions within this zone should be maintained by providing ample leaf litter, coarse woody debris, and shade cover. The critical terrestrial habitat zone provides habitat for hibernation, foraging, and migration. Managers should seek to maintain a partially shaded forest floor with a deep, loose layer of moist leaf litter, and abundant coarse woody debris. Ideally, less than 25% of the area defined as critical terrestrial habitat should be developed/disturbed. For all of these habitat zones, barriers to dispersal between zones should be minimized.

The presence of invasive species should also be addressed when managing upland habitat. Nonindigenous plants including honeysuckle and buckthorn are abundant at Tiff Nature Preserve, and such species may negatively impact amphibians through the release of phytochemicals (Sacerdote and King 2014; Watling et al. 2011a) and by altering the microclimate (Watling et al. 2011b). Efforts to control invasive species throughout upland habitat in the preserve may benefit pool-breeding amphibians. However, special attention to invasive plants in the pool depression and pool envelope is advised, as it is within these zones where amphibians (i.e. developing and recently metamorphosed) may be most vulnerable. In addition to removing exotic vegetation, establishing more native plants can enhance upland habitat. A list of

characteristic vegetation associated with ephemeral wetlands in New York State is available through the New York Natural Heritage Program (NYNHP 2015a). Invasive animal pests, such as the European fire ant (*Myrmica rubra*) also occur at Tifft and could potentially impact vernal pool wildlife. At present, it is unknown whether fire ants would be incorporated into the diets of pool-breeding amphibians, or if these exotic ants could negatively impact amphibians by displacing preferred prey.

Post-Construction Inventory & Monitoring

Post-construction inventory and monitoring would be necessary to evaluate the success of management actions (i.e. how closely constructed pools fill the roles of natural ephemeral wetlands). Post-construction surveys would follow the same methodology described for pre-construction surveys, including comparisons to reference pools. Post-construction monitoring efforts may indicate the need for additional habitat modification or reevaluation of the original management strategy. Windmiller & Calhoun (2008) recommend that monitoring protocols should exceed 3-5 years following the creation of vernal pools.

Conclusion

Vernal pools are unique environments that offer critical habitat for a number of species, and provide valuable ecosystem services. Despite the many threats facing these habitats, seasonal wetlands are afforded very little protection in New York State. As the value of ephemeral pools has become more apparent, there is growing demand for the enhancement of degraded wetlands, and the creation of artificial wetlands. Tifft Nature Preserve is an ideal setting for managing seasonal wetlands. Tifft is largely undeveloped, yet spatially isolated within an urbanized landscape. The creation of vernal pool habitat at Tifft could mitigate some of the losses to ephemeral wetlands that occurred in the surrounding region, and would enhance the biotic diversity within the preserve. The construction of vernal pools would also present excellent opportunities for public outreach, education, and collaboration. Although the industrial history of Tifft imposes some logistic constraints on vernal pool construction, this setting may prove beneficial by providing an impetus for the development of innovative strategies that could be applied elsewhere. The advancement of such approaches demands creativity, flexibility, and experimentation—privileges land managers working in more “pristine” environments are less likely to be granted.

Before pursuing vernal pool enhancement at Tifft Nature Preserve, it would be important to develop a comprehensive understanding of existing environmental conditions. For example, sites considered for wetland enhancement should be delineated, and local hydrology, topography, soil characteristics, and water chemistry should be thoroughly investigated. Biological surveys should be conducted to develop species inventories, and baseline data obtained from preliminary surveys would be later used to evaluate success. These surveys would also reduce the chances of management actions negatively impacting any sensitive species already occurring

within the preserve. Post-construction monitoring would be necessary to assess the performance of artificial pools relative to natural wetlands and pre-construction conditions. There is relatively little data available regarding the long-term success of artificial wetlands, and the development of constructed seasonal wetlands at Tiff Nature Preserve offers a unique opportunity to contribute to the emerging field of restoration ecology and habitat enhancement.

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Table 1 – “Obligate” vernal pool species of Western New York, with relevant phenology¹ and conservation status

Scientific Name	Common Name	Breeding	Metamorphosis	NYNHP Rank ²	NYS Listing ³	SWAP Status ⁴
<i>Ambystoma jeffersonianum</i>	Jefferson Salamander	March–April	July–September	S4	GN-SC	SPCN
<i>Ambystoma laterale</i>	Blue-spotted Salamander	March–April	July–September	S4	GN-SC	SGCN-HP
<i>Ambystoma maculatum</i>	Spotted Salamander	March–April	July–September	S5	GN	NL
<i>Lithobates sylvaticus</i>	Wood Frog	March–April	July–August	S5	GS	NL
Anostraca (Order) ⁵	Fairy Shrimp	March–May	N/A	NL ⁶	NL	NL

¹ Phenological data sourced from: Bishop (1941), Petranka (1998), Gibbs et al. (2007), and Kirpatrick (2013)

² New York Natural Heritage Program state ranks: S4 = apparently secure; S5 = demonstrably secure (NYNHP 2015b)

³ New York State Legal Status: GN (Game: No Season) = classified as a game species, but there are no seasons set and the species may not be hunted or taken at any time; GS (Game: Season Set) = seasons set for the species when they may be legally hunted; SC (Special Concern Species) = native species which are not yet recognized as endangered or threatened, but for which documented evidence exists relating to their continued welfare (NYSDEC 2010)

⁴ State Wildlife Action Plan categories: SGCN-HP (High Priority Species of Greatest Conservation Need) = The status of these species is known and conservation action is needed in the next ten years. These species are experiencing a population decline, or have identified threats that may put them in jeopardy, and are in need of timely management intervention or they are likely to reach critical population levels in New York.; SPCN (Species of Potential Conservation Need) = A species whose status is poorly known, but there is an identified threat to the species or features of its life history that make it particularly vulnerable to threats. The species may be declining or begin to experience declines within the next ten years, and studies are needed to determine their actual status. (NYSDEC 2015)

⁵ The following species have been documented in NYS: *Streptocephalus sealii*, *Eubbranchipus bundyi*, *E. holmanii*, and *E. vernalis* (Belk 1975)

⁶ NL = Not Listed

Table 2 – Precipitation records for Buffalo NY from May–June 2014 along with monthly averages from 1981–2010 (U.S. Climate Data)

Month(s)	2014 rainfall (in)	1981-2010 avg. rainfall (in)
May	3.12	3.46
June	3.8	3.66
May + June	6.92	7.12



Figure 1: Locations of existing seasonal wetlands at Tift Nature Preserve



Figure 2A-D: BP1 when visited on May 23, 2014 (A, B) and June 25, 2014 (C, D). The measuring stick indicates a water depth of 15 cm. The total area of this pool is estimated to be 800 m².

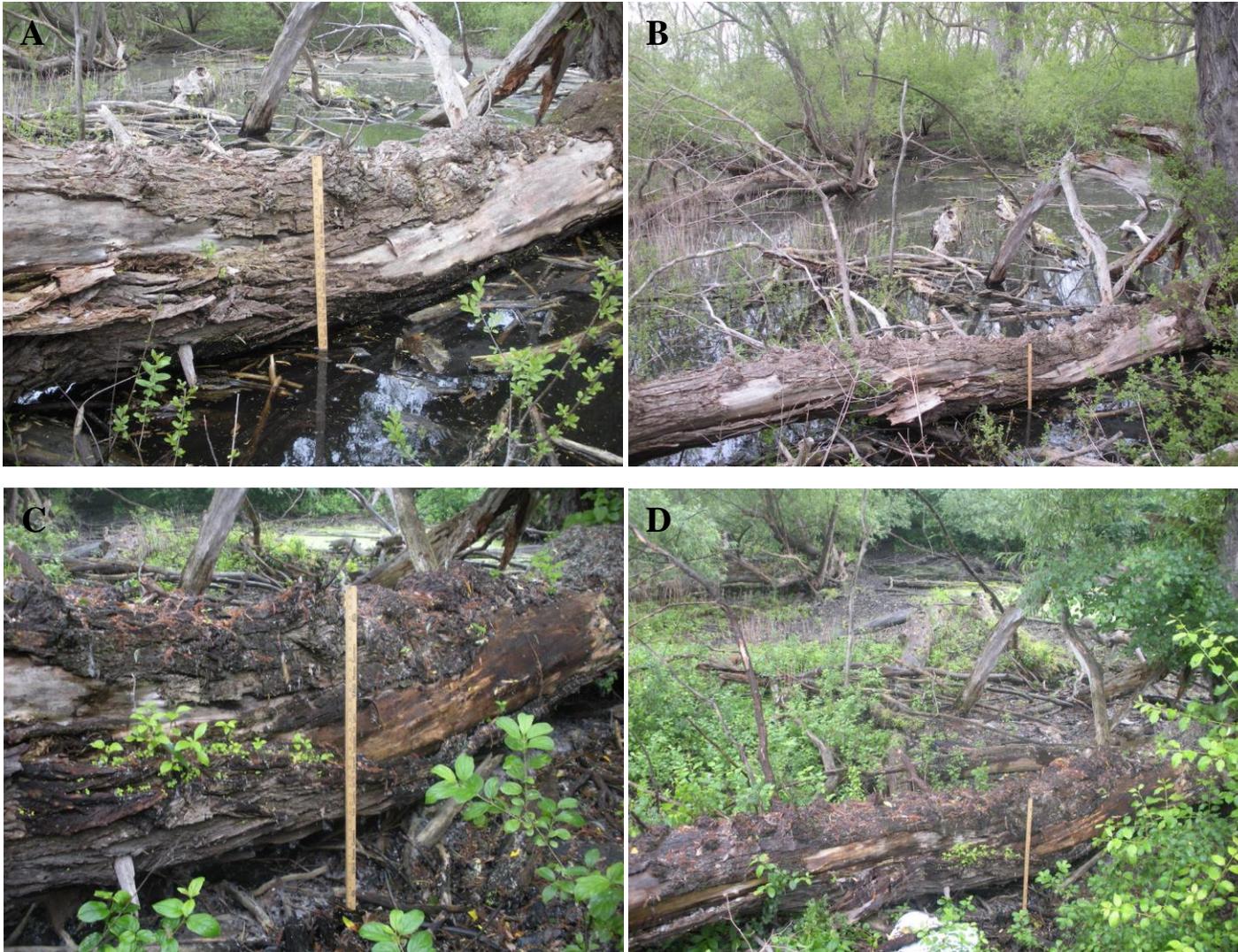


Figure 3A-D: BP2 when visited on May 23, 2014 (A, B) and June 25, 2014 (C, D). The measuring stick indicates a water depth of 31 cm. The total area of this pool is estimated to be 1,900 m².



Figure 4A-D: BP3 when visited on May 23, 2014 (A, B) and June 25, 2014 (C, D). The measuring stick indicates a water depth of 12 cm. The total area of this pool is estimated to be 3,000+ m².



Figure 5A-D: MJ when visited on May 23, 2014 (A, B) and June 25, 2014 (C, D). The measuring stick indicates a water depth of 14 cm. The total area of this pool is estimated to be 120 m².