Acacia Reservation
Ecological Restoration Master Plan

May 2014

Cleveland Metroparks

Acknowledgements

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GREAT LAKES BIOREGION

Cleveland Metroparks acquired the 155 acre Acacia Country Club through the generous and diligent efforts of The Conservation Fund, a national nonprofit organization saving special places, like Acacia, for nearly thirty years.

As one of the conditions in Section 6.5 of the November 2012 Donation Agreement, The Conservation Fund has to review and approve Cleveland Metroparks' restoration plan.

On behalf of The Conservation Fund, Matthew Sexton, Senior Vice President of Real Estate, has reviewed and approved the Acacia Reservation Ecological Restoration Master Plan, Final, dated May 2014 (the "Plan"). In providing this acknowledgement, both Cleveland Metroparks and The Conservation Fund are not waiving their ongoing rights and responsibilities with respect to the 2012 Donation Agreement.

This Plan outlines the vision for restoration of the property, and the implementation of the Plan will depend on a number of factors, including funding and adaptive management. Therefore, Cleveland Metroparks and The Conservation Fund will continue to engage with each other to collaborate regarding the implementation of the Plan.

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Matthew Sexton

Date

Senior Vice President of Real Estate
The Conservation Fund

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Date

Executive Director
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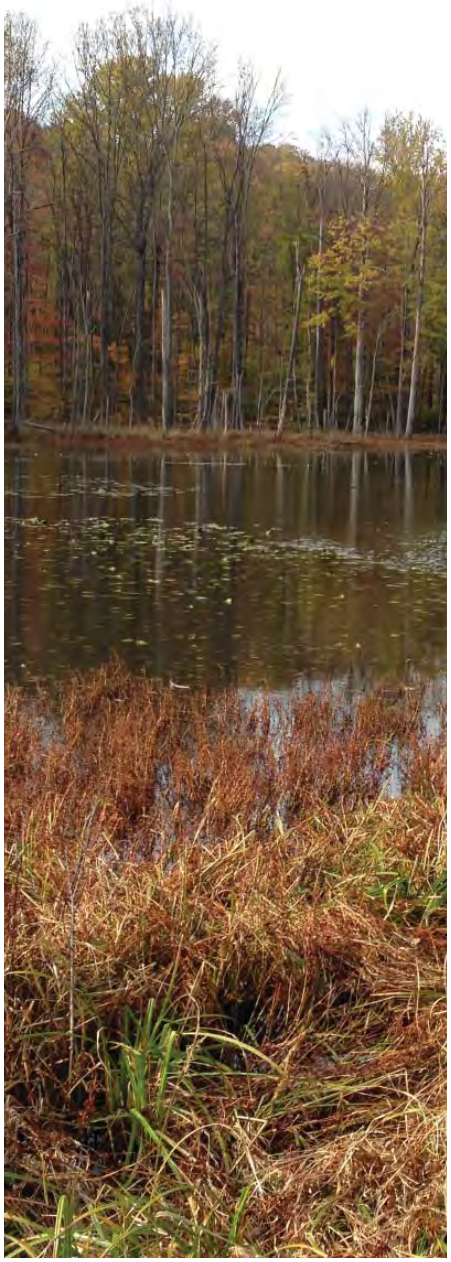
Executive Summary

Acacia Reservation Ecological Restoration Master Plan

The ultimate goal of the master plan is to create an ecological preserve as well as an open space oasis.



CONTEXT, PURPOSE, AND GOALS

In late 2012, Cleveland Metroparks acquired a 155-acre golf course through a generous donation from an anonymous donor group that was managed by the Conservation Fund, a national nonprofit conservation organization, with the intention of restoring the property as a naturalized public park. Acacia Reservation is envisioned as an ecological preserve as well as an open space oasis. Cleveland Metroparks staff pondered the question of how best to sustainably restore the property to a condition that satisfies the donor's intent and Cleveland Metroparks park user needs. This Ecological Restoration Master Plan for Acacia Reservation sets out a process and path to restore the former Acacia Country Club to an open space mosaic of forests, wetlands, streams, open water, and meadows to provide residents the opportunity to reconnect with nature.

The current conditions at Acacia Reservation include open turf-type grasslands associated with golf course fairways, tees, greens and roughs. These areas are showing some signs of succession but generally retain the 'feel' of the golf course and exhibit limited diversity and natural resource value. The areas of rough include a number of specimen trees, both native and non-native, which contribute to the attractiveness of the landscape. Three golf course ponds and a small wetland swale round out the 'natural' land cover on the property.

Euclid Creek, a direct tributary to Lake Erie, winds through the property and provides an important freshwater asset on the site. Unfortunately, the creek is degraded and eroding because of reduced floodplain access and upstream pressures associated with development and urbanization. Along a portion of the creek's corridor, the property contains a woodlot in good condition. Because this forested stream section is adjacent to other private properties in a similarly forested condition, Acacia Reservation appears to have a large area of forest cover. However, this forest is fragmented and degraded, and subject to increased unfiltered stormwater runoff coming from Acacia Reservation.

The streams and wetland depressions, historically common on the site, have been modified by buried tile drains and pipes that carry water to the margins of the site where it is discharged to Euclid Creek and its tributaries.

In addition to the golf course infrastructure modifications (e.g., drain tiles and irrigation lines), the maintenance facility, the clubhouse facility, paved cart paths, and parking areas comprise the remaining site features of note.

SITE HISTORY

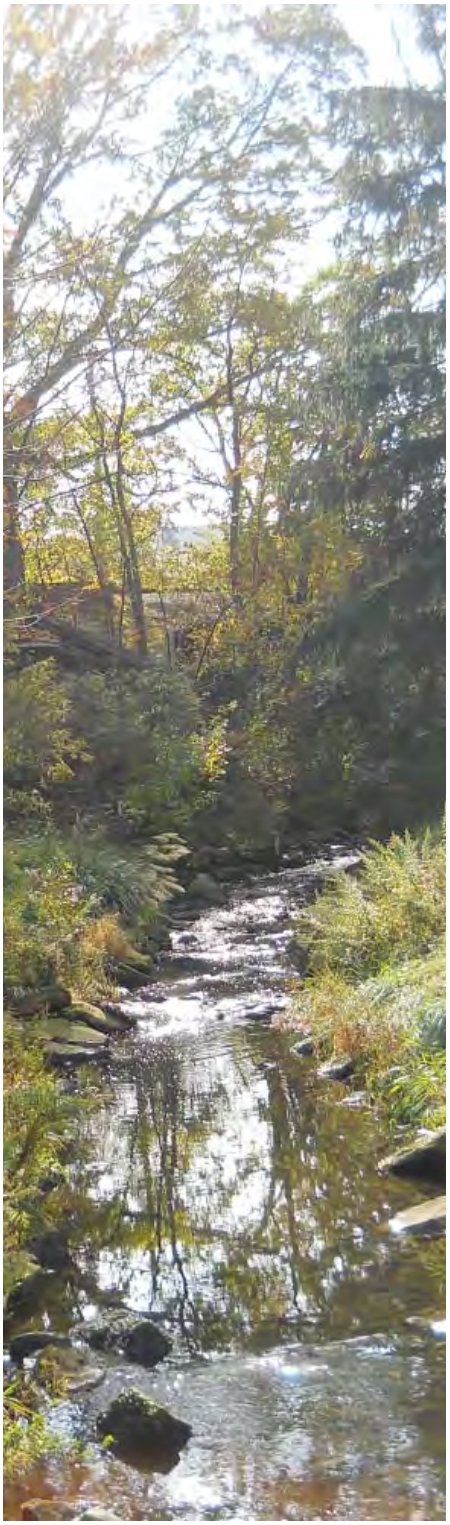
The Acacia Country Club was designed and constructed in 1921 using the understanding and methods for modifying site conditions that were commonly used at the time, including drainage improvements, small-scale grading, soil, pest and vegetation management, and irrigation practices. Over the better part of the last century, the country club maintained, modified, and reconstructed elements of the course. Many of the modifications are documented or readily visible, while others are largely undocumented and were implemented in a disjointed fashion by a succession of staff. How Park District staff sort through these historic changes and the remaining active infrastructure (e.g., tile drains) is the subject of this ecological restoration master plan. It is imperative that the ecological restoration of the site cost-effectively and sustainably transitions the property to a more biologically diverse and environmentally sustainable landscape while satisfying stakeholder desires for the property and meeting longer-term goals for the reservation's facilities.

TRANSITIONING TO A NATURAL LANDSCAPE

The managed effort to cost-effectively transition this site from a homogenous, extensively modified, and intensively managed property to meet the restoration vision is multi-faceted. It requires an approach that adapts to early project successes, provides flexibility to use diverse funding sources, capitalizes on Cleveland Metroparks' existing staff and material resources, and builds partnerships with adjacent property owners. Intensive efforts are required to realize Cleveland Metroparks and stakeholder project goals (e.g., new access, restored stream and wetland habitat). In addition, the reestablishment of forested conditions on the site will include active plant installation, protection and management in some areas as well as managed natural succession in other areas. While natural processes of change have already started in portions of the former golf course, these processes will take their own path and without active management will likely result in a number of undesirable results such as exotic, invasive species establishment, and continued homogenization.

Individual project implementation will be staggered in time and place. Naturally, implementation cost and capacity is a major reality on a property of this size and with its history of modification. As a result, prioritization of project implementation is necessary. In addition, even if funds and capacity were limitless, it would be advisable to carefully transition from the current condition to the desired ultimate project condition. By observing the nature of changes and potentially unexpected secondary effects, adjustments in subsequent implementation plans can be based on these observations through adaptive management practices. In this manner, Cleveland Metroparks can efficiently manage the implementaion process to achieve the best possible results, incorporate the greatest diversity of site conditions and sustainable uses, and get the greatest benefit for the financial and staff resources invested.

Consistent with Cleveland Metroparks organizational goals, the managed transition of the property will be used as a means to expose all park visitors, both young and old, to natural resources and ecological processes, with the goal of fostering natural resource stewardship and support for this reservation, Cleveland Metroparks and the region.



THE MASTER PLAN

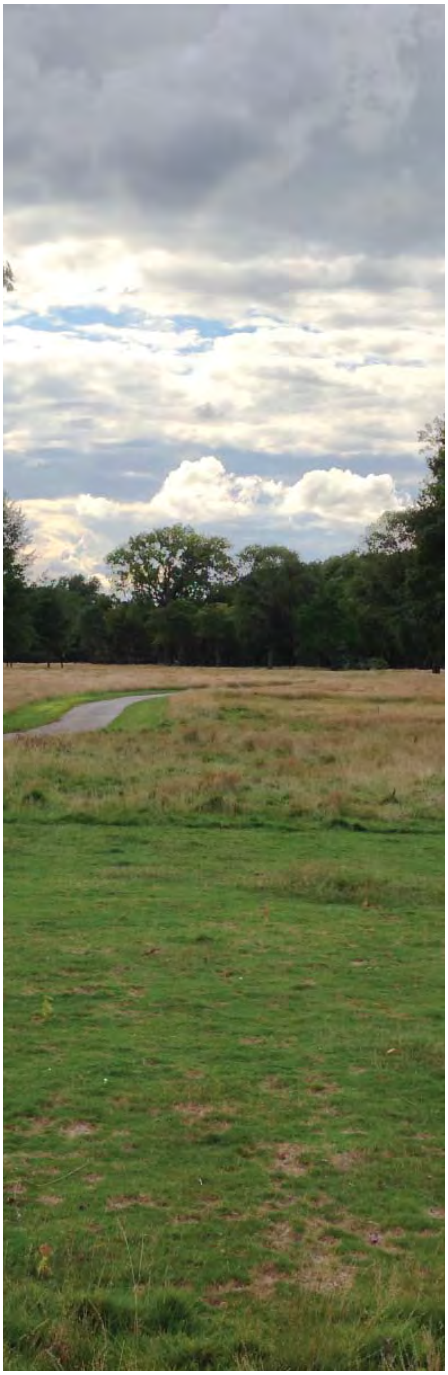
Two overarching ecological goals for the site drive the restoration plan: 1) reconnecting the shallow groundwater and surface water wetlands and streams, and 2) transitioning the vegetation across the site to a diverse mosaic of open meadow and forest communities overlain on the restored site hydrology. These goals involve many elements and require substantial preparatory and follow-up management efforts to increase their success (e.g., drain tile interruption, site preparation and introduction of preferred plant species, invasive plant management, pond management and deer management). Nine all-inclusive strategies have been outlined. These include several that focus restoration and management efforts on Euclid Creek and other existing and buried streams, and several that focus on forest and meadow establishment and management.

The plan addresses considerations for integrating these restoration efforts with park use and ongoing stewardship programs. The intention is to restore much of the ecological diversity and function of the site, resulting in a park setting that provides enhanced ecosystem services and attracts a greater numbers of users – human and nonhuman alike. Supporting this increased use in a sustainable and resilient manner requires consideration for trail networks, acceptable active and passive uses of the park, wildlife enhancements, and an active park interpretation program. These elements may evolve over time, as project implementation proceeds. Site improvements focus on maintaining and improving known uses of the site (e.g., fishing, hiking, jogging, bird watching, seeking solitude). Other areas of focus include supporting additional passive and low impact recreational opportunities consistent with the changing site conditions (e.g., cross country skiing, etc.), increasing opportunities for environmental education and watershed stewardship, and improving the natural resources of the site with an emphasis on increasing ecosystem services.

ECOLOGICAL RESTORATION MASTER PLAN

RESTORATION STRATEGIES

- Euclid Creek Conservation Corridor – Riparian Forest
- Euclid Creek Stream Restoration
- Forest Enhancement, Buffer Enhancement, Seedling Regeneration
- Stream Daylighting and Hydrologic Restoration –
  Headwater Tributaries, Southwestern Stream
- Pond Fringe Enhancement –
  Northeast Pond, Northwest Pond, and Central Pond
- Wetland Hydrology Restoration –
  Restore Forested Wetlands, Wet Swales & Meadows
- Fairway to Native Meadow Establishment –
  Moist to Wet Meadows as Transition Habitats
- Existing Maintenance Facility Upgrade/Retrofits –
  Potential Plant Nursery
- Off-site Stormwater Management/Partnering Opportunities



IMPLEMENTATION

Project implementation needs to be responsive to Cleveland Metroparks and stakeholder goals. Not all changes can be made at once. Certain efforts will be dependent on early restoration actions. Some projects will be implemented with the help of outside contractors while others can be managed and executed with existing staff resources. Similarly, some projects provide greater public benefit and may be funded by outside grantors (e.g., Ohio Surface Water 319 Grant program), while others will be included in annual operating and/or capital budgets.

The plan includes a summary of initial information to support the development of project implementation, with phasing and project costs. Finally, before Cleveland Metroparks can develop an implementation schedule, some additional elements need to be addressed. These include, but are not limited to, agreements with adjacent property owners, decisions relating to the amount and source of funding (internal and external), additional information on existing site conditions and proposed restoration components, and project priorities.

Acacia Reservation offers exciting opportunities to apply adaptive management in site restoration, which may generate lessons that can be applied to other restoration efforts both within and outside the Park District. The ecological restoration of this landscape will provide a diverse and continuously changing park experience for park visitors. It will also enrich the local natural resources from an open space, habitat, wildlife, and ecosystem service perspective.

I–Introduction

In late 2012 Cleveland Metroparks acquired 155 acres of open space at the former Acacia Country Club, through a generous donation from the Conservation Fund – a nonprofit conservation group devoted to the protection and restoration of "special places across America." The intention of the donors is to provide an ecological preserve of forested habitat, as well as an open space oasis for city dwellers to reconnect with nature. The characteristics of the property suggest that it be restored primarily to forested habitats with some scattered meadows and open water areas.

Over 100 years ago, this area's woods and streams were transformed into a golf course that required significant alteration of the natural systems found on the site, both in terms of hydrology and in terms of ecology (Figure 3). By examining existing conditions and understanding the landscape and ecological legacy of the site, a more functional landscape system can be envisioned. This functional landscape system provides a range of ecosystem services for park users and wildlife, as well as broader ecological connections.

Ecological restoration is defined as the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed[1]. Some of the considerations that apply to the restoraton of Acacia Reservation include a vision for the future system, land-use history, historic and current landscape features, existing topography and landscape patterns, hydrology and soil characteristics, historical and cultural information, and surrounding habitats.

A consideration in restoration planning is whether the opportunity exists for using a regenerative design approach. In regenerative design human activities are deeply integrated with living systems, and landscapes are continuously increasing in biological diversity, experiencing increased resilience and inspiring community spirit. Resilience is the capacity of an ecosystem to respond to disturbances by resisting damage and recovering quickly. There is the opportunity for regenerative design at Acacia Reservation. The goal is to promote ecological uplift[2] and create conditions for resilience, while understanding what Acacia Reservation can sustainably support.

1 Definition from the Society of Ecological Restoration: https://www.ser.org/resources/resources-detail-view/ser-international-primer-on-ecological-restoration#3

2 "Uplift" refers to the quantifiable environmental benefit or gain of the restorationa and management actions taken. Water stored or nutrients captured in wetlands, temperature drop from tree plantings, and changes in bird species diversity can be measures of uplift.

Figure 1. Summer conditions at Acacia Reservation

It is important to acknowledge the multiple benefits that a restored site will provide. Acacia Reservation is envisioned as a robust forest, dominated by native hardwood species, with a rich understory that provides improved structure for wildlife. The ecosystem services provided include flood and erosion reduction, groundwater recharge, carbon sequestration, climate regulation, areas for aquatic habitat, purification of water and air, seed dispersal, food sources for native wildlife, pollination, honey production, and pest control as well as cultural, intellectual and spiritual inspiration, and recreation.

As restoration proceeds, improvements at Acacia Reservation will provide wildlife habitat and connections including forest, meadow and wetland patches and corridor enhancement between patches along Euclid Creek. Enhanced stream ecosystem function will result from stream restoration projects, and the entire Reservation will serve as an important habitat patch or hub along the Euclid Creek stream corridor, which eventually flows into Lake Erie. The Reservation will provide stopover habitat for migrating birds. Steps taken to alter the water cycle on the site (i.e., retaining more water in the landscape) as well as actions taken to improve the quality of water leaving the site and entering Euclid Creek, will help improve the overall stream system. These steps include retaining water longer on the site, retaining water closer to where it lands, promoting wetland function and groundwater recharge, and filtering runoff through plants and soils.

GREEN INFRASTRUCTURE

"Green Infrastructure" is the use of natural, living systems (including wetlands, gardens, meadow, grassland, forests, open space, rivers, and streams) to provide services to people and the broader ecological community. It is also a cost-effective and sustainable approach to stormwater management that includes technologies to infiltrate, capture and reuse stormwater in order to maintain or restore natural hydrology.

This master plan is intended to map out the trajectory for the ecological restoration of Acacia Reservation. It provides guidance for strategic implementation of projects that support ecological uplift and improved function across the site. There are six priority habitat areas that have been identified for consideration in this restoration master plan: streams, forests, ponds, wetlands, and meadows, as well as green infrastructure applications near the developed areas.

Additionally, this master plan summarizes existing and historical conditions that help inform ecological potential, and reviews the restoration goals established by Cleveland Metroparks. Restoration strategies and a proposed implementation plan are included for this long-term effort that will improve ecological function and provide an inspiring place for respite, contemplation and recreation. Cleveland Metroparks is committed to the protection of the community's natural resources through the responsible stewardship of public funding to conserve, preserve, and restore natural areas. The long-term restoration efforts at Acacia Reservation continue that long tradition of taking a leadership role in enhancing the Cleveland region's green infrastructure (see call-out) by focusing on preservation, restoration, and management of natural resources, in both suburban and urban areas.

Figure 2. Acacia Reservation in winter (northeast pond)

Figure 3. Acacia Reservation Existing Conditions Aerial

II–Existing Conditions Observations

Ecosystem Context

Due to its long history as a golf course, Acacia Reservation is by its very nature a novel ecosystem. Human activities have dramatically altered the historic ecology of the site, which now hosts an assemblage of species that had not previously been present before disturbance occurred. Restoration approaches for novel ecosystems include 1) using historical ecology as a guide, 2) consideration of multiple trajectories, 3) an emphasis on process and adaptive management, and 4) consideration of pragmatic goals[1]. The risk in a novel ecosystem is the dominance of invasive species and a reduction in biodiversity. Biodiversity is one of the hallmarks of a resilient system, since a diverse set of flora and fauna are more likely to be able to rebound after serious disturbances in an ecosystem – a loss of biodiversity equates to a loss in resilience. Crucial restoration initiatives include the cultivation of species with native seed stock and the use of local reference ecosystems for guidance in restoring the site to a more complex and resilient ecosystem. As previously stated, resiliency is the capability of a system to maintain its current state when exposed to a disturbance, much like a well-buffered water can maintain a circumneutral pH even with the addition of acid or base. A resilient ecosystem is one that has the capacity to resist long-term damage and rebound quickly after disturbances like storms, floods, disease, and human activities.

From restoration as well as a novel ecosystem perspective, Acacia Reservation represents a unique opportunity because of its location in an urban area. It is transitioning from a heavily managed and altered golf course landscape to a natural resource area that will host a wide variety of native plants and wildlife, and a diverse palette of landforms and ecotypes. Several former golf courses are undergoing active and passive restoration, similar to what is proposed at Acacia. Former courses include Salem Golf Course in New Jersey, Ponderlodge Golf Course in New Jersey, and the Forest Beach Migratory Preserve in Wisconsin. In addition, two former golf courses in the region are also undergoing restoration: Orchard Hills Park (owned by Geauga Park District) and the former Aurora Country Club (now owned by the City of Aurora, Ohio). The Acacia Reservation ecological restoration is unique due to its location in an urbanized area, its opportunity to affect positive change in water quality of the headwaters of a creek watershed system, and the holistic approach proposed to establish restoration strategies. Returning golf courses to a natural condition is an increasing occurrence, and Cleveland Metroparks has the opportunity to be at the forefront of innovative restoration approaches within the urban context.

NOVEL ECOSYSTEMS

"Novel ecosystems contain new combinations of species that arise through human action, environmental change, and the impacts of the deliberate and inadvertent introduction of species from other regions. Novel ecosystems (also termed emerging ecosystems) result when species occur in combinations and relative abundances that have not occurred previously within a given biome. Key characteristics are novelty, in the form of new species combinations and the potential for changes in ecosystem functioning, and human agency, in that these ecosystems are the result of deliberate or inadvertent human action" (Hobbs et al 2006).

A robust ecological restoration master plan is responsive to current conditions and respectful of historical ecological systems, aiming for a resilient and regenerative future. Acacia Reservation will never return to its pre-golf ecological condition, but our vision is to optimize the ecological function and human benefits derived from this property. This requires a solid understanding of the existing landscape and watershed context and the natural resources that lie at its foundation. This section will describe some of the key elements that compose this landscape and make it a unique site.

1 Eric Higgs, http://dirt.asla.org/2013/10/16/novel-ecosystems-not-so-novel-anymore/

Watershed Context

Acacia Reservation is located in the Euclid Creek Watershed along the west branch, near its headwaters (Figure 5). The watershed drains approximately 23 sq. miles and is home to an estimated 60,000 people. Euclid Creek is considered part of the Cuyahoga River Area of Concern (AOC), a program established by the International Joint Commission to restore beneficial uses. Euclid Creek eventually drains into Lake Erie. Current impacts to the stream system, which are attributed mainly to development, include flooding, loss of headwater streams and tributaries, decrease in overall water quality, loss of floodplain, erosion and sedimentation, channelization of the main stem and tributaries, lack of habitat within the creek and along its buffers, urban runoff, sanitary sewer overflows, illegal dumping, excessive erosion, and loss of green space. By improving conditions within the Reservation, positive impacts to the stream system as a whole will be realized through filtration and retention of water higher in the watershed. Restoration of the stream channel and corridor within the property will also result in improved habitat within the larger green space network of Cleveland and across the region.

Figure 4. Euclid Creek

URBAN FORESTS & WATER QUALITY

The urban forest contributes many benefits to watershed health, water and soil protection. Research has shown that the urban forest plays a pivotal role in treating stormwater, providing water quality improvement and quantity management. Tree canopy helps catch precipitation before it reaches the ground. Some of the water gently drips to the ground, while some evaporates. Research indicates that 100 mature tree crowns intercept about 100,000 gallons of rainfall per year (USDA Forest Service 2005). Roots have been proven to provide for enhanced infiltration of rainwater (Day and Dickinson 2008). The presence of leaf litter on forest floors supports soil conditions that promote infiltration, helping to replenish groundwater and filter stormwater runoff. Floodplain trees along urban streams help to stabilize soils and provide further filtration of runoff before it enters the streams.

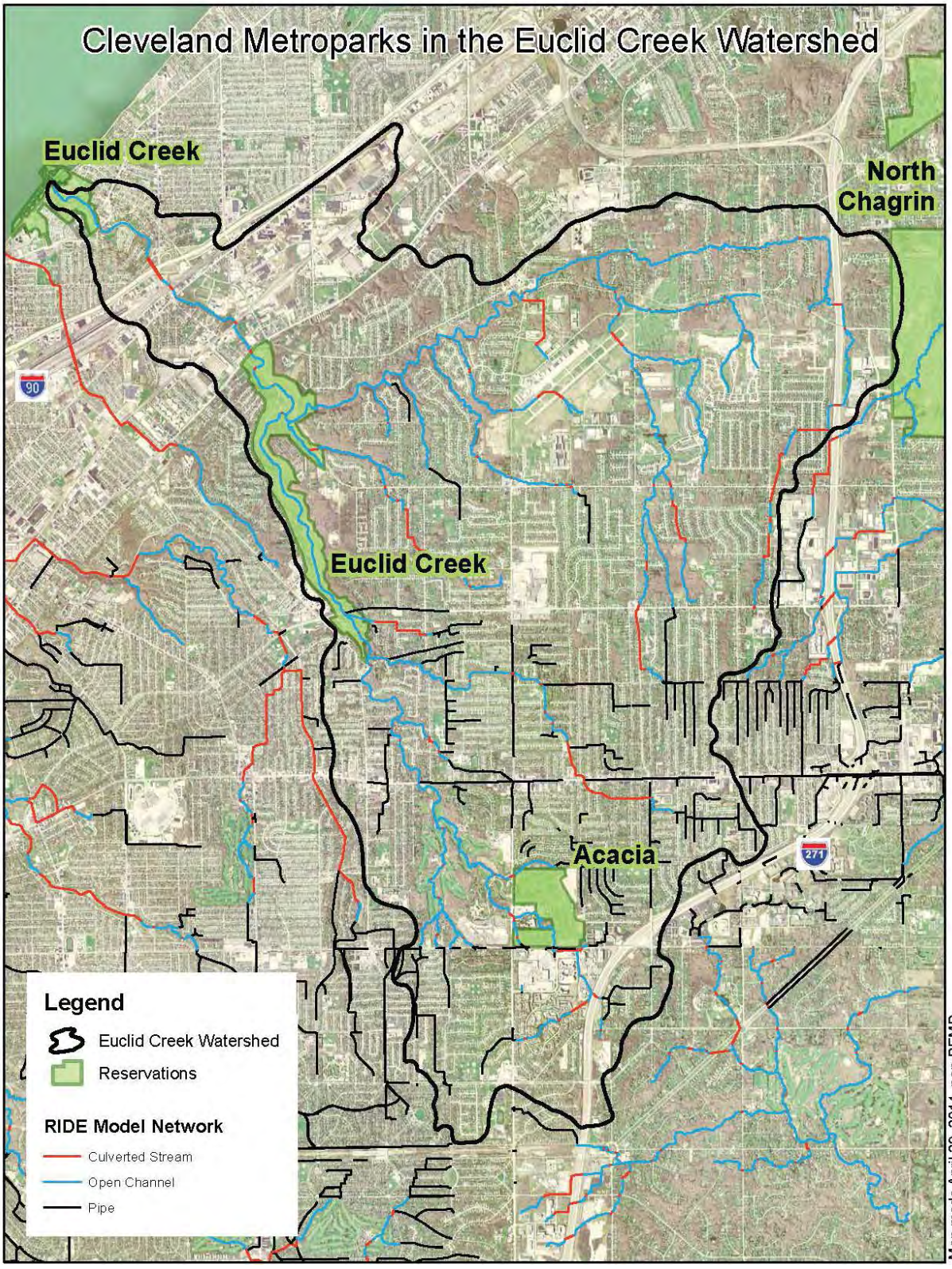


Figure 5. A Map of Cleveland Metroparks within the Euclid Creek Watershed. Acacia is within the headwaters of the creek.

Site drainage

Built in 1923, Acacia County Club most likely was constructed along original land contours because of the type of equipment available at the time. Early drainage efforts would have involved the use of terra cotta clay field tiles, installed by hand, in trenches and placed on the existing soil (i.e. no sand or stone placed around the tile to promote effective drainage). The tiles were either butted against one another or separated by a small gap. Later drainage efforts would have used whatever tile material was currently in use (e.g., perforated plastic drain tiles). In the last decade or so there have been some renovations to the drainage system with the clay tiles being replaced in certain bunkers and other periodically wet areas with corrugated PVC pipes that convey water to Euclid Creek. Older greens and tees are push-up features, meaning that existing soil was pushed up in mounds to create the feature, in contrast to today where greens are created by layering sand and soil with underdrains installed to enhance drainage and to improve turf management. Historically, fungicides and pesticides were used to treat the golf course. Many would have contained mercury and lead (up until the 1970's). In addition, prior to the advent of synthetic fertilizers, manure would have been applied to facilitate greening of fairways, greens, and tees. The irrigation system would have been installed to utilize the ponds that exist today as a source of water. The irrigation system does not have the same legacy impact as the tile drainage system, so it is not mandatory that the irrigation system be entirely removed as part of a restoration strategy.

The project site generally drains to the north and west and has several drainage features of high importance as elements in the site restoration (see Site Hydrology and Drainage Basins figures in Appendix A). Much of the project site is underlain by the Mahoning soil series (~60%), which have a high groundwater table and are somewhat poorly to poorly drained. Such a soil in its natural condition would support wet woodlands (see the soils section below for further discussion).

In addition to the seasonal saturation and presence of areas of ground inundation associated with the Mahoning soil, the project site hydrological profile includes (Figure 7):

- Euclid Creek,
- Three ponds (the Northwest Pond, the Northeast Pond, and the Central Pond),
- Two unnamed tributaries to Euclid Creek (the Central Tributary and the Southwest Corner Tributary),
- A wetland swale draining to Northeast Pond in the northeast part of the project site,

Figure 6. A former bunker begins to show signs of the historic seedbank.

- A piped stream draining the Northeast Pond to the 'off-site' stream, along the northern edge of the project site, which drains into the large stormwater/irrigation pond (the Northwest Pond) in the northwest corner of the project site,
- Overland drainage from the Central Pond across the maintenance area along the edge of the 'stump dump' to Euclid Creek; and
- Two broad topographic swales, which drain the site from east to west.

These features present compelling restoration opportunities, and if incorporated in the context of the Mahoning soils, may result in the development of a diverse wetland resource that can support a variety of flora and fauna.

The only 100-year floodplain areas mapped by the National Flood Insurance Program are along Euclid Creek (Zone A – no base flood elevation determined) just north of Cedar Road and continuing northwest along the stream as it flows through the Reservation and Three Villages property and exits underneath Richmond Road. A small portion of the Southwest Corner Tributary of Euclid Creek, which flows diagonally across the southwest corner of the property, is also mapped Zone A (Figure 7).

Figure 7. Hydrology on the Acacia Reservation.

Subsurface Drainage and Groundwater

Surface topography can be a general indicator of the direction of groundwater movement. Generally, surface drainage on the site is to the north and west. Based on this one it can be inferred that groundwater movement is generally in the same direction. While the past operation of the golf course has done little to change this broad subsurface flow pattern, the site has been modified by irrigation and drainage practices, which likely have had a significant effect on local groundwater distribution and quantity. In several instances, these modifications continue to adversely affect the local resources. As an example, a subsurface drainage tile network which 'daylights' at the top of a slope is actively eroding the stream and forest resources downstream. It will be crucial to evaluate the distribution of tile drains and develop an understanding of how these systems affect the groundwater and surface water resources. There is a general understanding of the major drain tile collection lines, but the ultimate solution to reducing the effects of the drain tiles will need to be developed in discussions with Park District staff. Additional detailed information about the entire drainage network and the type of materials that were used in the renovations during the management of the golf course should be gathered and synthesized. Similarly, a more complete understanding of how the ponds are interconnected would be helpful to pond rehabilitation. This understanding will contribute to the development of future Reservation ecological restoration components, or site features, that might not be apparent based on currently available information.

Figure 8. Another bunker shows some sign of the historic hydrology.

Acacia Country Club was designed like most golf courses to remove water from the site as quickly as possible through surface and subsurface drainage networks. From an ecological perspective, this evacuation or redistribution was conducted without a full understanding of material movement in water such as the energy released from tile drains into unprotected drainage paths, and the buildup of salt minerals. To effectively restore the project site, these historic modifications (surface and subsurface drainage) are to be disabled. Ideally, the project site should hold water to maximum capacity and then release it slowly without exporting nutrients, sediments or excess energy.

Figure 9. Subtle changes is vegetation and elevation show areas where water is currently draining across the site.

Geology

Acacia Reservation is situated within in the Killbuck Glaciated Pittsburgh Plateau, within the broader Allegheny Plateau physiographic region in Ohio. This region is characterized by ridges and flat uplands covered in thin glacial drift and dissected by steep valleys. This geological foundation provides parent material for the soils found on the site.[1]

This area of Ohio is historically home to some amazingly diverse forests and wetlands, based on the post-glacial soils and landforms that dominate the landscape. These include a diversity of upland and wetland systems, including the following: beech-maple forest, dry oak forest and woodland, hemlock hardwood forests, wet flatwoods, freshwater marsh, acidic peatland, acidic swamp, rich swamp, and wet meadow-shrub swamp.[2]

Soils

Soils are a critical consideration in developing the restoration plan for Acacia Reservation. The dominant soil mapping units are Mahoning silt loam, 0 to 2% (MgA); Mahoning silt loam, 2 to 6% (MgB); Urban Land-Mahoning complex undulating (UmB); and Mahoning-Urban land complex (MmB), respectively (see Soils figure in Appendix A). These mapped units comprise almost 70% of the project area. The site soils mapping occurred after golf course development, therefore it reflects post-development conditions, however their drainage classification remains somewhat poorly drained and their hydrologic soil group is C/D (i.e., poor infiltration rates). The MgA has a wetness limitation of 3w while the Chargin silt loam (Ch) soil has a 2w wetness limitation; therefore, both of these soils support wetland development and were likely wetlands prior to golf course development in 1923. Chagrin silt loam (Ch) occurs along Euclid Creek, in the floodplain and Ellsworth silt loam (EIC, EID, and EIF) occurs on the steeper slopes. Chagrin silt loams are well drained with a hydrologic soil group rating of B (i.e., good infiltration rates) while Ellsworth are considered moderately well drained with a hydrologic soil group rating of C.

A soil analysis was undertaken by Cleveland Metroparks to better understand site conditions. Sample locations were selected using a generalized random tessellation stratified (GRTS) spatial sampling system. Soil sample #15, located on the west side of the Northwest Pond, was not collected (missed during the sample collection). Thirty-nine (39) surface soil samples were collected between 0-6 inches from the ground surface and submitted to A&L Great Lake Laboratories. The soil laboratory tested the soil samples for the S1A test package (organic matter, available phosphorus, exchangeable potassium, magnesium, calcium, soil pH, buffer pH, cation exchange capacity, percent base saturation of cation elements, and strong bray phosphorus) and the carbon to nitrogen ratio package (carbon (LOI), total nitrogen, and C:N ratio).

The 39 soil samples were taken at three general locations – fairway (13), rough (16), or tree-covered (10) (Table 1). It is assumed all three locations may have experienced different management regimes while the site was an active golf course. For example, the fairway and rough would have had more mowing and chemical applications (i.e. fertilizer, herbicides and pesticides) than the tree-covered area.

The chemical parameter results between the soil samples varied slightly between the three different site locations – fairway, rough, and tree-covered area (Table 1). Soil samples taken along the fairways had higher average values for organic carbon, total nitrogen, organic matter percentage, available and strong bray phosphorus, exchangeable potassium, magnesium, calcium, soil pH, cation exchange capacity, and percent base saturation of cation elements (potassium, magnesium, and calcium). A continual level of maintenance along the fairways, most likely from lime and fertilizer applications, contributes to the higher average values for nitrogen, organic matter, macronutrients, and pH. The tree-covered area had the highest averages for carbon:nitrogen (C:N) ratio, buffer pH, and percent base saturation of cation element hydrogen. The latter two parameters are a result of having a lower pH. The higher C:N ratio is attributed to the availability of carbon sources from leaves and woody material in the tree-covered areas relative to the fairways and roughs and lack of nitrogen fertilization. Based on the current soil sample test results, the existing soil conditions would be adequate for supporting native vegetation with minimal amendments.

In December 2013, Biohabitats staff conducted a rapid soil assessment, taking three soil samples from different locations across the site. Soil profiles were described and soil textures were roughly estimated. References in the soil survey to "loam" are most likely silt loam on site, and references to "clay loam" are most likely silty clay loam. In several of the profiles taken, there was no obvious compaction and the most notable difference was the transition in texture at 8-9 inches to an increase in fines (silt/clay). This is likely the consequence of almost 100 years of golf course surface soil management, including regular aeration, top

1 http://www.dnr.state.oh.us/LinkClick.aspx?fileticket=AiYQf0bRUNc%3D&tabid=21903; http://www.dnr.state.oh.us/portals/10/pdf/physio.pdf
2 http://explorer.natureserve.org

dressing with sand and organic materials, and intensive grass management. Ground water was observed at about a foot below the surface, and there was a dominance of roots within the first 8 inches. No groundwater was observed in only a few profiles including a point just north and west of the sledding hill, within the fairway. This location also showed the least moisture of all of the profiles described. Loam to clay loam was the dominant soil composition with an increase in fines (silt and clay), lower in the horizon. Biohabitats collected several composited soil samples representative of the fairway conditions across the project site and submitted these samples to the A&L Great Lakes soil lab for soluble salts analysis (i.e. conductivity) to determine if salt concentration from past fertilizer regimes might negatively affect plant survival and growth. Laboratory results confirmed that salt concentrations are not a concern. One key point taken from this rapid assessment is that the soils do not display compaction (eg. evidence of a platy structure).

This evaluation of site soils indicated no strong subsurface barriers associated with compaction or concretion of fertilizer salts. However, the surface layer (~ 8-in thick) that has been intensively managed over almost 100-yrs of golf course use had a much different texture than the underlying soils. This different texture results in a 'discontinuity' between soil horizons that may negatively affect the movement of water and plant growth. This situation will need to be considered in discussions with Cleveland Metroparks on a project and area-specific basis.

Figure 10. Discontinuity between surface and subsurface soil layers. Line on photo shows approximate location of change in texture.

Table 1. Summary of soil tests provided by Cleveland Metroparks

CHEMICAL PARAMETERS	MINIMUM			MAXIMUM			AVERAGE		
	Fairway	Rough	Tree-covered	Fairway	Rough	Tree-covered	Fairway	Rough	Tree-covered
Carbon:Nitrogen Ratio	9.8	10.3	11.9	12.7	13.2	16.0	11.2	11.8	13.4
Organic Carbon (%)	2.3	1.5	2.7	5.2	4.4	4.6	3.9	3.2	3.8
Total Nitrogen (%,Dumas method)	0.222	0.146	0.221	0.481	0.371	0.363	0.356	0.265	0.289
OM (%)	4.0	2.5	4.6	9.0	7.5	8.0	6.8	5.4	6.5
P1 (PPM)	10.0	3.0	3.0	74.0	47.0	194.0	38.1	12.1	26.0
P2 (PPM)	21.0	6.0	4.0	236.0	117.0	290.0	94.4	21.6	38.8
K (PPM)	113.0	52.0	46.0	203.0	171.0	193.0	154.0	99.6	107.3
MG (PPM)	205.0	135.0	60.0	365.0	355.0	370.0	292.3	209.7	177.5
CA (PPM)	1500.0	800.0	350.0	2250.0	1950.0	2300.0	1834.6	1262.5	1110.0
PH	6.4	5.1	4.6	7.2	7.5	6.7	6.7	6.1	5.6
BUFFER PH	0.0	0.0	6.6	6.9	6.9	6.9	4.2	5.5	6.8
CEC	10.4	8.3	5.4	15.6	13.0	16.3	12.8	10.6	10.3
%K	2.2	1.3	1.2	3.9	3.9	4.3	3.1	2.4	2.7
%MG	14.0	10.9	8.3	23.2	24.8	18.9	19.0	16.6	13.8
%CA	63.7	40.3	28.9	82.0	84.1	70.6	71.8	59.9	51.3
%H	0.0	0.0	7.4	10.8	46.1	59.5	6.1	21.1	32.2

lowest value highest value

Current Land Use and Development Patterns

Acacia Reservation ceased being an active golf course during the winter of 2012. The site is mostly comprised of formally managed landscapes (greens, fairways, roughs, and tees). The areas between fairways are predominantly comprised of monotypic wooded areas dominated by groupings of ornamental trees (native, non-native, and cultivars) with a periodically mowed understory to control grass and herbaceous plant growth. A more natural forested area is found along Euclid Creek on the steep hillside and within portions of the floodplain not cleared for the golf course. A breakdown of the different site features is shown in Table 2.

Table 2. Acacia Site Features

FEATURE	ACRES
Past Roughs (Grassed Areas)	72.86
Wooded/Rough	40.62
Fairways/Tees/Greens	25.64
Developed/Path	9.72
Water	4.42
Sand Traps	1.54
Clubhouse	0.53
Total	155.33

Adjacent land uses include dense commercial, institutional and residential development (high rises, condominiums) and more traditional residential areas (small and large lots). The northern edge of the site is bordered by a strip of wooded land, which is owned in part by the City of Lyndhurst and by a homeowners association. Two major thoroughfares border the site, effectively creating a significant hazard for terrestrial wildlife movement or travel. Cedar Road runs along the southern edge and Richmond Road runs along the western edge. Acacia Reservation is essentially bordered on all four sides by "development" thus making this site a "patch" in landscape ecology terms. The riparian corridor associated with the portion of Euclid Creek that flows through the site provides connectivity to other habitat patches.

Figure 11. Surrounding land use context

Habitat

Existing habitat on Acacia Reservation is an artifact of the management of the golf course over the last 8 decades. Cultivated landscape plantings, some areas of non-native plant invasion, and remnant native vegetation communities in various stages of succession and transition provide the limited available habitat (see Site Landcover Figure in Appendix A).

Aquatic/Streams

As mentioned in the watershed discussion, Euclid Creek enters the site from the south and flows northwest, exiting the site on the western boundary under Richmond Road. Two other surface tributary headwater channels occur on site: one flowing west connecting to Euclid Creek (Central Tributary) and one at the southwest corner of the site, which flows north and joins Euclid Creek offsite (Southwest Corner Tributary). Another surface channel feature is located immediately outside the property in the northeast corner. Several historic tributaries or drainage areas are buried in pipes or maintained as shallow surface swales. The quality of the streams is observed to be fair to poor, based on qualitative observations including the following factors:

- Physical disturbance, clearing and site development
- Buried streams and drainages in pipe systems
- Bank erosion and channel degradation from urbanization and storm flows
- Water quality impacts from stormwater run-off, land use practices and trash

Figure 12. Euclid Creek near where it enters Acacia Reservation

- Maintenance of golf course landscapes reducing stream buffers and habitat

Wetlands

Historically, the site was part of a wetlands system characteristic of its position at the top of the watershed (see Soils section for nature of hydric soil units). The development and operation of the golf course intentionally drained or rerouted water flow to accommodate the course features and make it playable. In the process, the historically forested wetland areas have been reduced to fringe wetlands along the ponds and low-lying depressions and riparian wetlands along portions of the streams. Many sand trap (bunker) features show signs of inundation, most likely attributable to clogs in the drainage lines by fines, creating a perched water table. Seedlings of cottonwood and red maple have colonized these sites. Seasonal pools in tree 'tip ups' and other wet depressions on site support amphibian habitat and reproduction. The underlying and pre-development hydric soil conditions provide extensive opportunities to restore wetlands onsite including expanded fringes and benches along the ponds and riparian wetlands along restored or day-lighted stream channels. There may also be areas where modification of the existing drainage structures can restore hydrology to forested wetlands, mesic forest, emergent wetlands and vernal pools, and wet meadows.

Ponds

Three ponds are located on the project site in the center or northern areas of the property (Figure 7, Site Hydrology figure in Appendix A). The Northeast Pond is a manmade stormwater pond created to manage runoff from the homes located along the northeast corner of the property (Acacia Estates) as well as some runoff from the golf course. The property boundary line runs through the center of the pond. The pond consists mainly of open water with some minor areas of fringe emergent or adjacent wetlands. Several new homes are located in close proximity to the pond and the adjoining drainage swales, and their basements appear to be at or near surface elevations of the pond. These structures are a threat to the health of the pond because of their basement ground elevations (at or just above pond water elevation). Other threats to water quality include roof run-off and the proximity of highly maintained back yard lawns (i.e., fertilizer and pesticide inputs). This pond is piped underground from an outfall structure at the northern end, to the adjacent offsite open channel, which eventually drains to Euclid Creek.

The Northwest Pond is a larger body of water located on the northwest corner of the property. The surface water elevation is maintained by a dam, which is classified as a Class III structure by Ohio Department of Natural Resources, and is currently maintained by the City of Lyndhurst. The pond is characterized by a steep slope embankment along Richmond Road (essentially the dam face) and an open, sparsely vegetated perimeter. The dam must be maintained free of large vegetation as long as it is classified as a dam. A wetland has developed at the upstream end of the pond through sediment deposition. This pond is currently used for fishing and has little existing fringe wetlands. It is hydrologically connected to the Northeast Pond via an offsite channel through the adjacent woods and developed area.

The Central Pond is located at the center of the Reservation. It is hydrologically connected to an eroded gully outfall to Euclid Creek by a piped discharge through the former golf course maintenance facility area. There are no visible surface drainages connected to the pond. This pond has little wetland vegetation on its edges and is almost completely devoid of buffer vegetation. At the time of initial field observations, this pond was full to the top of the embankment and overflowing onto cart path areas.

In general, the ponds are not high quality features and do not provide good natural habitat or water quality functions. Their main function seems to have been to supply irrigation water for the golf course or manage stormwater runoff and drainage issues.

Fields/Meadows and Turf

Acacia Country Club was a highly maintained landscape. Cool-season turf grasses, such as bent grass and red fescue, which are traditional golf course grass species, dominate the tee boxes, fairways and greens. Fringes of the site have some limited transition of ruderal weeds, grasses and other non-native species to adjacent woodlands. These areas are not currently high value habitat for wildlife, particularly not for pollinator species

Figure 13. The Central Pond at Acacia.

or birds, but they do provide many opportunities for 'prairie' or wet meadow restoration to promote habitat diversity and a potential transition to future native forest habitat.

Forest/Canopy Cover

The managed roughs between the fairways do not have forest patches or woodland stands, but rather copses or rows of trees with a highly altered and maintained understory. Trees present include pin oak (*Quercus palustris*), swamp white oak (*Quercus bicolor*) and other oaks, red maple (*Acer rubrum*), white pine (*Pinus strobus*) and other pines, spruces (*Picea spp.*), shagbark hickory (*Carya ovata*), river birch (*Betula nigra*) and willows (*Salix spp.*). An encouraging sign along the fairways and roughs is a large recruitment of oak, maple and cottonwood seedlings that provide an opportunity for management practices to protect, propagate, and transplant them.

At least one large American elm (*Ulmus americana*) specimen is present near the Central Pond, which could be a potential seed source. Many other varieties of ornamental and non-native tree and shrub cultivars occur throughout the property. Areas along Euclid Creek, which contain one larger riparian forest patch,

Figure 14. Oak seedlings show a rich seedbank in the Acacia landscape

Figure 15. A large American Elm specimen is located near the Central Pond.

contain red maple, silver maple (*Acer saccharinum*), and sugar maple (*Acer saccharum*), American beech (*Fagus grandifolia*), shagbark and other hickories, and various mixed oak species.

Invasive and Nuisance Species

Deer

White-tailed deer (*Odocoileus virginianus*) are a natural part of the native forest ecosystem of Ohio. However, as is the case in much of the urban and suburban Midwest and Eastern US, white-tailed deer have become over-abundant because of a reduction in deer predators, forest fragmentation and associated increases in edge and foraging access, and increases in cultivated crops and landscape vegetation that provide an available food source. Cleveland Metroparks has taken measures to understand and manage deer populations. This effort includes studies of deer density, vegetation impact, contraception effectiveness, deer movement and fawn survival and well as management activities including lethal management, planting resistant species, utilizing taste deterrents, and exclusion fencing. Venison from the management program is donated to the Greater Cleveland Food Bank.

Figure 16. Deer are present on Acacia Reservation

As a part of annual surveys related to deer herd management across the Park District, Acacia Reservation area was the subject of nighttime 'spotlighting' deer counts during Fall 2013. Deer impact is evident as indicated by deer browse in the woodland understory, deer rubs on saplings and deer tracks in many areas. Large deer populations affect natural resources and humans in several ways: altering the composition and available biomass of native forest vegetation, carrying disease-carrying deer ticks (Lyme), increasing deer-vehicle collisions and significantly damaging landscape plantings and crops. Overpopulation of deer decrease biodiversity, limit regenerative capacity of forests, and limit ecological resilience. The concerns for deer impact are not only the damage done to existing native understory composition, but also to potential future impacts on the success of proposed native tree and shrub plantings and the viability of native tree seedling regeneration.

Insects and Infestations

Insect infestations are an issue throughout the Eastern US, and the associated pest species have proven to be serious and destructive to forests, killing trees and altering the current and future forest composition. Some of the key insect infestations that have made their way into Ohio (or adjacent states) and are potential threats at Acacia Reservation include the following:

- Emerald ash borer (*Agrilus planipennis*)
- Gypsy moth (*Lymantria dispar dispar*)
- Asian long-horned beetle (*Anoplophora glabripennis*)
- Hemlock wooly adelgid (*Adelges tsugae*)

The emerald ash borer (EAB) became established in Cuyahoga County around 2007. ignificant infestations are occurring throughout Cleveland Metroparks moving west to east across the Park District. Cleveland Metroparks is monitoring for EAB, surveying for telltale 'D' holes and for missing bark chip signs of increased woodpecker activity.

Gypsy moth has been in Ohio for decades and is established in the Northern parts of the state. Oak forests on drier sites are most at risk from gypsy moth, but aggressive management can protect oak forests, although the risk of future outbreaks is high in Ohio.

The Asian Long-horned Beetle (ALB) is a serious threat to a range of deciduous tree species including maple, elm, birch and willows. ALB has become a pest in nearby states and has also been found in Clermont County in Ohio, although the distribution is highly restricted (limited to this one county). However, these beetles are a constant threat of entry through cargo and associated crate materials.

Hemlock wooly adelgid (HWA) is a small aphid-like insect that targets Eastern hemlocks, causing them to decline and often die. HWA was discovered last year in Wayne National Forest in Southeast Ohio, which marks the first "natural spread" of HWA in Ohio. Hemlock wooly adelgid and Asian long-horned beetle have not been detected in Cleveland Metroparks forests to date. Other notable disease infestations that have substantially affected Eastern deciduous forest species composition include Dutch elm

disease and Chestnut blight. These diseases have seriously impacted mature American elm and American chestnut and altered the dominant community structure of vast forest acreages in their historic range. While both these tree species were prevalent prior to the construction of Acacia County Club, neither species will play a major role in the near future in its restoration.

More recent threatening diseases include dogwood anthracnose, a fungal blight that weakens and often kills flowering dogwood (*Cornus florida*) found in Ohio; beech bark disease, a lethal disease of American beech (*Fagus grandifolia*) caused by an insect/fungal association; and oak wilt, which mortally affects both white and red oak groups. Sudden Oak Death, caused by a fungus that can weaken and kill a variety of oak species, has not been found in Ohio. Insect pests and disease need to be considered as threats to existing forests and future restoration stands, and need to be monitored and managed for accordingly. Enhancing native species and genetic diversity is a key to restoration efforts in resisting current and future pest outbreaks.

Plants

Non-native plant species have been introduced for landscaping and gardening, erosion control and ground cover and accidentally through various types of international transport. Some of the non-native species are invasive, and because they often lack natural pest or predatory controls, can be highly invasive, often out-competing and displacing native species. The Park District staffs an Invasive Plant Management Program (IPMP), which is designed to expand ongoing invasive plant removal work performed by the Natural Resource Area Managers. IPMP has been performing invasive species treatment work at Acacia Reservation since the property acquisition, and this effort will continue. The targeted non-native, invasive plant species present on-site include reed canarygrass (*Phalaris arundinacea*), common reed (*Phragmites australis*), lesser celandine (*Ranunclus ficaria*), burning bush (*Euonymus alatus*), and glossy buckthorn (*Frangulus alnus*). Other occurring or likely potential invasive plant threats in the vicinity include Canada thistle (*Cirsium arvense*), Japanese knotweed (*Polygonum cuspidatum*), Norway maple (*Acer platanoides*) and Japanese barberry (*Berberis thunbergii*).

The invasive plant species not only threaten the existing native vegetation composition and diversity, but also pose future threats to the conversion of the golf course landscapes to a natural landscape. The site will need to be managed adaptively to control the invaders and meet targeted habitats.

istock photos

Figure 17. Lesser celandine

dreamstime stock photos

Figure 18. Japanese barberry

Photo by Kevin Heatley

Figure 19. Common reed

Ecological Function and Climate Change

One final restoration consideration at Acacia Reservation is the effect of climate change on ecological function and resilience over time, when considering ecosystem restoration. Reference ecosystems in the vicinity are crucial – both to understand native assemblages and responses to the pressures of climate change. Brian Starzomski at the University of Victoria states that all ecosystems – even novel ecosystems – are rapidly changing with climate shifts and "you need to move 110 meters per year to follow your climate."[1] If that is the case, this restoration project stands at a decisive point on the timeline of understanding ecological shifts and effects of climate change. Considerations may include the survival of native species over time and the potential for assisted migration of some at-risk species from further south. There are, however, complex relationships at play in ecosystems.

Native birds and pollinator species that are of considerable importance in the region should be prioritized in terms of their specific habitat needs and the potential for a restored Acacia Reservation to provide essential habitat. Restoration at Acacia Reservation will serve as important habitat for migratory stopover during both spring and fall migrations. Examples include warblers, vireos, thrushes, tanagers, kinglets, gnatcatchers, sparrows, blackbirds, (etc), sora, Virginia rail, marsh wren, spotted sandpiper, solitary sandpiper, etc. Key riparian forest dwellers that will or may likely nest in the Reservation include: Baltimore Oriole, orchard oriole, great crested flycatcher, eastern wood-pewee, Acadian flycatcher, eastern kingbird, blue-gray gnatcatcher, warbling vireo, yellow warbler, and the rose-breasted grosbeak.

Climate change may bring warming, as well as more frequent and more dramatic storm events, so the site stands to be an important resource as a location for studying climate change, ecosystem resilience, and specific species behaviors. Native species survival may vary, and the warming climate may provide conditions where non-native invasive species become more invasive. Warming trends may also provide ideal conditions for the survival of other pests and diseases that had been kept at bay with colder temperatures. Monitoring the restored systems on site will be crucial, as well as adaptive management techniques that respond to changing conditions.

1 Novel Ecosystems: Not So Novel Anymore: http://dirt.asla.org/2013/10/16/novel-ecosystems-not-so-novel-anymore/

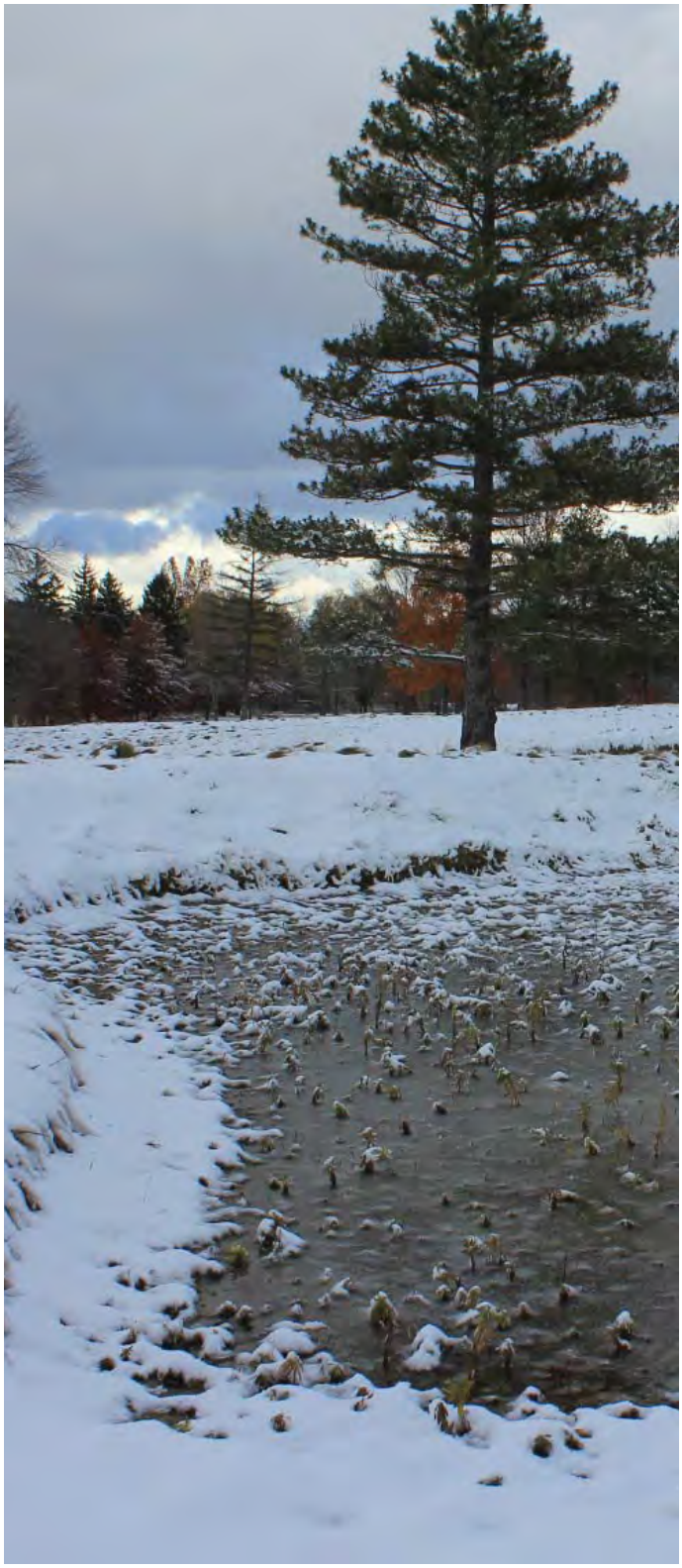


Figure 20. A former golf rough provides habitat as an element in this novel ecosystem.

Figure 21. Reference forest condition at North Chagrin Reservation

Site Constraints and Challenges

Acacia Reservation is bounded by high-density land uses in the form of residential and commercial development and transportation routes (Cedar and Richmond Road) with high traffic volumes; these off-site characteristics will likely influence restoration elements under consideration. The most dominant off-site influences are briefly described below. These influences can generate conditions that either detract from the experience of visiting the site and/or will impact the design of specific restoration components such as restoring Euclid Creek and features like trails. Adjacent owners have indicated a preference that trails not be located along the edges of the site and that no new visual intrusions are created.

Adjacent Private Development (Current and Future Development)

Acacia Reservation is surrounded on three sides by medium-density housing, commercial development, and institutional development in the form of medical facilities. The Three Villages community, which is surrounded on three sides by the Reservation, is in discussion with Cleveland Metroparks about ways to partner on conserving and potentially restoring some of the Euclid Creek riparian corridor. A relatively new subdivision (Acacia Estates) is currently being constructed along the east side of the Reservation (lots abut the property line) and is characterized by larger single-family homes. The subdivision has a buffer restriction of 100 feet along its western boundary (east side of Acacia Reservation), to be planted with a variety of native vegetation. Two major roads with relatively high traffic volumes border the south (Cedar Road) and west sides (Richmond Road). Beachwood and Legacy Village Malls and a concentration of high-rise apartments in the vicinity make the intersection of Richmond Road and Cedar Road is one of the busiest in Cuyahoga County.

Stormwater from Mall, Road, and Beyond

Near the Reservation, very little pervious area or natural habitat remains for the storage or attenuation of stormwater flows. Flows in Euclid Creek are flashy because of rapid runoff, caused by high amounts of impervious cover (hard surfaces) in the Euclid Creek watershed upstream of the site (Beachwood Mall and other high-density residential development). The runoff also washes pollutants (e.g., oil and grease, heavy metals, trash) from impervious surfaces into the creek (see Offsite Drainage and Site Hydrology figures I Appendix A). The following documents were obtained and reviewed:

Figure 22. The northeast pond along the eastern edge of Acacia Reservation.

- NEORSD's draft Regional Intercommunity Drainage Evaluation (RIDE) Study (2005)
- Utility maps from Lyndhurst and storm sewer maps from City of Beachwood.
- Stormwater engineering report for Acacia Country Club Estates

Flows from Beachwood Mall are partially attenuated by a detention area located adjacent to the entrance to Beachwood Mall and directly across from the Cedar Road entrance to Acacia; underground storage is provided to capture stormwater runoff from the parking lot of Beachwood Mall. Several storm sewer outfalls that discharge directly or indirectly onto Acacia Reservation impact flows and water quality (see Utilities figure in Appendix A). Euclid Creek, the Southwest Corner Tributary, and the drainage area flowing into the Northwest Pond are considered part of the Intercommunity Drainage System by the NEORSD. Euclid Creek is ranked as Moderate for Erosion Severity. The drainage area flowing into the Northwest Pond receives stormwater runoff from adjacent residential streets and yards that impact channel stability and result in increased stream bank erosion and degradation of water quality. The Northwest Pond has been identified by NEORSD to be a potential retrofit opportunity as a dry detention basin to help manage stormwater runoff. Coordination with the NEORD indicates that this recommendation is not fixed in stone since use is up to the owner, now Cleveland Metroparks. Therefore, Cleveland Metroparks may enhance the pond for fishing provided that existing stormwater management functions are maintained pursuant to City of Lyndurst requirements. The Northeast Pond , which is shared between Acacia Reservation and Acacia Estates, is part of the stormwater management system for the development; therefore, this will need to be considered when identifying potential restoration opportunities in this area. After reviewing RIDE model flows for Euclid Creek, there is a range of flows from 300 -800 cfs (the 2-yr to 100-yr storm events respectively), that can be attenuated through stream restoration and floodplain reconnection restoration practices.

Traffic and Noise

Traffic noise within the site comes mainly from automobile traffic on Richmond and Cedar Roads. The actual impact on park users depends on the location, with the highest noise levels most likely experienced in the southwest corner and along the western edge by the Northwest Pond. An earthen berm along the south side of the site partially mitigates noise impacts and serves as a visual barrier to Cedar Road. Existing vegetation also helps, although Federal Highway Administration reports that to achieve any significant noise reduction would require a 200-foot width of dense vegetation to experience a 10-decibel reduction, which is equivalent to 50% reduction in noise. However, the density required is considered nearly impossible to achieve. Vegetation barriers can provide visual and aesthetic benefits with some lessening of traffic noise.

Sanitary Sewer

Acacia Reservation is surrounded by sanitary sewer lines aligned mainly with existing roads, except for the presence of a sanitary line that crosses the property parallel to the small stream traversing the southwest corner of the property. This may provide some limitation on the type of restoration that can occur along this stream.

III– Opportunities Evaluation

Reference Site Observations

An important consideration for the restoration to a predominantly natural and native state at Acacia Reservation is that the site be reflective of the natural character of the Euclid Creek and North Chagrin Reservations. These designated reference sites provide important information regarding what ecological, structural, and spiritual functions are desired. This section provides brief discussions of the observations made during site visits to each of these reference sites as well as a visit made to Orchard Hills Park, a former golf course now undergoing restoration by the Geauga Park District.

Euclid Creek Reservation

Euclid Creek Reservation is a forested stream valley park; long and narrow, with the stream and Euclid Creek Parkway dominating the valley. The existing ecological condition of this Reservation is remarkably different than Acacia Reservation and offers only limited value for reference information. The forested nature of the site is one key condition. Trails coursing through a forested landscape with adjacent water may be the most notable and useful reference condition. The developed user interface, with picnic facilities, restrooms, and parking, are clustered at existing road intersections. The presence of the Parkway along the western edge of the Reservation opens the entire facility to a continuous and somewhat invasive procession of vehicles. This condition may also be a key consideration for Acacia Reservation –i.e., how does Cleveland Metroparks capitalize on existing access points and road frontage to provide good access, without dedicating too much of the site for this purpose and opening the site to views of buildings, parking lots, and cars.

Euclid Creek provides ample parking areas along its alignment, multiple picnic areas throughout and an all-purpose-trail that runs its length. Portions of the trail system that are not paved reveal some of the challenges of trail maintenance. Where natural surface trails travel through low woodlands, rutted surface conditions and wet soils often exist after rain or snowmelt. A portion of Acacia Reservation has a similar stream valley relationship with Euclid Creek; however, the stream at Acacia is better buffered from the developed edge conditions that prevail at Euclid Creek Reservation.

North Chagrin Reservation

Of the three reference sites, North Chagrin Reservation provides the most ecologically relevant comparison. Portions of the site have the same mapped soil unit as the dominant unit at Acacia (Mahoning Silt Loam), it has been undisturbed for 75 to 100 years or more, and it has been the site of previous vegetation composition studies by Cleveland Metroparks staff (information provided to Biohabitats). The diversity of forest plant communities serves as a model for the portions of Acacia that will ultimately be restored to forest cover. The forest at North Chagrin Reservation is dominated by oaks, beech, tulip poplar (*Liriodendron tulipifera*), ash, and maple, with trails interspersed throughout. In addition, vernal pools are common along these trails and scattered throughout the woods. Vernal pools are an important consideration for the Acacia restoration plan. From a drainage perspective, the terrain is undulating and gently sloping with swales becoming more pronounced as they approach the many ravines and steep slopes found along the Chagrin River.

Cleveland Metroparks innovations for trail management through wet areas observed at North Chagrin Reservation, in combination with the 'sand seepage' living trail approach (see images in Appendix C), can provide another vision for how the distribution of wet features along trails can benefit both trail users and site biodiversity. Some locations exhibited dense young tree stands consisting of mostly beech and maple species. While the understory has been impacted by deer grazing, dominant species include spicebush (*Lindera benzoin*), serviceberry (*Amelanchier spp.*), and small patches of maple leaf viburnum (*Viburnum acerifolium*). The control of deer populations is recognized as a critical element for incorporation at Acacia Reservation.

North Chagrin, Comparison and Contrast with Acacia

The North Chagrin Reservation is located in the Glaciated Allegheny Plateau, which is the same physiographic region as Acacia Reservation. However, the ecology of North Chagrin Reservation is considerably different because of a combination of soils, geology, and position in the landscape. These factors influence the ecological character of the associated native plant communities and habitats they provide. North Chagrin has connections to a broad and extensive forested corridor and open space and natural lands area. This benefits North Chagrin in several ways: 1) recruitment of plants and wildlife, 2) more stable resilient system, and 3) overall acreage of habitat to support diverse ecosystem. Conversely, Acacia is a moderately sized open space patch with fragmented forest and less substantial corridor connections, in an urban area.

In contrast, Acacia Reservation is located in a highly altered, fragmented and disturbed area of the Euclid Creek Watershed. Acacia has limited forest corridor connections. It's relatively small forest patch size also inhibits its use by interior forest species. Where North Chagrin has limited external influences, Acacia has external urban site influences in close proximity to the Reservation edges including roads, associated noise, storm-water run-off and residential and commercial development. Acacia also has the remnant golf course infrastructure, associated landform and drainage modifications, the legacy landscape of tees, greens and fairways, and their associated vegetation.

Most importantly, North Chagrin Reservation provides the spiritual and aesthetic "feel" the donors and Cleveland Metroparks wish to be represented at the restored Acacia Reservation. The potential for solitude in a primarily forested setting with embedded meadows is a key feature of North Chagrin Reservation. While the size of North Chagrin, which contributes greatly to this feeling, cannot be duplicated at Acacia, the sensation can be maximized by limiting vehicle access, properly placing developed user areas, and creating forested buffers to limit views and noise from off-site development.

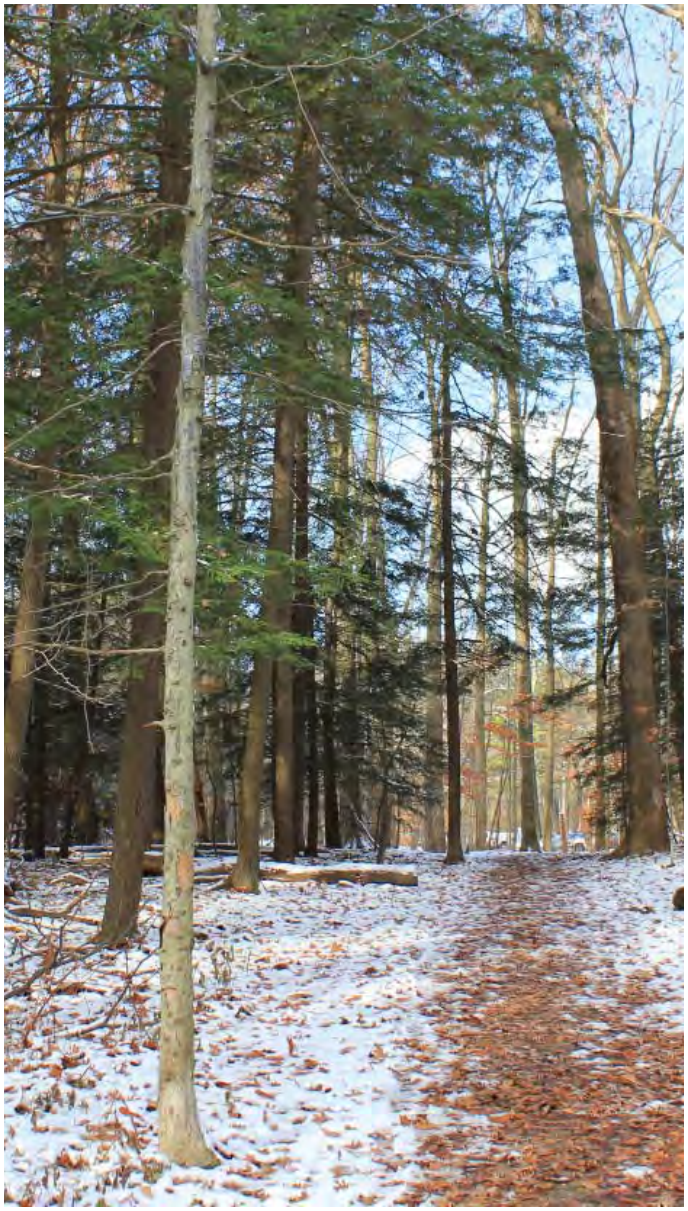


Figure 23. North Chagrin Reservation

Orchard Hills Park

The Orchard Hills Park site provides an excellent reference site at a macro-level. It is a former golf course site that is undergoing conversion from a golfing legacy to a public open space for natural resource conservation and restoration of ecological function. The park has undergone construction and implementation efforts to provide users access to the site and park amenities.

Initial restoration measures that have been implemented include:

- stream restoration and associated pond dam removal,
- stream bank stabilization,
- headwater stormwater non-point source control and bioswales,
- riparian wetland restoration and creation including vernal pools,
- open water and emergent wetlands,
- sedge and grass wet meadows,
- and forest restoration including reforestation plantings targeting approximately 50 acres of conversion of open golf course area to forest.

However, this site has limitations for direct applicability to the likely ecological restoration measures to be implemented at Acacia Reservation. First, the context of the site is very different. The Orchard Hills site is much more rural in character than Acacia. The tract of land is larger and the surrounding woodland and open space matrix is much larger and more connected, with less habitat fragmentation. Accordingly, there are greater available sources of vegetative species to colonize the former golf course landscapes, more opportunity for wildlife movement and biological interactions, and less urban stormwater runoff to the site. Additionally, the roughs at the Orchard Hills site appear to have been maintained in a less manicured condition. Native woodland stands are present with a diverse vertical structure and understory, in contrast to the groves of trees at Acacia Country Club that had a maintained ground cover that was controlled by periodic mowing and clearing. The Orchard Hills site does provide a good reference for understanding how the initial restoration techniques and management efforts of wetlands, meadows and forests are progressing on a converted golf course. Future work can serve as a shared adaptive learning opportunity for Geauga Park District and Cleveland Metroparks staff to collaborate on their respective ecological restoration efforts at these golf course sites and continue to improve techniques.

Figure 24. Orchard Hills Park

Park usage and Restoration

While the primary focus of this restoration plan will be on the ecological systems of Acacia Reservation and the associated ecological functions that can come from restoration initiatives, it is imperative to understand the importance of the interface with proposed programming and public access needs.

As restoration proceeds to a forested ecosystem, interspersed with wetlands, ponds, swales, and meadow zones, there will be a special opportunity to incorporate public access that does not interfere with ecosystem services but provides a positive experience for visitors and an opportunity for ecological learning and stewardship. Even as the fairways are filled in with successional forest species and native meadows, some of the existing golf trails can be incorporated in a network of loops that provide circulation through the park space, as well as enhanced views, overlooks and locations for recreation.

Trails may vary between the existing paved materials and boardwalks where wetlands and other restored systems may require less direct access. Being able to walk above or alongside these natural areas will promote curiosity, wonder, and respect for the natural processes of regeneration. Loops within the trail network will be a fundamental consideration, as well as access through any potential forest protection areas. Sledding, yoga, and fishing are other uses that have been mentioned for discrete areas in Acacia, and which could be integrated well with restoration initiatives – as long as areas are well delineated.

Parking and access will be a consideration, especially in the location of the proposed new gateway entry on the west side. Any new facilities should aim to use previously paved areas or developed locations within the site, as well as locations along the site's boundaries, in lieu of developing areas where native regeneration and hydrological restoration are being planned. Access and future development should be limited to the edges, sparing the core of the park from further fragmentation. This will separate the park from surrounding development and create more opportunities for restoration of natural processes.

Taking into consideration the landforms, there are some opportunities for creating spaces where visitors can experience unique ecological regeneration that may transport them from the suburban landscape into a space more reminiscent of some of Cleveland's wilder parks. The eastern and northern portions of Acacia Reservation are flat to subtly rolling landscapes where visitors can walk through restored forested wetlands and meadows, with long views across these landscapes at wetland swales and restored ponds. The southwestern leg provides a wholly different feel, a more sheltered woodland and meadow with views across the floodplain valley of Euclid Creek and the Southwest Corner Tributary. A natural bowl in the landscape provides for an interesting combination of a restored wetland complex and an amphitheater space sheltered by an enhanced vegetated edge.

ADAPTIVE MANAGEMENT

Adaptive management is a tool and process used to cope with the inherent changes and uncertainty fundamental to natural resources management, the ecological processes that encompass them, and changes in available funding. The goal of adaptive management is to build resilience into both the resource conditions as well as the management system, allowing flexibility and the incorporation of new information into the decision making process. An important part of long-term successful ecological restoration and management is a well-developed and executed monitoring program. Monitoring provides data on resource conditions and functions and helps determine the effects of restoration and management interventions.

Opportunities for research and monitoring collaboration with local universities and high schools abound; investigating the effects of climate change (as described above), as well as studies of wildlife use, soils, succession, hydrologic change over time, and vegetative provenance.

Expectations from benefactors

Vital to this restoration master planning process was the donor perspective on the restoration, as well as programming and management of Acacia Reservation. The priority is for this to be a natural site, not unlike North Chagrin Reservation, but there will also be a need for a balance of public access and passive recreation. Recreation would mainly be in the form of passive activities like walking, jogging, pushing a stroller, bird watching or photography. There is an interest in preserving green space and limiting development, and according to the deed restrictions, there cannot be more than two acres of development on the entire site.

The intention is that this is a park dedicated to preserving or promoting a sense of solitude and oneness with nature (in the woods, along the streams). The Conservation Fund will approve this restoration master plan.

Programming

Many opportunities exist to integrate programming within the restoration context, considering the most sustainable way to integrate public use with ecological function and uplift. Restoration is the first priority on the site, per the expectations of the donors and Conservation Fund; therefore, recreation activities can be adjusted in locations as needed for conservation compatibility.

Fishing

Fishing access will be primarily at the Northwest Pond. A fundamental consideration is children's safety. Gentle slopes near fishing areas are needed, to ensure safety and accessibility while promoting improved ecological function of the pond. Particular attention needs to be placed on providing fishing access while inhibiting nesting by Canada geese (*Branta canadensis*).

Activity Areas & Pavilion

Limited activity areas may be developed near one new shelter that is planned for the site, but no playground. This shelter is suggested for an area along Richmond Road near the anticipated new entryway, north of the River Creek development.

Trails

Existing cart paths will be evaluated and some used as all-purpose trails (APT). Loops are also important, thus an in-and-out APT loop is needed. New trails will be designed to complement and not fragment ecological restoration activities onsite and should be sustainably designed to be primarily responsive to management and restoration projects. Sustainable trail development is also crucial, so while there may be some paved asphalt or concrete trails that provide a primary loop through the site, other trails will be constructed with natural material surfaces that promote stormwater runoff infiltration, avoid forest fragmentation, and support natural processes while highlighting green infrastructure practices.

Sledding Hill

It is recognized that people are already using the hill on the southern edge near Euclid Creek for sledding during the winter. The sledding hill seems to be an important public use, but it must be designed with respect to floodplain restoration, safety, and hill aspect to avoid the floodplain and any accidental, and potentially dangerous, entry into Euclid Creek. Access from Cedar Road will be needed to accommodate emergency vehicles.

Boardwalks

Bridges and boardwalks can promote limited access to restored ponds and wetlands while providing interesting views and viewsheds. Any new built structures should be kept to a minimum, but there may be locations deemed appropriate for short boardwalk crossings in the interest of maintaining wetland function or stream daylighting activities. When constructed, wood material should be sourced from sustainably managed companies.

Other Passive Activities

Other activities most likely to be popular at the site include dog walking, bird watching, and artistic or meditative endeavors.

IV– Ecological Restoration Goals for Acacia Reservation

As part of the development of this master plan a set of restoration goals were prepared by Cleveland Metroparks with input from Biohabitats. The core goals are listed to the right. A more detailed list was developed during planning discussions and helped inform the restoration strategies in the following section (see Appendix D).

- Restore natural drainage systems and enhance the hydrologic function of the landscape
- Re-establish native forest and wetland communities
- Develop an adaptive management framework that is a model for the region, and incorporate scientific research and stewardship into management, monitoring and stewardship programs
- Incorporate cultural/social reflections that tie to the ecological restoration of Acacia Reservation, integrating public use and passive recreation

Figure 25. Changed mowing regimes have resulted in grassland.

V– Restoration Strategies

Figure 26. A wooded riparian corridor.

Euclid Creek Conservation Corridor – Riparian Forest
Description

This strategy is intended to provide an enhanced habitat corridor, conserve native biodiversity, provide movement access for wildlife and protect Euclid Creek. The basis of this strategy is to create a forest riparian corridor that is as contiguous as possible, given the site constraints and the existing adjacent development. At a minimum, the forested width of the conservation corridor should strive to be 300 feet, optimally divided equally between each stream bank. Other components of the strategy include the protection of steep slopes, not only from erosion but also in addressing safety considerations for Reservation users.

Some of the key components for establishing a conservation corridor along Euclid Creek include:

- Stream Forest Buffer – The stream (Euclid Creek) would be served best by a wide buffer within the valley and along the steep slopes on the southern portion of the site. The woods along the riparian floodplain should be expanded to a 300' conservation corridor.
- Invasive species management – Control measures shall be undertaken within the existing riparian forested habitats along Euclid Creek concentrating initially on the isolated patches of lesser celandine (*Ranunculus ficaria*). There should also be attention to reducing invasion potential within the newly planted buffer areas.
- Stream restoration synergy – This strategy needs to be considered in relation to the next Strategy (Euclid Creek stream restoration), as the two strategies provide additive benefit to the ecological system as a whole; the stream construction project and its associated disturbance is an opportunity for increased buffer plantings.

Techniques that are recommended include release or transplant of regenerating seedlings, buffer plantings of native container-grown planting stock (which could be part of an on-site nursery operation), and planting area protection including the temporary fencing of areas to protect against deer browse. The treatment of invasive species, both existing and future invasions, should include targeted herbicide applications and physical removal (cutting, pulling/digging and weed wrenching).

Quantifiable Targets

Targets for establishing a goal for this strategy and measuring future progress can include total area of corridor buffer plantings, average corridor width, and cover of invasive species, as follows:

- Total corridor buffer planting area: 3.5 acres
- Average corridor width onsite: 300 feet
- Maximum percent cover of invasive species: 5%

Focal Species/Habitat

Selected target guilds (groups of similar species) and representative species potentially benefiting from this strategy include:

- Riparian forest dwelling birds: hairy woodpecker (*Picoides villosus*). American redstart (*Setophaga ruticilla*)
- Floodplain/stream corridor amphibians: two-lined salamander (*Eurycea bislineata*), American toad (*Anaxyrus americanus*), gray tree frog (*Hyla versicolor*)
- Riparian dwelling small mammals: eastern chipmunk (*Tamias striatus*), star-nosed mole (*Condylura cristata*), American mink (*Neovison vison*)

Monitoring and Research Needs

Baseline conditions need to be documented before implementation, for comparison after implementation. To help track progress after implementation, understand positive and negative changes in ecological conditions, manage to meet goals successfully, and provide for learning opportunities, the following items can be monitored:

- Tree species composition and percent forest cover
- Canopy closure
- Forest canopy and understory regeneration success
- Leaf litter depth and downed woody debris
- Plant health (herbivory damage, disease and insect infestation)
- Animal species use (faunal composition and relative abundance)

Programming and Education

Considerations for the relationship of site programming, stewardship, and educational activities for this strategy include:

- Sledding hill location, orientation, access, and aspect - direct the sledding public away from the stream buffer and toward the existing greens
- Volunteer planting days and invasive plant weed removal activities
- Citizen science monitoring and selected data collection; 'Bioblitz' participation, riparian vegetation identification
- Educational and interpretive (low impact) riparian trails and boardwalk crossings
- Signage (mobile apps) strategically located to illustrate existing conditions and change over time

Figure 27. Current conditions along Euclid Creek.

Euclid Creek Stream Restoration

Description

This strategy is intended to protect and restore Euclid Creek and provide for stream bank stability, enhancement of water quality and improvement of aquatic habitat. The intent of this strategy is to improve the condition of Euclid Creek using natural channel design and ecologically regenerative design techniques through restoration of the portion of the Creek that flows through Acacia Reservation. Implementation should consider the historic alteration of the watershed, associated water flow regimes, and consequences of high storm flows in a highly impacted novel ecosystem. Another key consideration of this strategy is the reconnection of the stream channel with its floodplain to increase flood flow contact, improve water quality and reduce peak flows.

Some of the key components of establishing a conservation corridor along Euclid Creek as part of a stream restoration strategy include:

- Natural Channel Design – This includes addressing urbanized watershed flows, employing native materials for stabilization, and providing aquatic habitat features.
- Adjacent stream sections—Give consideration to Euclid Creek, just west of the Acacia Reservation property line, and within the Three-Villages property.
- Floodplain reconnection – Reconnect the incised channel with its floodplain in order to reestablish a more natural flood flow regime and support the associated riparian habitat (See A in Visual Glossary on page 48).
- Conservation corridor synergy – This stream restoration strategy needs to be considered in relation to the Euclid Creek conservation corridor strategy, as the two strategies are of additive benefit to the system both spatially and functionally.

Techniques that are recommended include channel invert fill to reduce incision and provide floodplain flow connection, and the use of berms and pools to hold water in the riparian landscape and manage its return to the stream. Material for channel invert modification is readily available on-site (eg. the sledding hill, channel daylighting of tributaries, etc.) Associated natural channel design materials recommended for use include rock and log vanes, soil bioengineering, root wads and woody debris, and native riparian plantings.

Quantifiable Targets

Targets for establishing a goal for this strategy and measuring future progress can include metrics as follows:

- Linear feet of stream restoration: 2000-2600 lf
- Reduction in entrenchment ratio of channel (incision)
- Area of floodplain reconnection: 4-6 acres
- Flood flow velocity reduction: will be based on hydrologic analysis

Focal Species/Habitat

Selected target guilds (groups of similar species) and representative species potentially benefiting from this strategy include:

- Aquatic fauna, fish: northern hog sucker (*Hypentelium nigricans*)
- Aquatic fauna, invertebrates: mayflies (*Ephemeroptera sp.*), crayfish
- Floodplain/stream dwelling amphibians: two-lined salamander (*Eurycea bislineata*), mountain dusky (*Desmognathus ochrophaeus*)

Monitoring and Research needs

To help track progress towards implementation, understand positive and negative changes in ecological conditions, manage to meet goals successfully, and provide for learning opportunities, the following items can be monitored:

- Sinuosity, bankfull width and elevation
- Bank erosion and scour; Bed substrate/pebble counts
- Flood flow attenuation – velocity and volume storage
- Cross sectional area and wetted width; floodplain profile
- Aquatic organisms (fish and macro-invertebrates)

Programming and Education

Considerations for the relationship of site programming, stewardship, and educational activities for this strategy include:

- Sledding hill location, orientation, access, and aspect
- Educational signage and viewing locations
- Citizen science monitoring and selected data collection – water quality, macroinvertebrate monitoring, stream bank assessment
- Strategically placed low impact stream and floodplain boardwalk crossings

Figure 28. Oak seedlings offier onsite harvest opportunities

Forest Enhancement, Buffer Enhancement, Seedling Regeneration

Description

This strategy is intended to meet the primary goal of this restoration master plan, in creating a wooded park landscape for enjoyment by residents, which restores a functional forested wetland and stream ecosystem similar to those endemic to this locale (See image B in Visual Glossary). The basis of this strategy is a focus on restoration of ecological function (ecological uplift) with phased implementation of forest restoration over time following an adaptive management approach. This strategy will need to be implemented recognizing that the forest in this part of the watershed is highly fragmented, and relegated mainly to remnant patches in a highly urbanized area. Given the lack of connectivity and large core forest patches, forest restoration at Acacia Reservation needs to be part of a broader watershed-level strategy to restore forest corridors along the Euclid Creek system (building on the efforts of the Euclid Creek Watershed Council, the Euclid Creek Watershed Action Plan and the existing Euclid Creek Reservation further downstream). Acknowledging this impacted novel ecosystem context also suggests that this site can be a vital forest patch in a highly disturbed region and serve as a key stepping stone woodland habitat, especially for birds.

Some of the key components of restoring a forested system include:

- Focus on forest regeneration – This includes selective planting and harvesting, and recruitment from locations across the site where there is noteworthy evidence of seedling regeneration.
- Unique eco-types: One example for the site would be an oak grove with meadow habitat, using oak seedlings harvested from the site, within a native warm season meadow matrix (See image C in Visual Glossary).
- Include fenced forest protection (deer exclosure) areas – These temporarily fenced areas of varying shapes and sizes can be integrated into the landscape in an effort to promote native regeneration and overall system restoration. Access for park visitors can be integrated into the design of the protective fencing.
- Forested buffers – Plantings of native forest species enhance desired native vegetative buffers along neighboring property lines. These plantings can soften edges, provide more diversity and add transitional habitat.

- Bat habitat – Acacia Reservation provides an interesting opportunity for bat habitat through the planting of exfoliating species such as shagbark hickory *(Carya ovata)*, the maintenance of dead, standing timber, and stand-alone bat boxes placed strategically throughout the site, including the riparian conservation corridor.

Techniques that are recommended include the harvest, transplant and management of seedlings from on-site regeneration zones. Another companion technique for forest restoration is the use of native container-grown nursery stock, which could be from an on-site nursery operation, from other Park District nurseries, or through out-sourced procurement. The establishment of deer exclosures along narrow bands, perhaps along an edge where a forested buffer is desired, is also a good starting point. The design of the exclosure can be done in conjunction with an environmental artist to help bring to light the issues associated with deer browse and hiking in young forest stands. Establishing a 100-foot natural vegetated easement along the eastern edge of the property is part of forest restoration; and it has stormwater management implications for the swale/wetlands along the eastern edge of the property. This may include the design and configuration of the swale to incorporate tree and shrub species. Newly planted and enhanced forested edges along the western side of the site can provide needed screening from the noise of the street, as well as a visual buffer. These could include native evergreens. An additional measure is to focus efforts on specific areas for invasive species management particularly along forest edges and within the wooded boundary buffer areas.

Quantifiable Targets

Targets for establishing a goal for this strategy and measuring future progress can include metrics as follows:

- Seedlings and saplings per acre in a free-to-grow state: 400-800
- Acreage of restored and managed forest: e.g., 100 acres
- Linear feet of eastern and western edge buffers: 2700 lf
- Maximum percent cover of invasive species: 5%
- Number of bat house structures: 6

Focal Species/Habitat

Selected target guilds (groups of similar species) and representative species potentially benefiting from this strategy include:

- Forest-edge dwelling bird species: red-headed woodpecker (*Melanerpes erythrocephalus*), red-eyed vireo (*Vireo olivaceus)*, wood thrush (*Hylocichla mustelina*)
- Small mammals: white-footed mouse (*Peromyscus leucopus*), flying squirrel (*Glaucomys volans*)
- Woodland lepidoptera: luna moth (*Actias luna*), cercropia (*Hyalophora cecropia*), polyphemus (*Antheraea polyphemus*)
- Forest dwelling amphibians: redback salamanders (*Plethodon cinereus*)

Monitoring and Research Needs

To help track progress towards implementation, understand positive and negative changes in ecological conditions, manage to meet goals successfully, and provide for learning opportunities, the following items can be monitored:

- Species composition, percent cover, density
- Forest canopy closure
- Forest canopy and understory regeneration success
- Mast/seed production and seedling regeneration densities
- Plant health (herbivory damage, disease and infestation)
- Target animal species (composition and relative abundance)

Programming and Education

Considerations for the relationship of site programming and educational learning and participation activities for this strategy include:

- Signage and environmental art integrated in the landscape/trailscape that circulates through these enhanced forested areas, bringing awareness to the crucial forest habitat.
- Deer exclosures done in an artistic way to help highlight and tell the story of deer overabundance and browse impacts to the forest system

Research partners (e.g., college and universities) can monitor selected data collection – seedling and sapling recruitment survival, deer exclosure effectiveness, fauna studies, diseases and infestations.

Figure 29. An existing drainage swale on site that can be enhanced for habitat and water quality tretament.

Stream Daylighting and Hydrologic Restoration – Headwater Tributaries, Southwestern Stream

Description

This strategy is intended to enhance and restore headwater tributaries and drainage swales to address erosion, sedimentation, and habitat loss that has been caused by historic efforts to drain the landscape using pipes and tile drain infrastructure. It is also intended to provide enhanced stream bank stability, enhancement of water quality, and improvement of aquatic habitat. The focus of this strategy is to enhance or restore the Central Tributary, modify the Southwest Corner Tributary, and daylight the piped Central Pond outlet channel. The Central Tributary project is proposed as a combination of more active restoration of the stream valley wetland swale by drain tile removal, and potentially relying on passive restoration of the middle 300-ft of the existing open tributary by attenuating flows in an upstream wetland swale (See image D in Visual Glossary). Because it is not clear that attenuating flows in the wetland will allow passive restoration to progress to sustainable success, monitoring of the open channel erosion rates is recommended after up-gradient restoration. Proposed daylighting of the Central Pond outlet consists of modifying approximately 650 ft of piped discharge from the pond through the maintenance facility, downstream to Euclid Creek. Replacing the piped outfall with an ecologically engineered base-flow channel would create wetland and aquatic habitat, improve water quality, reduce slope erosion and improve park visitor aesthetics (See images E and F in Visual Glossary, and Figure 7). The southwest corner channel was initially discussed as a stream-daylighting opportunity. Given that this approach would involve a large volume of excavation of fill, the presence of a sanitary sewer line paralleling the stream, and piped system downstream under Three Villages Drive, a less expensive and lower disturbance approach would be to create a larger wetland bottom. Such an effort would improve water quality and create a half-acre or more wetland that would provide wildlife habitat diversity on the site.

Some of the key components of this strategy include:

- Central Tributary Wetland Swale – This includes removal, interruption or filling (grouting) the drain tile, and creating a wetland swale valley in an attempt to reduce downstream velocities.
- Central Tributary Existing Channel – Protect and passively restore this channel via the upstream wetland swale hydrologic restoration through drain tile modification.
- Central Tributary Channel Response Monitoring – Provide annual monitoring for stability through cross sections and profiles; include estimating erosion rates.
- Central Pond Outlet Synergy - This effort can be designed as an element that enlarges the central pond thru raising the elevation of the outlet structure. It should be closely tied to the 'stump dump' removal, maintenance facility repurposing, and new western visitor entrance design and implementation.
- Southwest Corner Tributary – A bottomland wetland improvement to the habitat of the park rather than a required element to slow or stop park resource degradation.

Techniques that are recommended include active restoration of tributary channels and swales through excavation and grading, natural process-based water management features (e.g., berms, and riffle/boulder grade water elevation controls), drain tile modification (removal, interruption or plugging) and native habitat planting and management. An added passive approach is the downstream open channel monitoring (Central Tributary) for response to up-gradient hydrologic modifications.

Quantifiable Targets

Targets for establishing a goal for this strategy and measuring future progress can include metrics as follows:

- Linear feet of Central Tributary existing channel stabilization: 300 lf
- Linear feet of Central Tributary drain tile field modification : 100 lf
- Area of restored wetland bottom Southwest Corner: 0.5 acres

Focal Species/Habitat

Selected target guilds (groups of similar species) and representative species potentially benefiting from this strategy include:

- Aquatic fauna, fish: creek chub (*Semotilus atromaculatus*), western blacknose dace (*Rhinichthys obtusus*)
- Aquatic fauna, invertebrates: crayfish, caddisflies (*Trichoptera spp.)*
- Floodplain/stream dwelling amphibians: mountain dusky (*Desmognathus ochrophaeus*)

Monitoring and Research Needs

To help track progress after implementation, understand positive and negative changes in ecological conditions, manage to meet goals successfully, and provide for learning opportunities, the following items can be monitored (based on comparisons with pre-implementation baseline conditions):

- Bank erosion and scour; bank pins and bed chains
- Flood flow attenuation – velocity and volume storage
- Cross sectional area and wetted width; floodplain profile
- Fish and Wildlife Monitoring (fish, macro-invertebrates, wetland birds, amphibians)

Programming and Education

Considerations for the relationship of site programming, educational, and stewardship activities for this strategy include:

- Southwest Corner – ideal outdoor room/venue for public programming, making use of steep topography for viewing, seating or as a natural 'amphitheater'
- Consider and integrate viewsheds and vistas into Southwest Corner area
- Citizen science monitoring and selected data collection – water quality monitoring, bird lists

Interpretive signage and displays to highlight the value of daylighting natural channels to stormwater management, water quality and improved habitat

Figure 30. Riprap edge of the Northwest Pond.

Pond Fringe Enhancement – Northeast Pond, Northwest Pond, and Central Pond

Description

This strategy is intended to meet a primary goal of this restoration master plan, to provide for enhanced visitor experience while focusing on ecologically driven solutions for pond enhancement. The basis of this strategy includes an overall focus on restoration of ecological function (ecological uplift) of the three pond habitats for water quality improvement, fish habitat enhancement, wildlife habitat provision and associated natural buffer functions (Figure 7).

Northeast Pond

This pond is a considerable resource and a challenge because the eastern edge is a residential community and the pond is part of the stormwater management system for the subdivision. This pond could be enhanced through restoring fringe wetlands, establishing a wetland bench, and potentially using cut and fill to improve the littoral zone and the vegetative buffer. These steps would help with water quality and promote healthier habitat conditions for birds and aquatic wildlife. Any restoration accepted for implementation must not alter the hydrologic regime of the pond with respect to its capacity as a stormwater management feature.

Northwest Pond

The aquatic habitat and water quality treatment functions of this pond would benefit from restoration methods such as slope stabilization, edge plantings, and possibly floating wetlands. Peninsular projections into the pond could serve as wetland features and/or have higher plateau elevations that could serve as recreational fishing access points.

Central Pond

The potential exists for wetland bench establishment, a vegetated buffer, and some framed views from trails or elevated walkways that keep visitors from getting too close to the pond in this area. This pond appears to be hydrologically related to a conveyance that flows through the maintenance yard and south to Euclid Creek. This connection could be further explored and then enhanced as a day-lighted channel conveyance system.

Some of the key components of this strategy include:

- Wetland Benches - Adding littoral benches to the ponds is a key part of the strategy to help improve water quality and fish & wildlife habitat, using emergent and scrub-shrub plantings (see image G in the Visual Glossary).
- Northeast Pond stormwater capacity – It is important not to reduce existing capacity; this will be achieved by excavating benches out of the western most upland edge of the Northeast Pond.
- Northeast Pond adjacent swale – This swale will be enhanced through modifying the cross-section to handle the flow regime and to create an emergent wetland bottom. The 100-ft boundary buffer along the pond and swale system adjacent to Acacia Estates will be a blend of scrub-shrub and woodlands.
- Excavated soils – pond wetland bench excavation will likely yield excess cut material, particularly where pond capacity cannot be reduced. Associated soils may be suitable for road, trail or foundation base material but will require in-situ geotechnical and lab analysis testing to verify applicability.
- Central Pond project synergy – This project has synergy with the Pond outlet daylighting through a riffle grade control structure, which could enlarge the pond and wetland through cost-effective means.

Quantifiable Targets

Targets for establishing a goal for this strategy and measuring future progress can include metrics as follows:

- Area of wetland littoral bench by pond:
  Northeast Pond = 25,000 sq. ft.;
  Northwest Pond = 40,000 sq. ft.;
  Central Pond = 25,000 sq. ft.
- Linear feet of adjacent swale restoration : 350 feet
- Northeast Pond stormwater treatment volume increase : 15,000 cubic feet capacity increase
- Northeast Pond Boundary Buffer Area: 300,000 sq. ft.

Focal Species/Habitat

Selected target guilds (groups of similar species) and representative species potentially benefiting from this strategy include:

- Aquatic fauna, fish: sunfish (*Lepomis microlophus)*, bluegill sunfish (*Lepomis macrochirus*), pumpkinseed sunfish (*Lepomis gibbosus*), largemouth bass (*Micropterus salmoides*)
- Wetland dependent birds: green heron (*Butorides virescens*) song sparrow (*Melospiza melodia)*
- Aquatic fauna, pond reptiles & amphibians: midland painted turtle (*Chrysemys picta marginata*), leopard frog (*Lithobates pipiens*)

Monitoring and Research Needs

To help track progress after implementation, understand positive and negative changes in ecological conditions, manage to meet goals successfully, and provide for learning opportunities, the following items can be monitored:

- Water surface elevations
- Substrate texture, chemistry and nutrients
- Water quality parameters (e.g., dissolved oxygen (DO), total nitrogen (TN), total phosphorus (TP), total suspended solids (TSS), temperature)
- Vegetative species composition and percent cover
- Fish and Wildlife Monitoring (fish, wetland birds/waterfowl, reptiles)

Programming and Education

Considerations for the relationship of site programming, educational, and stewardship activities for this strategy include:

- Educational signage and learning opportunities related to pond buffers and wetlands
- Northwest Pond fishing access corridors and fishing areas
- Citizen science monitoring and selected data collection – water quality monitoring, bird lists Viewsheds and vistas to ponds
- Trails and platforms to ponds

Figure 31. An existing bunker wetland on site.

Wetland Hydrology Restoration – Restore Forested Wetlands, Wet Swales & Meadows

Description

This strategy is intended to meet a primary goal of this restoration master plan to enhance, restore and manage site-wide wetland hydrology, by planning for a mosaic of forested wetlands (floodplain, swamp and vernal pools), wet swales, and wet meadows. This will transition the existing golf course landscape to a predominantly forested wetland system. The basis of this strategy includes a focus on restoration of ecological function (ecological uplift) and natural processes associated with wetland hydrology through the phased implementation of restoration over time to allow for an adaptive management approach. This strategy will need to be implemented with consideration for the substantial alteration of the site hydrology brought about by the drainage infrastructure and landform modifications that occurred during the development of the golf course, and subsequent management regimes, involving drain tiles, irrigation lines, soil horizon manipulation, tributary alteration and swale formation. With an increased understanding of the drainage modifications and related soil hydrologic regimes, the adaptive management of restoration measures can restore hydrology and function that emulate more natural, pre-development conditions and communities, while still acknowledging the novel ecosystem context.

Some of the key components of restoring wetland hydrology and ecosystem characteristics include:

- Wetland restoration – There are a number of opportunities in wet/hydric soil areas for wetland restoration, including the lawn near the southern entry and many of the greens, fairways and rough areas. Disabling the function of the drain tile network is key to the success of this strategy (See image D in Visual Glossary).
- Wet swale expansion & enhancement – A number of areas associated with historic streams or drainages that can provide improved drainage through restored surface conveyance. These can also provide water quality treatment, enhanced habitat, and a new aesthetic.
- Re-envisioning hydrology on the site through integrated stormwater management (especially on the eastern side of the property): wetland features at ponds, swales and other BMPs.

- Sand trap conversion – Some of the sand traps are poorly drained areas where existing cottonwood seedlings and other woody plants can be managed and supplemented with other species. These wet features could be minimally managed in some cases to see how they evolve naturally over time.
- Trails/surface drainage/living trails – There are multiple areas where wet spots intersect with the existing trail network. As the future trail network is considered, it is essential to address issues of stormwater conveyance off of trails as well as their placement along restored wetlands (See image H in Visual Glossary).

Quantifiable Targets

Targets for establishing a goal for this strategy and measuring future progress can include metrics as follows:

- Area of forested wetland: Short term: 10 acres; Interim: 50 acres; long term: 80 acres
- Area of mesic to wet meadow : Interim 30 acres; long term: 5 acres (as forest canopy increases)
- Number of vernal pools and total area: e.g., 6 sites, totaling 1.5 acres
- Linear feet of wetland swale enhancement and restoration: 650 lf

Focal Species/Habitat

Selected target guilds (groups of similar species) and representative species potentially benefiting from this strategy include:

- Forested wetland amphibians: spotted salamander (*Ambystoma maculatum*), spring peeper (*Pseudacris crucifer*)
- Wetland birds/waterfowl: wood duck (*Aix sponsa*), migrant sora (*Porzana carolina*), Virginia rail (*Rallus limicola)*
- Swamp wetland mammals: meadow jumping mouse (*Zapus hudsonius*), raccoon (*Procyon lotor*), American mink (*Neovison vison*)

Monitoring and Research Needs

To help track progress after project implementation, understand positive and negative changes in ecological conditions, manage to meet goals successfully, and provide for learning opportunities, the following items can be monitored:

- Vegetative species composition and percent cover
- Groundwater and water surface elevations
- Vernal pool monitoring should include hydroperiod in addition to ground and surface water elevations
- Soil redox properties, compaction, texture, chemistry and nutrients
- Water quality parameters (e.g., dissolved oygen (DO), total nitrogen (TN), total phosphorus (TP), total suspended solids (TSS), temperature)
- Fish and Wildlife Monitoring (wetland birds/waterfowl, amphibians, invertebrates, mammals)

Programming and Education

Considerations for the relationship of site programming, stewardship, and educational activities for this strategy include:

- Educational signage and learning opportunities: wetlands and wetland wildlife
- Viewsheds, circulation, trails: viewing platforms and outdoor learning spaces
- An opportunity exists to construct living trails at selected locations. This approach involves placing a layer of coarse sand and shredded wood (80:20 by volume respectively) as the trail surface. The carbon-rich sand bed improves water quality, does not deform under pedestrian traffic, and by holding water on the landscape longer; attenuates peak flows, supports a diversity of wetland flora and fauna, and allows movement of water through the trail without degrading the trail user's experience.

Figure 32. Native meadow establishment will provide enhanced viewsheds across the site.

Fairway To Native Meadow Establishment – Moist To Wet Meadows As Transition Habitats

Description

This strategy is intended to protect, enhance, and restore native biodiversity for site habitats and species, within the context of ecosystem restoration. Other objectives of the plan related to maintaining access, providing scenic vistas and addressing safety concerns can be met with meadow establishment and management. Native meadows can play a short-term, transitional role in the management and conversion of fairways from predominantly turf grass fields to functioning native meadow grasslands. This transition acknowledges that conversion of the site to a predominantly forested wetland system will not happen quickly. Conversion of existing landscapes to native meadow can be broad scale in the short term, to be cost effective and aid in the transformation of soils and hydrology, and can later be reduced in scale to selected areas to move the system to a more complete forest cover. Native meadow establishment in moist areas and restored wetland areas can also play a part in the overall wetland system restoration in the form of native moist-mesic and wetland meadow establishment.

Some of the key components of this strategy include:

- Native meadow establishment – The larger central fairways can serve as beautiful interior relief from the forested edges in the form of native meadows dominated by warm season grasses and wildflowers.
- Wet to moist native meadow establishment – Where the conditions provide an opportunity for the establishment of wet meadow habitat, converting the maintained fescues to native meadow that can be adaptively managed over time to succeed to forested wetland
- Views and site lines – Viewsheds can be strategically planned along specific fairways throughout the Reservation, in order to provide a transition habitat and native biodiversity, while also acknowledging the golf course's legacy.
- Key habitat elements – Native meadow establishment can provide vital habitat for pollinators including bees, Lepidoptera (butterflies, moths and skippers) and certain grassland bird species.

Techniques that are recommended include appropriate herbicide treatment to kill turf grass and allow the drill seeding of native meadows, using a sub-soiler in selected areas to rip and loosen compacted areas (particularly where more well-drained conditions are desired). Other techniques for meadow establishment and management include tilling, selective small-scale planting with native plugs, establishing seed donor collection areas, periodic timed mowing, and invasive species management of meadow invaders.

For the large (~80 acre) centrally-located meadow restoration, (shaped like a V on its side) we recommend an 18-in deep subsoiling effort be undertaken to improve root penetration below the current 8-in root horizon. This subsoiling effort should be paired with carbon-rich material amendments (1e. Biochar) to improve the soil C:N ratio. Following this effort, drilling or slit seeding of a diverse meadow seed mix should occur. Follow-up monitoring of this meadow restoration area with the approximately 3-acre fairway west of the Central Pond, which does not receive the subsoiling or Biochar amendment treatment would be an interesting and useful comparison.

Quantifiable Targets

Targets for establishing a goal for this strategy and measuring future progress may be based on existing fairway acreage, soil types, or observations of wetness and can include metrics as follows:

- Acreage of established native meadow: Short term: 2 acres; Interim: 30 acres; Long term: 5 acres
- Ratio of native meadow types: Wet meadow: 50%; Moist meadow: 40%; Upland meadow: 10%
- Maximum percent cover of invasive species: 5%

Focal Species/Habitat

Selected target guilds (groups of similar species) and representative species potentially benefiting from this strategy include:

- Grassland/meadow birds: American kestrel (*Falco sparverius*), savannah sparrow (*Passerculus sandwichensis*), eastern bluebird (*Sialia sialis*)
- Grassland small mammals: deer mouse (*Peromyscus maniculatus*), meadow vole (*Microtus pennsylvanicus*)
- Pollinating species lepidoptera: twelve-spotted skimmer (*Libellula pulchella*), monarch butterfly (*Danaus plexippus*)

Monitoring and Research Needs

To help track progress after implementation, understand positive and negative changes in ecological conditions, manage to meet goals successfully, and provide for learning opportunities, the following items can be monitored:

- Species composition, percent cover, density
- Biomass production of grassland
- Occurrence of invasive species by habitat type
- Plant health (herbivory damage, disease and infestation)
- Target animal species (composition and relative abundance)

Programming and Education

Considerations for the relationship of site programming, stewardship, and educational activities for this strategy include:

- Educational signage and learning opportunities related to grasslands and pollinators
- Selectively identified mowed trails for access, and to minimize habitat fragmentation and disturbance
- Research partners (e.g. college & universities) monitoring and selected data collection – bees, butterflies and birds lists
- Viewsheds and vistas for visual perspective, views, reminder of golf course history and to provide safety site lines

Figure 33. The existing maintenance facility in the center of Acacia.

Existing Maintenance Facility Upgrade/Retrofits – Potential Plant Nursery

Description

This strategy is intended to adaptively re-use existing facilities and minimize the footprint of new development in the Reservation. The re-use of the existing maintenance facility will minimize new disturbance, assist in maximizing area of native habitats, provide needed maintenance and support facilities for restoration, and enhance the aesthetics of this area from the new western entry. A specific use for this project is to re-purpose the existing maintenance yard and buildings to support ecosystem restoration implementation including the potential development of an on-site nursery operation and green house. Other associated site uses can include materials storage, organic material composting and equipment staging. There are also associated ecological restoration measures proposed for this area including the Central Pond outfall channel daylighting and restoration identified in the stream daylighting strategy described earlier.

Some of the key components of this strategy include:

- Plant nursery – The existing maintenance yard and greenhouse facility in the center of the site provides an opportunity for an onsite native restoration plant nursery, and potentially a greenhouse.
- On-site seedling propagation – to collect seedlings that are already beginning to regenerate, and propagate onsite natives – species to consider would include hickories, silver maple, swamp white oak and pin oak.
- Facility clean-up – This facility area also needs a good cleanup, as it is has been used as a disposal site for stumps and other vegetative debris as well as equipment and debris.
- Restoration Center – In additional to a nursery this area can be used to process compost, store mulch, house motorized equipment and tools, and serve as a project crew staging area.

Techniques that are recommended include disposed material and debris clean-up and haul off, impervious surface removal, invasive species management, sustainable facility retrofits, and integration of stormwater best management practices.

Quantifiable Targets

Targets for establishing a goal for this strategy and measuring future progress can include metrics as follows:

- Reduction of effective impervious surface: 10%
- Pounds/Tons of vegetative debris and on-site materials: ~100 tons
- Number of integrated stormwater best practices: 3 types

Focal species/habitat

Selected target guilds (groups of similar species) and representative species potentially benefiting from this strategy include:

- Bird species (nesting structures): barn swallow (*Hirundo rustica*), eastern phoebe (*Sayornis phoebe*), American kestrel (*Falco sparverius*),
- Bat species (bat boxes): big brown bat (*Eptesicus fuscus*)
- Beneficial insects (bee boxes): honey bees (*Apis spp.*)

Monitoring and Research Needs

To help track progress after project implementation, understand positive and negative changes in ecological conditions, manage to meet goals successfully, and provide for learning opportunities, the following items can be monitored:

- Success and efficacy of on-site seedling collection, propagation and planting
- Projected cost savings from onsite plant propagation over time
- Local provenance seed collection and study of genetic variability
- Stormwater treatment effectiveness and day-lighted channel monitoring

Programming and Education

Considerations for the relationship of site programming and educational learning and participation activities for this strategy include:

- Native plant nursery tours and plant material learning sessions
- Native planting guides and keys to the use of native landscape plants (plants visual glossary)
- Citizen science monitoring and selected data collection – plant survival, water quality
- Interpretive signage and displays to highlight native plants, and facility repurposing

Figure 34. Euclid Creek where it enters Acacia below Cedar Road

Off-site Stormwater Management/ Partnering Opportunities

Description

This strategy is intended to address stormwater management and associated water quality and aquatic resource impacts to Reservation streams and ponds particularly influenced by off-site stormwater run-off impacts. It also serves to protect and restore Euclid Creek and provide for stream bank stability, enhancement of water quality and improvement of aquatic habitat. The goal of this strategy is to reduce stormwater impacts, protect and enhance aquatic resources in on-site streams and ponds while acknowledging system-wide relationships to the watershed, and finding collaborative solutions with local and regional partners to comprehensively find stormwater retrofit, best practice and associated ecological restoration solutions. To effectively reduce the effects of stormwater on our urbanized streams, the region needs active partnerships and collaboration. Stakeholder engagement is fundamental to successful community outreach and awareness efforts to garner support for implementing improvements. Some of the specific opportunities include collaboration between Cleveland Metroparks and programs/organizations currently focused on watershed stewardship and environmental education. Through collaborative awareness, information sharing and joint project efforts, partnering organizations can leverage public support for educational material campaigns, providing hands-on stewardship opportunities for volunteers, and identifying appropriate grants and other funding sources for stormwater pollution abatement and innovative green infrastructure projects (See image I in Visual Glossary). This strategy has synergy with other Reservation restoration strategies including Euclid Creek Conservation Corridor, Euclid Creek Stream Restoration, Forest Enhancement and Buffers throughout the site, as well as Pond Fringe Enhancement.

Some of the key components of this strategy include:

- Off-site stormwater – Considerations of stormwater-dominated streams that flow onto the site from the south. Related issues include trash/litter from the roadway intersections, and associated floatable debris and pollutants from local large-scale impervious surfaces (including commercial roofs and parking lots).

- Northwest Pond Off-site Influences – The watershed that drains to Northwest Pond receives stormwater from residential streets, buildings and yards via outfalls into to a small tributary. Retrofitted stormwater best management practices (BMPs) can improve stormwater quantity and quality conditions, while enhancing pond water quality.
- Northeast Pond Stormwater Functions – The proposed on-site pond enhancement will increase stormwater capacity and water quality functions, and should be done to augment the residential development stormwater controls and collaborative opportunities.
- Stormwater Best Practices – Comprehensively these will augment the on-site stormwater green infrastructure BMPs and address new entry and parking development. There are opportunities to retrofit practices throughout the site, and there are off-site opportunities for partnership, including the City of Lyndhurst.

Techniques that are recommended include green infrastructure practices for BMPs such as stormdrain retrofits, catch basins and street sweeping, rain gardens, buffers, swales/regenerative conveyances, and stewardship education and project participation.

Quantifiable Targets

Targets for establishing a goal for this strategy and measuring future progress can include metrics as follows:

- Stormwater Pollutant Reduction: run-off volume reduction, and pollutant removal efficiencies
- Volume of litter/trash and floatable debris reduction: lbs/tons per year
- Number of local practices target: 5 BMPs

Focal Species/Habitat

Selected target guilds (groups of similar species) and representative species potentially benefiting from this strategy include:

- Aquatic fauna, invertebrates: crayfish (*Cambarus spp., Oronectes spp.*), caddisflies (*Trichoptera spp.*)
- Riparian/aquatic amphibians: pickerel frog (*Lithobates palustris*), Two-lined salamander (*Eurycea bislineata*)

Monitoring and Research Needs

To help track progress after target implementation, understand positive and negative changes in ecological conditions, manage to meet goals successfully, and provide for learning opportunities, the following items can be monitored:

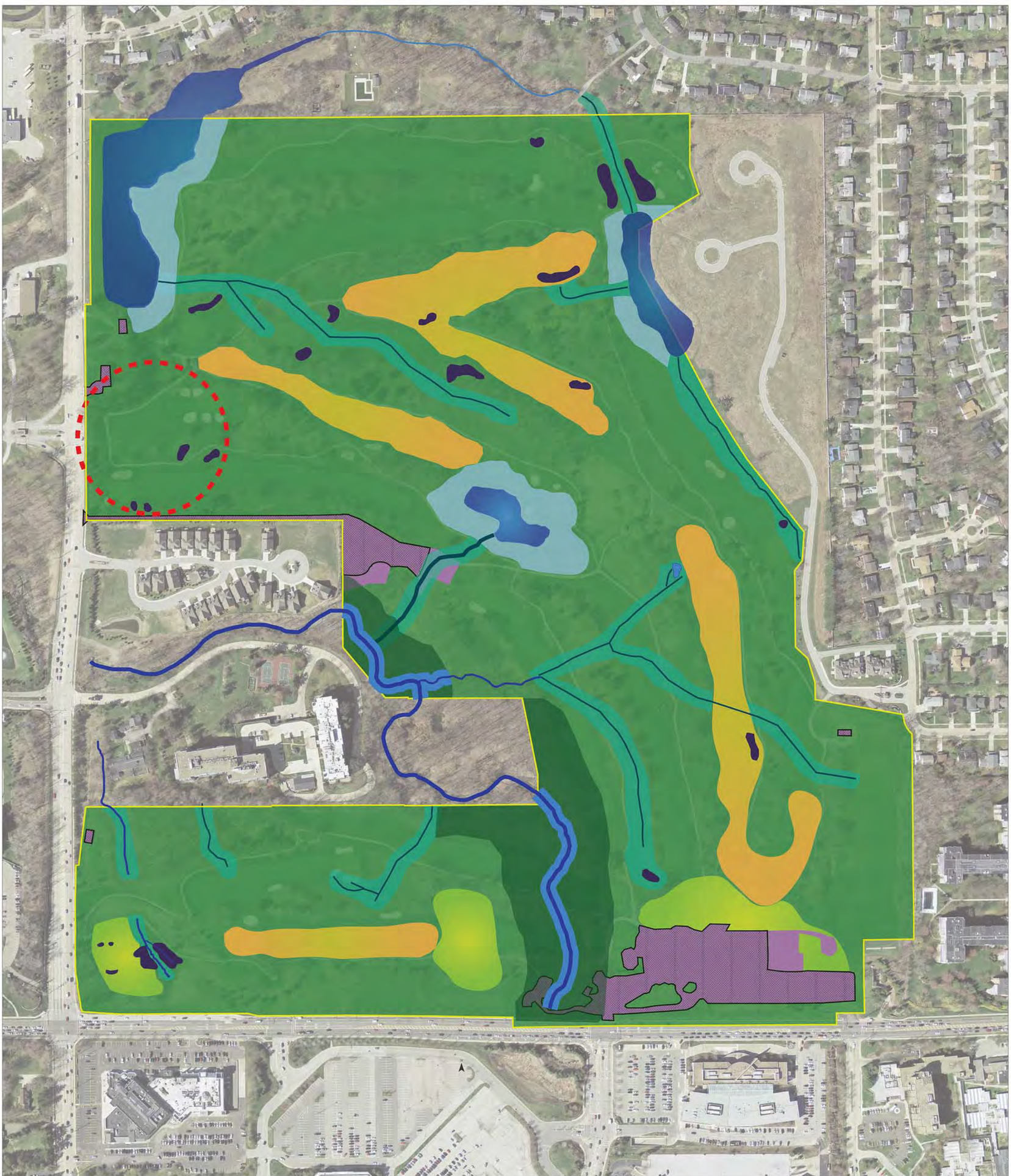
- Floatable debris reduction
- Water quality parameters (e.g., dissolved oxygen (DO), total nitrogen (TN), total phosphorus (TP), total suspended solids (TSS), temperature)
- Stormwater flows and volume reductions
- Community stormwater awareness and participation - survey
- Aquatic organisms (fish and macro-invertebrates, amphibians)

Programming and Education

Considerations for the relationship of site programming and educational learning and participation activities for this strategy include:

- Local pollution awareness campaign and surveys
- Community stormwater clean-up and implementation workshops
- Citizen science monitoring and selected data collection – water quality monitoring

ECOLOGICAL RESTORATION MASTER PLAN



ACACIA RESERVATION ECOLOGICAL RESTORATION MASTER PLAN

- EUCLID CREEK CONSERVATION CORRIDOR - RIPARIAN FOREST
- EUCLID CREEK STREAM RESTORATION
- FOREST ENHANCMENT/ RESTORATION- MESIC AND FORESTED WETLAND
- POND FRINGE ENHANCEMENT
- PONDS/ OPEN WATER
- EXISTING STREAMS
- EXISTING IMPERVIOUS DEV FOOTPRINT
- STREAM DAYLIGHTING/ WET SWALES
- POTENTIAL VERNAL POOLS/ WETLANDS
- FAIRWAY TO NATIVE MEADOW ESTABLISHMENT
- PROPOSED IMPERVIOUS DEV FOOTPRINT
- PROGRAMMABLE OPEN SPACE AREAS
- APPROXIMATE LOCATION OF FUTURE ENTRY/ DEVELOPMENT
- PROPERTY BOUNDARY

Biohabitats
GREAT LAKES BIOREGION

1 NORTH

0 100 200 300 400 500

ECOLOGICAL RESTORATION VISUAL GLOSSARY

A. Floodplain Reconnection

Photos copyright Biohabitats

Two examples of restored floodplains in similar forested settings.

B. Reforestation

Reforestation with a diverse understory.

C. Meadow Creation

Photos copyright Biohabitats

A restored meadow with a diverse native plant palette.

D. Wetland Restoration

Two examples of wetland restoration projects that exhibit similar character to expected restoration at Acacia.

E. Hydrologic Restoration - Stream Daylighting

A daylighted stream, where it was once buried in a pipe it has been brought back to the surface and planted with a diverse palette of native plant species.

F. Stream Restoration

Photos copyright Biohabitats

An example of a severely eroded stream (left) that has been restored for hydrologic and ecological function (right).

G. Pond Littoral Bench and Wetland Fringe

Photos copyright Biohabitats

Two different examples of pond designs where littoral edge is diverse in form and vegetation.

H. Sand Seepage Berm and Natural Trail Design

An example of a sand seepage berm, as part of a hydrological restoration that incorporates a natural trail design. The image on the right is 10 years after implementation.

I. Green Infrastructure Applications

Rain garden along parking lot

Bioretention area with boardwalk crossing

VI– Programming and Recreation

Considerations for integrating programming and recreation from a restoration and educational perspective (stewardship, research, and interpretation), include discussion of relationships between passive activities at the site and restoration strategies described above.

- Programming and recreation should be responsive to the ecological and park-like desires for this space. It takes advantage of natural forms in the landscape, avoids fragmentation of existing habitat and ecological zones of note, and enhances ecological function.
- Integrate trails in a way that promotes ecological function, avoiding direct access to certain restored areas, and providing environmental learning. Trails are designed in a way that respects the ecological function of restoration projects. Include trails that are designed to avoid wet areas and sensitive ecological zones but still provide a looped and interesting visitor experience, mixing APT (loop) with other types of materials on secondary trails.
- Memorialize elements of site history (e.g., golf course designer, etc) through meadow plantings.
- Information presenting the restoration approach is shared in signage including photos through the years, as changes begin to occur across the landscape (before and after images at specific locations; consider highlighting some viewsheds that may evolve over time).
- Development of a digital way-finding program that highlights the history (smart phone app).
- Create off site partnerships with the community to help promote stewardship.
- Maintenance facility – remove debris and clear area. Minimize excess surface disturbance at maintenance facility – investigate ways to treat stormwater runoff, lower percentage of impervious surface if possible.
- Evaluate opportunities with existing gas wells, including screening.
- Address irrigation infrastructure throughout the site (above ground pump boxes, concrete pads, below ground pipelines).
- Remove a portion of the eathern berm along Cedar Road (consider converting to supplemental parking area and north facing sledding hill with longer slope).

VII– Implementation Plan

Figure 35. The central pond is envisioned as a restoration opportunity in Focal Area 2.

Introduction

The purpose of this section is to assist with the development of a plan of action to move the restoration of Acacia Reservation forward in an efficient, coordinated, predictable and measureable manner. The implementation plan necessarily needs to be a living document, because Cleveland Metroparks will need to be flexible in the face of changes in funding, modified internal and stakeholder priorities, changes in site conditions, and feedback from observations/monitoring of initial restoration actions.

Implementation Phases

The implementation phases presented here are based on a limited understanding of Cleveland Metroparks funding and stakeholder goals. As such, we have focused on classifying the potential restoration efforts into three categories, Phase 1 (years 1-3), Phase 2 (years 4-6), and Phase 3 (years 7-10+). Our approach is to identify projects that are a critical path for project progress, like the new entrance and associated facilities on the western edge of the Reservation, as Phase 1 projects. Similarly, projects that should be implemented immediately for ecological or conservation objectives, the restoration of the mainstem of Euclid Creek through the Reservation, are also identified as Phase 1 projects.

Other Phase 1 projects include efforts that are temporally or spatially associated with Phase 1 project efforts, for example reconfiguring the maintenance area concurrent with the implementation of the proposed new western entrance.

Phase 2 projects include high priority projects that should not be implemented until a more fundamental, earlier sequence change is made, i.e., establishing a riparian forest buffer along Euclid Creek should be implemented only after the Euclid Creek Restoration project is implemented.

Phase 3 projects include a large suite of restoration and conservation projects that will need to be implemented over time. These projects will be more efficiently and successfully implemented with additional input from field observations and monitoring data, i.e., forest enhancement or adaptive management of forest succession into meadow areas.

In some instances, Phase 1 projects need to precede Phase 2 projects, as suggested above. However, some Phase 3 projects may precede Phase 1 projects, as in the case of adaptively managing vernal pool diversity in some of the ponded sandtraps. Projects requiring significant capital and the use of contractors may be implemented after projects that can proceed sooner, with existing or modest increases in equipment and personnel.

Early Action Restoration

The emphasis on a spatial organization for the various potential restoration strategies and elements, recognizes that certain areas may have a higher priority for environmental (eg. Euclid Creek) or programmatic (eg. new entrance) goals. The individual elements that are grouped into the focal areas are done so for practical reasons; whether for cost-effectiveness, as is the case of Focal Area 1 (Euclid Creek and its Tributaries), or for aesthetics, as is the case of Focal Area 2 (New Western Entrance and Surroundings). While these two areas overlap geographically and involve some of the same restoration elements, they should not be considered redundant. If Cleveland Metroparks receives funding for the Euclid Creek restoration it will be efficient to include tributary restoration and related activities in the same vicinity. Alternatively, if the new entrance becomes the first project, Cleveland Metroparks would likely want to improve resources in the immediate area (eg. trails in the vicinity of the Central Pond), before opening the new entrance.

Focal Area 1 – Euclid Creek and its Tributaries

Mainstem from Cedar Road Downstream to Richmond Road

The mainstem of Euclid Creek presents a critical opportunity for restoration. Euclid Creek is on Ohio's 303(d) list of impaired waters and has TMDL's established for phosphorus, sediment, and habitat (http://www.epa.state.oh.us/dsw/tmdl/2012IntReport/2012IRAssessmentSummaries.aspx). Using the floodplain reconnection approach proposed will enhance ecosystem services and provide benefits to property owners along its banks, as well as downstream public and private entities (see Figure 36). Restoration through floodplain reconnection will produce benefits including a reduction in channel erosion and lateral migration rates, with attendant benefits to the fish and aquatic resources of the stream. Through floodplain reconnection, the high peak discharges and short time of concentration associated

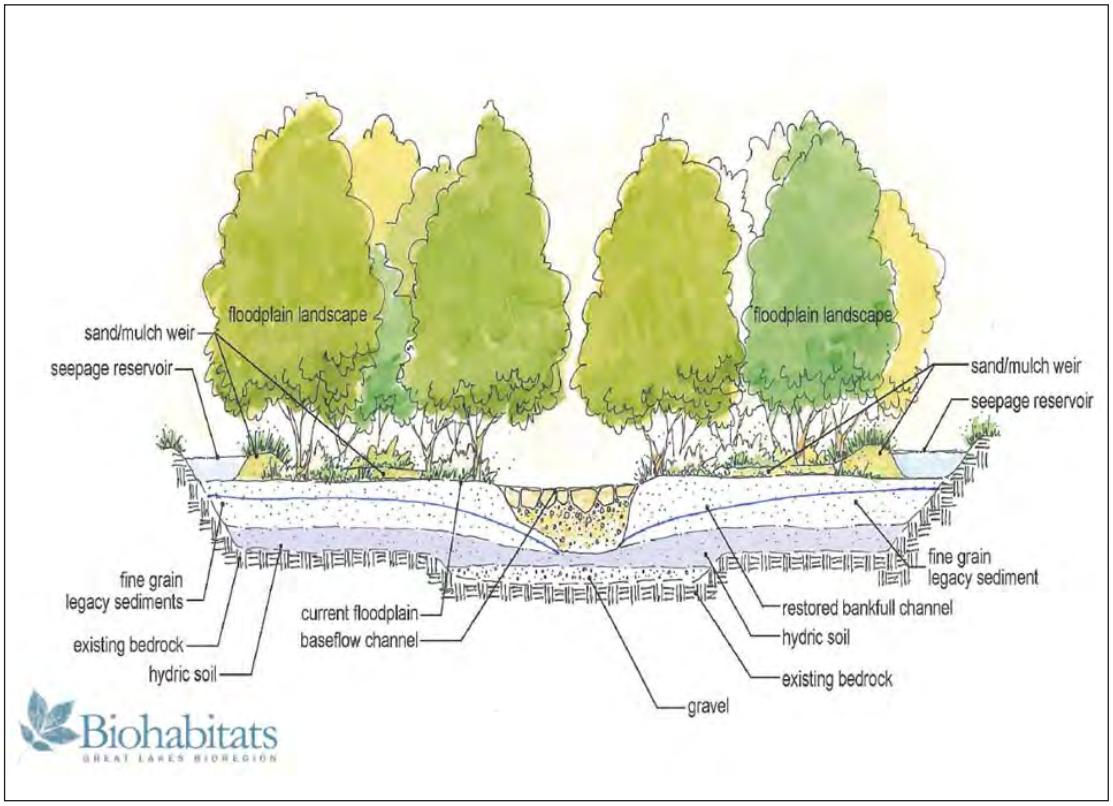


Figure 36. A typical cross section of floodplain reconnection (Copyright Biohabitats Inc.).

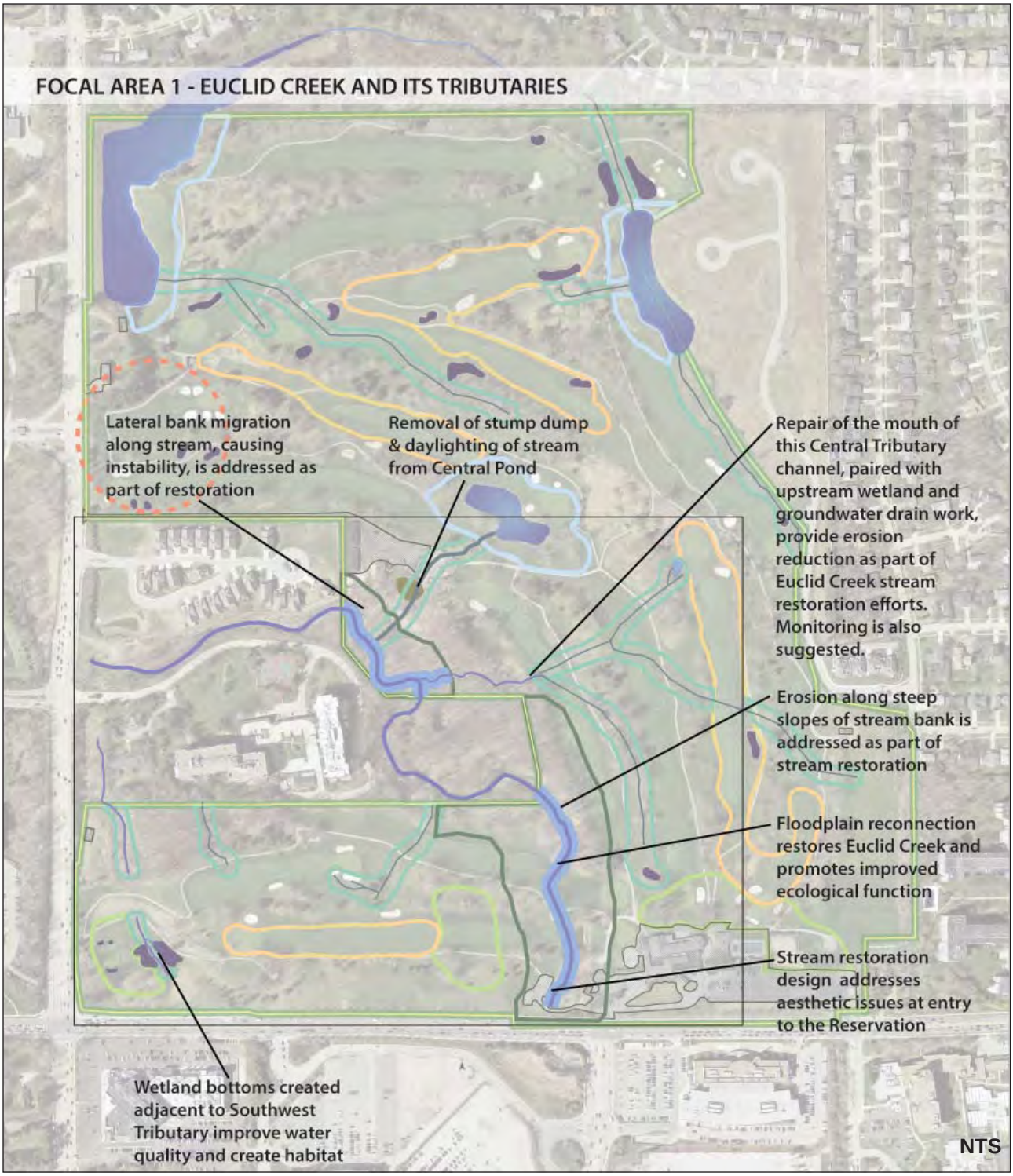


Figure 37. Focal Area 1 within the context of Acacia Reservation.

with runoff from upstream impervious surfaces will be attenuated by directing flows through a broader, shallower and rougher flow path created by restoring the channel connection to the floodplain and its riparian vegetation. This floodplain function restoration and enhancement will also contribute to improved forest, wetland, and soil conditions and associated wildlife resources of the flood prone areas along Euclid Creek.

Stream restoration through floodplain reconnection has been documented to reduce peak discharges and their erosive forces, increasing the time of concentration and reducing flooding frequency associated with short duration intense storms. This attenuation of the effects of urban hydrology will provide stream channel habitat benefits, improvements in water quality, and will support a more diverse and abundant aquatic community. Stream restoration will begin delivering these benefits immediately, with resource improvements continuing and building in value with time.

Timing

This focal area has a high priority due to environmental degradation, property impacts, and safety concerns (Figure 37). The existing toe erosion along Euclid Creek is a serious problem, as the slope at this location is very steep and tall. As slope erosion continues more sediment will enter the stream and be delivered downstream, creating a safety hazard and further degrading water quality and stream stability. Resources at the top of this eroding slope will be at risk. Immediate actions at the top of the slope may be necessary to protect park users from the health and safety risks associated with a 100-ft fall so steep that few would be able to recover their foothold once their footing was lost. Similar lateral bank migration is occurring near the downstream property boundary (Figure 37), though at this location a private residence is at risk.

Priority

This proposed project is a high priority. This is based on ongoing erosion of the property, an impending requirement for some form of barrier at the top of this rejuvenating slope as it worsens and presents an increasing risk of harm, and the unattractive aesthetic at the western branch of the south entrance near the existing sledding hill (Figure 37). In addition to these three considerations, the natural resource improvements on and off site, supportive relationships from private property owners contiguous to the new park, and public and private interests downstream of the property all support taking action on this restoration element.

Figure 38. Euclid Creek.

Active or Passive

This proposed project will require an active intervention, as continuing high-energy stormwater from offsite will continue to degrade Euclid Creek. Left alone to its own devices, the stream will continue to erode its channel, increasing public and private property loss, degrading aquatic habitat and life in the Reservation and downstream, and presenting an obvious conflict to Cleveland Metroparks philosophy for resource management.

Practical Considerations

The cost for a project of this type ranges from $400 to $800 per linear foot of project length, and with an estimated length of 3,200 ft (only about 1300 feet of the stream is within the Reservation); the cost for this effort is estimated to be in the range of $1.25 to $2.5 million. In terms of significant stream restoration projects, this is a relatively modest investment. Because of the high awareness of Euclid Creek, the ecological uplift associated with restoration, and the cooperation and support for the project among property owners, this project would be attractive to granting agencies (e.g., NOAA and NFWF).

Central Tributary

This tributary currently starts at the outlet of an 18-in drain tile serving the eastern quadrant of the property as shown on Figure 37. The immediate vicinity of the drain outlet has been an erosion problem for the golf course in the past, as evidenced by remnants of unsuccessful repair efforts. Downstream of this location, the channel is relatively narrow and incised, with the greatest erosion at the downstream confluence with Euclid Creek. t is apparent that if no changes were made, this channel would continue to enlarge and generate eroded sediments to Euclid Creek, contributing to Euclid Creek's problems, and degrading the parks resources. The tributary flows through a forested stream valley in good condition, but its active down-cutting threatens riparian trees and lowers the local groundwater table.

The mouth of the channel at its confluence with Euclid Creek could be repaired as part of the Euclid Creek restoration project. The upstream wetland and groundwater drain work, described in the stream daylighting strategy, terminating at the erosion gully at the upstream end of this reach, may provide sufficient erosion reduction through hydro-modification that active channel restoration in the good condition forested stream valley may not be necessary. As a result, the approximately 400-ft long portion of the stream flowing through the forested stream valley could be monitored for stability. Depending on the monitoring results and other resource goals, Cleveland Metroparks could decide whether physical restoration in this reach is needed or if the upstream changes to the golf course drains and increased wetland retention along the flowpath provide sufficient flow attenuation that further stream channel repair is unnecessary.

Timing

As discussed above, repairing the mouth of this tributary, where erosion is greatest, could be done concurrently with the Euclid Creek restoration. Restoration of the portion of this tributary flowing through the woods could be deferred pending an evaluation of how the channel erosion responds to wetland and drain tile restoration work immediately upstream.

Priority

This tributary is not as high a priority as the mainstem Euclid Creek project, because it has no park user safety concerns, it is largely out of sight of park users, and it doesn't have any of the flooding and erosion problems that are present in Euclid Creek. However, unlike some of the meadow and forest restoration projects, this channel has the potential to degrade existing, good condition riparian forest habitat. As a result, this project has a moderate priority for restoration.

Active or Passive

This tributary is situated between two projects proposed as active restoration projects (Euclid Creek and tile drain removal and wetland swale). This tributary may benefit sufficiently from the tile drain removal and wetland swale restoration project that no active restoration may be required. However, it is not clear that attenuating flows in the wetland will have the result of allowing passive restoration to progress to a sustainable success. As a result, monitoring will be key to establishing current baseline erosion conditions and rates. Then a comparison can be made between these and the conditions following the drain tile removal and wetland swale restoration at the upstream end of the tributary, as well as the tributary erosion and head cutting at its confluence with Euclid Creek, as part of that restoration project.

Practical Considerations

The monitoring of the middle 300-ft of this tributary is a small investment of labor and equipment, requiring fixed cross sections and profiles to be identified and monitored seasonally. This monitoring effort could also include monitoring bank pins and bed chains to estimate erosion rates. Annual review of these sections and comparison to the pre-restoration condition should

be sufficient to support an analysis of whether the erosion problem has been addressed or if active intervention is necessary.

Such monitoring investment is estimated to be on the order of $5,000 per year, assuming eight cross sections and two profiles.

Daylighting Piped Central Pond Outlet

This opportunity consists of approximately 650-ft of piped discharge from the Central Pond, through the access to the maintenance facility, downstream to Euclid Creek. Replacing this piped outfall with an engineered baseflow channel would create wetland and aquatic habitat, improve water quality, reduce slope erosion, and improve park visitor aesthetics. In addition, this project could be designed as an element to enlarge the Central Pond through raising the elevation of the pond outlet structure.

Timing

This project timing needs to receive a bit more discussion, as it should be implemented concurrent with the removal of the 'stump dump' and any repurposing of the maintenance yard. These efforts should likely be implemented as local improvements associated with the proposed western entrance improvements. If not, it is likely that some of the first views of the new park for many visitors will be the 'stump dump' and the existing maintenance facility.

In addition, as referenced above, the plan to enlarge the Central Pond with a wetland fringe could be cost effectively implemented with a riffle grade control structure. The elevation of the existing outlet structure could be raised and surplus water could be conveyed by an attractive surface channel.

When implemented, this project will have aesthetic, habitat, and water quality benefits immediately upon implementation.

Priority

As referenced above, this potential project could be closely tied to other projects (e.g., 'stump dump' cleanup, repurposing the maintenance yard, new western visitor entrance, and Central Pond modifications). Of these, the new visitor entrance is likely the highest priority. As discussed above, the cleanup of the maintenance yard should be done before the entrance is opened. As a result, it may be most cost effective to complete the Central Pond modification and the daylighting at the same time as the western entrance.

Active or Passive

By necessity, this project is an active intervention, requiring removal of existing subsurface piping, concrete junction boxes, and creation of a surface channel with associated engineering.

Practical Considerations

In addition to the coordinated nature of this project with the other projects in its immediate vicinity, this project will require consideration of the existing fence, the access to the maintenance yard, and the protection of the existing gas well. The cost for a project of this type would be estimated at $200 to $400 per linear foot. The length of this daylighting is estimated to be 650-ft, so a cost of $130,000 to $260,000 should be planned. As with the Euclid Creek project, this project would be permittable.

Modifying Southwest Corner Tributary

This highly modified stream and wetland in the southwestern corner of the Reservation (Figure 37) originates offsite in a buried pipe system under the mall property and is designed to move water through the site quickly, ultimately discharging to Euclid Creek immediately north of the intersection of Richmond Road and Three Village Drive. The first choice for a stream of this type is to modify its flow path to provide natural areas for water contact, where natural process can attenuate the earlier effects of piping, which effectively minimizes the natural surface area the water contacts. The initial thought was to daylight this stream. This would involve a large volume of excavation of placed fill (on the order of 20,000 cubic yards). Furthermore, the system is piped downstream under Three Village Drive. As a result of these considerations, another less expensive and equally effective approach would be to create a larger wetland 'bottom' adjacent to the southwest corner tributary. Such an effort would still improve water quality, but it could also create ½ acre or more of wetland habitat that could be designed to support wetland wildlife (e.g., birds, amphibians, macroinvertebrates, plants) while retaining access to the southwest corner of the property.

Timing

The timing for this restoration project is independent of other park restoration elements. No new access or infrastructure is planned for this part of the park, although the topography for this southwestern quadrant of the park is remarkable (natural amphitheater) and may draw its own crowd of favorite users.

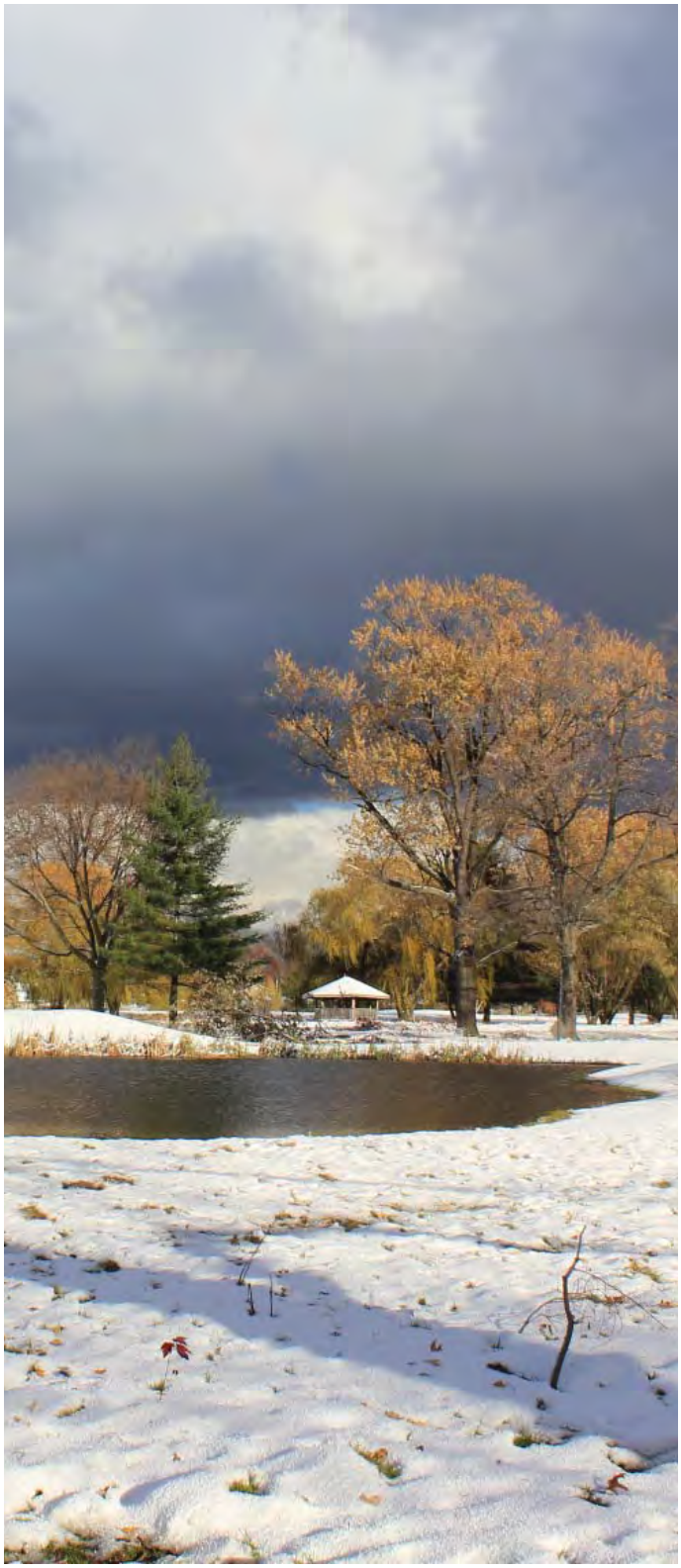


Figure 39. The Central Pond in winter conditions.

Priority

The proposed restoration can be considered an improvement to the habitat of the park, rather than a required element to slow or stop park resource degradation. As such, this effort could be assigned a moderate or low priority, depending on Cleveland Metroparks and other stakeholder goals for this part of the park. Whether such stakeholders would be in the position to help financially to implement projects in this part of the park should be investigated.

Active or Passive

This restoration element would involve active restoration elements, including excavation and grading, nature-based water management features such as berms and riffle/boulder grade water elevation controls and native planting.

Practical Considerations

Based on the upstream resource, the project's landscape context, and the fundamental ecological uplift such a project would produce, this project would likely receive state and Federal support and would be permittable.

Focal Area 2 New Western Entrance and Surroundings

The immediate focus in this area is creating a properly located entrance off Richmond Road and the Cleveland Clinic Lyndhurst Campus entrance (Figure 41). The current entrance in this vicinity is 150 ft north of River Creek Road and Richmond Road intersection and approximately 300 ft south of the proposed future entrance location. In addition, a second existing entrance exists i.e., to the existing 'seasonal house', approximately 150 ft north of the proposed new entrance.

This new entrance project is not strictly a restoration element but it does have the potential to enhance or diminish the resources of the property as well as the visitor experience. The intent of this entrance is to limit its projection into the park and capitalize on its location along Richmond Road and the two existing entrances. In addition to considerations of its size, exact location, and design, the existing 'seasonal house' to the north along Richmond Road and the existing entrance road and fenced but visible townhouse community to the south of the proposed new entrance are elements that need to be considered in the entrance design.

This is the limit of our discussion of the new entrance road, as it will need a traffic and feasibility study. However, the new entrance will dramatically increase activity in this portion of the Acacia Reservation, so it seems prudent to emphasize several projects in the immediate vicinity that will add to the visitor experience and promote enhanced ecological function.

Existing Maintenance Facility

The existing maintenance facility is in the immediate vicinity of the new entrance. As a result, this facility, which is in poor condition, will be exposed more to the public. The current condition is not the image Cleveland Metroparks would want its visitors to associate with the Acacia Reservation. As a result, the facility should be repurposed and cleaned up. This might include:

- Removing the existing entrance road and fence and establishing an attractive forest buffer,
- Reducing the size of the existing oversized gravel access area which is in poor condition and/or converting to a more park-like surface,
- Removing the 'stump dump' by tub-grinding the wood to make mulch for use in the Reservation or distributed to local homeowners, and
- Cleaning around existing buildings to be retained (e.g., greenhouse, parking and storage sheds) and removing all buildings and equipment that are no longer required.

Central Pond

The Central Pond, with its surface and subsurface drainage issues, needs to be addressed on the same timeline as the new park entrance, to avoid the development of muddy trails and poor visitor impressions and experiences. As introduced above, this pond and its piped outfall to the side slope of the Euclid Creek stream valley could be modified to great advantage to resolve the existing surface hydrology problem, to create additional pond and wetland surface area, and to create a small perennial stream providing a natural drainage path from the pond to Euclid Creek.

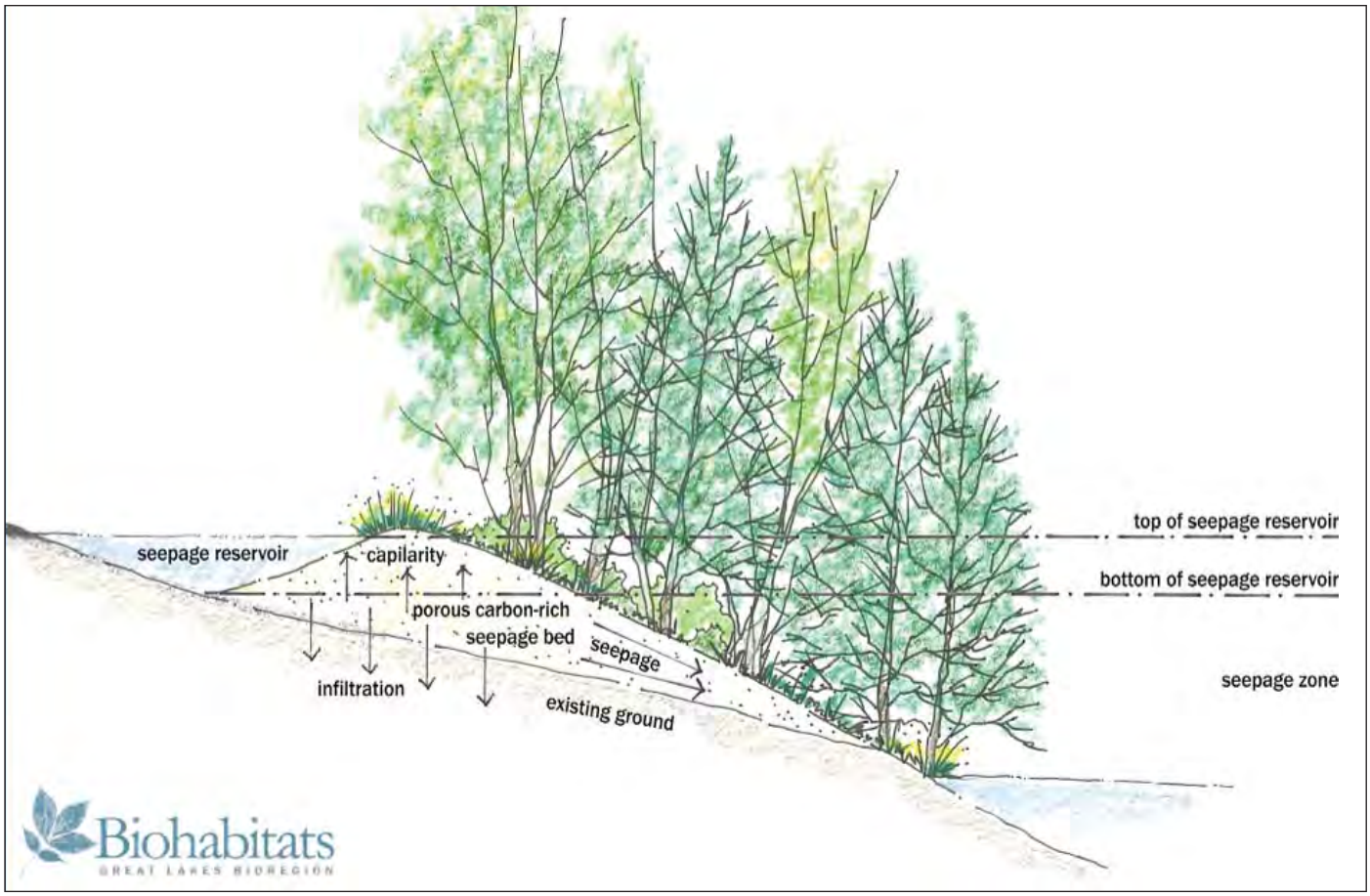


Figure 40. A typical cross section of a sand seepage berm design (Copyright Biohabitats Inc.).

Figure 41. Focal Area 2 within the context of Acacia Reservation.

The daylighting of the Central Pond outlet and channel creation will require excavation, material placement, and installation of native plant material. The enlargement of the Central Pond will likely require a blend of excavation of the existing pond margins in combination with the installation of a riffle water level control (associated with daylighted stream) to raise the pond water surface. As an element of this riffle water level control and daylighted stream, a carbon-rich sand seepage berm on the downslope side of the Central Pond can be designed to provide sustainable park visitor access to this part of the park (See image H in Visual Glossary and Figure 40). Together, these efforts will provide the most cost-effective approach to pond enlargement, increased pond depth, and improved trail conditions. These shallow margins will be designed to support a range of shallow water emergent and submersed plant beds as well as shrub wetlands, capable of supporting greater fish, amphibian, reptile and bird use.

Proceeding from the riffle grade control structure at the pond edge, a channel would be created to carry water flow and storm drainage from the pond, through a predetermined flow path (most likely through the 'stump dump'), into the floodplain of Euclid Creek, where the channelized flow would stop. This approach will enhance the existing forested floodplain wetlands and would create additional riparian wetlands along the new channel's flowpath. In addition, the channel would be an aesthetic amenity and support increased park usage – with the inclusion of some seating and programming to enliven the space.

Timing
The Central Pond restoration elements outlined above should be implemented in advance of, or concurrent with, the planning and implementation of the new park access and associated facilities to provide an ideal initial visitor experience.

Priority
The new park entrance is assumed to be a high priority item, but from a restoration perspective, it should not be opened to support greater visitor numbers and access to this distant portion of the facility until the surface drainage and inundated/saturated sections of trail are addressed.

Figure 42. Acacia's grassland will transition to forest with some areas of native meadow.

Active or Passive
The restoration elements recommended above are active restoration elements.

Practical Considerations
The daylighted stream, sand seepage park trail, and increased water surface area and elevation in the Central Pond is estimated to cost approximately $400,000, including planting. This cost does not include the removal of the 'stump dump' and assumes shallow bench excavation generating approximately 300CY of soil to be used on-site. Stream daylighting, increasing the surface area of the pond at the expense of turf, and creating additional wetland habitat around the pond would be permittable.

Meadow Establishment
From the proposed new park entrance, looking to the east is a vista that could make a meaningful impression on new visitors to the park. The current view is of long, linked grasslands with large trees, and gently rolling to level topography with a water feature. This view could be dramatically enhanced with native meadow plantings to increase the diversity of the plants and increase the apparent scale of the impression. In addition, once the meadow vegetation is established, better habitat, seed production, flower,

nectar and pollen production will create greater butterfly, other insect, and bird habitat. This will provide much more productive habitat as well as more enriched visitor experiences.

An improved forest buffer along the south edge of the meadow and the existing large trees along the north edge provide an enhanced viewshed. The meadow integrated with a sustainable trail along the south edge of the larger Central Pond will create a path that draws visitors from the parking along Richmond Road into the center of the Acacia Reservation.

Timing
This work should be initiated as early as possible to give sufficient time for meadow establishment.

Priority
The new park access will deliver visitors to a large open landscape. The proposed meadow and the Central Pond will be one of the highlights of the new park, readily accessible from the new access road. As a result, this is a high priority.

Active or Passive
The initial part of this effort is active, with drill or slit seeding of the fairway on the south side of the existing access trail to the Central Pond. Supplemental installation of plug container stock of highly valued pollinator species is also recommended to advance this function. As follow-up, more passive efforts provide greater likelihood of meadow establishment (e.g., non-native plant invasive suppression).

Practical Considerations
One of the issues worth additional consideration is deer management in this area. Fencing the meadow with deer exclusion (protection) fencing may be an effective measure to help with meadow establishment. Unfortunately, such efforts are expensive, can be obtrusive and may yield greater value in the areas where reforestation is being initiated. Assuming deer exclosures are not necessary, the meadow establishment in this area (5 acres) is estimated to cost approximately $40,000.

Figure 43. A native meadow planting with a mown path.

Matrix of Strategies

This table presents a comparison of restoration strategies in terms of their implementation timing, potential priority, and likely monitoring needs. General unit costs can be included with Cleveland Metroparks input.

Table 3. Implementation of Restoration Strategies

STRATEGY	PHASE	YEAR	ASSOCIATED MAINTENANCE TASKS	PRIORITY	MONITORING AND RESEARCH NEEDS	ORDER OF MAGNITUDE COSTS
Euclid Creek Conservation Corridor - Riparian Forest	1 to 3	3 to 10+	invasives control, herbivory supression, habitat structures	High	Seasonal condition assessment to support understanding and ability to predict performance.	$20,000 to $40,000 per acre, depending on contractor vs Metroparks staff and stewradship planting, and deer fencing.
Euclid Creek Stream Restoration	1	1 to 2	trash removal	High	Metrics of channel stability, habitat, aquatic biology, water quality, etc.	$1.75 to $3.25 million for all four elements (main stem, trubutary, daylight, and SW trib)
Forest enhancement, buffer enhancement, seedling regeneration	1 to 3	1 to 10+	invasives control, herbivory supression, habitat structures	High to Low	Seasonal condition assessment to support understanding and ability to predict performance.	$20,000 to $40,000 per acre, depending on contractor vs Metroparks staff and stewradship planting, and deer fencing.
Stream Daylighting and hydrologic restoration - headwater tributaries, southwestern stream	1 to 2	1 to 5	trash removal	High to Moderate	Metrics of channel stability, wetland condition, aquatic biology, water quality	$300 to $600 per linear ft of stream length
Pond Fringe Enhancement – Northeast Pond	2	4 to 5	installed and volunteer plant management	Moderate - Low	Metrics for aquatic biology, soil stabilization, and wetland condition.	$35,000 to $75,000 depending on volume of grading and Metroparks stewardship planting vs contractor work
Pond Fringe Enhancement – Northwest Pond	2	4 to 5	installed and volunteer plant management, access and path maintenance	Moderate	Metrics for aquatic biology, soil stabilization, and wetland condition. Pehaps creel census and user satisfaction survey	$150,000 to $300,000 depending on grading, material disposition, and planting by contractor vs Metroparks stewardship project.
Pond Fringe Enhancement – Central Pond	1	1 to 2	installed and volunteer plant management, access and path maintenance	High	Metrics for wetland condition, aquatic biology, and user satisfaction survey.	$130,000 to $260,000 based on 5,000 CY of excavation, disposition of material, and contractor vs Metroparks stewardship implementation.
Wetland Hydrology Restoration (restore forested wetlands, wet swales & meadows)	1 to 2	1 to 5	installed and volunteer plant management, management of any surface erosion, access and path maintenance	Moderate	Peak discharge and hydrograph duration, pre- and post-restoration, metrics for wetland condition and aquatic biology.	$150 to $300 per linear ft based on extent of drain removal and earthwork
Fairway to native meadow establishment moist to wet meadows as transition habitat	1	1 to 3	plant community management	Moderate to low	Seasonal condition assessment to support understanding and ability to predict performance.	$4000 to 10,000 per acre depending on Metroparks or contractor led services; drill seeding, with higher costs for areas of nursery stock planting
Existing Maintenance facility upgrade/retrofits - potential plant nursery	1	1 to 2	'stump dump' removal and grinding, mulch access, upgrade building and material/ debris removal.	High	Monitoring associated with seedling collection, growout and replanting in the rehabilitated greenhouse?	Placeholder estimate of $200,000 to $300,000 pending refinement with metroparks
Off-site stormwater management/ partnering opportunities	1 to 3	1 to 10+	litter pickup, street sweeping, other best practices	High to Low	Floatable debris and water quality	TBD based on opportunitiy, could reflect a cost or an income

Adaptive Management Framework

Adaptive management is a tool and process used to cope with the inherent changes and uncertainty fundamental to natural resource management, the ecological processes that encompass them, and potential changes in goals, intended outcomes, support and available funding over time. The goal of adaptive management is to build resilience into both the resource conditions as well as the management system, allowing for flexibility and the incorporation of new information into the decision making process.

One conceptual set of specific steps for an adaptive management process suggested (Blann et al. 2003) includes the following:

- Establish a clear and common purpose
- Design an explicit model for your system
- Develop a management plan that maximizes results and learning
- Develop a monitoring plan to test your assumptions
- Implement your monitoring and management plans
- Analyze data and communicate results
- Use results to adapt and learn

Adaptive Management is incomplete if it only focuses on woodland, or stream and wetland resource management in isolation. Instead, it should take a more holistic approach, considering water quality and stream system health, meadows, trails, wildlife and other recreational use. This is particularly true given the fact that the impetus for resource management ultimately relates to the ecosystem health of the Euclid Creek watershed, its natural systems, and the relationship to the protection of the Great Lakes.

Incorporating adaptive management into a practical system for ecological resource management involves two components: adaptive learning and stakeholder interaction. "Adaptive learning" is a process through which management protocols and priorities can be revised as new data and feedback becomes available.

To ensure the long-term resilience of the institutional and ecological processes it is necessary to facilitate a dialogue between resource managers and stakeholders. The stakeholders can be a discreet group or the broader community, but should include relevant City departments and non-governmental resource and citizen organizations. Groups responsible for land or property management (in adjacent neighborhoods), volunteer stewardship, research, education natural resource management and funding allocation are essential to the process. Through the incorporation of diverse interests, the Park District will be able to move forward with the combined support of multiple parties,

THE GOAL OF ADAPTIVE MANAGEMENT

Adaptive management incorporates research into conservation action. Specifically, it is the integration of design, management, and monitoring used to systematically test assumptions in order to adapt and learn (Salafsky, et al 2002).

Adaptive management is often referred to as experimental management. The management approach is intended to inform process-directed decisions. It has also been referred to as "learning by doing". Two major considerations of adaptive management are model-based process research and experimental design testing. The design of experimental trials has to take into account the costs and constraints of large-scale experimentation. The intent of experimentation is to develop diagnostic field trials that provide response information to better inform resource management or policy changes. It can be used to help determine critical space/time scales and necessary steps in the management process.

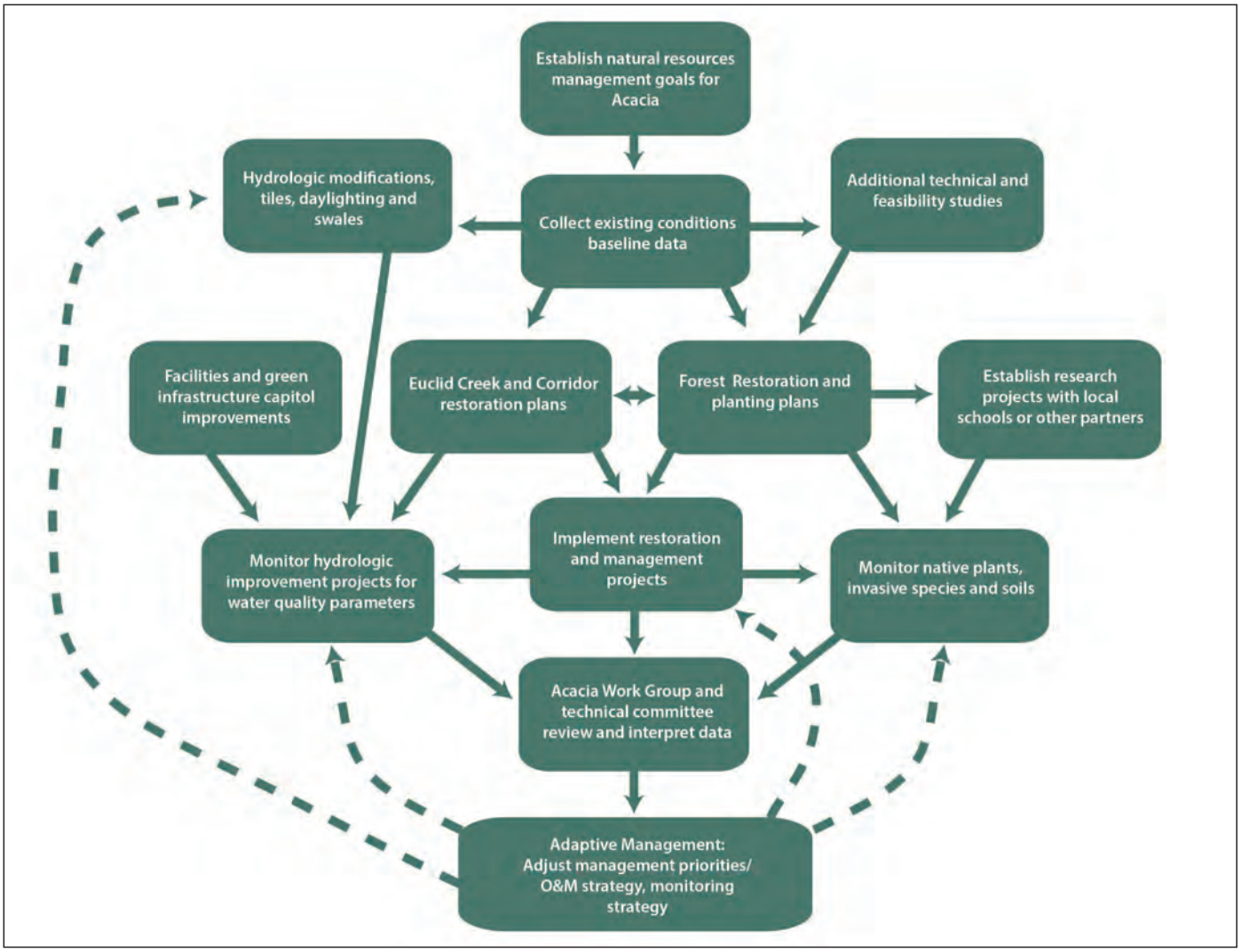


Figure 44. An adaptive management process diagram for Acacia Reservation

empowering the stakeholders and investing them in the process. This process will work best as staff members continue outreach and collaboration with representatives of the various local stakeholder groups, non-governmental organizations responsible for water or natural resource issues, and other interested individuals.

The restoration and management strategies presented in this master plan should become part of a continuous feedback loop of informed learning-by-doing. The more implementation, the more lessons learned in a collaborative process. Those involved in an adaptive management strategy ideally are part of a process that sets a trajectory for achieving established goals, guides current and future management actions, helps acquire necessary funding and resources, implements projects, and monitors and evaluates progress, to adaptively manage and maintain Acacia Reservation's ecological resources. A suggested adaptive management process diagram is provided in Figure 44.

One option for Acacia Reservation is to form an Adaptive Management Work Group with representatives of the various resource and management disciplines within Cleveland Metroparks, as well as any other interested organizations and individuals who have a role in natural resource stewardship or applied research. Ideally, a smaller Adaptive Management Technical Committee appointed by the Work Group would be responsible for coordinating and reviewing assessment needs, monitoring data collection, coordinating research group partners and evaluating system responses. The input and expertise of the Technical Committee may also help inform an understanding of any changes in the trajectory of the natural systems on site, and any needs for modifications related to management measures. Feedback from the Technical Committee can inform decisions made by the Working Group regarding future shifts in goals and objectives. Cleveland Metroparks already employs an adaptive management approach at all of its natural areas. Through its staff of professional ecologists, biologists, park planners, park managers, outdoor education managers and strategic initiative directors, the Park District has a comprehensive, interdisciplinary staff that works collaboratively on resource management issues in an investigatory, inclusive and adaptive way. Working with other partnering organizations, including community members and volunteers, an adaptive management process for Acacia Reservation can be a valuable and far-reaching effort supporting master plan implementation & success.

Figure 45. Winter sun peaks through willow trees at Acacia.

Information Needs

Listed below are information/data gaps that are crucial for project success.

- Offsite stormwater management control strategies associated with Beachwood Mall and Euclid Creek watershed upstream from the site have been secured. Beachwood Mall actively manages trash and provides underground and detention storage. Elsewhere, newer developments in the watershed also provide stormwater detention and retention. However, in anticipation of stream restoration, flow monitoring should be considered to better characterize flows to assist with the restoration design.
- Location of drainage tile distribution and associated subsurface connections (e.g., Central Pond). The more complete our understanding the less uncertainty surrounding the design and construction efforts. Often, reductions in design and construction uncertainty result in reductions in costs.
- Groundwater levels across the site (Cleveland Metroparks staff is monitoring the site with results to be provided as they become available). This data supports design decisions relating to the removal of drainage tiles, groundwater versus surface water wetland hydrology, opportunities for optimizing diversity of wetland communities, and other considerations.
- Park District funding strategy(ies) to help plan and program implementation projects.
- Preferences for removal of irrigation lines is important in developing an appreciation for limits of disturbance, locations for restoration project elements, etc.
- Cleveland Metroparks feedback on preferences for long-term forest cover composition (e.g., 90 % vs. 50%).
- Deer density through visual encounter survey will need to be monitored as active restoration is started (eg. native plantings)

Next Steps

The implementation plan for the two Focal Areas is intended to highlight the type of information and considerations that need to be applied to transition from the master plan restoration strategies to a detailed implementation plan. While the scope of this master plan was not intended to deliver a project design plan, the implementation plan provided herein should help envision the kind of considerations needed to advance the many restoration strategies identified in the master plan.

Ultimately, the recommendation is for the development of an ecological restoration "capital improvement plan" (CIP) for the entire Acacia Reservation, identifying the timing of priority individual and grouped restoration projects, line-item cost estimates to establish annual capital budget needs to fund priority projects, funding sources (Cleveland Metroparks or grant funds or combination), etc. Further efforts involving preparation of schematic design plans may be needed to fully establish CIP cost estimates, particularly near term priorities. Developing these plans to move a project into an 'on-the-ground' reality may require identifying separate preliminary and detailed design, survey, permitting, and construction costs since funds may need to be budgeted over multiple budget cycles. Ultimately, the CIP provides the detailed roadmap for which of the restoration opportunities (active and passive) we have identified in the Ecological Restoration Master Plan will be pursued, timing of when the projects will occur over the next five-years (typical time frame for a CIP), and the estimated costs required so that budget resources can be established. Typically, CIP's are updated annually to reflect changes in priorities and available funds. For a project requiring outside funding, construction funding is often not secured until at least project-specific detailed conceptual plans are available to present to project grantors. As a result it will be imperative to identify those potential projects likely to be implemented/supported with outside funding (has not been established here).

The implementation plan as conceived here also shows the difference between the initial identification of the range of potential restoration project opportunities and the prioritized concepts Cleveland Metroparks may want to address first. As an example, the Euclid Creek mainstem restoration project has been identified as a high priority early phase project, but if construction access and easements cannot be obtained with adjacent property owners at the Three Village community, the Euclid Creek mainstem restoration project could not be implemented in a meaningful way. This is because two sections of Euclid Creek on Acacia Reservation are separated by an intermediate section on the Three Village community property. As a practical matter, the development of a comprehensive implementation plan is less of a roadmap and more like a menu, with the practical implementation of individual projects changing with time based on preferences and available funding. This flexibility in future project implementation is very much driven by grantor goals, funding levels and other practical realities.

Thus, the next step for Cleveland Metroparks will be to develop a comprehensive "CIP" for the entire Reservation, including known constraints and partnering opportunities with adjacent landowners and stakeholders. This CIP would be based on this Master Plan (including the Implementation Plan included herein). This will include determining which projects will require outside funding to move these forward with schematic planning in an effort to obtain implementation funding.

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VIII– Appendices

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Appendix A - Mapping

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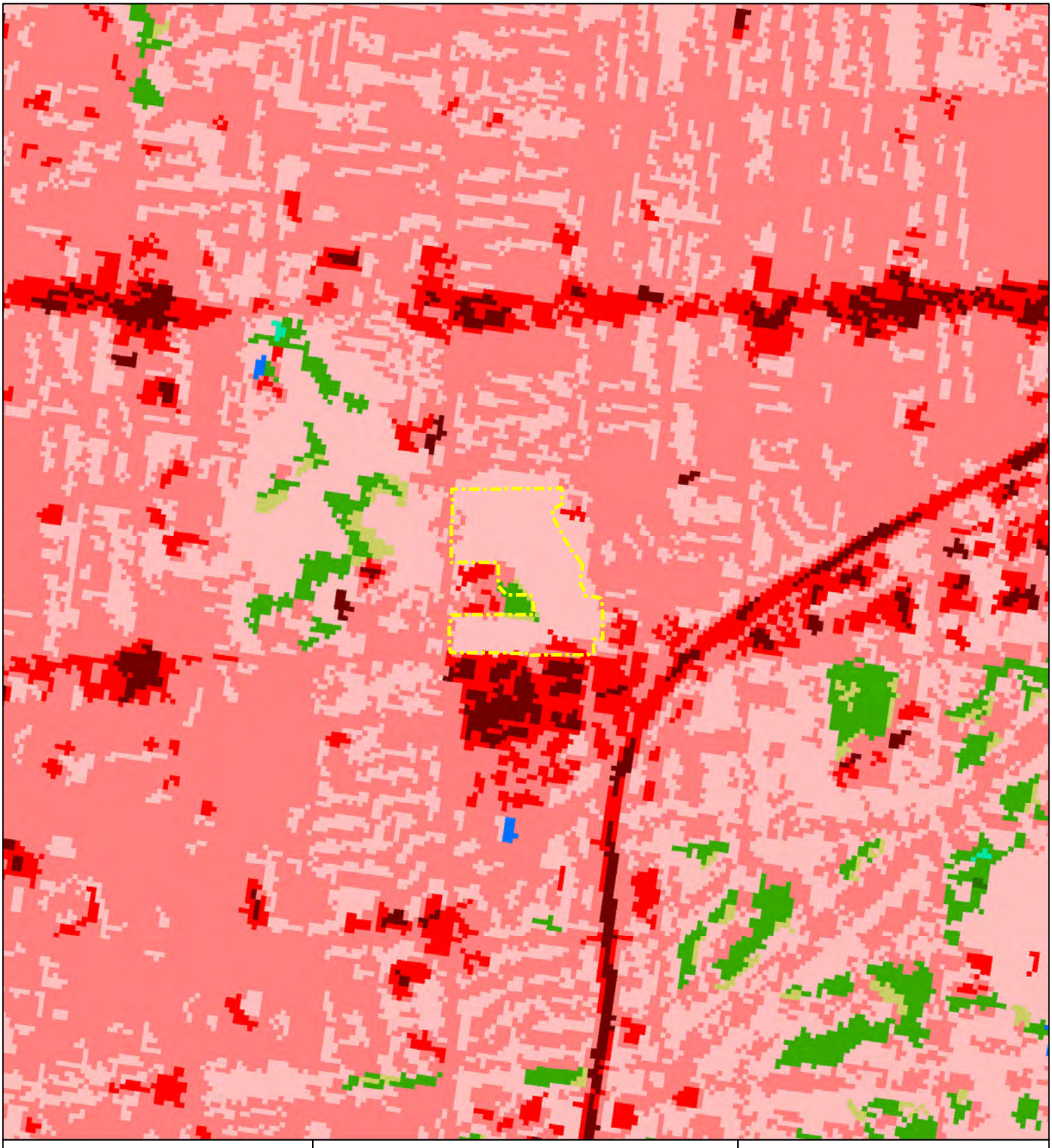


CLEVELAND METROPARKS
ACACIA RESERVATION
LOCAL LANDCOVER

- Property Boundary
- Water
- Developed Open Space
- Developed Low Intensity
- Developed Med. Intensity
- Developed High Intensity
- Barren Ground
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Grassland
- Woody Wetland

0 0.5 1

Miles

Biohabitats
GREAT LAKES BIOREGION

Cleveland Metroparks

CLEVELAND METROPARKS ACACIA RESERVATION SITE LANDCOVER

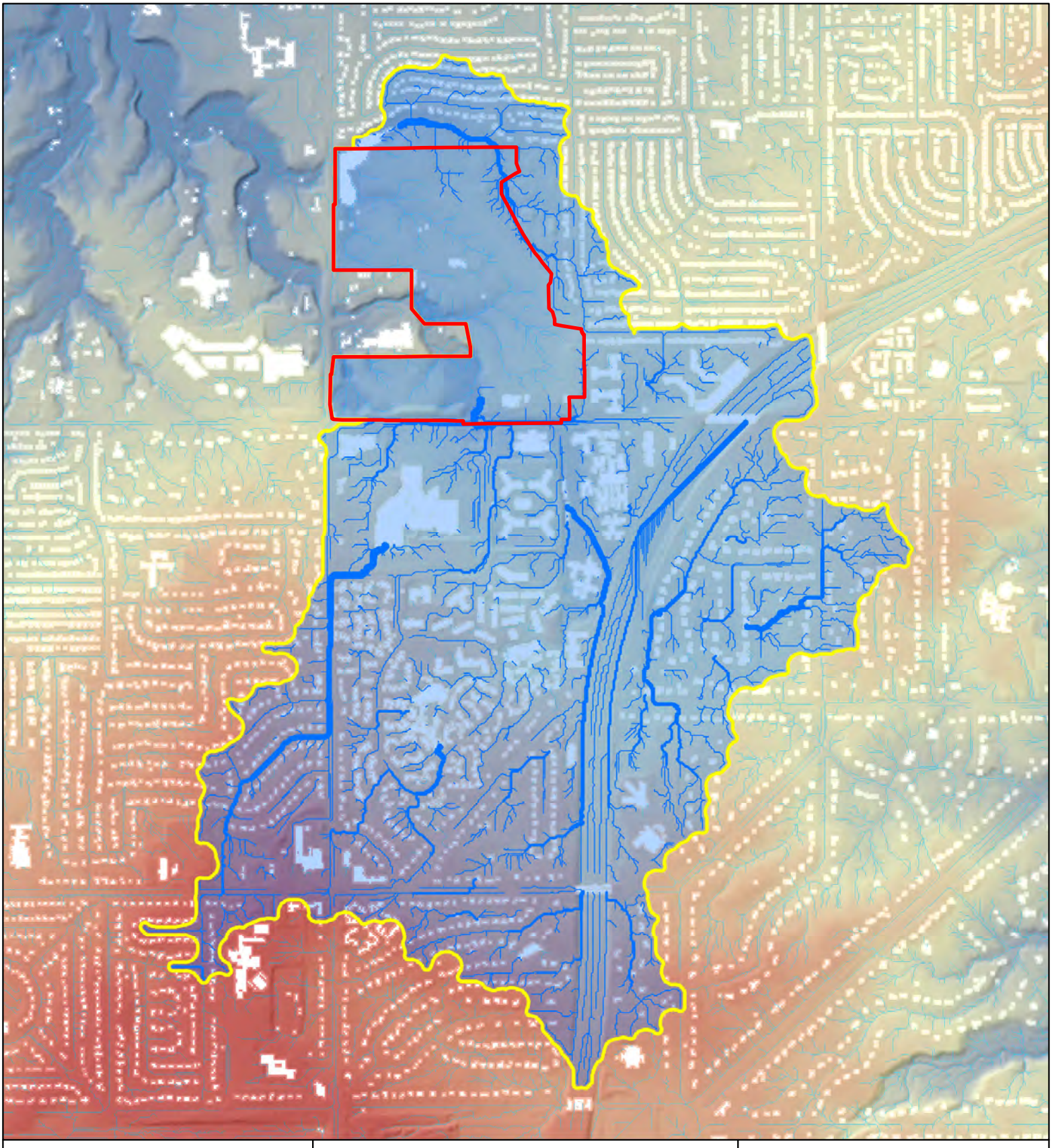
- Property Boundary
- Clubhouse
- Developed Area/Trail
- Maintained/Wooded
- Fairway Grasses
- Sand
- Water
- High Grasses

0 250 500

Feet

Biohabitats GREAT LAKES BIOREGION

Cleveland Metroparks



CLEVELAND METROPARKS
ACACIA RESERVATION
OFFSITE DRAINAGE

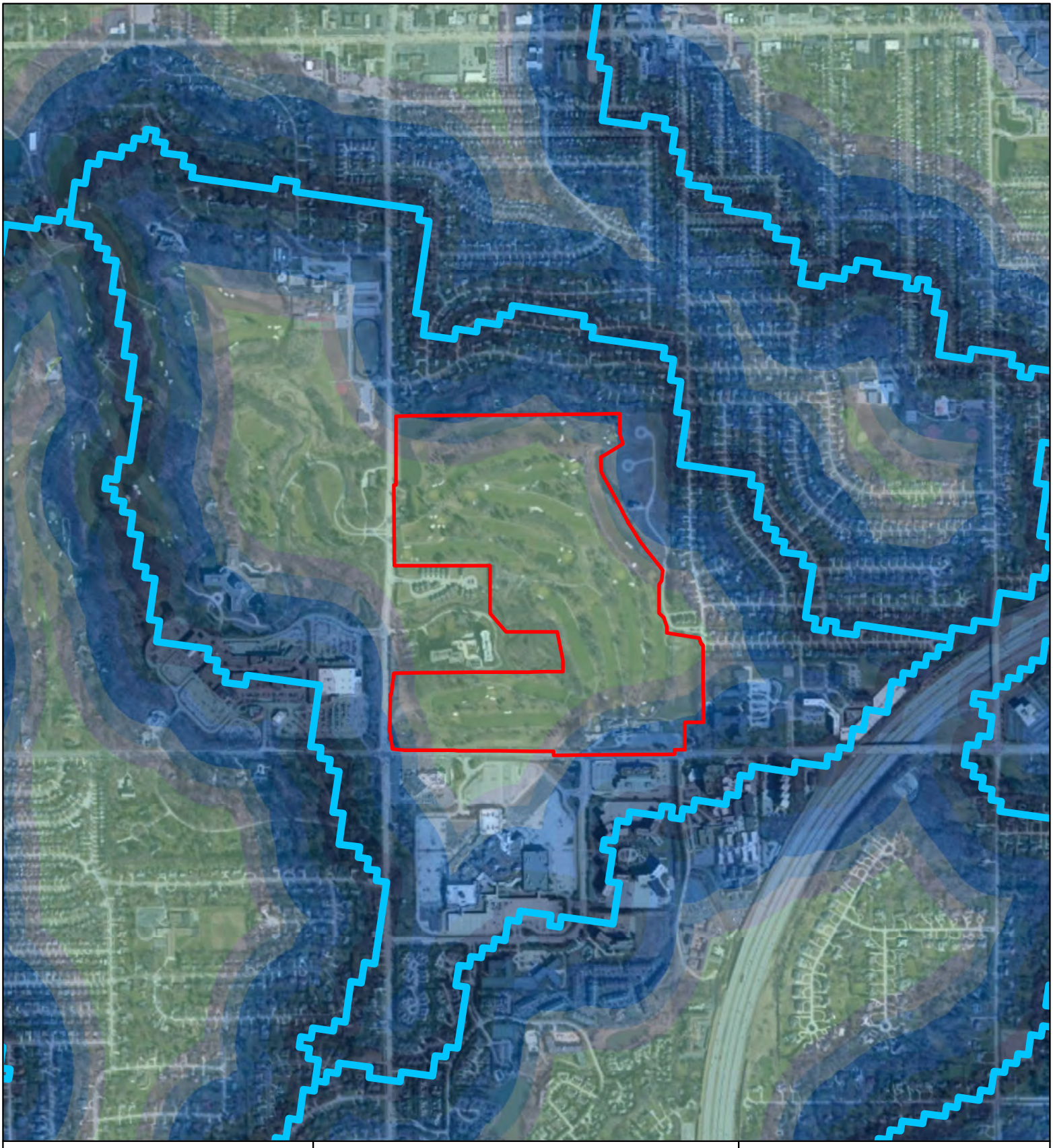
Property Boundary
Offsite Drainage Area
Surrounding Drainage

Flow Line
1st Order
2nd Order
3rd Order
4th Order
5th Order

0 1,000 2,000
Feet

Biohabitats
GREAT LAKES BIOREGION

Cleveland Metroparks



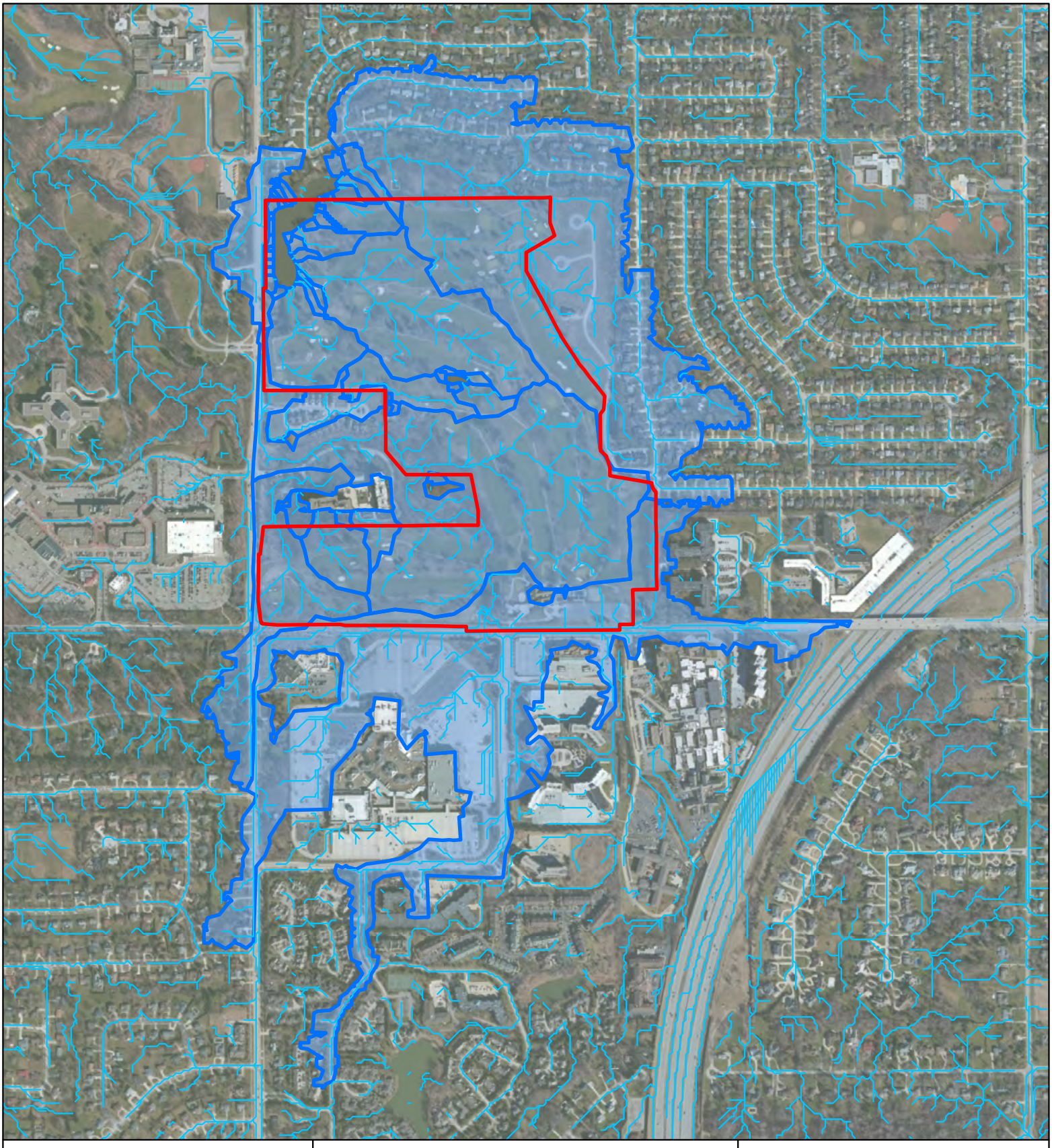
CLEVELAND METROPARKS
ACACIA RESERVATION
NHD CATCHMENTS

Property Boundary
NHD Catchment Boundary

0 1,000 2,000
Feet

Biohabitats
GREAT LAKES BIOREGION

Cleveland Metroparks



CLEVELAND METROPARKS ACACIA RESERVATION DRAINAGE BASINS

Property Boundary

Site Drainage Basin

Flow Lines

0 500 1,000

Feet

Biohabitats GREAT LAKES BIOREGION

Cleveland Metroparks

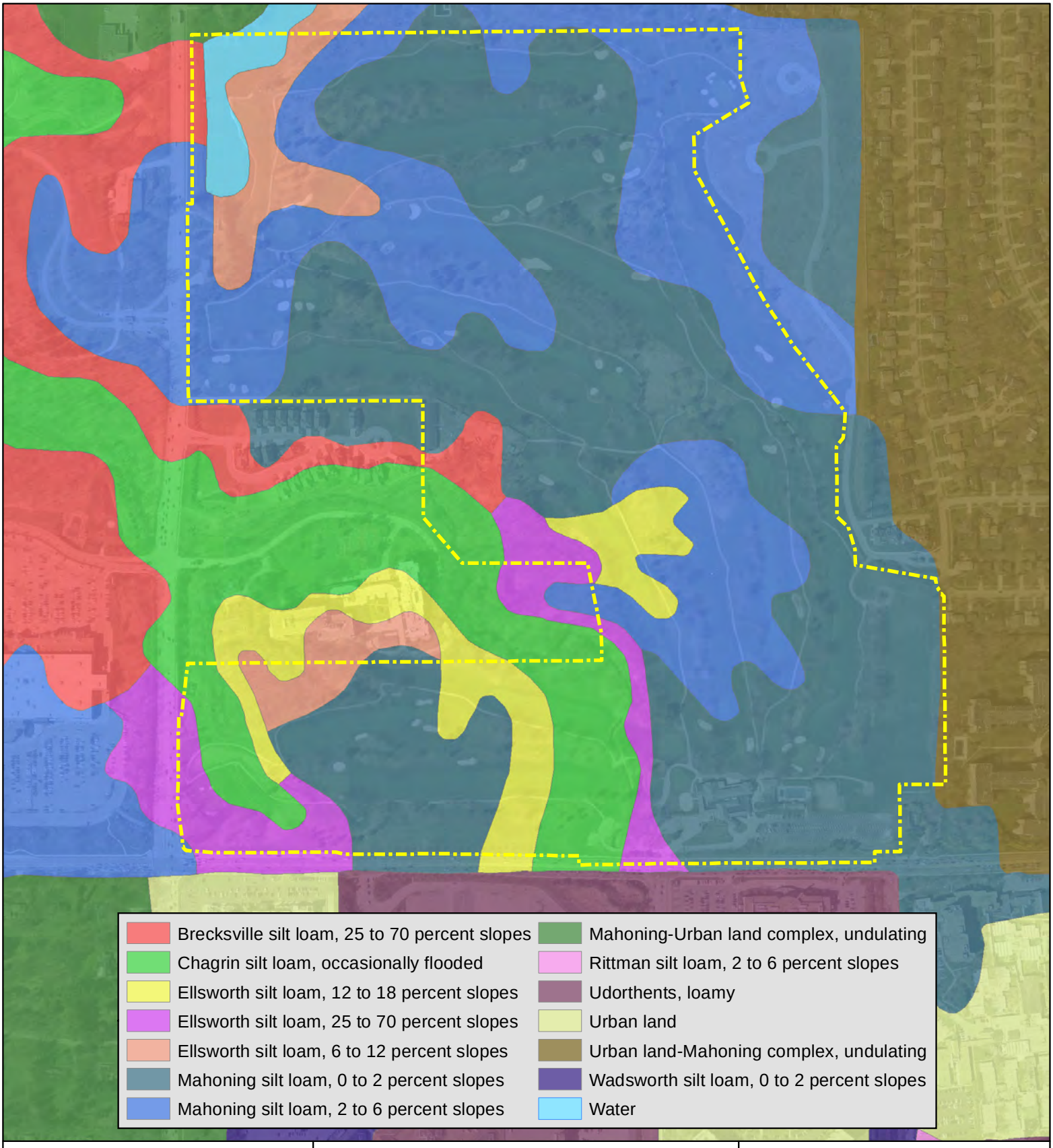
CLEVELAND METROPARKS ACACIA RESERVATION SITE HYDROLOGY

Biohabitats
GREAT LAKES BIOREGION

Cleveland Metroparks

- Property Boundary
- Freshwater Pond
- FEMA Flood Zone A (2009)
- Freshwater Emergent Wetland
- Stream
- 2-ft Contour

0 250 500
Feet



CLEVELAND METROPARKS ACACIA RESERVATION SOILS

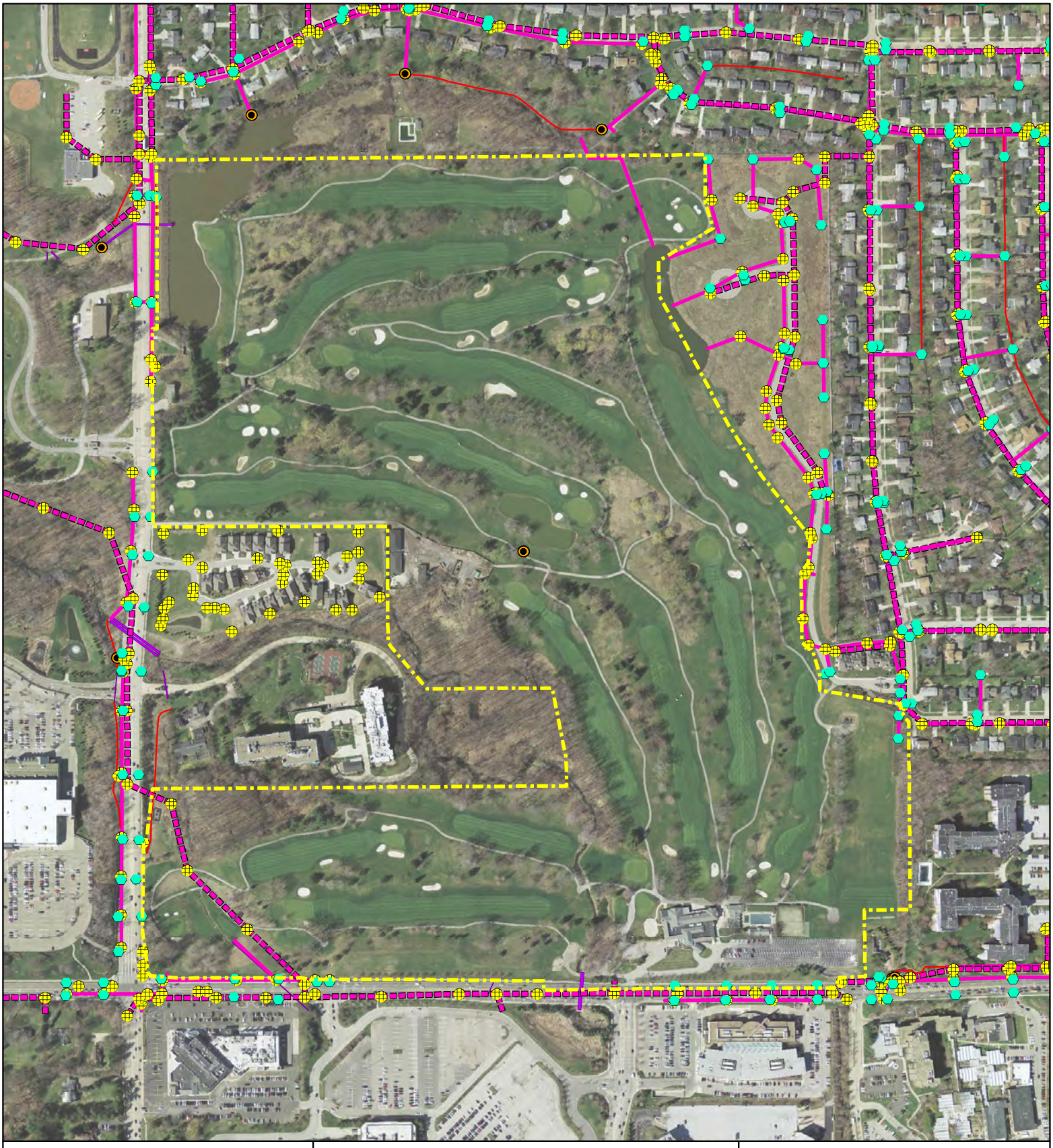
Property Boundary

0 250 500

Feet

Biohabitats GREAT LAKES BIOREGION

Cleveland Metroparks



CLEVELAND METROPARKS
ACACIA RESERVATION
UTILITIES

Property Boundary
Culvert
Storm Sewer
Sanitary Sewer
Ditchline
Outfall
Manhole
Catchbasin

0 250 500
Feet

Biohabitats
GREAT LAKES BIOREGION

Cleveland Metroparks

ACACIA GOLF COURSE
SOIL SAMPLE LOCATIONS AND FIELD OBSERVATIONS
DECEMBER 10, 2013

0 250 500 1,000
Feet

ACACIA GOLF COURSE
DRAINAGE
FEBRUARY 2014

0 250 500 1,000
Feet

Appendix B - Initial Observations Summary

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Initial observations and opportunities

(presented at the Planning Charrette with Cleveland Metroparks staff)

An initial assessment of Acacia Reservation was completed on October 28, 2013. A follow-up visit was made on November 12, 2013 with Cleveland Metroparks staff. These assessments resulted in a list of observations and opportunities for ecological restoration and the associated figure (see Biohabitats Opportunities and Opportunities/Concept Overlay figures). The underlying logic for the identification of these opportunities incorporates an emphasis on restoring the heavily modified drainage network of the property (including drainage from off-site), the restoration of a diverse native-dominated plant community, an appreciation of the Park District's and donors' restoration vision for the project, and our understanding of practical implementation, including the opportunities that present the greatest potential for ecological uplift.

Three areas that were identified for further consideration, as the team explores the interface with the neighbor stakeholder groups and revisit strategies are: the Euclid Creek corridor just east of Three Village Condominiums; the northeast corner of the property and the ongoing development of private homes and the associated stormwater management considerations at the interface with the reservation's property with the shared pond; and the sledding hill location, aspect and access.

a. Euclid Creek Forest Conservation Corridor

- ***Euclid Creek Conservation Corridor*** - The creek would be served best by a wider buffer within the valley and along the steep slopes on the southern portion of the site. The woods should be expanded to a 300' conservation corridor.

b. Forest Edge Enhancement

- ***Existing woods enhancement*** – Plantings could be used to enhance desired forest buffers along neighboring property lines and along the Euclid Creek corridor. These plantings can help soften edges, provide more vegetative diversity, and add transitional habitat. Signage and environmental art pieces may also be incorporated into trails that circulate through these enhanced forest edges, bringing further awareness to the importance of forest habitat.

- ***Western edge*** **plantings** – Newly planted and enhanced forested edges along the western side of the site can provide needed screening from the noise of the street, as well as visual buffer. These could include native evergreens. Native landscape plantings throughout the site could provide buffering, biodiversity, aesthetics and education.

c. Stream Restoration

- ***Bank stabilization along Euclid Creek*** – The southernmost portion of Euclid Creek within the Reservation has a high susceptibility to bank erosion and there is little to no native riparian buffer. This is an area that should be focused on for stream restoration efforts to help stabilize the creek and promote habitat and water quality treatment.

d. Daylighting Potential

- ***Southwestern corner*** – This corner could be an ideal outdoor room/venue for public programming, making use of the steep topography, for viewing, seating, as an amphitheater, along with integrated daylighting of the existing stream that flows north through the center. The soils moved for the daylighting could be used to enhance the surrounding berms and planted with native screening trees, to help combat the noise from the intersection on the corner.

- ***Headwater tributaries*** – there are opportunities for daylighting some of the headwater tributaries to Euclid Creek that appear to run throughout the site. This would include the restoration of wooded buffers along these tributaries and the restoration of headwater wetlands.

e. Pond Fringe Restoration

- ***The Northeast Pond -*** This pond is an important resource, and a challenge because the eastern edge is residential a residential development and is part of the stormwater management system for the subdivision. This pond could be enhanced through restoring fringe wetlands, establishing a wetland bench, and cut and fill options that could lead to littoral zone improvement and an enhanced vegetative buffer. These steps would improve water quality and promote enhanced habitat conditions for birds and aquatic wildlife. Any restoration accepted for implementation must not alter the hydrologic regime of the pond and its capacity as a stormwater management feature.

- **The Northwest Pond –** This pond would benefit from the enhanced aquatic habitat and water quality treatment provided by slope stabilization, edge plantings, and possible inclusion of floating wetland islands, .

- ***The Central Pond*** –Potential exists for wetland bench establishment, a vegetated buffer, and some framed views from trails or elevated walkways that keep visitors from getting too close to the pond in this area. This would also deter Canada geese from maintaining residence at this site. This pond appears hydrologically related to a conveyance that flows through the maintenance yard and south to Euclid Creek. This connection could be further explored and then enhanced as a vegetated conveyance system. There may also be some relation to the Northwest Pond.

f. Wetlands/Swale Potential

- ***Wetland restoration*** – There are a number of opportunities in wet/hydric soil areas for wetland restoration such as the lawn near the southern entry. Restored wetlands could be designed to consider open viewsheds.

- ***Wet swale expansion and enhancement*** – There are a number of areas most likely associated with historic streams or drainage-ways through the site that could provide improved drainage through restored surface conveyance, which also provides water quality treatment, improves habitat, and provides a new aesthetic.

g. Seedling Regeneration

- ***Recruitment*** - A few locations across the site show significant seedling regeneration. One example are the oak seedlings, which provide an opportunity to transplant onsite.

h. *Fairway t*o Meadow

- ***Native meadow establishment*** - The larger central fairways could serve as a beautiful interior relief from the forested edges in the form of native meadows dominated by warm season grasses and wildflowers that can be drill-seeded.

- ***Wet to moist native meadow establishment*** – There are locations where the current conditions indicate an opportunity for the establishment of wet meadow habitat, converting the maintained fescues to native meadow that may over time succeed to forested wetland.

i. Sand Trap Conversion

- ***Sand trap conversion*** – Some of the sand traps are poorly drained areas where cottonwood and other woody plants could be planted and managed. These wet features could be minimally managed in some cases to see how they evolve naturally over time.

j. Nursery Opportunity

- ***Plant nursery*** - The existing maintenance yard and greenhouse facility in the center of the site provides an opportunity for an onsite native restoration plant nursery, to collect the seedlings that are already beginning to regenerate, and propagate onsite natives – species to consider would include hickories, silver maple, swamp white oak and pin oak. This area also needs a good cleanup, as it is currently used as a dumping site.

k. Deer Exclosure Opportunity

- ***Deer exclosures*** – Fenced areas of varying shapes and sizes could be integrated into the landscape in an effort to promote native regeneration and overall system restoration. A long narrow band, perhaps along an edge where forested buffer is desired could be a good starting point. The design of the exclosure could even be done in conjunction with an environmental artist to help bring to light the issues associated with deer browse and hiking in young forest stands.

l. Other Observations & Opportunities

- ***Trails/surface drainage/living trails*** - There are multiple areas where wet spots intersect with the existing trail network. As the trail network is considered for the site going forward, it is going to be important to address issues of stormwater treatment and conveyance off of trails and

pervious surfaces. An opportunity exists to construct living trails at selected locations. This approach involves placing a layer of coarse sand and shredded wood (80:20 by volume) as the trail surface. The carbon-rich sand bed improves water quality, doesn't deform under pedestrian traffic, and by holding water on the landscape longer; attenuates peak flows, supports a diversity of wetland flora and fauna, and allows movement of water through the trail without degrading the trail user's experience.

- ***Bat habitat*** - Acacia Reservation provides an interesting opportunity for bat (species of concern) habitat through planting preferred species (exfoliating species such as shagbark hickory), leaving standing, dead trees, and stand-alone bat boxes placed strategically throughout the site.

- ***Off-site stormwater*** – Considerations must be made for the stormwater dominated streams that are flowing onto the site from the south. This may include stormwater treatment practices along Cedar Road to the south. Also the small watershed that drains the Northwest Pond receives stormwater contributions from residential streets and yards via stormsewer outfalls directed to this small tributary. A partnership opportunity exists with the City of Lyndhurst to install stormwater control measures (SCMs) to reduce water quality impacts to the Northwest Pond.

- ***Sledding hill and stream buffer*** - The sledding hill on the southern edge has been noted as a popular destination in winter. If sledding were to continue, it would be best to direct the sledding public away from the stream buffer and more inward toward the existing greens.

- ***West-side access*** – if this access is preferred it would be best to limit any new impervious surfaces and to keep them away from the Central Pond restoration zone.

- ***Ecological uplift*** - Other considerations from the site visit include an overall focus on restoration of ecological function (ecological uplift) with phased implementation to allow for an adaptive management approach.

Other considerations that the Biohabitats team should be aware of, as well as a review of the main themes that appeared to have consensus as overarching themes for the restoration planning effort. The following is a list of key points made by the participants during the discussion.

- The project provides an opportunity for this restoration plan to enhance how visitors experiences conservation and restoration in Cleveland Metroparks system.
- The evolution of the space provides an interpretable theme, from the Ross-designed golf landscape to a 'pristine oasis' park space.
- Development and restoration should be park-centric, providing the feel of an arboretum/preserve.
- An opportunity exists for letting some of the ecological rebirth happen organically – maybe there is an opportunity to not do anything and see what happens in some distinct locations?

- Some conflict exists between the initial programming and access concepts and the Charette's discussion of restoration-based access and site opportunities. Charette discussions have helped refine an understanding of limiting fragmentation and access into natural restored areas, and focusing new development/access improvements to the edges. Restoration is at the core of the property, while the access improvements are kept to the outer edge.
- A separate "successional garden" is not needed, because the park will be successional by its very nature
- The intern house will remain and is helpful for providing "eyes on the park".
- Consensus exists for the need of at least one shelter.
- Consensus also exists to consider revised footprints for the sledding hill, considering safety, avoidance of the floodplain, and experience.
- Consideration for trails should include options that are sustainable and can be complimentary with restoration goals for the site. The group would like feedback from Biohabitats on the feasibility/sustainability of incorporating lengths of trails for cross-country skiing/running (5 mile loop – is it even feasible?).
- The design and programming of any activities including fishing, cross-country and sledding should be deliberate.
- Ice-skating on the ponds was raised for consideration but there was no further discussion.
- Club house – There was a question of whether or not to emphasize or de-emphasize the club house. It was the consensus that the clubhouse is there but it will not be there forever. The question was posed to the group, if the building does comes down what do you want it to become/ look like in 20 years? This is something both for the Biohabitats team to consider and for the Park District's team to consider in terms of programming and restoration.

Other themes generated during the charrette included:

- The site's water management (hydrology) should be a driver for what is done first.
- Fix problems – There are issues off site, but there are plenty on site first.
- This location is envisioned to be a headwater, wet forest.
- Project sequencing, timing and phasing are important.
- Recreational opportunities interface with ecological opportunities, restoration is a priority with programming following form - done to experience site ***- Optimize but not maximize***
- Trails and programming should be consistent with ecological restoration.
- Folks want to go to water and see vistas.
- The site should be operationally sustainable.
- What goes on at North Chagrin is a consideration.

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Appendix C - Charrette Memo

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MEMORANDUM

Date: December 20, 2013
January 10, 2014 (revision)

To: Connie Hausman, Ph.D., Cleveland Metroparks

From: Jennifer Dowdell, Joe Berg, Tom Denbow and Ed Morgereth, Biohabitats, Inc.

RE: Acacia Charrette – December 5, 2013

Subject: Task 2.2 Technical Memo Documenting Charrette

On Thursday December 5, 2013, Biohabitats team members attended an internal charrette hosted at Cleveland Metroparks Headquarters. The attendees included 4 members of the Biohabitats team, and 17 members of Cleveland Metroparks staff. A list of attendees is included at the end of this memo.

The purpose of this charrette was to have a dialogue with Parks staff to develop a consistent understanding of Cleveland Metroparks' ecological restoration goals for Acacia Reservation. In addition, Biohabitats presented their preliminary thoughts on restoration goals based on our work completed in Task 1. The final goal was to hear consensus from the staff on a general understanding of restoration goals and important considerations for the Biohabitats team to be aware of as the development of the ecological restoration master plan for Acacia moves forward, while meeting the expectations set out by the donor group and the Conservation Fund. A copy of the Agenda and other handout materials provided at the charrette are attached.

INTRODUCTIONS, OVERVIEW AND OPPORTUNITIES DISCUSSION

The day was begun with a brief synopsis by Connie Hausman describing the work that the Metroparks staff has done to date in developing a conceptual plan for the improvement and management of the Acacia property, including circulation and programming opportunities, as well as the ecological goals that had been discussed internally.

These included:

1. *Restore natural water flows, drainage systems*
    - *Stream channel restoration*
    - *Floodplain re-establishment*
    - *Dismantle sub-surface drainage*
    - *Broaden swales & integrate wet depressions*
    - *Introduce shallow/vernal pools, wetlands*
2. *Restore soil composition/conditions, natural landforms*
3. *Re-establish native plant communities*
    - *Upland wet woods with understory*

- *Scrub/shrub areas*
- *Open fields, grassland & meadows*
- *Floodplain & riparian areas*
- *Specimen, naturalized & edible gardens*

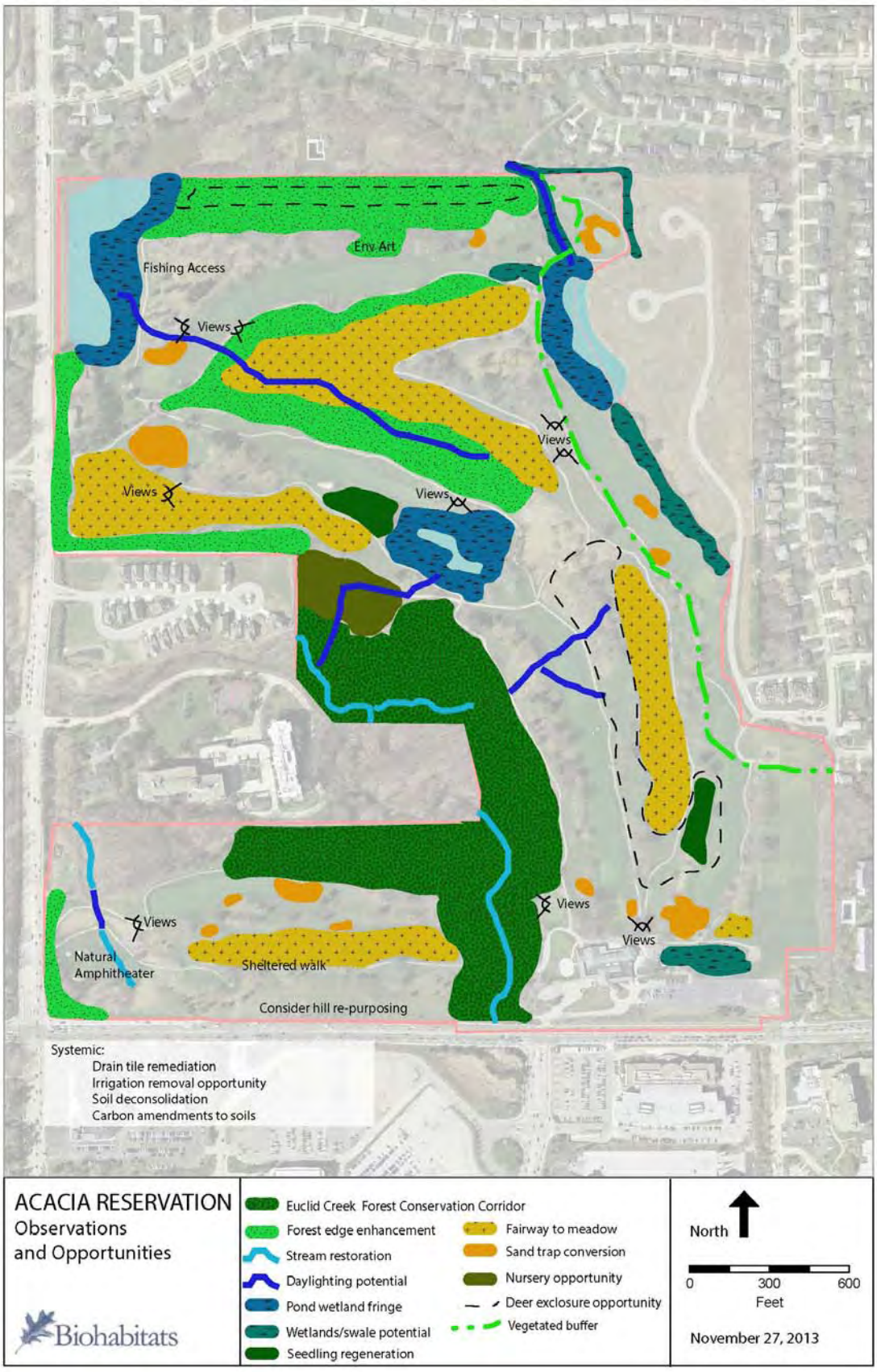
4. *Model adaptive management & incorporate scientific research*

The Metroparks conceptual plan was introduced briefly and the key components and thoughts behind the plan were shared with the group. There has been a lot of work done by the Cleveland Metroparks staff on developing and refining this plan, and it has a series of important components associated with programming and use that will be important as the Biohabitats team considers restoration master planning concepts for the site.

Joe Berg, a senior ecologist with Biohabitats, followed with a brief synopsis of the work that the master planning team has done to date and a discussion of the ecological restoration opportunities and observations that the team has developed after two site visits and a review of the existing data. (*See the Observations and Opportunities figure on the following page*.)

Joe shared images and stories of a number of ecological restoration projects and processes that have relevance to the Acacia Reservation and answered questions posed by the group with regard to feasibility, timing, and anticipated success over time. This resulted in a fruitful discussion of those elements that may become key opportunities at Acacia: restoring hydrologic function, promoting native regeneration, treating stormwater, reconnecting floodplains and improving hydrologic function of streams onsite, daylighting streams, integrating trails with restoration projects, creating littoral benches in ponds, deer fencing options, successional meadows and woodland landscapes, and integrating environmental art. Biohabitats will revisit these observations as the Ecological Restoration Master Plan is developed, to consider general structure, function, and location.

Three areas that were identified for further consideration, as the team explores the interface with the neighbor stakeholder groups and revisit strategies are: the Euclid Creek corridor within the potential easement just east of Three Village Condominiums; the northeast corner of the property and the ongoing development of private homes and the associated stormwater management considerations at the interface with the reservation's property with the shared pond; and the sledding hill location, aspect and access.


Env Art
Fishing Access
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Natural Amphitheater
Sheltered walk
Consider hill re-purposing
Systemic:
Drain tile remediation
Irrigation removal opportunity
Soil deconsolidation
Carbon amendments to soils
ACACIA RESERVATION
Observations and Opportunities
Biohabitats
Euclid Creek Forest Conservation Corridor
Forest edge enhancement
Stream restoration
Daylighting potential
Pond wetland fringe
Wetlands/swale potential
Seedling regeneration
Fairway to meadow
Sand trap conversion
Nursery opportunity
Deer exclosure opportunity
Vegetated buffer
North
0
300
600
Feet
November 27, 2013

BREAKOUT DISCUSSIONS

The remainder of the day focused on facilitated discussions amongst Metroparks staff with representatives from the Biohabitats team. These discussions were formulated to better understand the key issues and opportunities that should be reflected in the development of ecological restoration goals for an ecological restoration master plan. Participants were broken into three groups evenly with a member of the Biohabitats team serving as facilitator for each conversation. A set of questions was provided to stimulate discussion (see attachment). The summaries of key points from each breakout provided below are based on the reporting out that each small group did when the group was reconvened as a whole, following the breakout discussions.

Breakout # 1

Breakout #1 was geared toward determining the ecological priorities as they relate to (1) restoring ecosystem function and associated strategies and (2) external site influences and (3) research and adaptive management and visitor experience. The following are the key issues raised in each of the three groups, regarding ecological priorities and associated issues:

(1) Restoration Strategies

- **Subdrainage basins -** One of the main priorities is restoring the natural hydrology of the site by subdrainage area- as a way to organize restoration projects and consider phasing for implementation.
- **Subsurface drainage -** A critical next step is understanding the subsurface drainage system and flows.
- **Ponds -** There are three pond systems on site and each has a slightly different opportunity for restoration and access. Two of the three ponds are fed by stormwater (Pond 1 and 2). The third, in the center of the site (Pond 3), may not be fed solely by stormwater runoff. There is a need to better understand the hydrology of that pond and of the entire system. The Northwest Pond (Pond 2) is the key location for fishing access- individual anglers as well as small youth groups, and an important part of the restoration of that pond will be controlling the carp and other nonnative invasive fishes that have been found in the pond. A living shoreline will be a welcome enhancement, as long as access is also incorporated with pier/decks or a peninsula of land and safety benches are provided. A living shoreline could have an undulating edge of varying widths. The Pond on the eastern edge (Pond 1) of Acacia abuts a housing development still under construction immediately to the east (Acacia Country Club Estates). This is a stormwater management pond that is shared by the two entities (Cleveland Metroparks and the housing development). Therefore, considerations of restoration of that site will need to consider capacity of the pond. Opportunities were highlighted for shoreline restoration and habitat improvement, to help as part of the natural buffer along the eastern edge of the property –if these features do not pre-empt the developer's stormwater management commitments or alter storage capacity. The central pond (Pond 3) is seen as a natural feature of considerable ecological value that should be enhanced for ecological function, with shoreline/wetland enhancement, as well as further consideration of the opportunity for creating seasonal mudflats for migratory birds. Access to this pond should be limited to passive experiences- no fishing.
- **Forest/ meadow proportions** - It was the consensus of the group that Acacia be considered mostly forested in its restored state, but that there would be some temporal native vegetative zones including scrub/shrub habitats and successional meadows. There may also be the opportunity to consider maintaining some meadow or prairie, as a way of recognizing the broader regional ecology and native systems, and promoting pollinator habitat. 'Biodiversity is good.'

- **Deer** – While the current counts of deer on the site are low, there is an expectation that the population will increase as reforestation and restoration commences. This provides an important stewardship and education opportunity in terms of the presence of exclosures/ fenced areas that are protecting young forest seedlings, etc. The aesthetics of the fence and the phasing or temporary nature of the fence (preferred) should be considered and should be aligned with other efforts and restoration steps so that it is not just an exclosure but is serving many purposes. (Later conversations revealed an interest in finding another name for the enclosures.. not "deer exclosure" but something like "restoration protection zone" or "fenced reforestation protection areas")
- **Self organizing/adaptive management** - There is some interest in allowing Acacia to self-organize (wet meadow; scrub-shrub; forest; meadow) and then adapt management practices to reflect natural processes.
- **Eastern Buffer** - The eastside protection/ buffer (100') can be considered mutually beneficial in that it helps limit effects of offsite erosion, creates distinct public access points, and provides screening.

(2) External Site Influences

- **Partnering opportunities** - Several partnering opportunities exist off site (established neighborhoods to the north and east, Three Village Condominiums, Acacia Country Club Estates [under development], and other apartment complexes located in the area, etc.). Each potential partner offers a different set of conditions (access, buffering, and expectations) that will need to be considered by the plan. Deer exclosures could be considered along the east edge where seedlings have already started appearing (deer exclosure should be renamed something like "fenced reforestation protection areas").
- **Three Village Condos** – Three Village Condos is an important and potentially influential neighbor to consider (anything done in the potential conservation easement between Three Village Condos and the Acacia site along Euclid Creek would have to be considered carefully with regard to viewsheds into the creek valley from the residential development).
- **Richmond and Cedar Roads Intersection** - With regard to the SW corner traffic and views into Acacia (visual gateway), it was discussed that there should be consideration for re-sculpting the existing berms to provide new views through strategic openings. According to staff, the fence is going to be removed along the SW corner, which will provide new visual access opportunities. In addition, with the fence coming down the bus stops located adjacent to the site may pose a potential safety consideration. They may also provide new opportunities for connectivity with the community.
- **Mall connections (Upstream stormwater implications)** – There is an opportunity to draw connections between the stormwater seen and experienced at the mall and along Cedar and the streams that flow through Acacia. There are upstream stormwater effects felt onsite, so it is worth considering opportunities to connect to a Complete Streets project along Cedar. Any new stormwater practices on Cedar will help alleviate some of the pressures in the Euclid stream system in Acacia. There are potential educational and partnering opportunities associated with these efforts.
- **Downstream Euclid Creek** – The group acknowledged that Acacia's placement within the watershed provides for a teaching opportunity associated with different restoration efforts downstream of the Reservation.
- **Gas well accessibility** – A question was raised about the possibility of centralizing the wells to eliminate multiple access points and roads. There was mention of security issues associated with access to the gas wells.

(3) Research/Adaptive Management, and Visitor Experience

- **Visitor experience** – There is interest in an enhanced visitor experience but without taking away from the restoration of the site, which is the priority.
- **Deer exclosure** – There was some hesitation expressed about the extent of suggested deer exclosures on site, particularly with regard to their shape and size. The group explained that they are interested in exclosures being smaller than initially suggested, not permanent. Size is a big issue especially with regard to any question of limiting access to the site for visitors. The consensus is that the exclosures should not overwhelm the site and should be done in conjunction with other restoration efforts.
- **Study plots** – Similar to the issues raised with regard to the deer exclosures there is no interest in having the site become parceled out into many small study plots. The enclosure areas should be multipurpose – soil, tree study, etc. While there was acknowledgement of the value of research on this site, it should be done in a way that does not take away from the experience of the park user.
- **Researc**h – It was acknowledged that this is a great site to support visible partner/ restoration research; and partnership with community.
- **Tree study area** – The tree study areas (as noted above) should be integrated with the restoration activities on the site. Climate change is an issue that can be considered when studying trees and succession on the Reservation, as restoration activities commence.
- **Demonstration** – Opportunities for demonstration plantings can be interspersed throughout the reservation, as appropriate with the restoration goals. Near the clubhouse, native foundation plantings could be featured as an educational and aesthetic element, and could enhance visitor experience. There may be ways to highlight learning and research being done. Pollinator plantings could be highlighted to exhibit the importance of pollinators in ecosystem function and health.
- **Succession gardens** - In discussion of succession gardens there were different time horizons considered, from the early 5-year horizon to a longer-term 30 year horizon, and how things will change, and how that can be interpreted or show. There is interest in interpreting this change over time. There was also discussion about how much land should be allotted for succession gardens, whether they are to be dedicated-small scale gardens and interspersed through the park- either of which could enhance visitor experience. A native plant garden may also support a native plant sale associated with green house, or perhaps areas of the site could be considered nurseries as they go through successional periods with many seedlings.
- **Environmental art** – In reaction to the examples that Joe shared during his presentation there is interest in keeping the environmental art elements very limited and integrated with the park's restoration mission. Interpretive sidewalk art is okay (Philly example) but there is no interest in art sculptures just being placed around the site.

Breakout #2

After lunch the second breakout session was geared toward (1) understanding what amenities are necessary and how they will be sustainably managed within the ecological restoration context; (2) determining what recreation and programming opportunities are desirable and ecologically sustainable, and how they will interface with ecological restoration actions taken across the site; (3) educational and programming visitor experience associated with ecological restoration. The morning breakout groups were shuffled to be in slightly different groupings, in order to help open up new conversation and dialogue among staff. The summaries of key points from each breakout provided below are based on the reporting out that each small group did when the group was reconvened as a whole, following the breakout discussions.

(1) Amenities/Park Management

- **Sustainable management practices** - The priority is for the site to be a model of efficient and sustainable management through design - minimize plowing and mowing, and focus on sustainable practices and materials (pervious paving, some asphalt trails and some that are made of alternatives like soil adhesives, etc) and green infrastructure. Experiment with alternatives to salt.
- **Construction practices** - Consider the implementation of green construction practices.
- **Access/parking/structures** – Public access should be concentrated in areas along the outside of site, to extent practical, the rest remaining in a more passive experience. There is a need for expanded parking in the southeast corner and some parking at the new entry at Richmond Road. Focus development on the two main activity areas; clubhouse (limit activities/conflicts); Richmond road - Shift parking off of Richmond Road – near intern house, focus high use to NW corner. Consider availability of parking off Cedar in support of sledding hill.
- **Maintenance area** - The central location (the current greenhouse and maintenance area) could be smaller. It does not need all the current space but this area could also provide an interesting space for outdoor learning, if redesigned. Maintenance could be moved elsewhere, since it does not need to be in that location at all.
- **Trails -**
    - Existing trails – Identify areas that are currently a problem
    - Loops are important, in and out on an APT loop is needed. The rest of the trails could be alternatives to paved trails, lower impact (more natural materials) surfaces.
    - Trails should be designed to be primarily responsive to management and restoration projects.
- **Intern house** - There was a question of the use of the footprint and need for the intern house. Seems like the consensus is that the intern house is likely to remain, and will provide some “eyes on the park”.
- **Equipment use** - Minimize large equipment use and disturbance. This will depend on what is being done and what is needed.
- **Pavilions** - Need at least one pavilion space that can be reserved at the proposed entrance off Richmond.
- **Sledding hill** – People are already using it, and will continue to, so better to design it for safe access. Access from Cedar will be needed in order to accommodate emergency vehicles.
- **Boardwalks** - Bridges and boardwalks can promote limited access to restored ponds and wetlands, by providing views in. New built structures should be kept to a minimum.
- **Cross-country skiing** - No mown paths for cross-country skiing.

(2) Recreation development – what recreational opportunities are ecologically sustainable

- **Restoration** - Restoration is the first priority, therefore recreation activities can be adjusted in location as needed for conservation compatibility.
- **Fishing** – An important consideration is children’s safety. Slopes near fishing areas should be regraded as needed, along shore of NW pond in particular.
- **Trails** – There could be a full spectrum of types (asphalt, mown, etc) utilized on site.
    - All-purpose is okay. Cross-country skiing is questionable.
    - Can there be a separate trail system for cross-country running and cross-country skiing? The challenge regarding cross-country ski or cross-country running is a question of whether or not they are feasible and sustainable with the restoration strategies? Perhaps

in the short term but not in the long term – should be based on restoration plan initially and then later after a few years may want to revisit.

- **Activity areas** – There can be limited activity areas near a shelter, but no playground.
- **Clubhouse** – There is the potential for conflicts with programming around clubhouse. Would like to keep separate and do not want to drive visitors to the clubhouse.
- **Boardwalk** – One idea was for a "bird walk" along Euclid floodplain. (*The team has learned since the Charrette that this consideration will have to be sensitive to the viewshed needs and expectations from the Three Village condominium community*.)
- **Sledding hill** - Sledding hill must be considered but designed with respect to floodplain restoration, safety, and hill aspect.
- **ADA accessible paths** – Consideration for ADA compliance will be something that Metroparks will be working to define and design.
- **Other** - Dog walking, bird watching, fishing, safety of kids are other considerations for programming and interface with restoration.

(3) Educational/Programming/Visitor Experience

- **Signage** – Signage is considered a key part of the education and visitor experience but there is an interest in limiting the signs, so that they do not become overwhelming in the landscape. The suggestion was that there could be three signs, maybe up to five in total.
- **Floodplain** – The floodplain along Euclid Creek in the southern portion of the reservation property, as it enters from under Cedar Road, is an important element to interpret, with regard to issues of stormwater, watershed health and connectivity, landform and ecological function.
- **Tree study area** – Any areas where tree studies are highlighted are also an opportunity to interpret and discuss site history and natural succession (scales of time, evolution, and climate change).
- **Education** – There is an opportunity to memorialize Acacia history. Restoration is not the only story of this landscape. It is also important to interpret the anthropogenic influences that have been felt through history on the site.
- **Cliff edge** – Biohabitats, in their presentation of observations and opportunities, highlighted a steep slope above the Euclid corridor, which has characteristics of a cliff, where there could be safety concerns. Joe Berg had mentioned this area, which is at the north and east edge of the Euclid Valley, along the western edge of the central portion of the property, as a location where forest restoration would help stabilize this slope and provide some buffer and hopefully block access at a point where safety could be an issue. The group in the small discussion noted that this should be addressed.
- **Planting** – Planting celebration(s) could help kick off and promote the visitor experience at Acacia Reservation, and help draw connections between visitor experience and expectations and the restoration activities on site.
- **Stewardship** - There are opportunities with restoration activities to integrate stewardship activities. There is also an opportunity to watch what happens, a more passive witness to restoration.
- **Like Central Park** – There was a link drawn to Central Park as a model, where there are multiple services, from ecology to water, but also to provide respite and to restore human spirit.
- **Use of technology** – Smart phone apps were suggested for integrated technological learning and communications.
- **Program focal points of interest** – Some of the focal points included: NW Pond, the NE, the amphitheater-like space in the Southwest corner.

THE DONOR PERSPECTIVE

Another important discussion during the lunch break was about the donor perspective on the restoration, programming and management of Acacia Reserve. Donna Studniarz, Director of Metroparks Strategic Initiatives, gave a brief description of the acquisition process and the ongoing communications with the Conservation Fund and the donor group. The project manager for the Conservation Fund grew up in Shaker Heights and has a feeling of deep connection and understanding of the site. It has been a process of education with the donors about the need for restoration planning. Their interest is in a natural site, not unlike North Chagrin. They see and understand the need for a balance of public access and passive recreation but mainly for taking a walk, going for a jog, walking with a stroller, or doing photography. They are interested in preserving green space and limiting development and are not interested in a research (project) park. They would like a park that looks and feels like a park, more like the larger national parks of the West – preserving or promoting a sense of solitude and oneness with nature (in the woods, along the streams). Donna explained that it will be important to share a plan, and the steps that should be taken to get to the end goal, with the donor group. It was made clear that the Conservation Fund needs to be fully on board with the restoration plan, as well as the broader planning efforts being undertaken by Cleveland Metroparks, and will need to approve of the plans for Acacia.

PRELIMINARY ECOLOGICAL RESTORATION GOALS

After the second breakout session, as the discussions were wrapping up, the Biohabitats team presented draft thoughts on restoration goals, based on the Metroparks stated goals and initial efforts. Biohabitats then presented expanded restoration goals associated with the opportunities identified during field investigations. These are listed below.

A. Elaboration on Metroparks' stated Ecological Restoration Goals for Acacia Reservation

1. *Restore natural drainage systems and enhance the hydrologic function of the landscape*
    - *Stream channel restoration*
    - *Floodplain re-establishment*
    - *Assess and consider the evolution of the sub-surface drainage system (dismantle or facilitate daylighting of piped tributaries and wetlands).*
2. *Re-establish native plant communities*
    - *Forested wetland*
    - *Wooded upland buffer*
    - *Scrub shrub areas*
    - *Native wet meadow*
    - *Native upland meadow*
    - *Wetland fringe along open waters*
    - *Floodplain and riparian zones*
    - *Specimen vegetation, productive landscapes (food forest concept)*
3. *Develop an adaptive management framework that is a model for the region, and incorporate scientific research into management and monitoring programs*
4. *Manage stormwater onsite, and help treat off-site stormwater as it is conveyed onto the site*
5. *Restore soil composition/conditions, natural landforms where possible – consider the site as a research opportunity to study soils and novel ecosystems*
6. *Promote research and stewardship through programming and cooperative opportunities*
7. *Integrate public use and passive recreation (trails and boardwalks, and limited locations for active recreation like running, fishing, sledding, yoga)*

8. *Improve fishing opportunities through edge treatment of western edge pond and habitat enhancement, direct fishing to distinct locations to allow for restoration to continue elsewhere.*

B. Additional Biohabitats thoughts on Ecological Restoration Fundamentals for Acacia Reservation

1. *Hold water as high on the project site as possible, and make it 'work' to leave the site*
   - **a. Elements**
     - i. *Address soil compaction*
     - ii. *Address drainage system*
     - iii. *Address pond connections as consequence of irrigation system*
     - iv. *Incorporate 'rain gardens' in vicinity of existing structures*
     - v. *Enhance surface swale system to support wetland diversity*
     - vi. *Daylight buried stream in northeast part of site to create a continuous stream and wetland conveyance system for stormwater pond in northwest part of site*
     - vii. *Capture stormwater from new offsite residential lots in wetland swale system*
     - viii. *Enhance area and quality of narrow pond and wetland in northeast part of site*
     - ix. *Enhance area and quality of 'stormwater' pond in northwest portion of site*
     - x. *Widen wetland edge of central pond, to provide more habitat and further treatment of surface runoff in vicinity of the pond*
     - xi. *Address buried outfall from central pond to dump side slope*
   - **b. Benefits**
     - i. *Water quality benefits*
     - ii. *Attenuation of peak discharges*
     - iii. *Increased time of concentration*
     - iv. *Soil benefits*
     - v. *Wetland benefits*
     - vi. *Flora and fauna benefits*
     - vii. *Aesthetic benefits*
2. *Receive water from off-site and improve how it moves through the site*
   - **a. Elements**
     - i. *Recreate 'connected' wetland forested floodplain on Euclid Creek in vicinity of sledding hill*
     - ii. *Restore stable bed and banks of Euclid Creek*
     - iii. *Restore channel to an integrated stream and wetland in southwest part of site*
   - **b. Benefits**
     - i. *As above (1.b)*
3. *Initiate plant community restoration*
   - **a. Elements**
     - i. *Identify areas for initial forest plant installation to establish buffers (e.g., top of slope above Euclid Creek, area on south side of '3 Villages community"*
     - ii. *Manage succession of areas with strong tree seedling regeneration*
     - iii. *Establish successional pollinator meadows and manage succession to forest condition, with potential tree spade installation of larger trees, harvesting and replanting of desired species from areas with strong regeneration, etc.*
     - iv. *Experimentally investigate different scales and approaches to deer exclusion fencing*
     - v. *Implement strong native/invasive species control program*
   - **b. Benefits**
     - i. *Improved soil conditions*
     - ii. *Improved flora and fauna composition of site*

iii. *Improved aesthetics*
iv. *Increased sustainability*
v. *Improved surface and shallow groundwater hydrology*

4. *"Clean up' facility*
   a. Elements
      i. *Dumping along Euclid Creek at maintenance facility – remove debris and clear area*
      ii. *Excess surface disturbance at maintenance facility – investigate ways to treat stormwater runoff, lower % of impervious surface if possible*
      iii. *Evaluate opportunities with existing gas wells*
      iv. *Address irrigation infrastructure throughout the site (above ground pump boxes, concrete pads, below ground pipelines, etc.)*
      v. *Remove soil stockpile mound along Mayfield Road (consider converting to supplemental parking area and north facing sledding hill)*
      vi. *Replace overgrown chain link fence with more appropriate boundary fence*
   b. Benefits
      i. *Model appropriate stewardship to visitors*
      ii. *Improve site aesthetics*
      iii. *Reduce long-term operations and maintenance*
      iv. *Optimize use of disturbed 'edge' conditions while minimizing interior fragmentation*
5. *Incorporate Cultural/Social Reflections that tie to Ecological Restoration of Acacia Reservation*
   a. Elements
      i. *Environmental art display/programs*
      ii. *Memorialize elements of site history (e.g., golf course designer, etc)*
      iii. *Information presenting Metroparks restoration approach and elements -signage*
      iv. *Before and after images at specific locations, consider highlighting some viewsheds that may evolve over time*
      v. *Consider development of digital way-finding program that highlights story of Acacia*
   b. Benefits
      i. *Environmental education*
      ii. *Increased stewardship*
      iii. *User ownership*

There was consensus that these were appropriate goals but there was some discussion that a goal associated with site programming and access was still needed. Further discussion resulted in this draft statement on the site goal:

6. *Site programming is ecologically driven, with recreation and access being optimized but not maximized.*

   a. Elements
      i. *Integrate trails in a way that promotes ecological function, avoiding direct access to certain restored areas, and providing environmental learning*
      ii. *Consider programming that takes advantage of natural forms in the landscape, avoids fragmentation of existing habitat and ecological zones of note, and enhances ecological function*
      iii. *Programming and recreation should be responsive to the ecological and park-like desires for this space.*

iv. *Trails are designed in a way that respects the ecological function of restoration projects on site as the priority of the park.*
v. *Include trails that are designed to avoid wet areas and sensitive ecological zones but still provide a looped and interesting visitor experience, mixing APT (loop) with other types of materials on secondary trails.*
vi. *Limit active recreation to fishing, walking, trail running, strolling, nature enjoyment and sledding on a devoted and adequately designed sledding hill.*
vii. *Create off site partnerships with the community to help promote stewardship.*

b. Benefits

i. User enjoyment
ii. Environmental education
iii. User ownership

CLOSING DISCUSSION

In closing, there was a brief discussion of other considerations that the Biohabitats team should be aware of, as well as a review of the main themes that appeared to have consensus as overarching themes for the restoration planning effort. The following is a list of key points made by the participants during the discussion.

- There is an opportunity for this restoration plan to enhance how a visitor experiences conservation and restoration in the Metroparks system.
- There is an interest in considering the evolution of the space, from the Ross-designed golf landscape to a 'pristine oasis' park space.
- Development and restoration should be park-centric, providing the feel of an arboretum/preserve.
- There is interest in letting some of the ecological rebirth happen organically – maybe there is an opportunity to not do anything and see what happens in some distinct locations?
- There was some conflict with the initial plan programming and access concepts and today's discussion of restoration-based access and site opportunities. Today's discussion has helped refine an understanding of limiting fragmentation and access into natural restored areas, and focusing new development/access improvements to the edges. Restoration is at the core of the property, while the access improvements are kept to the outer edge.
- A separate "successional garden" is not needed, since the park will be successional by its very nature
- The intern house will remain for now and is helpful for providing "eyes on the park".
- There is a need for at least one shelter.
- There is consensus in beginning to consider revised footprints for the sledding hill, considering safety, avoidance of the floodplain, and experience.
- Consideration for trails should include options that are sustainable and can be complimentary with restoration goals for the site. The group would like feedback from Biohabitats on the feasibility/sustainability of incorporating lengths of trails for cross-country skiing/running (5 mile loop – is it even feasible?).
- There should be intentionality in the design and programming of any activities including fishing, cross-country and sledding.
- Ice-skating on the ponds was raised for consideration but there was no further discussion.

- Club house – There was a question of whether or not to emphasize or de-emphasize the club house. It was the consensus that the clubhouse is there but it will not be there forever. The question was posed to the group, if the building does comes down what do you want it to become/ look like in 20 years? This is something both for the Biohabitats team to consider and for the Metroparks team to consider in terms of programming and restoration.

Other big ideas (themes) generated during the charrette included:

- The site's water (hydrology) should be a driver for what is done first.
- Fix problems – There are issues off site, but there are plenty on site first.
- This location is envisioned to be a headwater, wet forest.
- There will be a need to consider sequencing, timing and phasing.
- Recreational opportunities interface with ecological opportunities, restoration is a priority with programming following form - done to experience site ***- Optimize but not maximize***
- Trails and programming should be consistent with ecological restoration.
- Folks want to go to water and see vistas.
- The site should be operationally sustainable.
- What goes on at North Chagrin is a consideration.

Attendee List

Acacia Charrette

December 5th 2013

Name:	Title	Sign-IN
Constance Hausman	Plant & Restoration Ecologist	
Jennifer Grieser	Senior Area Manager	
Terry Robison	Interim Director	
John Reiner	Wetland Ecologist	
Erik Shaffer	NR Area Manager, East	
Mike Durkalec	Aquatic Biologist	
Richard Kerber	Chief Planning and Design Officer	
Patty Stevens	Manager of Park Planning	
John Cardwell	Senior Landscape Architect	
Brian Zimmerman	Chief Executive Officer	
Joe Roszak	Chief Operating Officer	
Brad Shawhan	Senior Park Manager (Acacia)	
Donna Studniarz	Director of Strategic Initiatives	
Wendy Weirich	Director of Outdoor Education	
Barb Holtz	Nature Center Manager (Acacia)	
Andy Hudak	Youth Outdoors	
Ralph Protano	Trails Development Manager	
Tim Krynak	Naturalist	
Biohabitats Team		
Tom Denbow	GL Bioregion Team Leader	
Joe Berg	Senior Ecologist	
Ed Morgereth	Senior Ecologist	
Jennifer Dowdell	Landscape Ecological Designer	

ACACIA RESERVATION
ECOLOGICAL RESTORATION MASTERPLAN CHARRETTE AGENDA
December 5, 2013

AGENDA TOPICS	WHO	START	END
Welcome and Introductions	Cleveland Metroparks	9:00	9:15
Agenda and Overview	Cleveland Metroparks	9:15	9:25
Review of Cleveland Metroparks Conceptual Plan	Cleveland Metroparks	9:25	9:40
Ecological Restoration Observations and Opportunities	Biohabitats	9:40	10:10
Introduce Potential Ecological Restoration Goals	Biohabitats	10:10	10:35
Break	All	10:35	10:45
1st breakout discussion - Ecological Priorities	Biohabitats facilitate small groups	10:45	11:30
Feedback to Entire Group	Biohabitats	11:30	11:45
Summarize What We Heard	Cleveland Metroparks	11:45	12 noon
LUNCH break	All	12 noon	1:00
2nd breakout - Amenities &Programming as They Interface with Ecological Restoration	Biohabitats facilitate small groups	1:00	1:45
Feedback to Entire Group	Biohabitats	1:45	2:00
Summarize What We Heard	Cleveland Metroparks	2:00	2:15
Collaborative break	All	2:15	2:30
Review Ecological Restoration Goals Draft and Begin to Make Revisions	Cleveland Metroparks Facilitator & Biohabitats staff	2:30	3:15
Recap and discuss next steps (partner, community meetings, schedule)	Biohabitats and Cleveland Metroparks staff	3:15	3:30

Questions for Breakout Discussion

There will be three tables for the breakouts. Participants will be broken into three groups evenly. Biohabitats will be facilitating each group's conversations and reporting out for each group.

Breakout #1 This session is geared toward determining the ecological priorities as they relate to 1) restoring ecosystem function and 2) public perception and restoration education.

a) Restoration Strategies (Group 1)

1. Passive vs. active restoration; low management input vs. high management input
2. How do we incorporate community resilience (ability of the site to respond to changing environmental threats…climate change, pests/pathogens, invasive species establishment)
3. How is deer management considered as part of this process?
4. How is habitat restoration prioritized across the site; By community type (meadow, forest, riparian corridor, and wetland)?
5. Phased implementation; how do you envision restoration occurring across the site? focal areas? by tee? Edges inward?
6. Any thoughts on an onsite plant nursery to assist with restoration?
7. How can buffers along edges near residential communities be developed as habitat and screen?

b) External Site Influences (Group 2)

1. How are projects developed to deal with offsite stormwater issues?
2. How do we work within the watershed to help mitigate stormwater issues? (Beachwood to the south, new development to the NE, homeowners association to the N)
3. Do we manage sound and noise issues along Cedar and Richmond? How?
4. What viewscape issues are most concern and what might be done to address them within the context of the restoration plan?
5. How do well leases affect restoration? Access?
6. Where are the potential property access locations for phased restoration work? Could these be turned into permanent public access locations?
7. What other external site influences may need to be considered?

c) Research/Adaptive Management, and Visitor Experience (Group 3) (How do we include surrounding schools and academic partners to help us document the changes that will occur at Acacia?)

1. Can deer exclosures be incorporated into the landscape and yet also allow the public to feel included? What educational message should be conveyed with these exclosures?
2. Is there an opportunity for the Tree study area?
3. Is it worth it to have a demonstration garden that symbolizes succession? (Earlier there was a proposed a succession garden that could be used as a focused interpretive location for what "change" to anticipate)
4. Opportunity for Acacia to be a native seed source for other restoration initiatives with a focus on rare plants?

5. How do we incorporate the golf course history into the plan?
6. Environmental / Golf art?

Breakout #2 This session is geared toward 1) understanding what amenities are necessary and how they will be sustainably managed within the ecological restoration and 2) determining what recreation and programming opportunities are desirable and ecologically sustainable, and how they will interface with ecological restoration actions taken across the site.

a**) Amenities/Park Management (Group 1)**

1. What are the additional infrastructure needs at Acacia (i.e. access, parking, shelters)
2. How will daylighted streams, restored swales, and wetlands affect circulation? what alternatives may be considered to paved trails to better interface with these restored habitat areas?
3. What are the limitations or restrictions for additional development based on restoration plan?
4. Are there priorities for reservable areas?
5. How will paved surfaces (parking, trails) be managed in the winter with the potential conflict between salt and wetland habitat?
6. What viewscapes should be incorporated – will they be maintained? (eg clubhouse) others?
7. Are there areas that should have limited access, foot traffic, to promote habitat / hydrologic function?
8. How could the site be considered in terms of outdoor room experiences? One experience on the east and north? Another in the southwest leg?

b) Recreation development (Group 2)

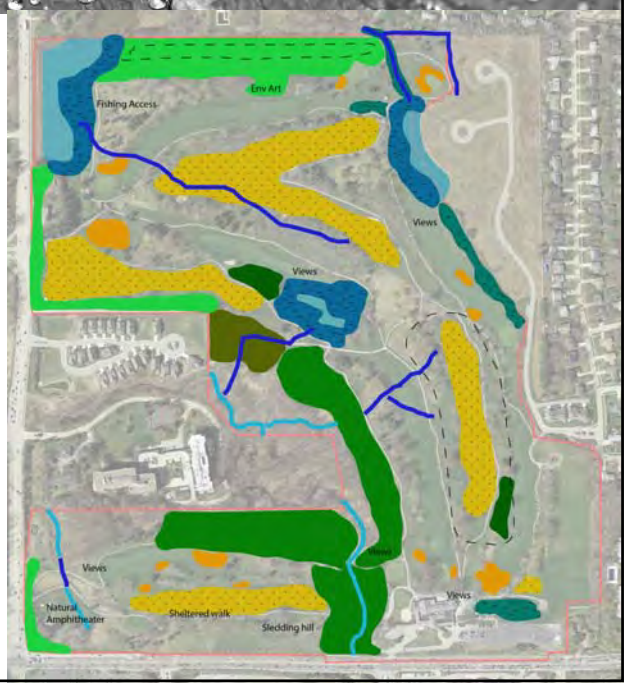
1. What recreation opportunities are ecologically sustainable at Acacia?
2. Are there recreation opportunities that are not ecologically sustainable at Acacia?
3. Trails
    a. What types of trails are sustainable (paved vs. natural surface vs. boardwalk) – what are typical paving styles used park system wide? Other potential options that could be a pilot for sustainable design techniques? (pervious pavers)
    b. Should the trail system include loops? How many? Lengths?
    c. Where should ADA accessible routes be provided?
    d. How should bridges or boardwalks be incorporated?
4. What are the various seasonal recreation opportunities? (fishing….ice fishing, cross country skiing) Are they compatible with the restoration plan?

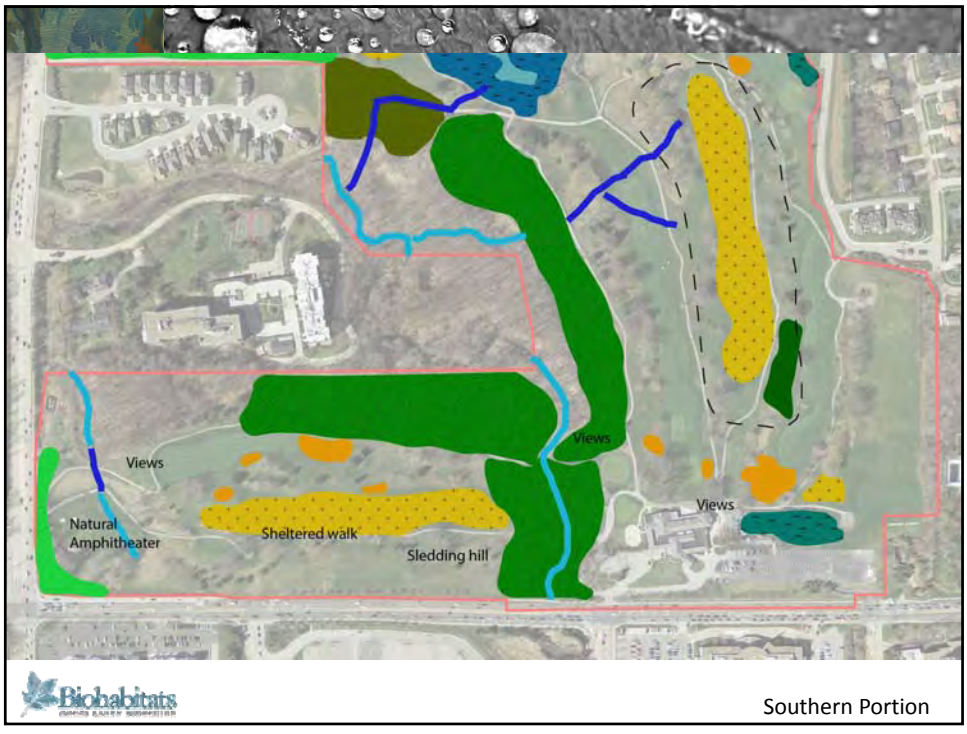
c) Educational/Programming/Visitor Experience (Group 3)

1. What are the themes or messages that should be interpreted for Acacia?
2. How much interpretive signage should there be? Where?
3. Where are the programming focal points of interest?

4. How can restoration activities be integrated with stewardship projects that may be undertaken by park users?

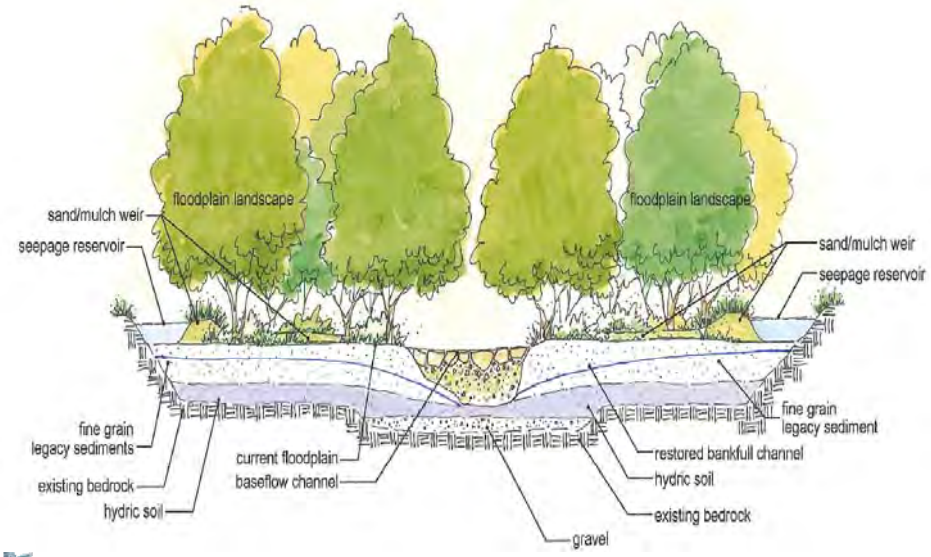
Overall Acacia Site





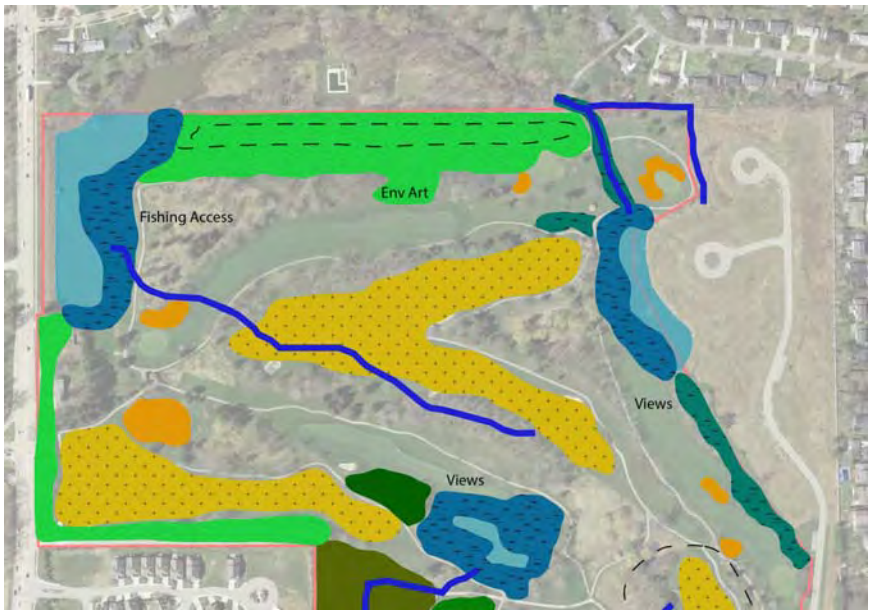
Southern Portion

Floodplain Connection

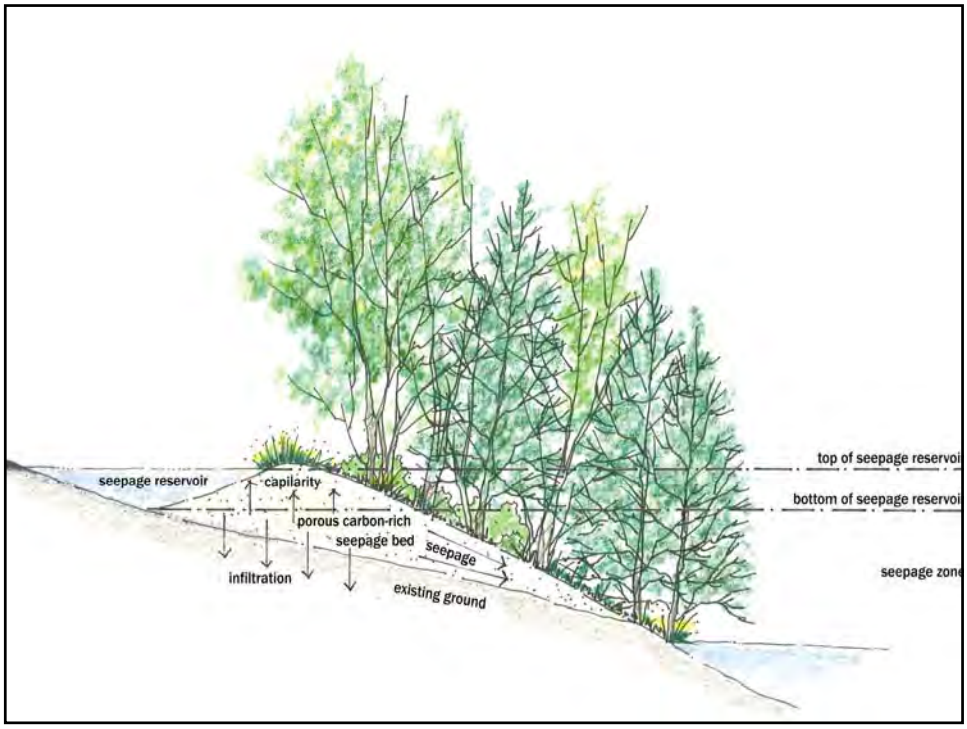


Day-lighted Stream

Biohabitats



Wetland Swales


top of seepage reservoi
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porous carbon-rich
seepage bed
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infiltration
existing ground


Upslope water stored
Trail surface during construction


Trail 10 years later


Wetland condition on upslope side of sand seepage trail

Pond Littoral Bench

Central

Rain Gardens

Integrated Trails and Bioretention / Rain Gardens – Lynchburg, VA

Deer Fence

Pollinator Meadows and Managed Successional Woodlands

Biohabitats

Meadow succession– Fairmount Park, Philadelphia,

Environmental Art

Biohabitats

Biohabitats

Willow Play Structure and Garden – Morton Arboretum, IL

Environmental Art – Morton Arboretum, IL

Soil Ideas

- The nature and extent of soil compaction on the project site has yet to be determined
  - If next weeks evaluation documents compaction
    - A 'grass subsoiler' can be used
      - We'll need to address irrigation lines
    - http://www.youtube.com/watch?v=8l8JAG_sJWA&feature=player_embedded
- Soil quality not a big problem, but
  - Too little Carbon and too much Nitrogen
    - Amend with carbon-rich material (shredded wood and/or biochar)
      - Benefits soil health and sequesters/supports processing of legacy golf course materials
    - http://www.greenyourhead.com/2013/01/the-perfect-mobile-biochar-machine-maybe.html

Dealing with Legacy Drainage

- An unmapped system of groundwater drain tiles exists
  - Existing drain tiles continue to perform
    - This limits ultimate ecological restoration opportunity
  - Drain tiles should be rendered ineffective
    - Complete removal—very intrusive, very effective
    - Plugging at outlet end—easy to do once all the outlets are located, some may be in ponds, partially effective
    - Breaking tile network at some high frequency (e.g., every 50 to 100-ft)—requires understanding of tile drain distribution, moderately intrusive, moderately effective
    - Pumping clay-cement slurry under high pressure into drain tile outlets—not intrusive, moderately effective

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Irrigation Network

- Need to understand and address irrigation system connection to ponds
- Unlike drain tiles, abandoned irrigation lines do not continue to degrade site conditions
- Reasons to leave in place
  - Defer or incrementalize cost of removal
  - Reduce intrusive ground disturbing activities
- Reasons to remove
  - Reduce long-term problems (e.g., wind thrown trees or earthwork) with exposure

Biohabitats

Irrigation Network

Biohabitats

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Appendix D - Detailed Restoration Goals

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Detailed Restoration Goals

ECOLOGICAL RESTORATION GOALS

1. *Restore natural drainage systems and enhance the hydrologic function of the landscape*
    - *Stream channel restoration*
    - *Floodplain re-establishment*
    - *Assess and consider the evolution of the sub-surface drainage system (dismantle or facilitate daylighting of piped tributaries and wetlands).*

2. *Manage stormwater onsite, and help treat off-site stormwater as it is conveyed onto the site*

3. *Hold water as high on the project site as possible, and make it 'work' to leave the site*

a. Elements

i. *Address soil compaction*
ii. *Address drainage system*
iii. *Address pond connections as consequence of irrigation system*
iv. *Incorporate 'rain gardens' in vicinity of existing structures*
v. *Enhance surface swale system to support wetland diversity*
vi. *Daylight buried stream in northeast part of site to create a continuous stream and wetland conveyance system for stormwater pond in northwest part of site*
vii. *Capture stormwater from new offsite residential lots in wetland swale system*
viii. *Enhance area and quality of narrow pond and wetland in northeast part of site*
ix. *Enhance area and quality of 'stormwater' pond in northwest portion of site*
x. *Widen wetland edge of central pond, to provide more habitat and further treatment of surface runoff in vicinity of the pond*
xi. *Address buried outfall from central pond to dump side slope*

b. Benefits

xii. *Water quality benefits*
xiii. *Attenuation of peak discharges*
xiv. *Increased time of concentration*
xv. *Soil benefits*
xvi. *Wetland benefits*
xvii. *Flora and fauna benefits*
xviii. *Aesthetic benefits*

4. *Receive water from off-site and improve how it moves through the site*

c. Elements

xix. *Recreate 'connected' wetland forested floodplain on Euclid Creek in vicinity of sledding hill*
xx. *Restore stable bed and banks of Euclid Creek*
xxi. *Restore channel to an integrated stream and wetland in southwest part of site*

d. Benefits

xxii. *As above (1.b)*

5. *Improve fishing opportunities through edge treatment of western edge pond and habitat enhancement, direct fishing to distinct locations to allow for restoration to continue elsewhere.*

6. *Re-establish native plant communities*
    - *Forested wetland*

- *Wooded upland buffer*
- *Scrub shrub areas*
- *Native wet meadow*
- *Native upland meadow*
- *Wetland fringe along open waters*
- *Floodplain and riparian zones*
- *Specimen vegetation, productive landscapes (food forest concept)*

7. *Initiate plant community restoration*

e. Elements

xxiii. Identify areas for initial forest plant installation to establish buffers (e.g., top of slope above Euclid Creek, area on south side of '3 Villages community"

xxiv. Manage succession of areas with strong tree seedling regeneration

xxv. Establish successional pollinator meadows and manage succession to forest condition, with potential tree spade installation of larger trees, harvesting and replanting of desired species from areas with strong regeneration.

xxvi. Experimentally investigate different scales and approaches to deer exclusion fencing

xxvii. Implement strong native/invasive species control program

f. Benefits

xxviii. Improved soil conditions

xxix. Improved flora and fauna composition of site

xxx. Improved aesthetics

xxxi. Increased sustainability

xxxii. Improved surface and shallow groundwater hydrology

8. *Develop an adaptive management framework that is a model for the region, and incorporate scientific research into management and monitoring programs*

9. *Restore soil composition/conditions, natural landforms where possible – consider the site as a research opportunity to study soils and novel ecosystems*

10. *Incorporate Cultural/Social Reflections that tie to Ecological Restoration of Acacia Reservation*

g. Elements

xxxiii. Environmental art display/programs

xxxiv. Memorialize elements of site history (e.g., golf course designer, etc)

xxxv. Information presenting Cleveland Metroparks restoration approach and elements -signage

xxxvi. Before and after images at specific locations, consider highlighting some viewsheds that may evolve over time

xxxvii. Consider development of digital way-finding program that highlights story of Acacia Country Club's conversion to a public park

h. Benefits

xxxviii. Environmental education

xxxix. Increased stewardship

xl. User ownership

11. *Site programming is ecologically driven, with recreation and access being optimized but not maximized.*

a. Elements

i. *Integrate trails in a way that promotes ecological function, avoiding direct access to certain restored areas, and providing environmental learning*

ii. *Consider programming that takes advantage of natural forms in the landscape, avoids fragmentation of existing habitat and ecological zones of note, and enhances ecological function*

iii. *Programming and recreation should be responsive to the ecological and park-like desires for this space.*

iv. *Trails are designed in a way that respects the ecological function of restoration projects on site as the priority of the park.*

v. *Include trails that are designed to avoid wet areas and sensitive ecological zones but still provide a looped and interesting visitor experience, mixing APT (loop) with other types of materials on secondary trails.*

vi. *Limit active recreation to fishing, walking, trail running, strolling, nature enjoyment and sledding on a devoted and adequately designed sledding hill.*

vii. *Create off site partnerships with the community to help promote stewardship.*

b. Benefits

i. *User enjoyment*

ii. *Environmental education*

iii. *User ownership*

12. *Promote research and stewardship through programming and cooperative opportunities*

13. *Integrate public use and passive recreation (trails and boardwalks, and limited locations for active recreation like running, fishing, sledding, yoga)*

14. *"Clean up' facility*

i. Elements

xli. *Dumping along Euclid Creek at maintenance facility – remove debris and clear area*

xlii. *Excess surface disturbance at maintenance facility – investigate ways to treat stormwater runoff, lower % of impervious surface if possible*

xliii. *Evaluate opportunities with existing gas wells*

xliv. *Address irrigation infrastructure throughout the site (above ground pump boxes, concrete pads, below ground pipelines)*

xlv. *Remove soil stockpile mound along Mayfield Road (consider converting to supplemental parking area and north facing sledding hill)*

xlvi. *Replace overgrown chain link fence with more appropriate boundary fence*

j. Benefits

xlvii. *Model appropriate stewardship to visitors*

xlviii. *Improve site aesthetics*

xlix. *Reduce long-term operations and maintenance*

l. *Optimize use of disturbed 'edge' conditions while minimizing interior fragmentation*

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Appendix E - Soils and Subsurface Drainage Rapid Site Assessment

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Soils and Subsurface Drainage Site Assessment

December 10, 2013 - Sarah Roberts

- All locations of soil samples, soil profiles and surface drains (informing subsurface drainage system) were GPS'd
- Three soil samples were taken (soil samples #1-3).
- Five soil profiles were described (soil profiles A-E). Three were taken at the soil sample location.
- Soil textures were roughly estimated. After referring to the soil survey the references to 'loam' are most likely silt loam and references to 'clay loam' are most likely silty clay loam
- Approximately 2 inches of snow on the ground. Cloudy and 23 degrees Fahrenheit
- Recommendations with respect to assessing compaction:
    - Excavate a soil pit to observe the entire soil profile more easily
    - Use a soil pentrometer/compaction tester to measure compaction either from the surface or within each horizon from the face of the soil profile in an excavated pit
- Recommendations with respect to assessing groundwater table:
    - Excavate a soil pit to observe the entire soil profile more easily. The redox features need to be assessed from bottom up not top down to determine if they are related to groundwater (refer to soil profile B)
    - Cleveland Metroparks staff have installed wells, so this maybe not an issue
- Soil Sample #1
    - Taken ~5feet away from 4" HDPE slotted drain pipe inlet with grate
    - Sample taken from 0-6 inches (*depth measurements are always from the soil surface)
    - Sampled ~ in MgA soil map unit
- Soil Profile A
    - Taken at the soil sample #1 location in the fairway
    - No obvious compaction. Most notable difference is the transition in texture at 8 inches – increase in fines (silt/clay).
    - Groundwater observed at 12 inches
    - Many roots from 0-8 inches
    - 0-1 inches was mostly roots

Depth (inches)	Matrix color	Redox (%, color, location)	Notes
0-8	10YR5/2	-	Loam
8-12	10YR5/1	25%, 10YR5/6, masses	Clay loam

- Soil Profile B
    - Taken at the end of the fairway to the west from soil profile A
    - Groundwater seeping in at 13 inches
    - No obvious compaction. Most notable difference is the transition in texture at 9 inches – increase in fines (silt/clay).
    - Many roots from 0-9 inches
    - Augered down to 30 inches; soil started to appear brighter which would indicate the redox feature in the surface are from surface saturation and slow infiltration not from the groundwater below; this appearance could also be a result of the auger disturbing the soil too much and mixing the gray matrix color with the red redox concentrations
    - Noticeable difference in texture and matrix color at 9 inches. Obvious that the golf course management was "working" the surface horizon.

Depth (inches)	Matrix color	Redox (%, color,	Notes

		location)	
0-9	10YR3/3	-	Loam
9-18	10YR5/2	25%, 10YR5/6, masses	Clay loam

- Soil Profile C
  - Taken at a place where a clay tile was located in the middle of fairway, running east-west (assumed to be a main line for this drainage running to the NW pond)
  - Top of clay tile at 18 inches

Depth (inches)	Matrix color	Redox (%, color, location)	Notes
0-2	10YR3/4	-	Loam
2-5	10YR4/2	1%, 10YR5/6, pore linings	Loam
5-12	10YR4/1 or 10YR4/2	-	Clay loam

  - No obvious compaction. Most notable difference is the transition in texture at 5 inches – increase in fines (silt/clay).
- Soil Profile D
  - Taken adjacent to water level recording well 136AC163 and along fairway just north of the houses
  - Within an area designated as a Fairway to Meadow opportunity
  - 0-2 inches had many roots
  - Roots present from 0-8 inches
  - Decaying roots observed. These can be mistaken as redox concentrations along the pore linings.
  - No groundwater observed
  - No obvious compaction. Most notable difference is the transition in texture at 8 inches – increase in fines (silt/clay).

Depth (inches)	Matrix color	Redox (%, color, location)	Notes
0-2	10YR3/4	-	Loam
2-8	10YR5/1	1%, 10YR5/6, pore linings	Loam
8-16	10YR5/1	-30%, 10YR5/6, masses	Clay loam

- Soil Sample #2
  - Taken at soil profile D
  - Sampled 0-6 inches
  - Sampled ~ in MgA soil map unit
- Soil Sample E
  - Taken north of the "sledding hill" within the fairway
  - No groundwater observed
  - Had the least moisture of all the soil profiles described
  - 0-1 inches had many roots
  - No obvious compaction. Most notable difference is the transition in texture at 7 inches – increase in fines (silt/clay).

Depth (inches)	Matrix color	Redox (%, color, location)	Notes
0-7	10YR3/3	-	Loam
7-12	10YR4/2	-	Clay loam

12-19	10YR5/2	-25%, 10YR5/6, masses	Clay loam

- Soil Sample #3
  - Taken at soil profile E
  - Sampled 0-6 inches
  - Sampled ~ in MgA soil map unit
- Surface drain (10 inch corrugated PVC) with a grate
  - located in the SW corner relatively close to soil profile E/soil sample #3
  - main pipe invert at 36 inches
  - two, 4 inch lateral pipes; both had an invert of 18 inches
    - one flowing SW; the other flowing NW
  - Flow observed in the main pipe; drops from the 4 inch pipe flowing NW

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