



9 Mile Creek Watershed District
Discovery Point Ecological Master Plan



9 Mile Creek Watershed District Discovery Point Ecological Master Plan

Project conducted by the 9 Mile Creek
Watershed District

This report prepared by Barr Engineering Co.



Table Of Contents

Introduction	2
Leaving a Legacy	3
Site History & Existing Conditions	4
Restoration Strategy	5
Phasing Plans	6
Plant Communities	7
Ultimate Plant Communities	8
Selective Clearing	9
Planting the Site	11
Plant Community Management	13
How Long Will it Take	14
Evaluating Progress	15
Expanding the Vision	16
Appendix A: Species Planted	17
Appendix B: Site Photos	19
Appendix C: Ash Tree Survey	27
Appendix D: Restoration Areas	28

Introduction

This plan describes our process for regenerating the native plant community at Discovery Point. Nine Mile Creek Watershed District sees native plant community regeneration as an important endeavor because of the prevalence of invasive plant species in woodlands throughout the District. Invasive plants negatively impact native understory vegetation often leaving soils exposed to the erosive forces of water and wind. Soil that washes into natural water bodies as a result of erosion can disrupt fish habitat, reduce water clarity and provide excess nutrients that can result in algae blooms.

Vision:

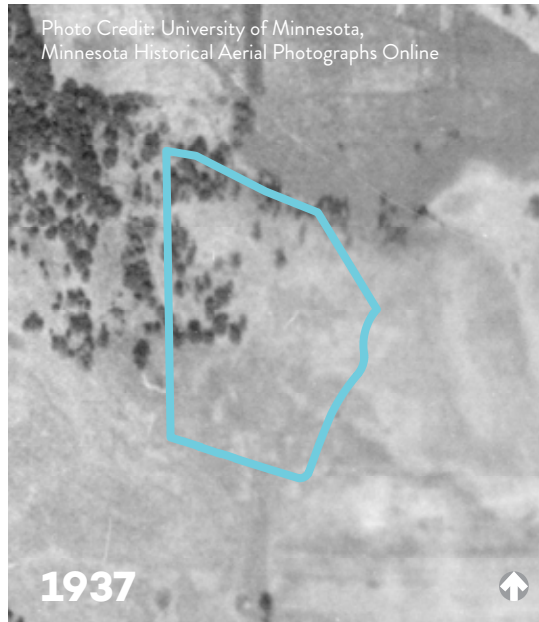
To regenerate urban habitat in the face of aggressive invasive plant species and to demonstrate for property owners within the District how to stabilize soils and increase plant diversity in urban settings.

Goals of the Discovery Point Landscape:

- To demonstrate the process of invasive species control and native plant establishment
- To be a teaching site for the regeneration of upland native plant communities within the District
- To demonstrate native landscape management process and techniques and expenses
- Protect and restore local ecological health



Plant Community Regeneration is a process to establishing a native plant community by emphasizing relationships between ecological systems and the human influences on these systems.



Leaving a Legacy

The land and original home on the site were donated to the Nine Mile Creek Watershed District by the previous homeowner, Barbara Kaerwer. The District renovated and added to the house and began operating there in late 2014. Barbara dedicated her life to protecting the natural environment. Through her tremendous act of kindness, Discovery Point has become a place for all visitors to learn how to be good stewards of the land.

Barbara Kaerwer was an art historian and collector. She and her husband had a strong land conservation ethic, leading them to donate their Eden Prairie property to the Nine Mile Creek Watershed District for future protection and continued access to the public.

What is Discovery Point?

Discovery Point is the headquarters of the Nine Mile Creek Watershed District. It is a unique educational facility where visitors can learn best practices in water management and conservation. Discovery Point provides visitors with direct and memorable experiences with stormwater management and conservation—in both residential and commercial settings.

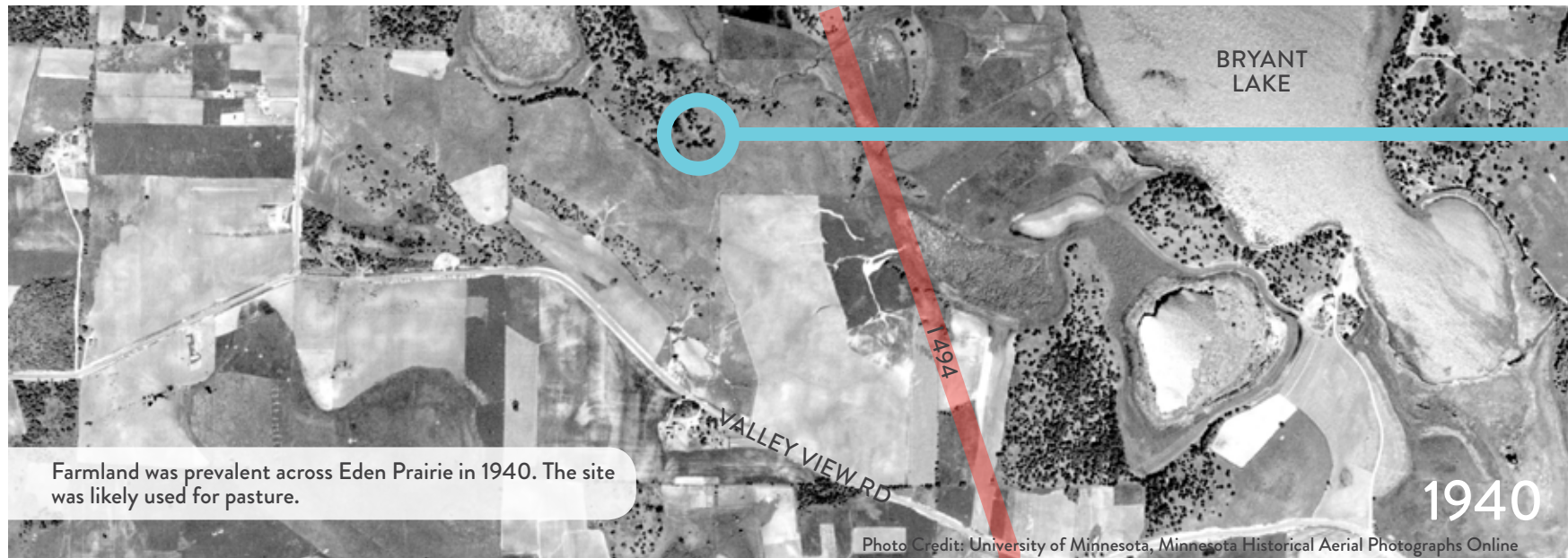
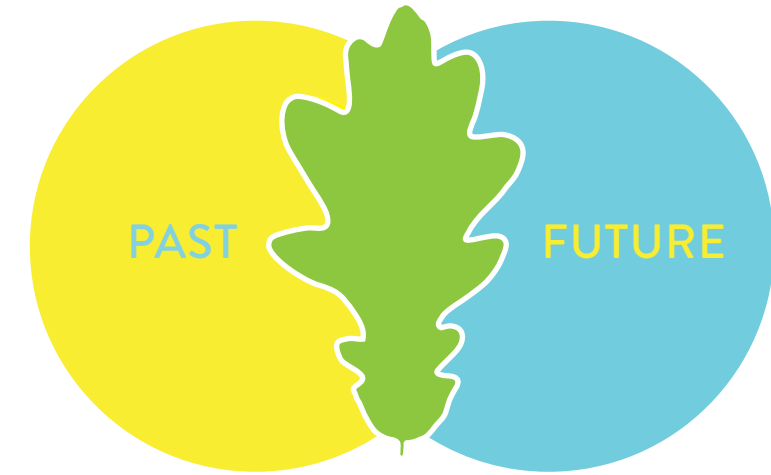
Visitors learn best practices in water management and conservation in a wooded setting. The 5.3 acre site is located in a residential neighborhood in Eden Prairie overlooking the Cardinal Creek Conservation Area. The wooded site connects to local walking trails and a wetland. Working stormwater structures and artful landscape features provide opportunities to learn while enjoying peaceful surroundings. Visitors touch, step around, and move through landscape elements designed for users to gather ideas, and to explore their own interests and curiosities. Inside the building, there are additional resources that help visitors understand what they see outdoors, how to start a project, and what the District is up to.





The Helen Allison Savanna Scientific and Natural Area, in East Bethel, MN, is a remnant oak savanna that resembles what would have been present at Discovery Point prior to agricultural development.

PRECEDENT LANDSCAPE



Farmland was prevalent across Eden Prairie in 1940. The site was likely used for pasture.

Photo Credit: University of Minnesota, Minnesota Historical Aerial Photographs Online

Site History & Existing Conditions

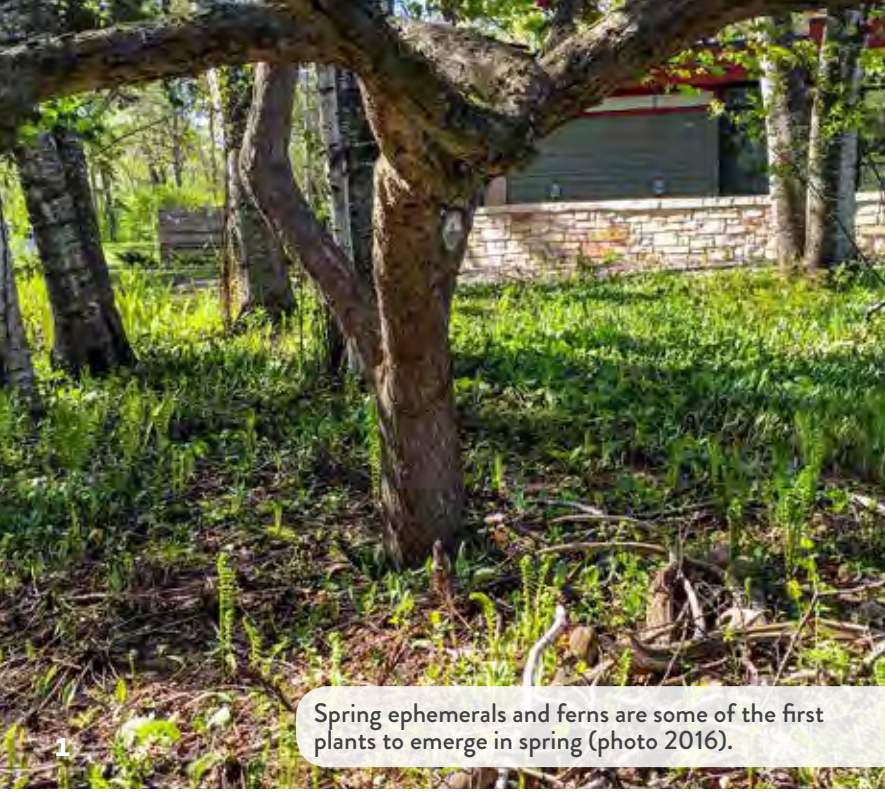
Original land surveys (1847 – 1907) from the US General Land Office records provide valuable detail about how the state looked at the time of European settlement. This data shows that the region of Discovery Point consisted of oak barrens; defined as scattered trees and groves of oaks of scrubby form with some brush and thickets. This community had a great diversity of prairie grasses and wildflowers along with shrubs and a few trees. The landscape was altered by settlers who suppressed fire and introduced agriculture. Extensive clearing and grazing occurred. At Discovery Point farming eliminated many species and degraded the soil. By the time grazing ceased and suburban development began, many native species were no longer present and could not re-colonize the site. This made the site vulnerable to invasive species establishment. When the District took ownership of the site it was composed of a tree canopy of a few remnant oaks, a variety of weedy trees, and a variety of non-native trees planted by the previous property owner. Invasive species such as common buckthorn, Tartarian honeysuckle, garlic mustard and narrowleaf bittercress dominated the site. The site is also heavily grazed by deer and rabbits.

A primary motivating factor to implement this program in native plant regeneration for the District is to prevent erosion in woodlands. Sheet erosion can occur in woodlands where invasive species like garlic mustard and buckthorn have out competed native understory plants resulting in exposed soil under the trees. Heavy rain eats away at the topsoil slowly eroding the entire surface and potentially polluting natural water bodies downstream. Earthworms complicate this issue by quickly devouring fallen leaves and eliminate natural duff.



Parts of the property were left to naturalize after agricultural activities ceased. This resulted in the proliferation of a low diversity understory dominated by dense stands of buckthorn and garlic mustard (Discovery Point 2016).

2016



1 Spring ephemerals and ferns are some of the first plants to emerge in spring (photo 2016).



2 Regeneration begins at specific nodes of existing native vegetation.

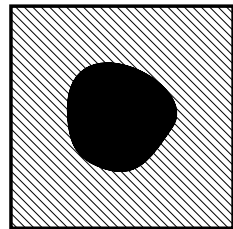


3 Buckthorn out competes many plant species resulting in degraded habitat and reduced diversity.

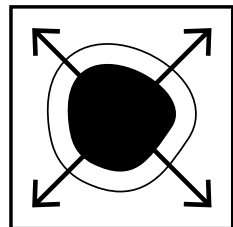
Regeneration Strategy

The District's goal is to demonstrate how to re-introduce and *maintain* native plant communities in the face of degraded soils, invasive plant species and aggressive wildlife browsing. This can feel like a daunting task!

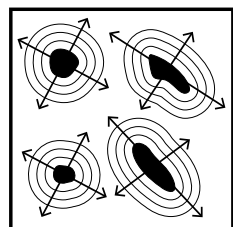
An incremental approach is to be taken at Discovery Point to make the effort affordable and practical. Plant community regeneration begins by protecting remnant colonies of native plants:



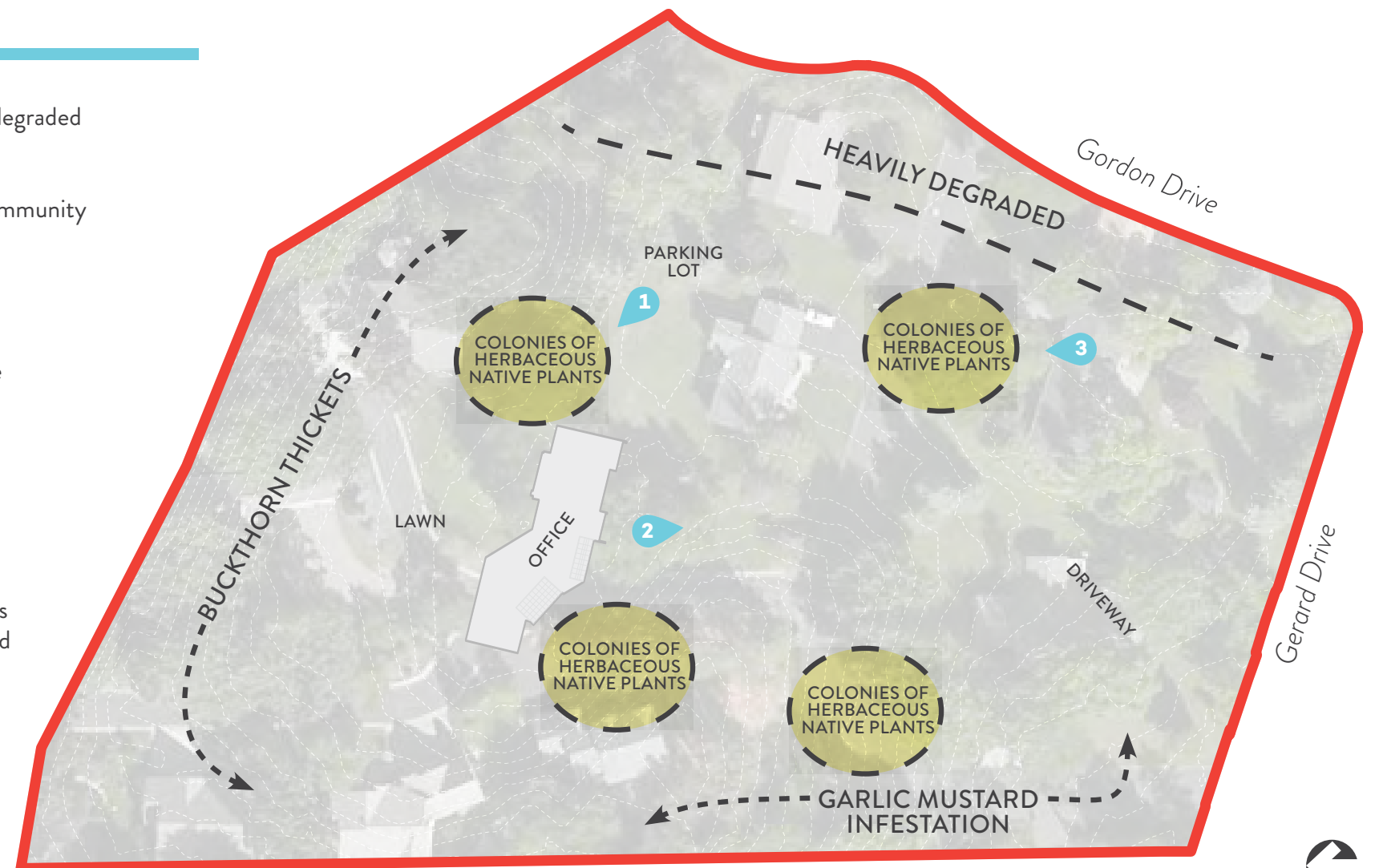
Remnant colonies of herbaceous native plants (nodes) are first identified and protected by carefully eliminating invasive species. Undesirable trees are removed to reduce competition. The idea of starting at the nodes is to protect and rejuvenate these native plants before expanding regeneration efforts out into extensively degraded areas. Over time new native species are introduced within the node to increase diversity.



Around the nodes invasive species will be eliminated and in some cases a temporary planting of creeping red fescue will be planted. The purpose of the fescue is to establish a mowable ground cover to prevent erosion. Mowing eliminates invasive plants that germinate from seeds in the soil. As the nodes become established and as budget allows, the creeping red fescue around the node will be removed and replaced with native plants. The node of native plants slowly expands.



This phased approach to invasive species removal and planting of native species is to occur simultaneously within several nodes on the site. As restoration progresses, high quality nodes become connected.



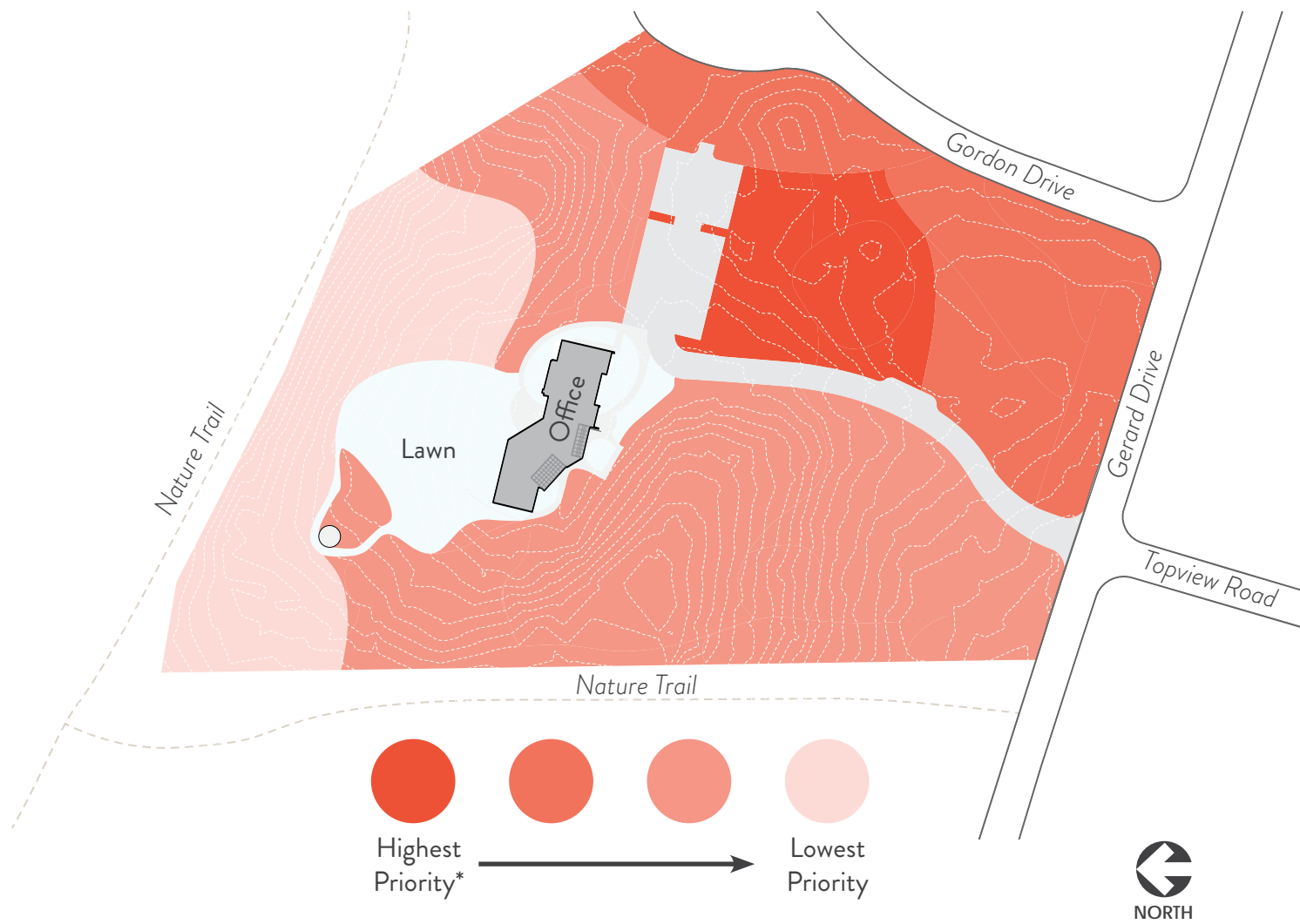
2016 Nodes of Remnant Native Plants



Phasing Plans

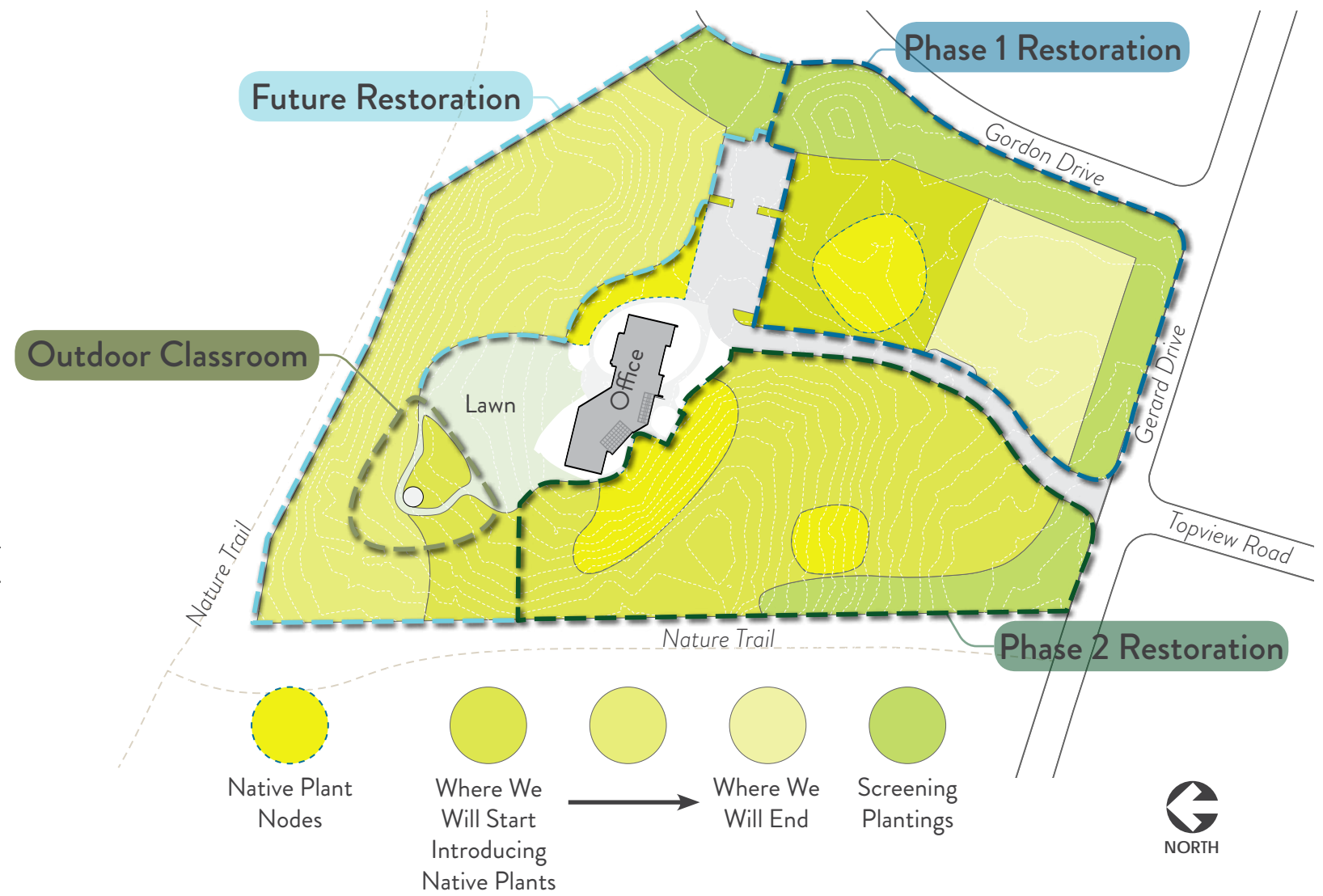
There are four primary nodes of existing native plants at Discovery Point Center. Initial regeneration efforts will be to weed out invasive plants and cut down undesirable trees in these nodes. Other native plants will be added over time. This multi-year process will proceed as budget allows.

Phasing of Invasive Plants Removal



*Prioritization was based on existing native plant colonies, site degradation and overall visibility of the restoration efforts.

Phasing of Native Plant Species Introduction





Woodland Areas

Once invasive species area removed and the fescue has done its job, native woodland species will be planted.



Savanna Areas

Lightly forested grassland (oak savanna) was likely historically present prior to settlement.

Plant Community

Native plant species chosen for the restoration are based on their ability to establish and thrive. Because different species require different resources (soil type, light conditions, nutrients, moisture, etc.) selecting plants suited for their planting conditions is essential. The following species are just a sample of what is planted at Discovery Point. These resilient species serve as a valuable source of food for local insects and animals in addition to providing cover for them to live. For a full list of all the plants installed on site, see Appendix A.

Plant Community Signature Plant Species:

	Woodland						Savanna	
Canopy	Maple	Cherry	Red & Pin Oak	Basswood	Birch	Honey Locust	Bur Oak	Red Pine
Understory	Jack In The Pulpit	Cinnamon Fern	Penn Sedge	Wild Ginger	Bloodroot	Little Bluestem	Sideoats Grama	Butterfly Milkweed
	Wood Sedge	Solomon's Seal	Zig-Zag Goldenrod	Wild Geranium	Columbine	Coneflower	Prairie Clover	Blazing Star



Ultimate Plant Communities



Selective Clearing

Before re-introducing native plant communities, invasive and non-native perennial plants should be cleared. In addition, trees that are diseased, dying, and prone to infestation are to be identified for removal. Opening up the tree canopy at Discovery Point allows for the reintroduction of the native plant communities that were once present. Prior to construction a detailed tree inventory was completed and the District worked closely with landscape architects to identify trees needing removal. Restoration goals were then developed based on the selective tree removal plan.

Invasive Trees and Shrubs

Prior to beginning site restoration effort Siberian elm, European buckthorn, Amur maple, Tartarian honeysuckle, Norway maple, and Norway spruce were identified for removal.



Stopping the Spread of Disease and Infestation

Emerald ash borer (EAB), is an exotic beetle that feed on the inner bark of all species of ash trees. The EAB larvae kill ash trees by destroying the tree's nutrient transport systems. EAB has been confirmed within 1.1 miles of Discovery Point. To prevent the spread and proliferation of the EAB in the area small ash trees have been or will be removed while a select few large ash trees will be preserved and treated for EAB.



Photo Source: U.S. National Park Service



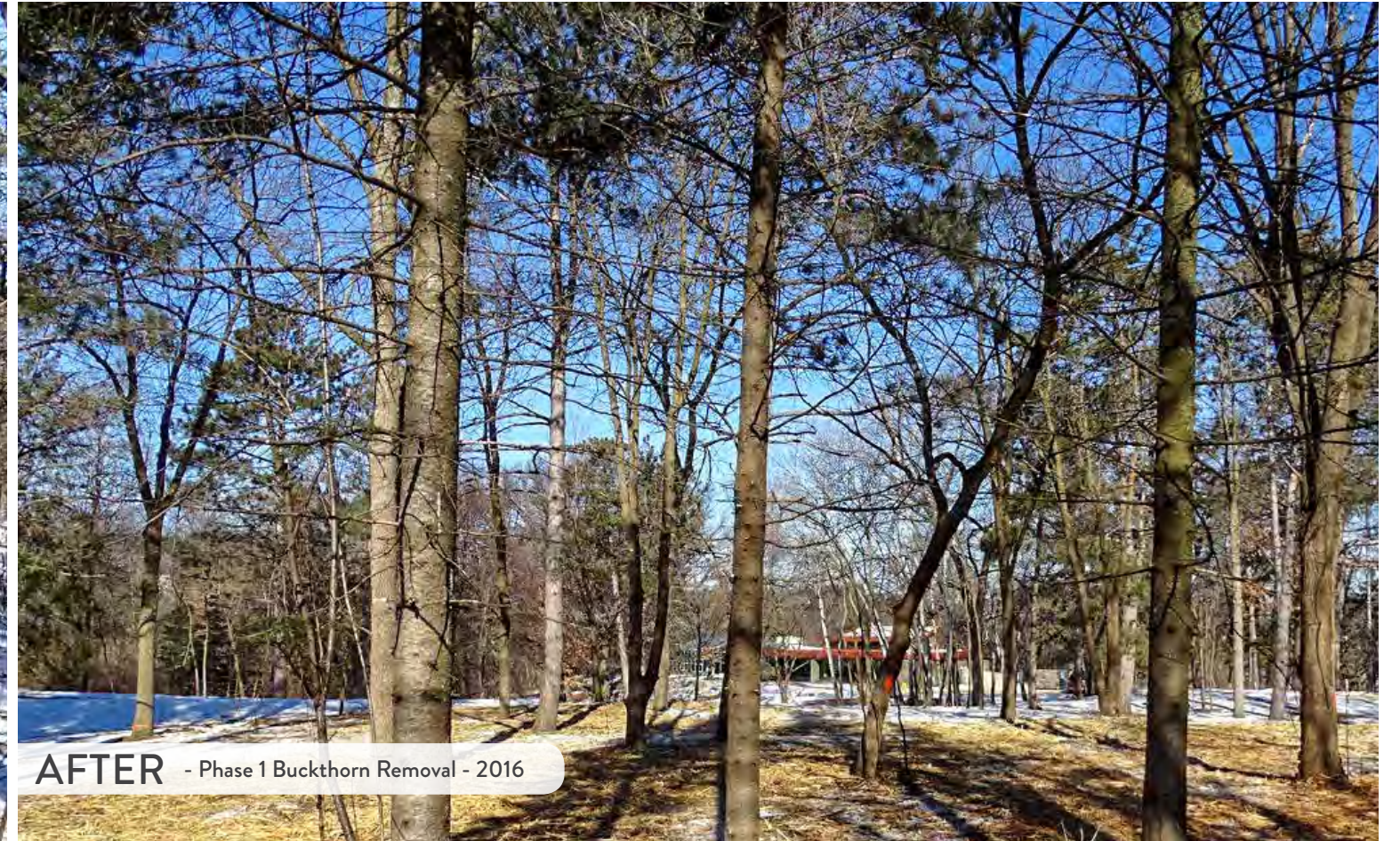
Volunteers removing buckthorn from steep slope and sensitive areas along north side of Discovery Point (10/28/2017).



Woody-invaded savannas, like at Discovery Point, require a combination of mechanical removal and selective herbicide treatments. A forestry mower was used to quickly clear large areas of buckthorn and prep soil for spring seeding (photo taken 2/7/2017).



BEFORE - Phase 1 Buckthorn Removal - 2016



AFTER - Phase 1 Buckthorn Removal - 2016



BEFORE - Phase 2 Buckthorn Removal - 2017



AFTER - Phase 2 Buckthorn Removal - 2017

Planting the Site

Removal operations are followed by seeding and planting operations. To create an urban habitat oasis at Discovery Point a combination of seeds and live plants were installed during restoration efforts.

Seedbed Preparation

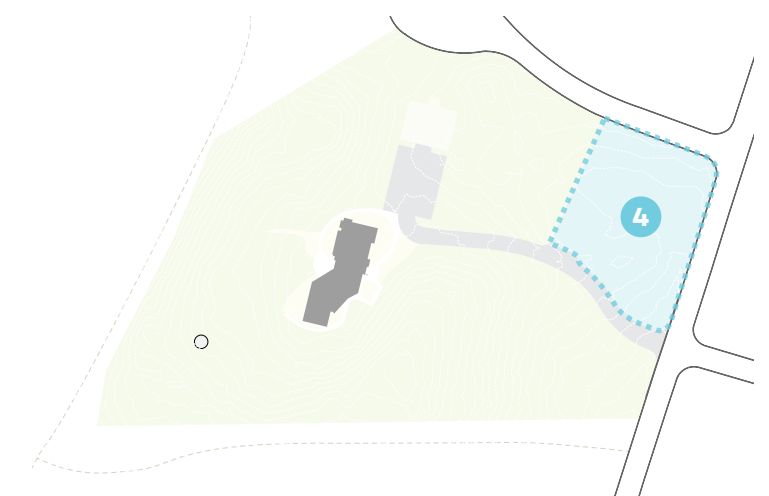
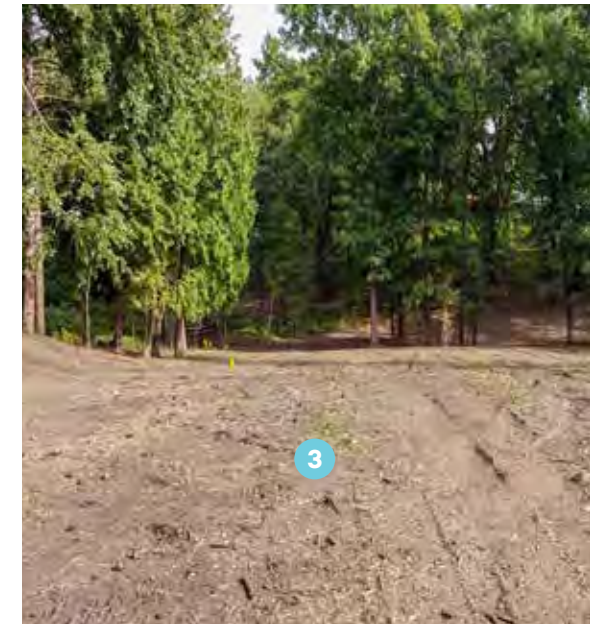
A greater investment in weed control at the start of a restoration project will result in less time, money, and effort needed for long term weed control. Many restoration fail due to poor site preparation. To avoid long-term maintenance issues at Discovery Point care was taken to:

- 1 Herbicide buckthorn and other invasive plant species that sprouted after initial clearing operations.
- 2 Avoid existing native vegetation. Areas of existing and desirable native vegetation were preserved and have been promoted through selective weeding operations.
- 3 Prepare the soil to maximise seed-to-soil contact during seeding. Soil disturbance was minimized in most areas. Areas with the heaviest infestations were lightly turned to exhaust the existing weed seed bank.

Temporary Ground Cover Crop - Creeping Red Fescue

Creeping red fescue is a typical lawn grass that can be used as an easy to maintain, temporary cover. It can be used in extensively degraded areas because it can compete with invasive species. It will stabilize soils and prevent the reproduction of invasive species during the time between initial invasive removal and planting. Fescue plantings will be maintained by mowing and/or spot spraying with a broadleaf herbicide to easily control invasive plants and prevent them from producing seed. It also forms a dense cover that makes invasive species establishment difficult. When it comes time to plant natives the fescues can be sprayed or cut and removed, and replaced with native plants.

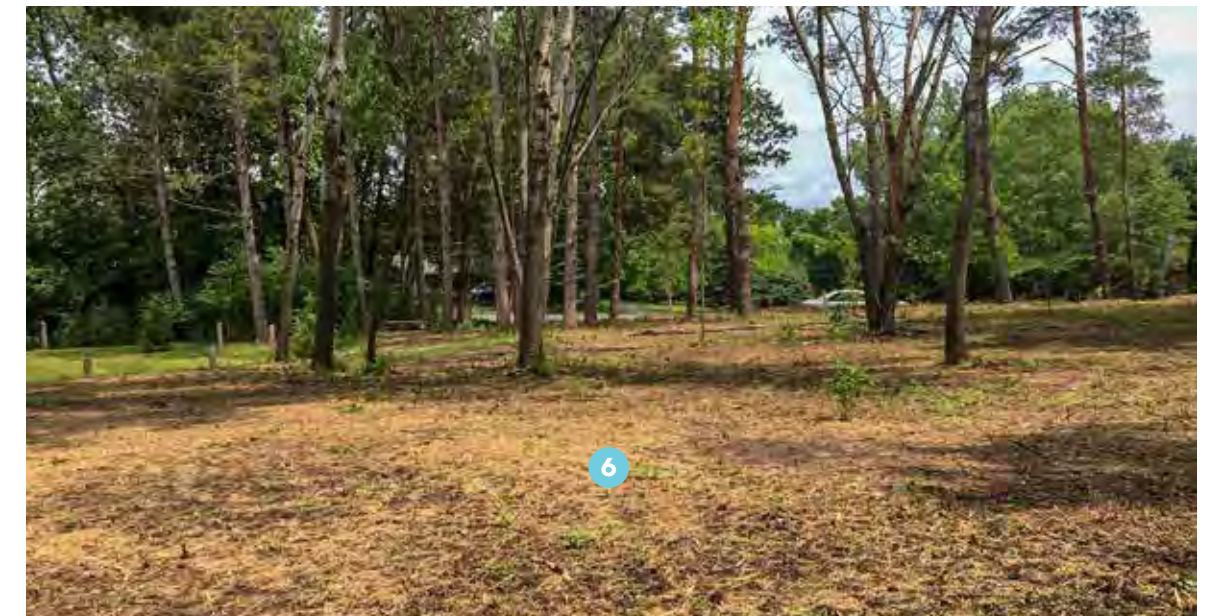
- 4

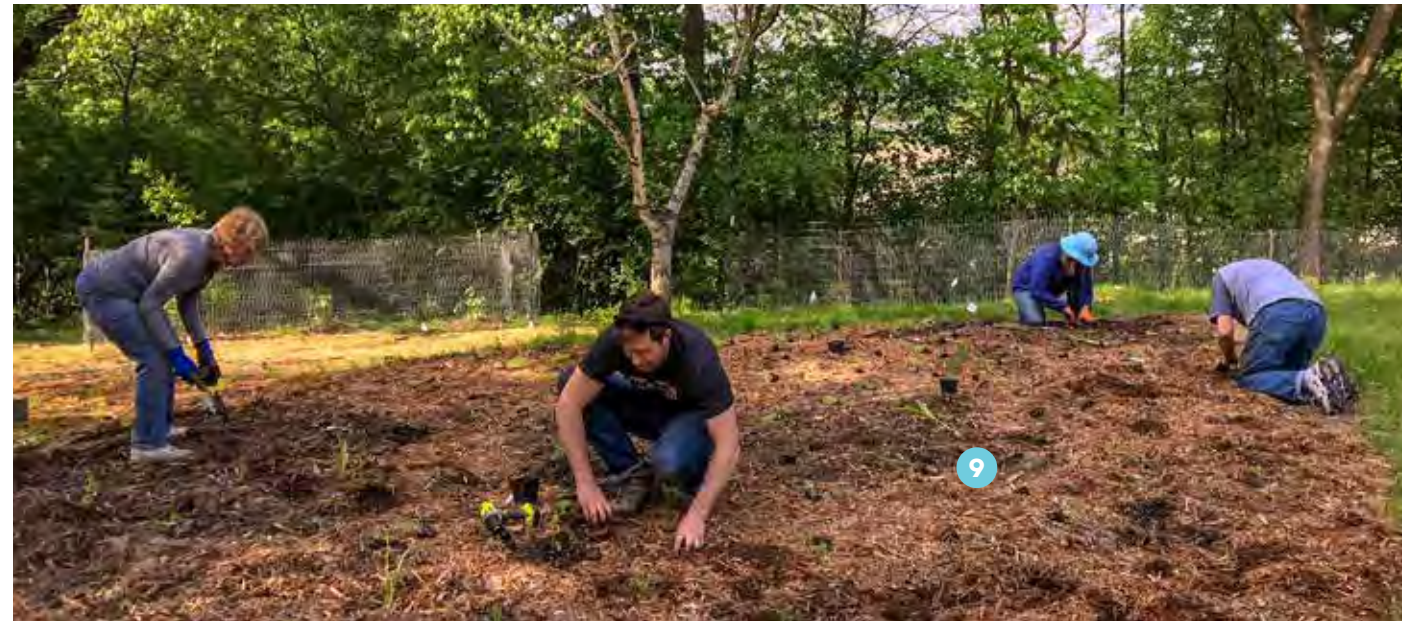


Seeding

Due to the varied topography and canopy density a variety of seed mixtures were installed at Discovery Point. Local genotype seed mixtures were applied in zones throughout the site based on soil moisture, sunlight, and aesthetics. The best time to install native plant seed is either during spring or fall. To minimize erosion potential:

- 5 Seed was drilled into the ground to reduce tilling where possible. A no-till native-seed drill is adapted to accommodate the different seeding requirements for the various shapes and sizes of native seeds.
- 6 Straw mulch was applied and anchored into the soil to hold the seed in place, prevent seed predation by birds, and to prevent erosion. Weed-free straw mulch is easily applied and naturally decomposes. On steeper slopes erosion control fabric is recommended.





Live Plants

Live plants were installed throughout Discovery Point to help screen the site and to provide additional plant diversity. Live plants are typically used in restoration projects for species that do not establish well from seed or are slow growing.

- 7 Trees and shrubs with high habitat value were selected for this site. Current and future climate conditions were taken into consideration when selecting specific species. Since 2014, more than 300 shrubs and 100 trees have been planted on site.
- 8 Large containerized trees and shrubs were located along the perimeter of the site. Trees and shrubs help screen the building and the parking lot from the surrounding residential neighborhood.
- 9 Volunteers have been supportive throughout the restoration efforts. The care and effort provided by active citizens has been a large reason for the site's current success. As of 2019 volunteers have planted more than 2,000 native plants on site.

Deer Exclosure

Deer and rabbit populations in the metro-area are very high mainly due to lack of predators. These animals are herbivores and have a huge impact on native plants as they are their primary food source. At Discovery Point fenced deer and rabbit exclosures were built to protect these caged areas from grazing and demonstrate how greatly these animal impact the plant community.

- 10 On site there is one large exclosure protecting an area of remnant vegetation. Individual trees and shrubs, planted elsewhere on site, have fencing around them to protect the plants while they mature.



Plant Community Management

On going plant community management is critical. The metro area today is full of invasive plant species. Canada thistle blows onto our properties in the wind, garlic mustard seed comes in on the feathers of birds, seed stored in the soil germinates, and birds deposit the seed from buckthorn berries in their droppings (along with a packet of fertilizer).

The phasing of plant community regeneration at Discovery Point spreads planting and maintenance costs over time. A fully established native planting is more resistant to invasive species encroachment.

Just like in a traditional landscape where we spend time and money on mowing, fertilizing, irrigating and weeding, resources must be invested into our native landscapes. This is the plan for some invasive species control at Discovery Point.



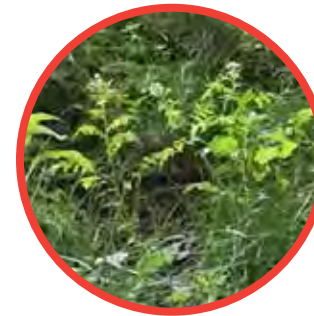
Buckthorn Removal Strategy:

Removal of buckthorn is accomplished by cutting and carefully treating the stump to prevent regrowth. The phased approach requires targeting of mature fruit bearing individuals first. This reduces ongoing seed production as the restoration process progresses. Following up on previously treated areas will be necessary until the existing seed-bank is depleted.



Garlic Mustard Removal Strategy:

Garlic mustard can be controlled by pulling the plant in early spring prior to it producing seeds. Removal efforts are to begin in areas of dense infestations and progress outward from there. Areas where the plant is able to go to flower prior to removal should be mown down to prevent the plant from going to seed. Adequate budget will be allocated at Discovery Point to maintain the regenerating plant communities. This cost will lower over time as natives establish and dominate the site.



Narrowleaf Bittercress:

Narrowleaf bittercress is a woodland invader considered by the DNR as an early detection noxious weed with limited distribution in Minnesota. The goal is to limit and eradicate this plant before it continues to spread off site. It has a shallow root system that makes it easy to hand pull. The plant pulled must be disposed of in garbage bags if it is flowering or has gone to seed.

How long will it take?

It takes 5-7 years for most native plants to reach maturity. Proper site maintenance following a planting is essential to reduce weed competition and ensure the success of the restoration project. An anticipated budget and schedule for the first few years of maintenance activities was developed. Planning ahead is essential for maintaining control of buckthorn and garlic mustard resprouts.



Year 1 The site will not look like much for the first year following plantings. Cover crop grasses pop up quickly to stabilize soils but native perennial plants may only grow to a height of six inches in a season. Most of the growth of native perennial plants will be in the underground roots for the first few years.

Mowing is the best way to control annual weeds during the first few years. Mowing is generally completed 2-3 times in the first year to prevent annual weeds from going to seed. Discovery Point is monitored frequently by the District to properly time mowings.

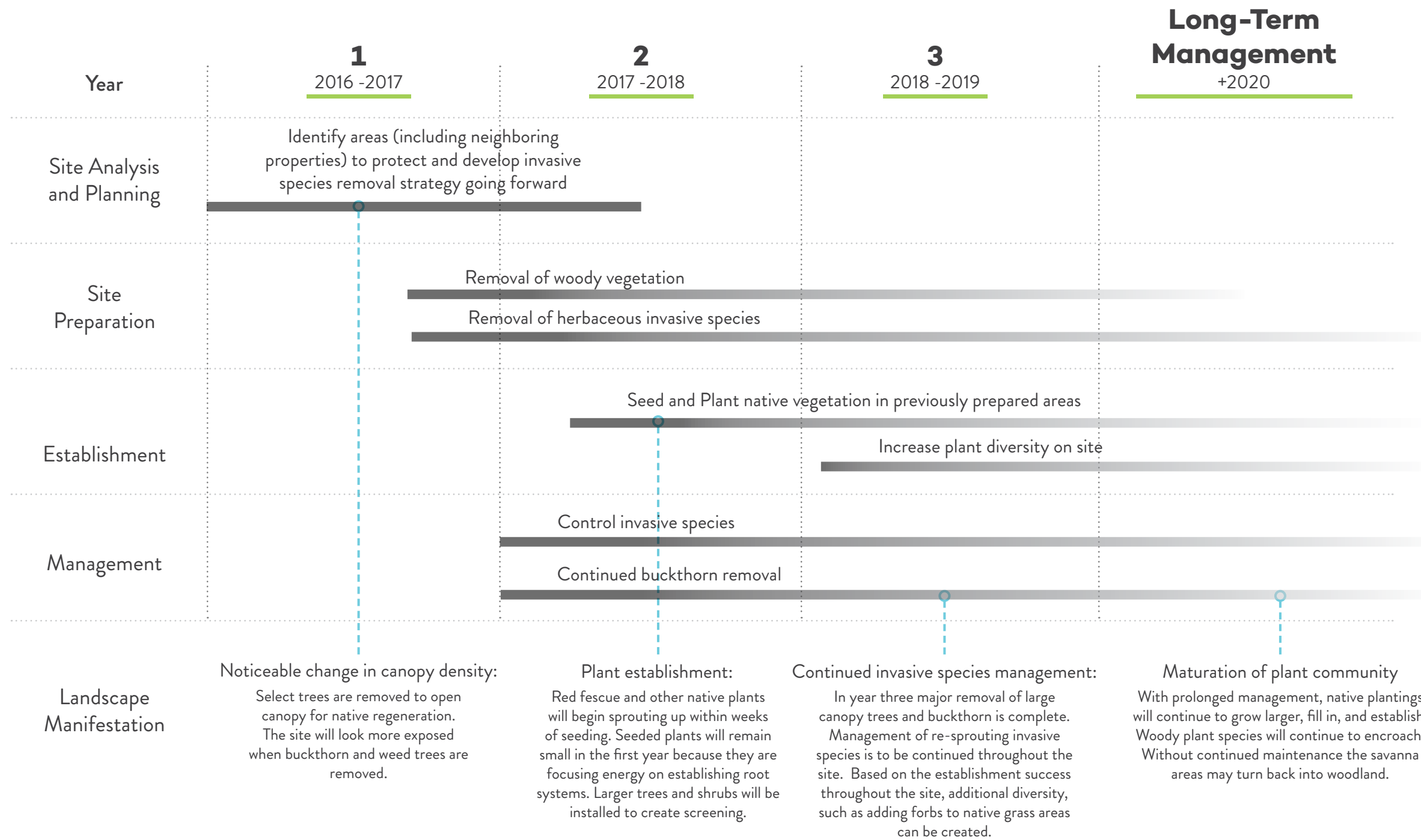
Year 2 Some of the short-lived flowering species bloom in abundance during the second year. Plants like wild bergamot, tall bellflower, fragrant hyssop, and black-eyed Susan were some of the first to flower on site.

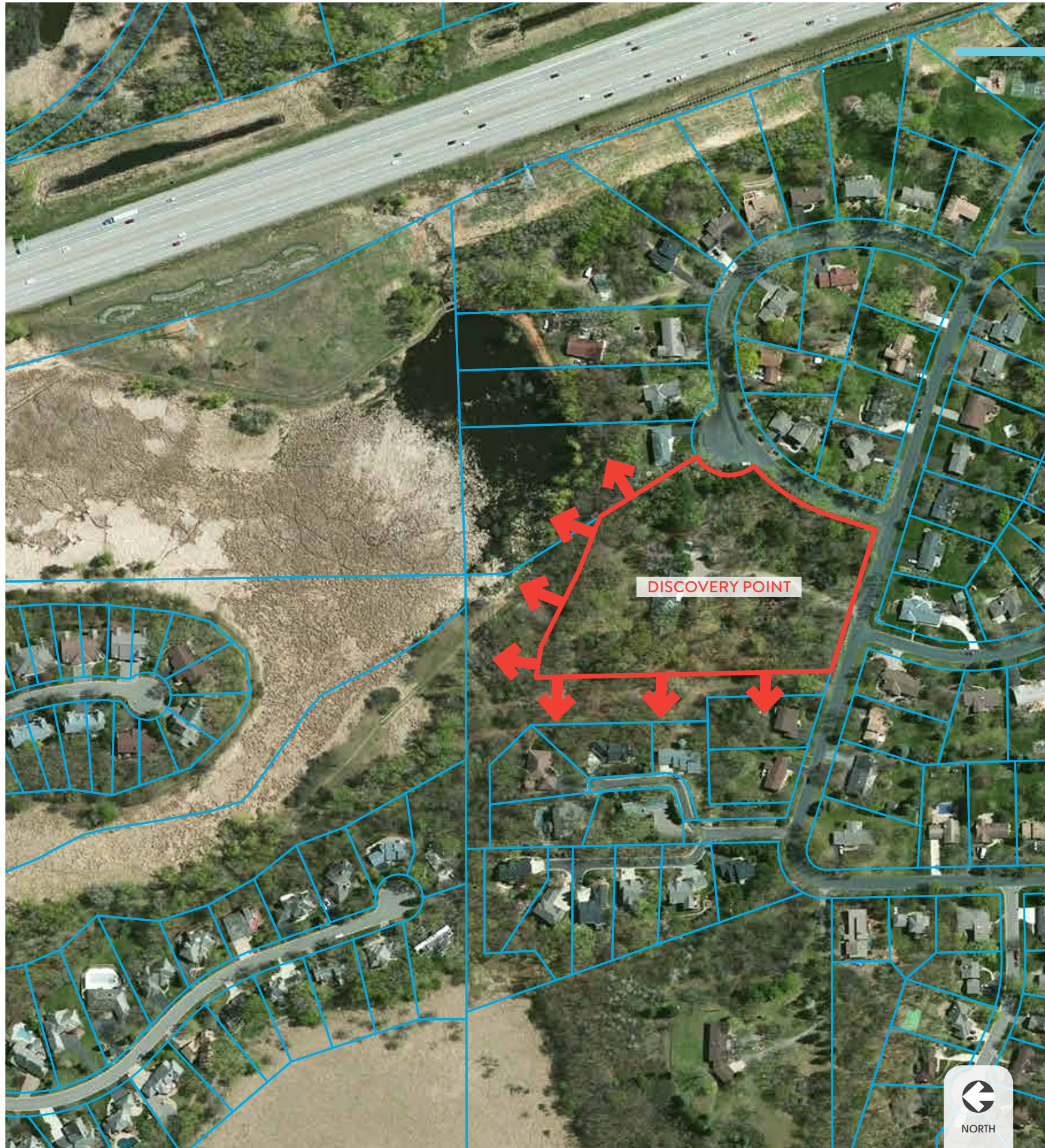
Mowing is generally limited to one or two times during the second year. Some herbicide spot spraying is anticipated for persistent woody invasive species. Tree and woody brush control at Discovery Point is essential given the previous abundance of buckthorn and honeysuckle.

Year 3 & Beyond Over 100 native plant species have been planted on site. The composition and appearance of these planted communities will continue to fluctuate and evolve over time. Most native forbs and grasses begin to reach maturity during the third year. More slow-growing species like prairie dropseed, culver's root, and lead plant may take up to 10 years to establish and bloom.

Prescribed burning is one of the best tools to help establish and maintain a native planting over the long term. Prescribed burns should be completed every 2-3 years to stimulate native plant growth and to kill unwanted woody shrubs and trees. In addition to burning, mowing and spot treatments will continue to be a critical short and long-term management technique to maintain natural areas. The frequency of these activities will be reduced over time but continued management will be necessary.

Evaluating Progress





Expanding The Vision

The complete extent of this project is still yet to be determined. Additional investigation is needed to prioritize work expanding off the Discovery Point site. Working with interested neighboring property owners, including city property, to survey existing plant communities, areas for expanded invasive species removal and native planting are to be identified. The management strategies set in place now will help us develop an approach for partnering funding and regenerating these adjacent lands.

Since beginning education and outreach, neighboring properties and parts of the City's Nature Trail have begun restoration efforts.

Getting Involved

Thanks to everyone who has participated in buckthorn busts and volunteer planting events at Discovery Point! Stay tuned to the District's website for upcoming events. For other programs visit the District's Upcoming Events web page.

Cost share grant funds are available to residents, associations, nonprofits, schools, businesses, and cities for similar projects located within the boundaries of the Nine Mile Creek Watershed District. Grant funding for Discovery Point's neighboring residents have been awarded by the district to cover a portion of the residents' costs for their efforts to preserve, protect, and restore habitat and water quality. Refer to the 9 Mile Creek Watershed District's website for additional details on the cost share program. (ninemilecreek.org)



Appendix A: Species Planted

Live Plants

VINES

Clematis virginiana (Virgin's Bower)

TREES

Acer nigrum (Black Maple)
Aescleus glabra (Ohio Buckeye)
(Amelanchier x grandiflora) (Serviceberry 'Autumn Brilliance')
Amelanchier laevis (Smooth Serviceberry)
Carpinus caroliniana (Blue Beech)
Celtis occidentalis (Hackberry)
Cercis canadensis (Eastern Redbud)
Cladrastis kentukea (Yellowwood)
Crataegus macracantha (Fleshy Hawthorn)
Crataegus mollis (Downy Hawthorn)
Gymnocladus dioica (Kentucky Coffeetree)
Juniperus virginiana (Red Cedar)
Ostrya virginiana (Ironwood)
Pinus banksiana (Jack Pine)
Pinus Strobus (White Pine)
Platanus occidentalis 'Bloodgood' (Sycamore)
Prunus virginiana (Common Chokecherry)
Quercus alba (White Oak)
Quercus ellipsoidalis (Northern Pin Oak)
Quercus macrocarpa (Bur Oak)
Quercus rubra (Red Oak)
Tilia americana (American Basswood)
Tsuga canadensis (Eastern Hemlock)
Ulmus americana 'Valley Forge' (Valley Forge Elm)

SHRUBS

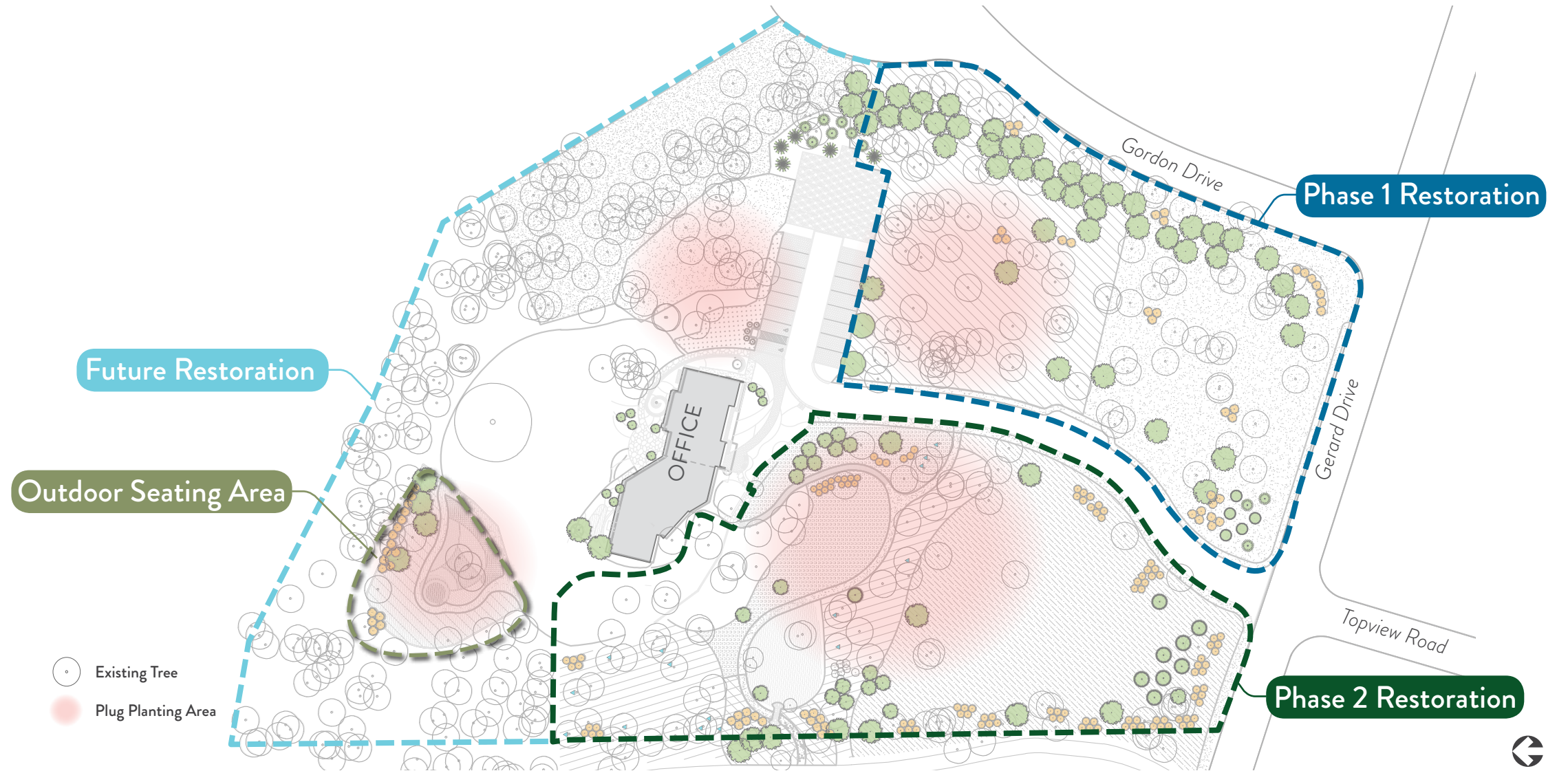
Amelanchier alnifolia 'Regent' (Serviceberry 'Regent')
Amelanchier borealis (Downy Serviceberry)
Aronia melanocarpa (Black Chokeberry)
Ceanothus americanus (New Jersey Tea)
Cephalanthus occidentalis (Buttonbush)
Cornus alternifolia (Pagoda Dogwood)
Cornus racemosa (Gray Dogwood)
Corylus americana (American Hazelnut)
Dirca palustris (Leatherwood)
Euonymus atropurpureus (Eastern Wahoo)
Hamamelis virginiana (Witch Hazel)
Ilex verticillata (Winterberry)
Juniperus communis var. *depressa* (Common Juniper)
Physocarpus opulifolius (Common Ninebark)
Rhus hirta (Staghorn Sumac)
Rosa blanda (Early Wild Rose)
Rosa carolina (Pasture Rose)
Symphoricarpos albus (Snowberry)
Viburnum rafinesquianum (Arrowwood Viburnum)

PERENNIAL PLUGS

Echinacea angustifolia (Narrow-leaved Coneflower)
Adiantum pedatum (Maidenhair Fern)
Allium cernuum (Nodding Onion)
Allium stellatum (Prairie onion)
Amorpha canescens (Leadplant)
Anaphalis margaritacea (Pearly Everlasting)
Anemone americana (Round-lobe Hepatica)
Anemone patens (Pasque Flower)
Anemonella thalictroides (Rue Anemone)
Aquilegia canadensis (Columbine)
Arisaema triphyllum (Jack-in-the-pulpit)
Asarum canadense (Wild Ginger)
Asclepias purpurascens (Purple Milkweed)
Asclepias speciosa (Showy Milkweed)
Asclepias tuberosa (Butterfly Milkweed)
Asclepias verticillata (Whorled Milkweed)
Asclepias viridiflora (Green Milkweed)
Aster divaricatus (White Wood Aster)
Astragalus canadensis (Canada Milk Vetch)
Athyrium filix-femina (Lady Fern)
Baptisia alba (Wild White Indigo)
Bromus kalmii (Prairie Brome)
Campanula americana (Tall Bellflower)
Carex brevior (Plains Oval Sedge)
Carex eburnea (Ivory Sedge)
Carex gracillima (Graceful Sedge)
Carex pennsylvanica (Pennsylvania Sedge)
Carex radiata (Eastern Star Sedge)
Carex rosea (Curly-Styled Wood Sedge)
Carex sprengei (Long Beaked Sedge)
Carex vulpinoidea (Brown Fox Sedge)
Caulophyllum thalictroides (Blue Cohosh)
Coreopsis palmata (Prairie Coreopsis)
Dalea purpurea (Purple Prairie Clover)
Dicentra cucullaria (Dutchman's Breeches)
Echinacea angustifolia (Narrow Leaved Coneflower)
Echinacea palida (Pale Purple Coneflower)
Eryngium yuccifolium (Rattlesnake Master)
Eurybia macrophylla (Big Leaved Aster)

Fragaria virginiana (Wild Strawberry)
Geranium maculatum (Wild Geranium)
Geum rivale (Water Avens)
Heuchera richardsonii (Prairie Alum Root)
Hydrophyllum virginianum (Virginia Waterleaf)
Juncus tenuis (Path Rush)
Lespedeza capitata (Round Headed Bush Clover)
Liatris aspera (Button Blazing Star)
Liatris ligulistylis (Meadow blazing star)
Liatris punctata (Dotted Blazing Star)
Lupinus perennis (Wild Lupine)
Mitella diphylla (Bishop's Cap)
Monarda punctata (Spotted Bee Balm)
Oligoneuron album (White Upland Aster)
Oligoneuron rigidum (Stiff Goldenrod)
Onoclea sensibilis (Sensitive Fern)
Penstemon digitalis (Foxglove Beardtongue)
Penstemon grandiflorus (Large-Flowered Penstemon)
Phlox divaricata (Wild Blue Phlox)
Polygonatum biflorum (Solomon's Seal)

Pycnanthemum virginianum (Mountain Mint)
Schizachyrium scoparium (Little Bluestem)
Solidago nemoralis (Gray Goldenrod)
Sporobolus heterolepis (Prairie Dropseed)
Symphotrichum cordifolium (Blue Wood Aster)
Symphotrichum lateriflorum (Calico Aster)
Symphotrichum oblongifolium (Aromatic Aster)
Symphotrichum oolentangiensis (Sky Blue Aster)
Thalictrum dasycarpum (Purple Meadow Rue)
Thalictrum dioicum (Early Meadow Rue)
Tradescantia ohioensis (Ohio Spiderwort)
Vernonia fasciculata (Common Ironweed)
Veronicastrum virginicum (Culver's Root)



Seed Mixes

HIGH DIVERSITY WOODLAND SEED MIX

Grasses

- Bouteloua curtipendula* (Sideoats Grama)
- Bromus kalmii* (Kalm's Brome)
- Bromus pubescens* (Hairy Wood Chess)
- Elymus hystrix* (Bottlebrush Grass)
- Elymus villosus* (Silky Wild Rye)
- Panicum virgatum* (Switchgrass)
- Schizachyrium scoparium* (Little Bluestem)
- Diarrhena obovata* (Beak Grass)

Sedges & Rushes

- Carex blanda* (Common Wood Sedge)
- Carex brevior* (Plains Oval Sedge)
- Carex davisi* (Awned Graceful Sedge)
- Carex eburnea* (Ivory Sedge)
- Carex gracilescens* (Slender Wood Sedge)
- Carex molesta* (Field Oval Sedge)
- Carex pennsylvanica* (Pennsylvania Sedge)
- Carex radiata* (Straight-styled Wood Sedge)
- Carex rosea* (Curly-styled Wood Sedge)
- Carex sprengei* (Long-beaked Sedge)
- Carex stipata* (Common Fox Sedge)
- Juncus torreyi* (Torrey's Rush)

Forbs

- Allium canadense* (Wild Garlic)
- Allium tricoccum* (Wild Leek)
- Anemone virginiana* (Tall Thimbleweed)
- Anemonella thalictroides* (Rue Anemone)
- Arisaema triphyllum* (Jack-in-the-Pulpit)
- Asclepias exaltata* (Poke Milkweed)
- Caulophyllum thalictroides* (Blue Cohosh)
- Eurybia macrophylla* (Big-leaved Aster)
- Juncus tenuis* (Path Rush)
- Penstemon digitalis* (Foxglove Beardtongue)
- Sanguinaria canadensis* (Bloodroot)
- Smilacina racemosa* (Solomon's Plume)
- Smilacina stellata* (Starry Solomon's Plume)
- Symphotrichum cordifolium* (Heart-leaved Aster)
- Symphotrichum ericoides* (Heath Aster)
- Tephrosia virginiana* (Goat's Rue)
- Thalictrum dioicum* (Early Meadow Rue)
- Tradescantia ohiensis* (Ohio Spiderwort)
- Uvularia grandiflora* (Bellwort)

PRAIRIE GRASS SEED MIX

Grasses

- Bouteloua gracilis* (Blue Grama)
- Elymus canadensis* (Canada Wild Rye)
- Bouteloua curtipendula* (Sideoats Grama)
- Schizachyrium scoparium* (Little Bluestem)

HIGH DIVERSITY SEED MIX (SAVANNA AREAS)

Grasses

- Andropogon gerardii* (Big Bluestem)
- Bouteloua curtipendula* (Sideoats Grama)
- Bromus kalmii* (Kalm's Brome)
- Elymus hystrix* (Bottlebrush Grass)
- Elymus villosus* (Silky Wild Rye)
- Glyceria striata* (Fowl Manna Grass)
- Panicum virgatum* (Switchgrass)
- Schizachyrium scoparium* (Little Bluestem)
- Sorghastrum nutans* (Indiangrass)

Sedges & Rushes

- Carex blanda* (Common Wood Sedge)
- Carex brevior* (Plains Oval Sedge)
- Carex eburnea* (Ivory Sedge)
- Carex gracilescens* (Slender Wood Sedge)
- Carex molesta* (Field Oval Sedge)
- Carex muskingumensis* (Palm Sedge)
- Carex sprengei* (Long-beaked Sedge)

Forbs

- Actaea rubra* (Red Baneberry)
- Allium canadense* (Wild Garlic)
- Allium cernuum* (Nodding Onion)
- Agastache foeniculum* (Fragrant Hyssop)
- Asclepias exaltata* (Poke Milkweed)
- Aster lateriflorus* (Calico Aster)
- Aster macrophyllus* (Big-leaved Aster)
- Arisaema triphyllum* (Jack-in-the-Pulpit)
- Astragalus canadensis* (Canada Milk Vetch)
- Aquilegia canadensis* (Columbine)
- Campanula americana* (Tall Bellflower)
- Caulophyllum thalictroides* (Blue Cohosh)
- Chamaecrista fasciculata* (Partridge Pea)
- Coreopsis palmata* (Prairie Coreopsis)
- Echinacea palida* (Pale purple coneflower)
- Euphorbia corollata* (Flowering Spurge)
- Geranium maculatum* (Wild Geranium)
- Helianthus occidentalis* (Western Sunflower)

- Lespedeza capitata* (Round-headed Bush Clover)
- Monarda fistulosa* (Wild Bergamot)
- Monarda punctata* (Spotted Bee Balm)
- Oligoneuron rigidum* (Stiff Goldenrod)
- Penstemon grandiflorus* (Large-flowered Beardtongue)
- Sanguinaria canadensis* (Bloodroot)
- Smilacina racemosa* (Solomon's Plume)
- Polygonatum canaliculatum* (Solomon's Seal)
- Pycnanthemum virginianum* (Virginia Mountain Mint)
- Ratibida columnifera* (Long-headed Coneflower)
- Rudbeckia hirta* (Black-eyed Susan)
- Rudbeckia subtomentosa* (Sweet Black-eyed Susan)
- Solidago nemoralis* (Old Field Goldenrod)
- Tephrosia virginiana* (Goat's Rue)
- Thalictrum dioicum* (Early Meadow Rue)
- Verbena stricta* (Hoary Vervain)
- Veronicastrum virginicum* (Culver's Root)
- Zizia aurea* (Golden Alexanders)

WOODLAND SEED MIX

Grasses

- Bouteloua gracilis* (Blue Grama)
- Bromus kalmii* (Kalm's Brome)
- Elymus canadensis* (Canada Wild Rye)
- Elymus hystrix* (Bottlebrush Grass)
- Elymus virginicus* (Virginia Wild Rye)
- Elymus villosus* (Silky Wild Rye)

Sedges & Rushes

- Carex hystericina* (Porcupine Sedge)
- Carex pennsylvanica* (Pennsylvania Sedge)
- Carex molesta* (Field Oval Sedge)
- Carex sprengei* (Long-beaked Sedge)

FESCUE LAWN SEED MIX

Grasses

- Festuca rubra* (Creeping Red Fescue)





2016



2015



2014



2014

Appendix B: Site Photos - Before Restoration





2017



2017



2017



2016

Appendix B: Site Photos - Site Clearing





Appendix B: Site Photos - Planting



2017



2018



2017



2018



2018



Appendix B: Site Photos - Restoration Progress



Appendix C: Ash Tree Summary



Appendix D: Restoration Areas

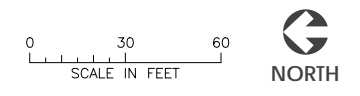
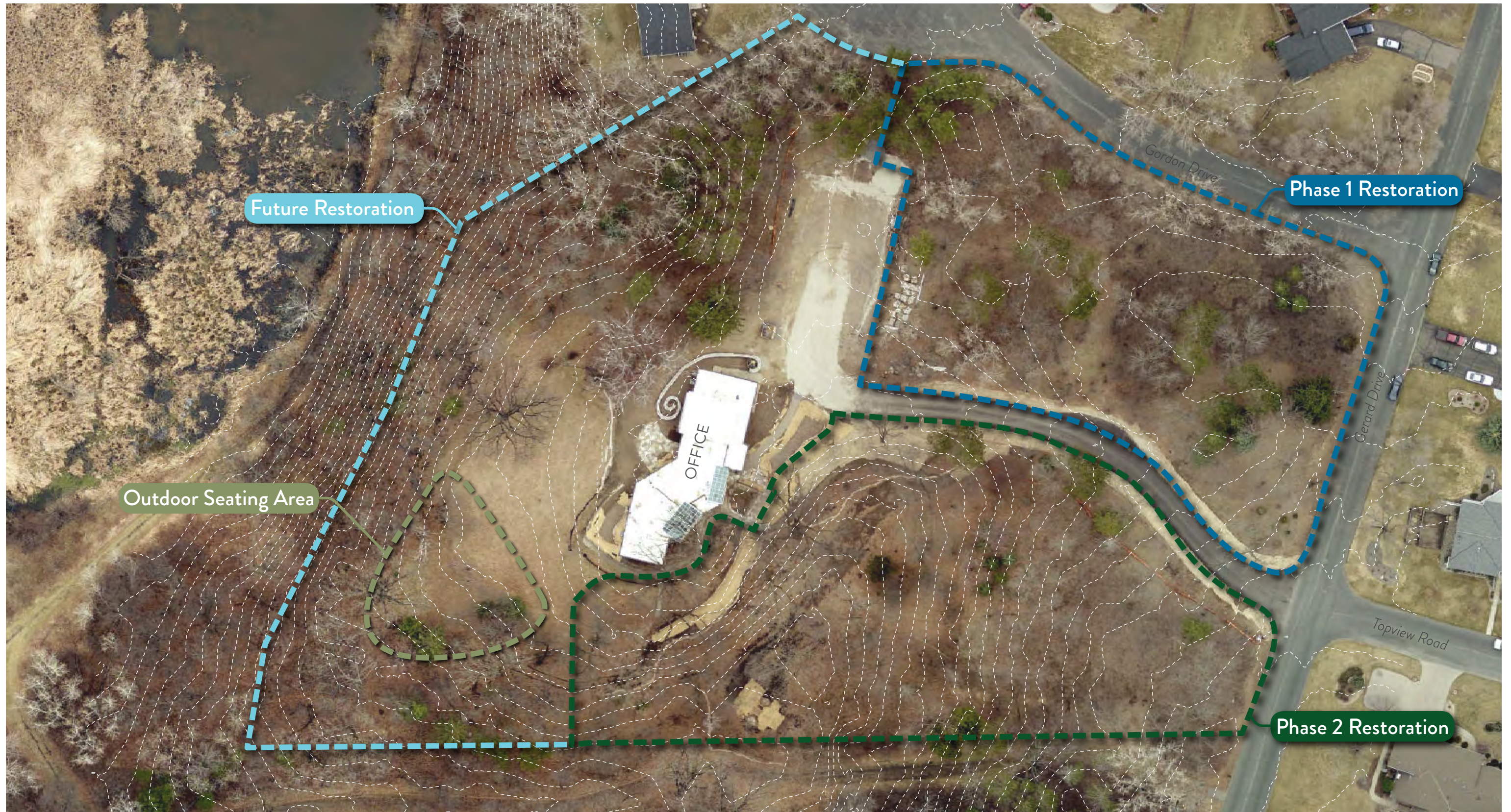




Photo: Pennsylvania Sedge

This resource is meant to be a living document and to be updated as the restoration process progresses. Documenting the key elements of the process, including costs, plant list, maintenance activities, and photos would serve as a valuable resource for the District and landowners. As the project progresses these elements should be added to this document.



DRAFT 8/5/2019