HIGHLANDS OF RIVER POINTE PARK

Natural Resources Management Plan

Prepared for:
The City of Otsego, MN
Parks and Recreation

Prepared by:
Friends of the Mississippi River, St. Paul, Minnesota

April 2025

This Natural Resources Management Plan and Work Plan has been reviewed and approved by:

City of Otsego Parks and Recreation Chair

Kitty Baltos _____ Date: 4/23/2025

City of Otsego Parks and Recreation Director

Nick Jacobs _____ Date: 4/23/2025

This document can be changed only by written agreement between the City of Otsego and Friends of the Mississippi River.

SITE INFORMATION

Owner name, address, city/township, county, and contact

Otsego, MN Parks and Recreation
13400 90th Street NE, Otsego, MN 55330
Wright County, Minnesota
CONTACT PERSON: Nick Jacobs, Otsego Parks and Recreation Director 763.334.3170

Section, township, and range

Sections 1 and 12 of Township 120 North, Range 23 West

Parcel Identification Number

118320000010

Watershed

North Fork of the Crow River Watershed

Rare Features

Black sandshell mussel *(Ligumia recta)*

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EXECUTIVE SUMMARY

This Natural Resources Management Plan presents the site analysis and recommended land management activities for the 62-acre Highlands of River Pointe Park property in Otsego, Wright County, MN. This document was drafted by Friends of the Mississippi River (FMR) in 2024-25 and is based on documentation of site characteristics, including natural resource and community access priorities, issues, and corrective actions. These actions reflect community values regarding the unique features of the Highlands of River Pointe Park (HRP). The protection of HRP's features points to restoration and improvement of access for the health and well-being of the community. This natural resources management plan (NRMP) provides a framework for those goals, including recommended restoration and public use enhancement activities, timing and costs for those activities, long-term management objectives, and funding opportunities.

Highlands of River Pointe Park is facing threats and pressures related to habitat loss and fragmentation, non-native species abundance and native plant community suppression, uses that are incompatible with habitat protection, and climate change. These threats are meaningful even if they only affect certain aspects of the site, as the park is seen as a contiguous habitat. As a result, taking no action will ultimately result in the degradation of the system.

This NRMP recommends targeted restoration of the grasslands, which would include woody removal, invasive species management, supplemental seeding and planting, and reintroducing a disturbance regime through prescribed fire. The NRMP also recommends woody invasive shrub management in the oak woodland and terrace forest, followed by replacement shrub planting. Lastly, the NRMP guides the improvement of the stormwater basins by ruderal tree removal, invasive species management and enhancement seeding and planting. Over a five-year restoration timeline, total costs are estimated at $313,000. These restoration activities will be responsive to any infrastructure improvements to the park, including trail improvements and the addition of park signage.

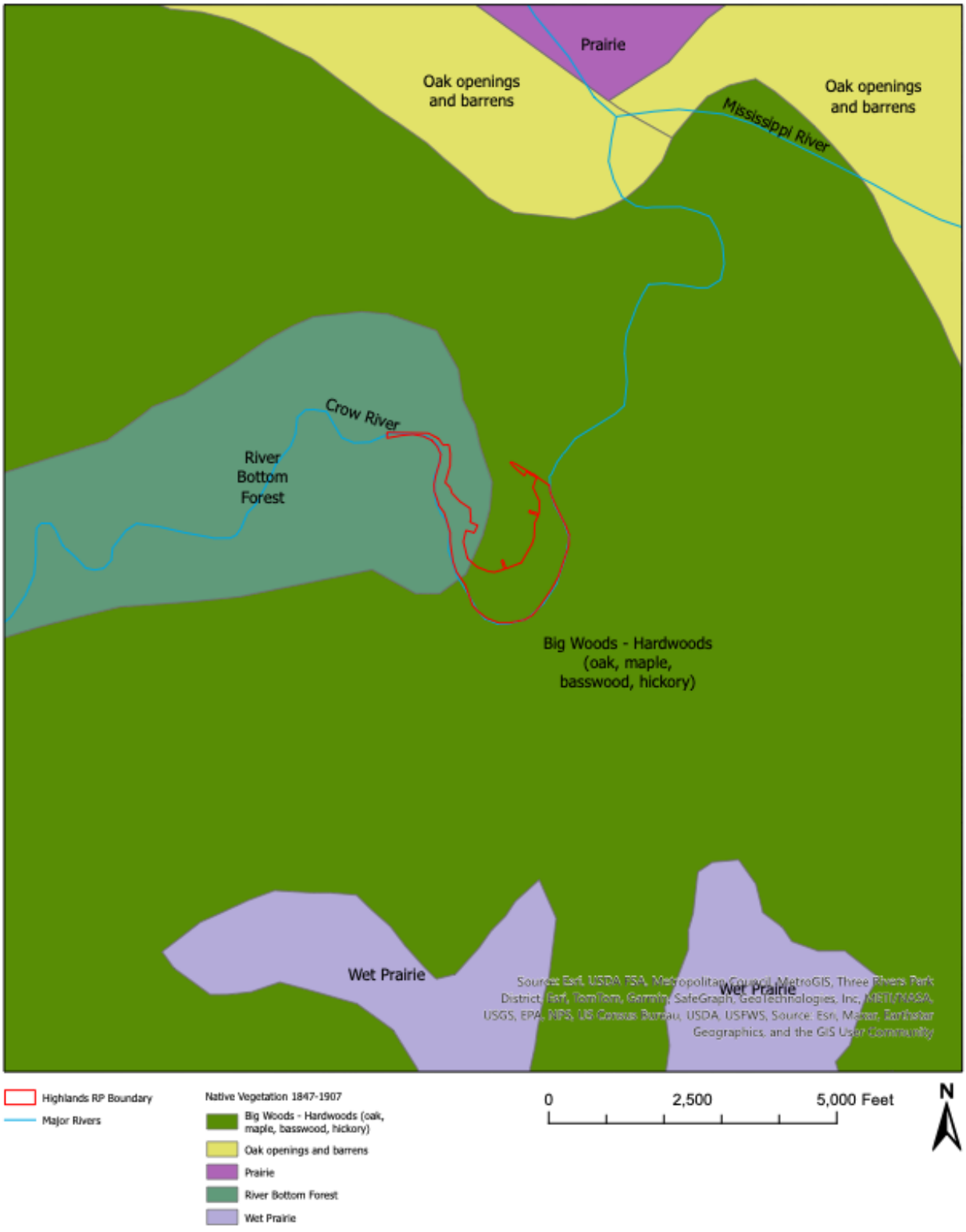
BACKGROUND

Highlands of River Pointe Park's location on the Crow River and the site's adjacency to the Crow River's confluence with the Mississippi River may point to a long history of Indigenous use, and this is likely given archaeological records of nearby locations on the river. The Office of the State Archaeologist notes 2 cultural resource sites within the land section where HRP is located. While cultural resources have not been identified on the site itself, their presence is possible based on its location.

The land cover around the time of the public land survey of Minnesota (1847-1907) was classified as "River Bottoms Forest" and "Big Woods-Hardwoods (oak, maple, basswood, hickory)". This cover type is most closely associated with present-day Minnesota native plant communities of forested floodplain/terrace forest and maple-oak-basswood forest, respectively.

While the landscape has changed considerably since the late 1800s, these plant communities can still be referenced when setting broad restoration goals and considering target plant communities.

Figure 1: Historic Plant Communities of Highlands of River Pointe Park



Aerial imagery of Minnesota was captured starting in the 1930s, with image quality improving as technology advanced. The four aerial images below show the progression of land use and changing plant communities over a 30-year period from 1940 to 1970.

Figure 2: 1940, 1953, 1963, and 1970 aerial imagery of the Highlands of River Pointe site

These images tell a story of relatively stable and consistent land use over these thirty years. During most of the 20th century, the site was part of a large family farm with diverse row crop agriculture dominating most of the landscape to the north of today's parkland. A large woodland has been present on the site since at least the 1930s, and a portion of that woodland remains today. The Crow River streambank has been lined with floodplain trees over the last century, and in the 1980s, buckthorn began to dominate the understory. In 2017, the property was subdivided and sold for residential development. An outlot containing the land adjacent to the Crow River was deeded to the City of Otsego as part of the park dedication required by the plat approval, and this parkland is the subject of this natural resources management plan. The City of Otsego's 10-Year Comprehensive Plan (2023) describes the park in its adjacency to the Crow River and notes that the floodplain and

surrounding uplands are to be “kept in a natural state and accessible as part of the City’s trail system.”

The park also includes a large stormwater retention area that serves the housing development to the north. As such, there are four primary landcover types across the site: upland grassland, wet meadow/shrub carr, oak forest, and terrace forest near the river. These landcover types are discussed in greater detail in the management unit sections that follow.

SURROUNDING LAND USE

Land use adjacent to HRP is primarily single-family residential and rural areas that are developing into residential neighborhoods. Across the Crow River in Hennepin County, land use is also single-family residential, but lots are considerably larger, and homes sit above an unvegetated 40-foot vertical and undercut bank. Hennepin County has two planned trails that reach the Wright-Hennepin County border near the west and east sides of the park. Additionally, the Crow River Regional Trail Master Plan developed by Three Rivers Park District plans a trail corridor through Hennepin and Wright Counties with a river crossing into HRP (Figure 3) and connecting to the present alignment of the River Trail shown in Figure 4. The park dedication of the 61 acres of HRP included land for the regional trail corridor.

Figure 3: Crow River Regional Trail planned, Three Rivers Park District

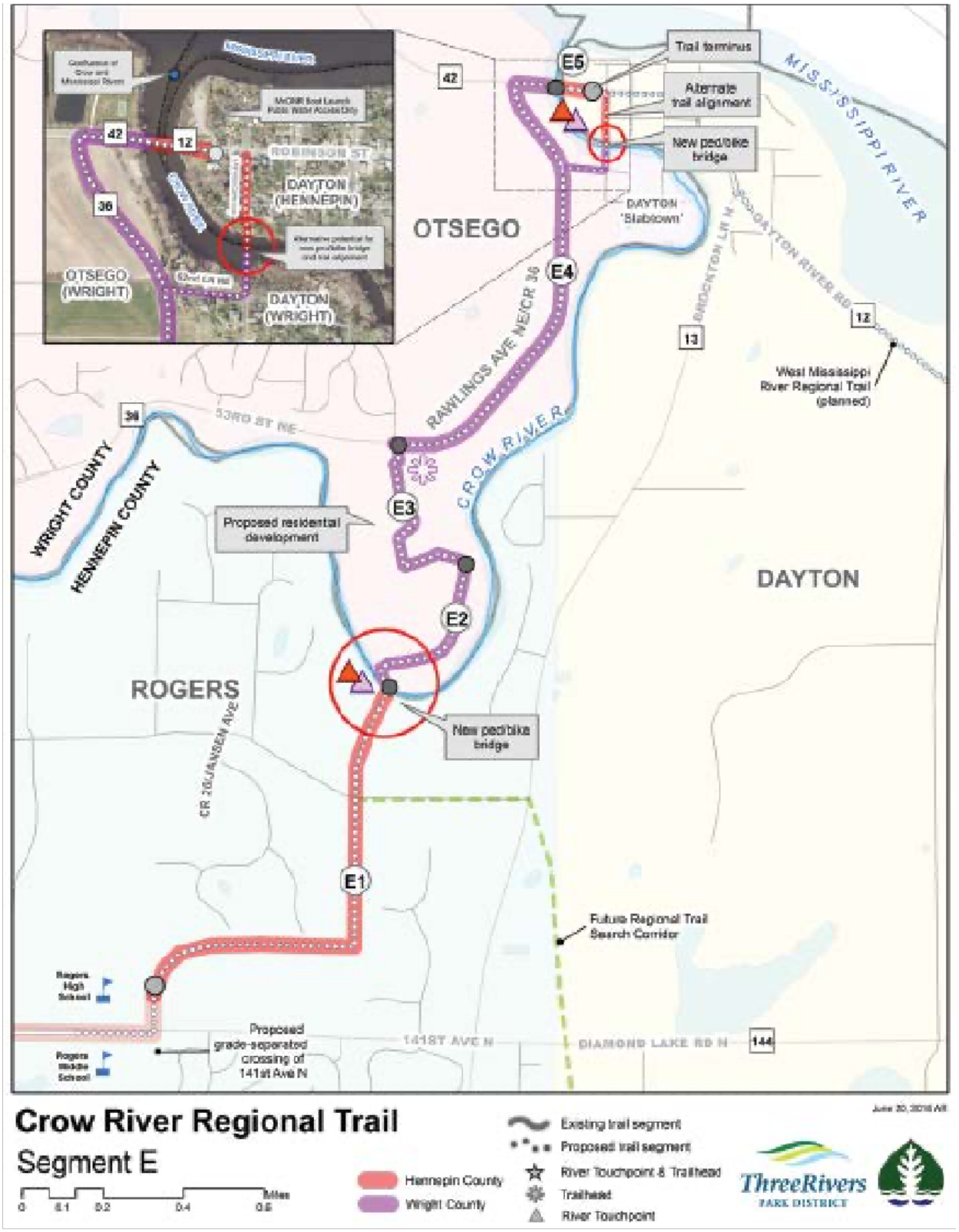


Figure 4: Existing and Planned Trails near Highlands of River Pointe Park

BENEFITS TO RESTORATION

Driven by the desire to preserve natural areas in this matrix of developing residential and agricultural lands, this plan recommends managing invasive species within the park, restoring native plant communities on the site, and improving public access. Restoration of floodplain terrace forest, oak forest, and grassland communities on the site is prioritized as invasive species and erosion imperil these habitats. Yard waste dumping in the park and the extension of residential landscaping into the park call for attention to the site and public outreach and education. Because the recreational use of the site is not well understood and site orientation is poor, the community should be involved in decision-making and stewardship of the park. This is vital to the park's success as a community asset.

These benefits align with goals set in the City of Otsego Parks and Recreation System Master Plan, which lists "existing streambank stabilization and woodland restoration projects, potential forest and river shoreland restoration, soft-surface hiking and mountain bike trails, connection to the Crow River Regional Trail, and a canoe/kayak launch."

INVENTORY AND ASSESSMENT

FMR ecologists conducted a natural resources inventory and assessment during the summer and fall of 2024 to document existing plant and wildlife communities, identify opportunities for restoration, and develop guidance for long-term public use. HRP consists of four primary vegetation cover types: upland grassland, wet meadow/shrub carr, oak forest, and terrace forest along the river (Figure 5). The wet meadow/shrub carr, oak forest, and terrace forest occur in single distinct units across the park, and the upland grassland occurs in four geographically distinct units separated by other cover types.

Units 1a, 1b, 1c, and 1d.: Upland Grasslands

Units 1a, 1b, 1c, and 1d, the Upland Grasslands, are characterized by pockets of native prairie forbs (wildflowers) and grasses within larger swaths of non-native grasses, weedy forbs, and significant non-native woody encroachment. Some native plants may occur because of site restoration following the construction of the housing development, but based on species assemblages, there are also likely remnant plant communities within the grasslands. Recent aerial imagery indicates that the upland has been maintained with prescribed fire, which is key to the persistence of prairie species and suppression of shrubs and trees, as well as weedy cool season grasses. Units 1c and 1d sit on either side of two stormwater basins and, in high-water years, can be temporarily saturated. The natural surface trail creates the southern boundary of Unit 1c and the eastern boundary of Unit 1d.

Unit 2: Wet Meadow/Shrub Carr

Unit 2, the Wet Meadow/Shrub Carr, is a constructed stormwater basin that receives piped runoff from the residential subdivision to the north of the park. Recent aerial imagery documents that this area also receives flood flows from the Crow River during high-water events and can be nearly entirely inundated. Willows and eastern cottonwood are well-

established in the basin, and in non-treed areas, sedges, cattails, and reed canary grass comprise the herbaceous layer. Fluctuating soil moisture, soil type variability, and slight elevation differences have led to a high degree of vegetation community diversity in the unit.

Unit 3: Oak Forest

Unit 3, the Oak Forest, is likely the most unchanged plant community within the site. Aerial images from 1937 and 1940 show an oak woodland or dense oak savanna with an open understory within the larger matrix of agricultural fields. The woodland may have been grazed or burned to maintain its open character throughout most of the 20th Century, but in the last 20 years, the understory has filled in considerably and is now dominated by invasive common buckthorn and Tatarian honeysuckle.

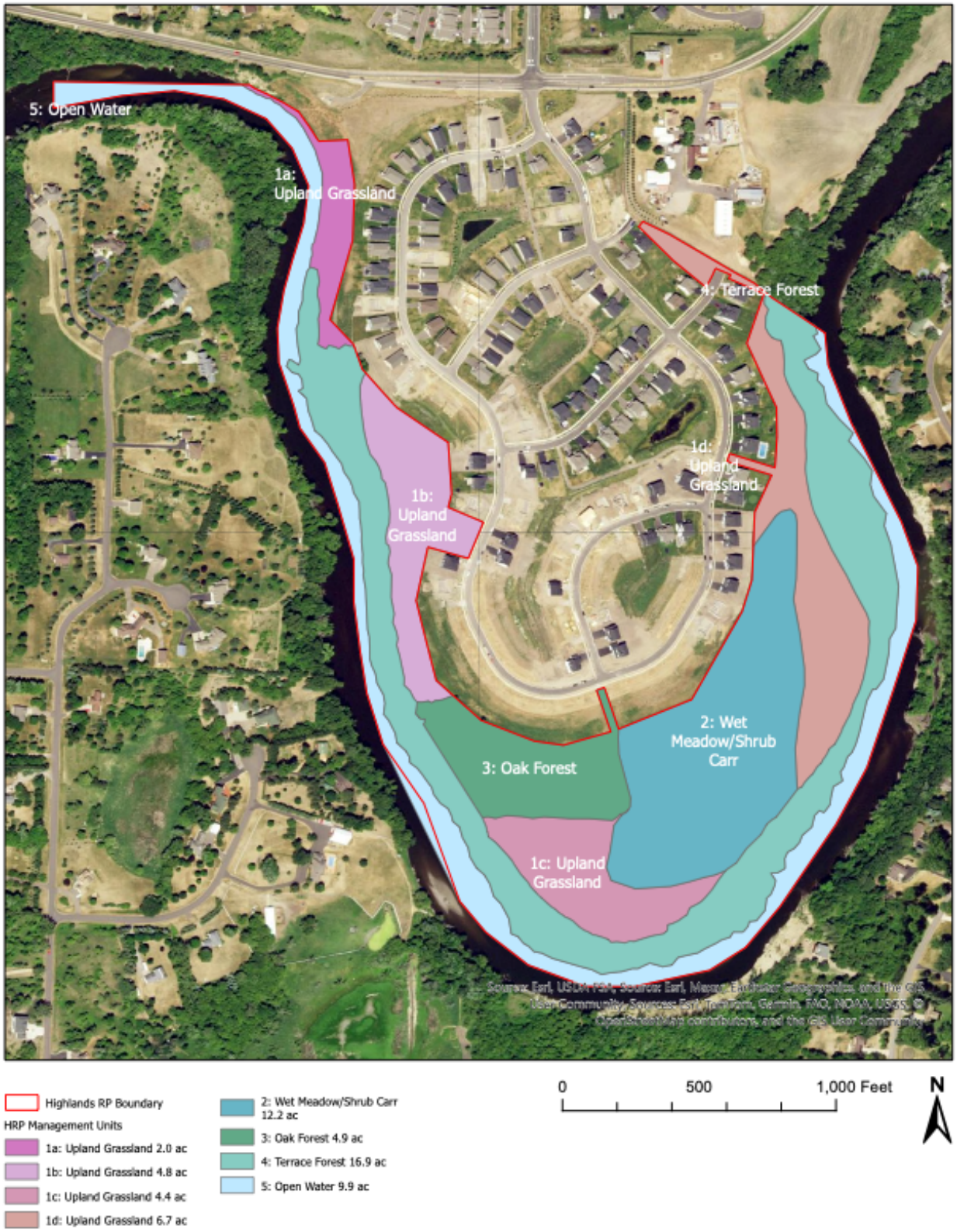
Unit 4: Terrace Forest

Unit 4, the Terrace Forest, lies slightly higher in elevation than the floodplain of the Crow River and is characterized by a sometimes-dense tree canopy and shrubby understory, as well as open sandy areas that receive frequent disturbance from flood flows. The unit is the inside bend of a large oxbow in the river, where waterborne sediment drops out as water slows, making the wide turn of the oxbow. Large floodplain trees such as silver maple and eastern cottonwood line the banks, but the invasive tree Siberian elm is also present, which is the likely seed source for the Siberian elm in the grassland. The most common understory shrub in the unit is common buckthorn, some of which are very large and produce fruits. Several "social trails" lead from the mowed natural surface trail to the river through this unit. The Terrace Forest would be bisected by a trail when the Crow River Regional Trail connects to HRP via a new bridge across the river from the south.

Unit 5: Open Water

Unit 5, Open Water, is 9.9 acres of open water on the Crow River within the park property's parcel boundary. This management unit is only designated to account for those acres in the overall delineation of management units and in consideration of the total property acreage of 61.8 acres. No specific management is prescribed in open water areas.

Figure 5: Management Units of Highlands of River Pointe Park



PRIORITY ISSUES

Priority Issues are concerns that pose the greatest risk or threats to the ecological integrity of the site. They can be addressed through a variety of management actions over time. If left unmanaged, current conditions will persist or worsen.

Priority Issues for Highlands of River Pointe Park include:

1. The abundance of non-native and invasive species degrades habitat and displaces native species that would otherwise create much-needed habitat and provide other ecosystem services.
2. The low plant species diversity within native plant communities across the site creates poor habitat, including a lack of floral resources for pollinators throughout the growing season.
3. The misuse of parkland for yard waste dumping and the extension of lawn mowing into park natural areas diminishes habitat value and leads to phosphorus and other nutrient runoff into the Crow River.

PRIORITY FEATURES

Priority Features are key components identified to require management to sustain ecological integrity and build resiliency in the face of Priority Issues. This NRMP will focus on three Priority Features and provide associated management recommendations.

Priority Features at Highlands of River Pointe Park include:

1. The remnant and re-established prairie plant communities within the grassland and the potential to expand and enhance these plant communities to provide critical habitat for pollinators and grassland songbirds.
2. The oak forest plant community and the potential to preserve and enhance this historic habitat within the site.
3. The terrace forest and the potential to restore its degraded understory plant community while also enhancing access and providing for climate resiliency.

Natural resources management recommendations associated with each Priority Feature incorporate the resource assessment conducted by FMR, past land use and management activities, the goals and perspectives of Otsego Parks and Recreation, and the community's values for the park. The recommendations stem from general ecological guidelines for these types of landscapes set by the Minnesota Department of Natural Resources (MNDNR) in and address the Priority Issues mentioned above.

PRIORITY FEATURE 1:

Remnant and re-established prairie plant communities within the grassland and the potential to expand and enhance these plant communities to provide critical habitat for pollinators and grassland songbirds and improve aesthetics for the community.

Priority Management Objectives include:

1) Reduce or eliminate invasive herbaceous plants and eliminate invasive woody shrubs and trees
2) Reestablish mesic-wet prairie plant communities
3) Establish a 3–4-year prescribed burn rotation
4) Reduce or eliminate yard waste dumping and mowing and underground fence encroachment

The primary goals will be to reduce non-native plant cover, increase native vegetation cover, diversity, and habitat structure, reintroduce a historical disturbance regime, and increase habitat for rare features like Species of Greatest Conservation Need (SGCN).

PRIORITY FEATURE 2:

Oak forest plant community and the potential to preserve and enhance this historic habitat within the site.

Priority Management Objectives include:

1) Reduce or eliminate invasive herbaceous plants and eliminate invasive woody shrubs.
2) Reestablish an earthworm-resistant herbaceous plant community.
3) Reestablish a fire-resistant native shrub layer
4) Close and revegetate redundant trails within the forest to increase habitat integrity and limit habitat edge effects.

The primary goals will be to reduce non-native plant cover, increase native vegetation cover, diversity, and habitat structure, reintroduce a disturbance regime, and increase habitat for rare features like Species of Greatest Conservation Need (SGCN).

PRIORITY FEATURE 3:

The terrace forest and the potential to restore its degraded understory plant community while also enhancing access and providing for climate resiliency.

1) Reduce or eliminate invasive herbaceous plants and eliminate invasive woody shrubs and trees.
5) Reestablish an earthworm-resistant and flood-tolerant herbaceous plant community.
6) Establish safe and maintainable river access points

ECOLOGICAL CONTEXT

GEOLOGY AND GROUNDWATER

The site's geologic history is from the Cambrian era, and bedrock is comprised of sandstone, siltstone, shale, and dolostone with rift-flanking sandstone from the Hinckley, Fond du Lac, and Solar Church formations. These formations are from ~1,000,000,000 years ago and developed from deposition in eolian, fluvial, and lacustrine environments. (Jirsa, et al., Geologic Map of Minnesota Bedrock, 2011.)

The depth of groundwater across the eastern and central portions of the site is between 0 and 10', and the northwestern portion has groundwater at a depth of between 10 and 20'. The shallow depth of groundwater increases its sensitivity to pollution from contaminants that might move through the soil profile.

TOPOGRAPHY & ASPECT

The site is slightly sloped from north to south, with a 10-foot elevation drop from the northern edges of the park (860 FASL) to the Crow River streambank (850 FASL). This slight change in elevation creates a minor south-facing aspect that accelerates soil warming on the northern edge of the park, but the floodplain treeline shades the southern edge of the site during the fall, winter, and early spring when the sun is lower in the sky.

Figure 6: Topography Contours at Highlands of River Pointe Park

SOILS

Three soil types are dominant across the site, with several subtypes of these filling out the remainder of the park. Adjacent to the Crow River floodplain at the southern tip of the park, Elkriver fine sandy loam covers approximately 18.0 acres. It is a somewhat poorly drained, deep alluvial floodplain soil with more than 60 inches to a restrictive feature.

The central area of the park, where the oak forest and stormwater basins are located, has another type of Elkriver fine sandy loam covering 20.5 acres. This soil is moderately well-drained, rarely flooded, and very deep, with alluvial parent material. It can be assumed that the soil profile within the stormwater basin's construction limits has changed.

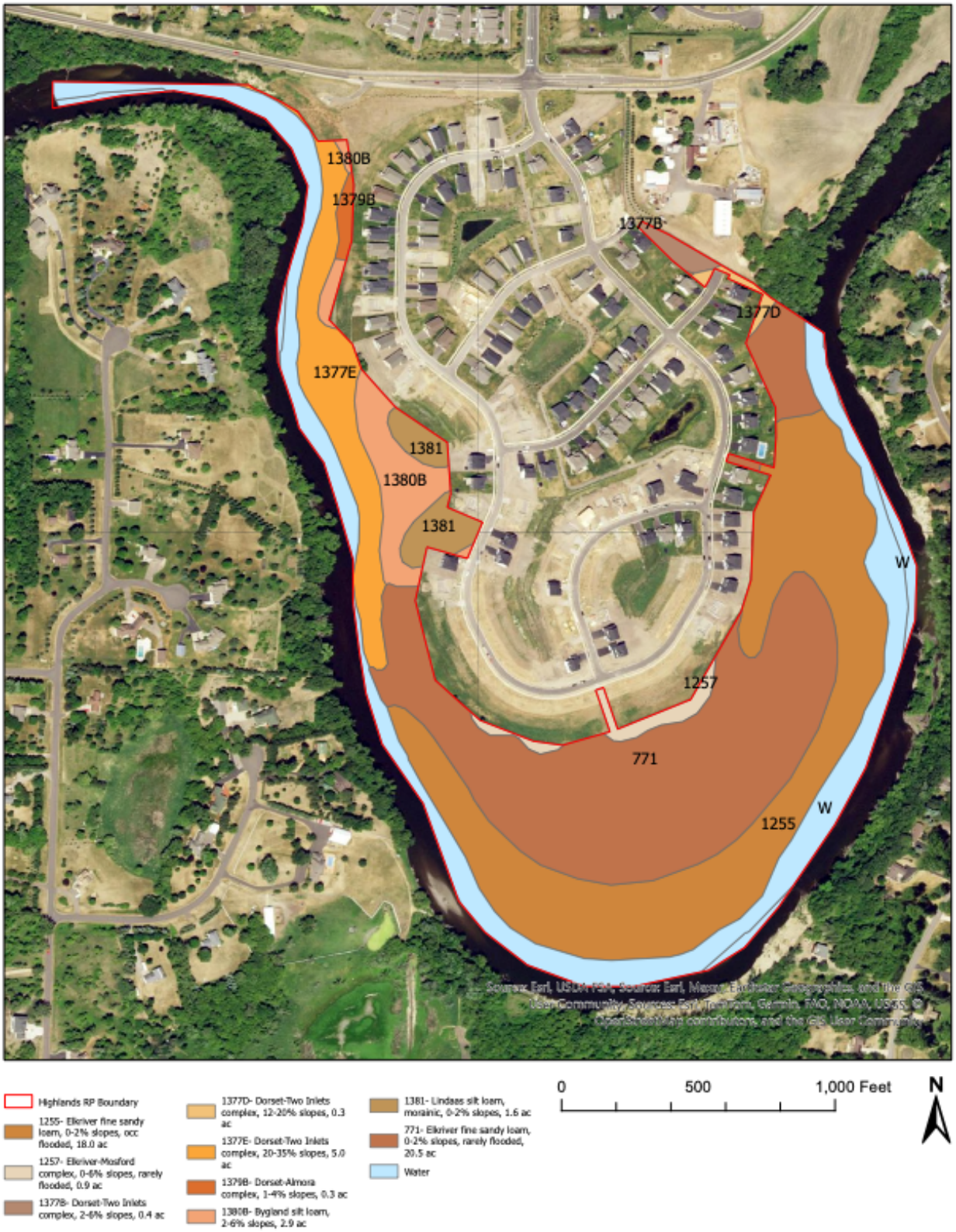
The western edge and extreme northeast corner of the park's terrace forests covering 6.0 acres have Dorset-Two Inlets/Dorset-Almora complex soils, which are very deep, well-drained sandy loams. These soils typically occur on hills on outwash plains and stream terraces.

The western upland lobe of the park contains two silt loams, Bygland and Lindaas silt loam, covering 4.5 acres. Bygland silt loam is a very deep, moderately well-drained soil that typically occurs on hills in lake plains, with glacial lake sediments as its parent material. Lindaas silt loam is also very deep but moderately well-drained, with glacial lake sediments as its parent material. (Figure 7).

Soil types within each management unit are listed in Appendix A.

The remaining acreage within the park boundaries is open water.

Figure 7: Soil Units within Highlands of River Pointe Park



SURFACE WATER RESOURCES

RIVERS

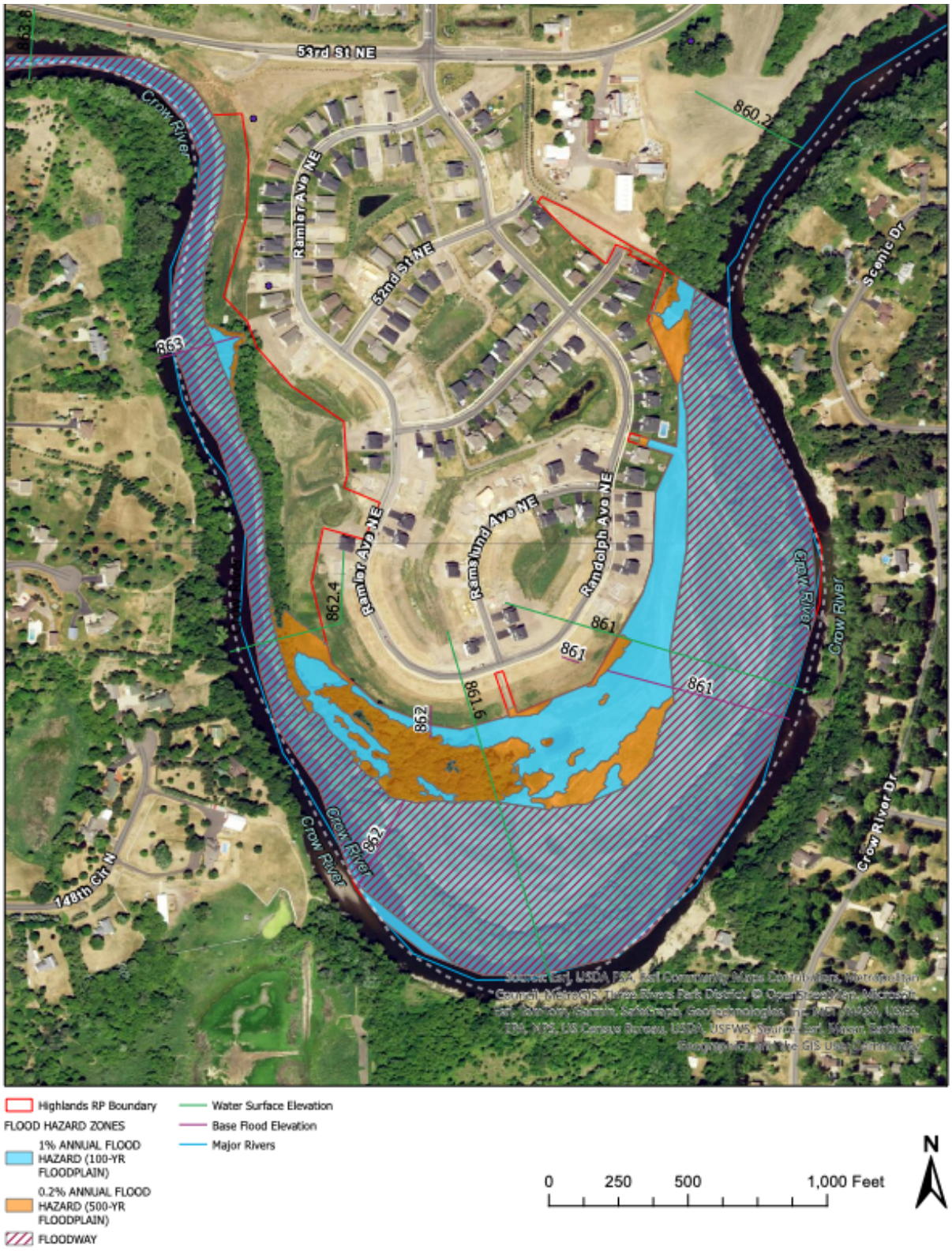
The North Fork of the Crow River borders the park to the south and is a tributary to the Mississippi River. It is impaired for fecal coliform, fish biodiversity, invertebrate biodiversity, nutrients, and turbidity. The Minnesota Pollution Control Agency, which monitors stream health in Minnesota, has determined that a Total Maximum Daily Load (TMDL) study is required for this reach of the Crow River. The City of Otsego has an opportunity here to work with the North Fork of the Crow River Watershed District to advance a TMDL study so that water quality improvements are targeted toward measurable and achievable reductions.

Highlands of River Pointe Park has a high degree of interaction with the Crow River, and the landform itself is the result of river-borne sediment deposition. The meander in the river south of the park slows the current, and sediments suspended in the water drop out as the water slows around bends in the channel. These deposits have built up over time and created a small peninsula of land on which the park is located.

Healthy streams are connected to their floodplains with shallow banks that gradually rise in elevation to wide, flat terraces. During periods of high water, flood flows exceed the banks and are stored within the floodplains, where sediments and debris drop out before water levels recede. At HRP, the floodplain and adjacent terrace forest provide that water quality benefit while protecting nearby homes and infrastructure from flooding (Figure 8).

The majority of the land area within Highlands of River Pointe Park is within the Crow River's floodway, and most of the park has a 1% annual chance of flooding. This likelihood is expected to increase as climate change increases the rate of precipitation during rain events. These conditions should be taken into consideration when planning and locating infrastructure improvements such as trails and signage. Likewise, periods of inundation will also influence restoration practices such as seed mix design, planting, and the timing of management techniques such as mowing and prescribed fire.

Figure 8: Flood Zones of Highlands of River Pointe Park

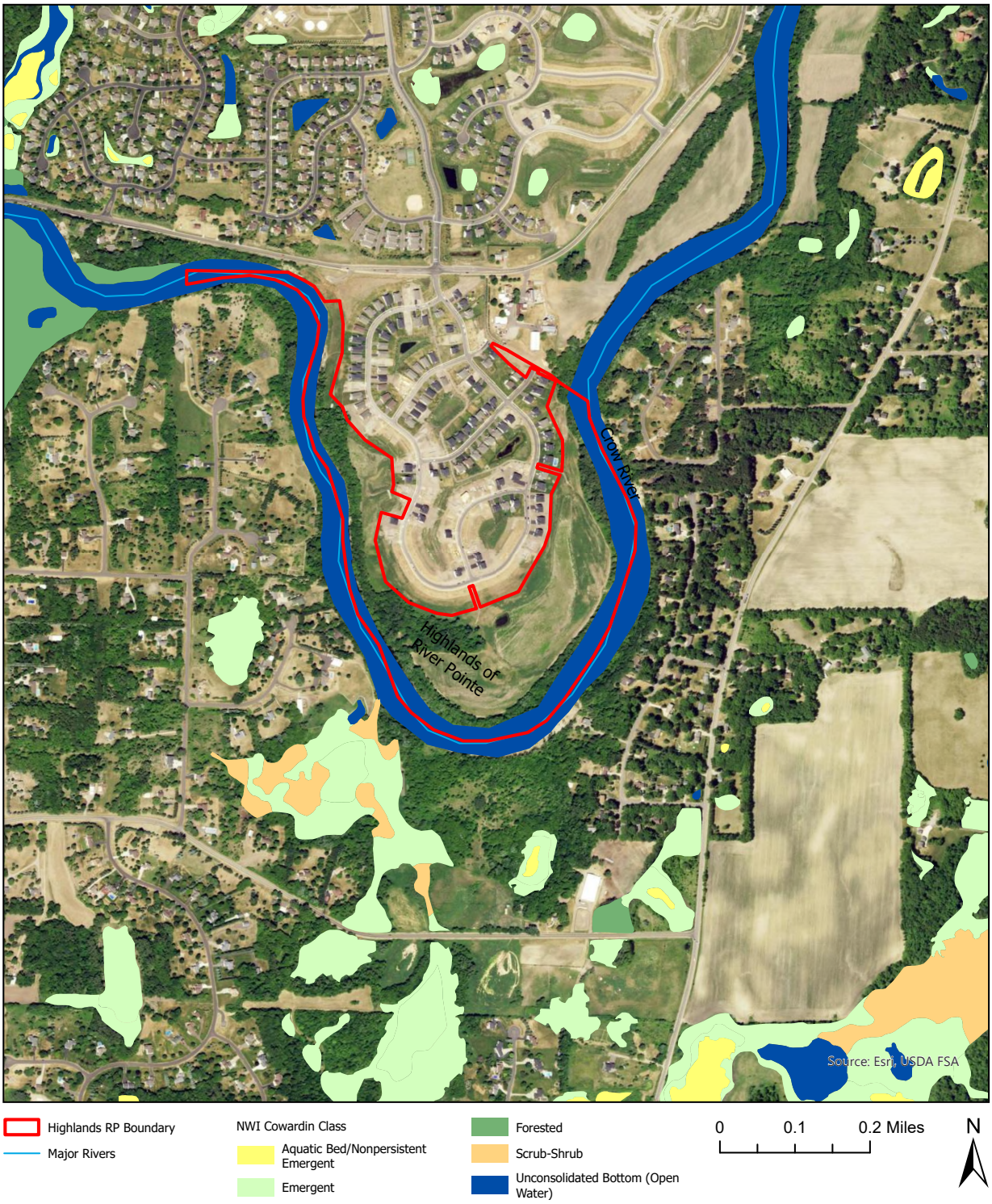


WETLANDS

According to the National Wetland Inventory (NWI), one wetland type is present within the boundary of HRP: “Unconsolidated Bottom-Open Water,” which is associated with the Crow River (Figure 9). Any management within this boundary, such as streambank restoration, must adhere to Minnesota Wetland Conservation Act rules and would require an official wetland delineation to provide certainty of exact wetland boundaries. The addition of material to potentially rebuild areas of erosion in the riverbank would also be restricted by watershed regulatory rules for floodplain fill.

The stormwater basin within the park, while characterized for management purposes as a “wet meadow-shrub carr,” is not a naturally occurring wetland.

Figure 9: Wetlands in the Area of Highlands of River Pointe Park



HISTORICAL VEGETATION

Based on data transcribed from the original Public Land Survey of Minnesota from 1847-1907, the Crow River flowed through uplands of hardwood forest and lowlands of river bottom forests (Figure 1).

In the historical hardwood forests of the uplands, oaks, maples, and basswoods would have filled the canopies of the forest, and this would have been the cover type of the eastern two-thirds of the park around the time of the public land survey.

In lower-lying areas, where the streambanks gently sloped to meet uplands, higher stream flows would have reached hundreds of feet into river bottom forests with early successional species such as silver maple, box elder, and eastern cottonwood. Historically, the western "leg" of the park would have had this cover type.

Further supporting this characterization of historical vegetation is the recording of five bearing trees near the present-day park, those trees marked during the Public Land Survey as a standard way to facilitate the relocation of a lost or moved section corner marker. The species of these five trees are American elm, red maple, red or rock elm, American basswood, and sugar maple, which are all species of hardwood forests and river bottom forests.

Historical aerial photos can also help to understand vegetation and land use changes over the last 75 years (Figure 2).

CONNECTIVITY

ADJACENT LAND USE

Highlands of River Pointe Park is located within an area of rapid development and conversion of natural and agricultural lands to residential development. While the park itself is a significant area of protected and naturalized land, its shape creates a significant amount of "edge habitat," where vegetation types creating blocks of habitat are in linear strips rather than large contiguous areas. Some wildlife species require larger blocks of habitat and can be adversely affected by an increased ratio of edge to total interior habitat. These "edge effects" are parasitism or predation, adverse microclimate conditions, and competition from invasive species. In response to this unavoidable arrangement of habitat types across the park, efforts should be made to improve each habitat type through vegetation restoration and encouraging native habitat landscaping throughout neighboring residential areas. Nearby habitat is especially useful to species with short dispersal ranges, such as insects and insect-pollinated plants.

Related, the park's location within a residential and developing area also lends itself to future introduction of invasive species and escaped garden plants. As park use increases and naturalized spaces near the park shrink, the likelihood that people will transport weedy species on their shoes, yard waste dumping may establish populations of cultivated plants,

and wildlife will move invasive species to the site. Ongoing attention to the plant community conditions and responsive management will abate these issues.

The 62 acres of the park do create a small link in a larger habitat corridor between the restored prairie across 840 acres of the Crow-Hassan Park Reserve five miles to the west and the Mississippi River Flyway migration corridor two miles to the east.

PROXIMITY TO ECOLOGICAL CORRIDORS

Metro Conservation Corridor

Highlands of River Pointe Park is located within a lobe of the Metro Conservation Corridors (MeCC), a series of connected habitat corridors throughout the greater Twin Cities area. The MeCC was originally developed from natural resource analysis work completed by the MNDNR in the 1990s. Subsequently, this work has been refined through the partnership of many metro organizations, with the goal of providing communities with open space, wildlife habitat, and water quality benefits. Restoration within HRP will contribute to all three of those goals.

Mississippi River Habitat

Highlands of River Pointe Park is less than 2 miles upstream of a Mississippi River reach designated by the MNDNR as a "medium-high" quality aquatic habitat based on an exceptional Index of Biological Integrity (IBI) score as determined by Minnesota Wildlife Action Network or WAN. The MNDNR developed the WAN as a part of the 2015-25 Minnesota Wildlife Action Plan revision. Habitat enhancement at HRP will further extend this corridor, supporting both migratory and resident wildlife populations.

ECOLOGICAL SIGNIFICANCE AND WILDLIFE VALUE

Nearly all forms of wildlife depend on rivers for sustenance, especially invertebrates, amphibians, reptiles, and fish. Mammals and birds also benefit greatly from the water, shelter, and nutrients provided by the river, and birds use the river corridor as an important migratory flyway. While HRP is not ranked for ecological significance by the Minnesota County Biological Survey, its adjacency to the Crow River confers habitat value in that it is upland of this river system. The site is also upstream and downstream of areas of high and moderate biodiversity, and habitat restoration within the park would create additional habitat linking these areas, which is highly valuable for species with larger ranges or higher dispersal rates.

Wildlife observed at the park during 2024 site surveys included a bald eagle, ruby-crowned kinglet, yellow-rumped warbler, white-tailed deer, and evidence of racoon and opossum consuming mussels (Photo 1). FMR ecologists encountered abundant deer and wood ticks in 2024, potentially related to the white-tailed deer population and high precipitation.

COMMUNITY VALUE

In addition to the habitat and water quality benefits provided through restoration at HRP, removal of dense invasive woody plants and the enhancement of the plant communities will create a beautiful destination for the community to spend time, exercise, enjoy nature, and learn about Minnesota's ecology. The value of community open spaces like HRP cannot be understated.

Photo 1: Mussel shells discarded by raccoons or opossums.

RARE SPECIES

According to the DNR natural heritage database, there is one rare species recorded within the site: black sandshell mussel. However, 17 additional rare species have been recorded within 5 miles of the site. Thirteen of these rare species are designated as species of greatest conservation need (SGCN) in Minnesota (Table 1). Habitat loss and degradation have been primary drivers of decline for SGCN.

*Table 1: Rare Species and Species of Greatest Conservation Need (SGCN) in **bold** within 5-mile radius of site.*

Common Name	Scientific Name	Category	Status*
American ginseng	*Panax quinquefolius*	Vascular plant	SPC
Black sandshell	*Ligumia recta*	Invertebrate	SPC
Blanding's turtle	*Emydoidea blandingii*	Vertebrate animal	THR
Big brown bat	*Eptesicus fuscus*	Vertebrate animal	SPC
Butternut	*Juglans cinerea*	Vascular plant	END
Common gallinule	*Gallinula galeata*	Vertebrate animal	SPC
Creek heelsplitter	*Lasmigona compressa*	Invertebrate animal	SPC
Gray's sedge	*Carex grayi*	Vascular plant	SPC
Henslow's sparrow	*Ammodramus henslowii*	Vertebrate animal	END
Leadplant flower moth	*Schinia lucens*	Invertebrate animal	SPC
Loggerhead shrike	*Lanius ludovicianus*	Vertebrate animal	END
Plains hog-nosed snake	*Heterodon nasicus*	Vertebrate animal	SPC
Red saltwort	*Salicornia rubra*	Vascular plant	THR
Regal fritillary	*Speyeria idalia*	Invertebrate animal	SPC
Rusty patched bumblebee	*Bombus affinis*	Invertebrate animal	Watchlist**
St. Lawrence grapefern	*Sceptridium rugulosum*	Vascular plant	SPC
Tricolored bat	*Perimyotis subflavus*	Vertebrate animal	SPC
Trumpeter swan	*Cygnus buccinator*	Vertebrate animal	SPC

*Status refers to conservation status in Minnesota. SPC=special concern, THR=threatened, END=endangered. Rusty patched bumblebee is federally endangered but not listed in the state of Minnesota.

The species of greatest conservation need listed above are species of prairies (Henslow's sparrow, leadplant flower moth, loggerhead shrike, plains hog-nosed snake, regal fritillary, rusty patched bumblebee), woodlands and forests (big brown bat, tricolored bat), and rivers, marshes, and sandy uplands (black sandshell, Blanding's turtle, common gallinule, creek heelsplitter, trumpeter swan). Highlands of River Pointe Park has the diversity of all three habitat types, and restoring native plant communities and returning historical disturbance regimes, such as fire, to this landscape will create conditions to support these and other species suffering from habitat loss.

MANAGEMENT UNITS AND RECOMMENDATIONS

BACKGROUND DATA

This natural resources management plan uses two primary data sets to characterize the property's existing land cover and identify target plant communities for restoration: the MNDNR Minnesota Land Cover Classification System (MLCCS), which integrates cultural and vegetation features of the landscape into one comprehensive land classification system, and the *Field Guide to the Native Plant Communities of Minnesota: The Eastern Broadleaf Forest Province* (MNDNR, 2005) which identifies ecological systems and native plant community types in the state based on multiple ecological features such as major climate zones, origin of glacial deposit, and plant composition.

To simplify and summarize these data, Native Plant Community conditions (grades) were identified for each intact community and are ranked from A (excellent), B (good), C (fair), to D (poor). This ranking considers the abundance of non-native species, diversity and health of native species, level of disturbance and degradation, and impacts or alterations to water features. Condition ranks are only assigned to native plant communities classified according to DNR guidelines; other plant communities are considered land cover types and are not assigned condition ranks.

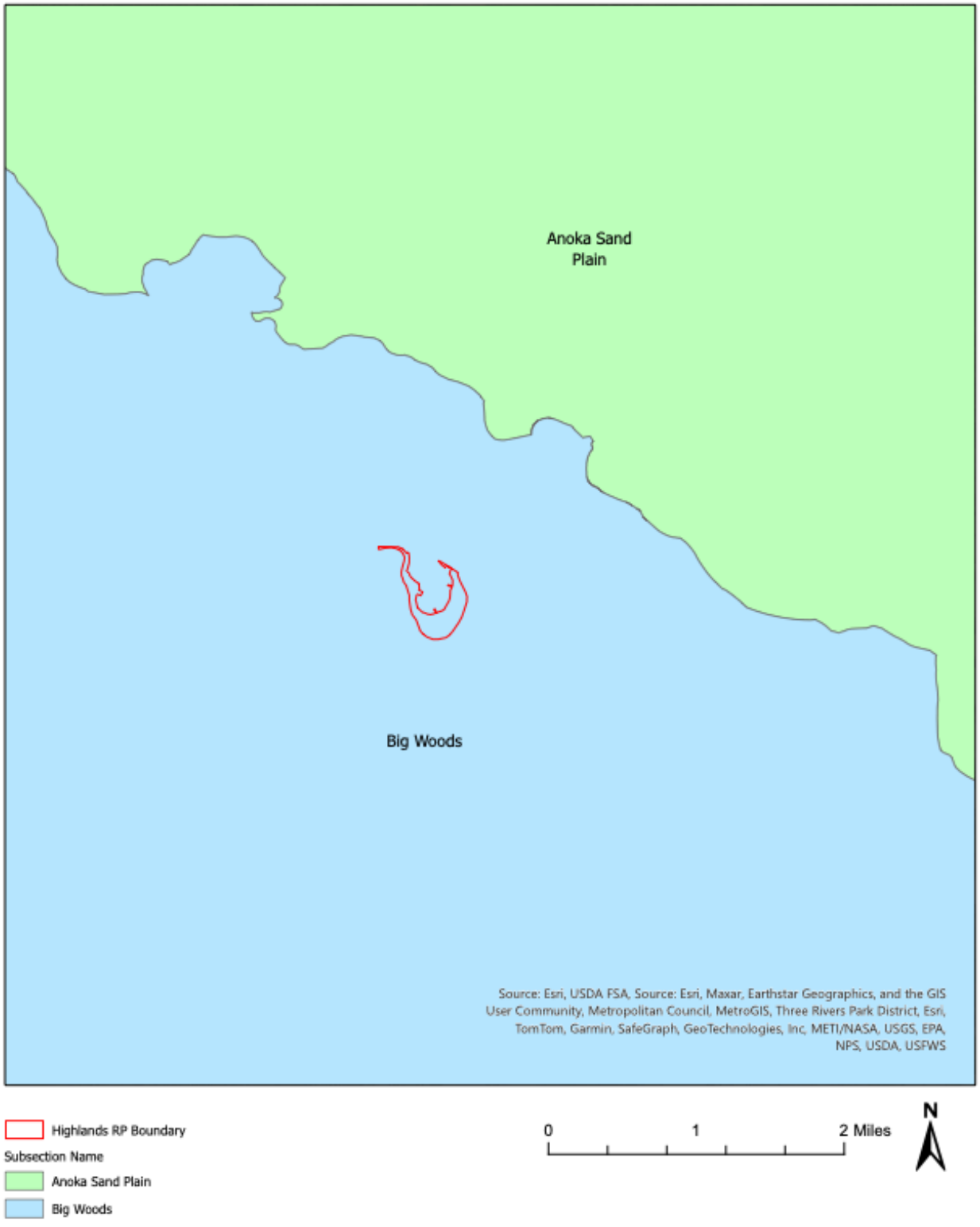
The following site-specific factors were also considered when determining the target plant communities for restoration (Appendix A): historic conditions, existing conditions, relative effort to derive benefits, and community values for the park. These considerations help to determine the optimal and most suitable goals for restoring plant communities within the park.

There are four ecological provinces in Minnesota (prairie parkland, eastern broadleaf forest, Laurentian mixed forest, and tallgrass aspen parkland), ten sections within the provinces, and 26 subsections. Highlands of River Pointe Park is classified as follows (Figure 8):

Ecological Province: *Eastern Broadleaf Forest*
Section: *Minnesota and Northeast Iowa Morainal*
Subsection*: Big Woods*

The Big Woods subsection coincides with a large block of deciduous forest present at the time of European colonization. To the west, tallgrass prairie was the dominant vegetation type, which suggests differences between the two subsections in climate, topography, and natural disturbance. East of the Big Woods subsection, oak savanna and tallgrass prairie communities are indicative of varied topography and disturbance regimes, as well as the soil parent material. Presently, most of this region is farmed.

Figure 10: Ecological Subsection of Highlands of River Pointe Park



MANAGEMENT UNITS OVERVIEW

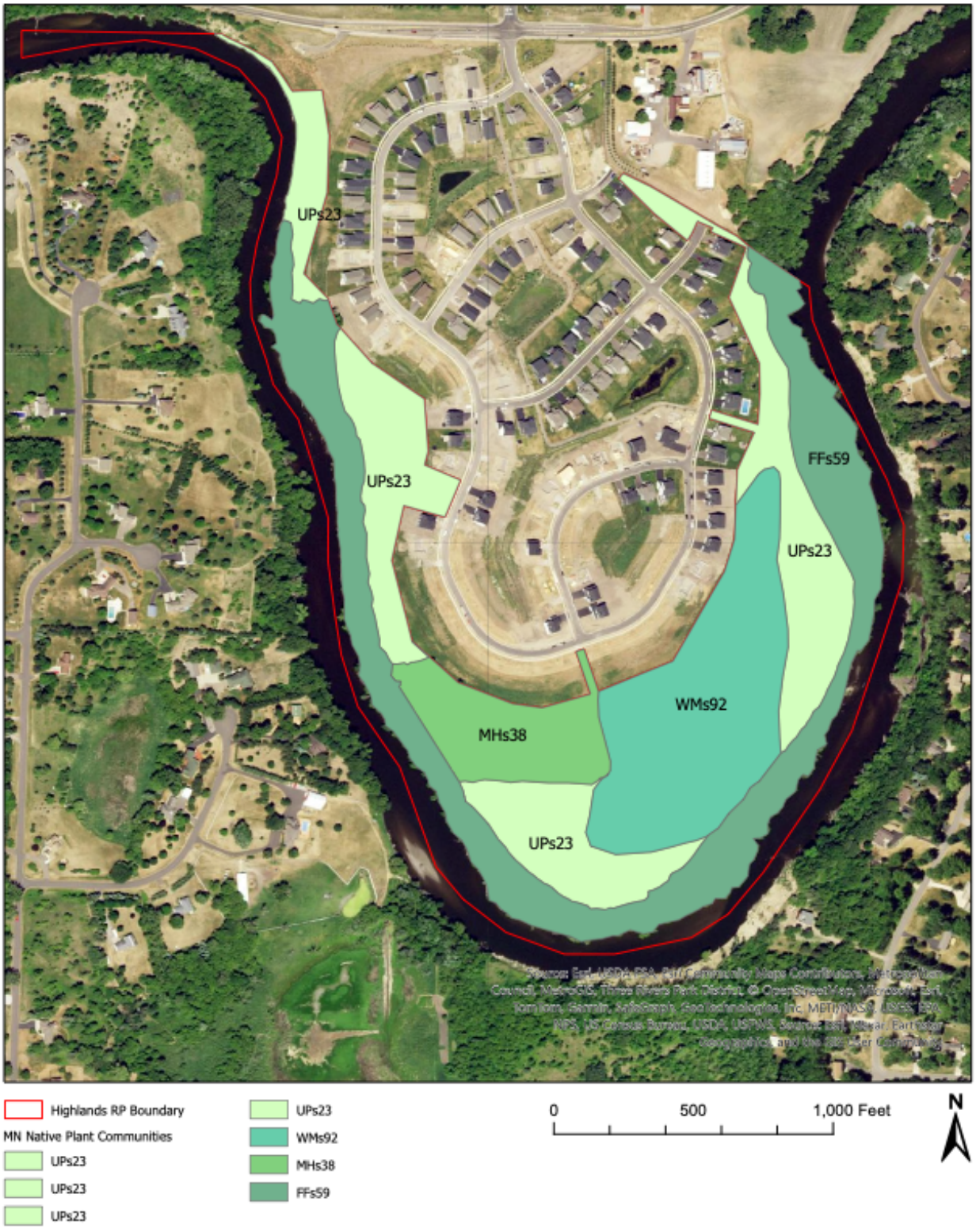
FMR ecologists conducted a natural resources inventory and assessment from May to November 2024 to determine the existing plant and wildlife communities, identify opportunities for restoration, and develop guidance for long-term community use.

Highlands of River Pointe Park consists of four primary management units, with one primary unit divided into 4 subunits.

The following section includes a description of each management unit and subunit, the plant communities or land cover types within each management unit, and possible management strategies. Each unit description also includes a recommended plant community based on the MNDNR Native Plant Communities, which can be used to guide restoration, and full descriptions of each native plant community recommended for the property can be found in Appendix A.

This section also contains representative photos of each Management Unit, and Figures 4 and 11 are maps of the management units and target plant communities for each management unit, respectively.

Figure 11: Target Plant Communities for Management Units of Highlands of River Pointe Park



MANAGEMENT UNIT 1 (Subunits a-d): Upland Grassland

Photo 2. MU1 Grassland with woody encroachment.

Management Unit 1 (MU1) consists of four grassland subunits located in the northwest, south-central, and northeast portions of the site totaling 17.9 acres. The existing plant communities are graded 'D' based on low native plant diversity, high non-native and invasive species presence, and lack of disturbance regimes.

The existing plant community is dominated by cool-season, weedy grasses, such as smooth brome, Kentucky bluegrass, and reed canary grass, invasive forbs (flowers), such as Canada thistle, white sweet clover, bird's foot trefoil, and absinthe wormwood, and encroachment from Siberian elm. Pockets of native tallgrass prairie plants are present in Subunits 1b and 1c, including big bluestem, junegrass, side-oats grama, and gray-headed coneflower.

Species assemblages indicate a grazing or agricultural history, and more recent soil disturbance is likely related to nearby residential construction. Subunits 1c and 1d are also affected by periodic flooding of the Crow River during very wet periods, but the soils in these areas are fine sandy loams characterized as occasionally or rarely flooded, so saturated soil

conditions do not greatly influence the plant communities. The topography within the unit has a more significant impact on soil moisture and localized plant communities with floodplain tree (eastern cottonwood, box elder) encroachment in the unit's boundaries with the stormwater basins. Higher and drier areas have significant encroachment of Siberian elm, which has seeded in from Unit 4, the Terrace Forest. The western subunits, 1a and 1b, exhibit a higher degree of degradation with very few native species present and overall low species diversity.

In terms of infrastructure in this unit, the park also receives piped stormwater from the adjoining neighborhood. Unit 1b contains a very large stormwater basin that was without standing water during any 2024 field visits despite above-average precipitation. One of the two trail connections from the neighborhood to the north enters the park through Subunit 1d. This asphalt trail has mowed edges, and its terminus in the unit connects to the mowed River Trail that traverses the east edge of the park and most of its southern tip.

Photo 3: Unit 1b Dry Basin.

Subunits 1a, 1b, and 1d border the neighborhood to the north, and 42 houses' rear property lines adjoin the units. There are several instances of private landowner encroachment,

including an underground “invisible fence” marked with pin flags, which appears to be located beyond the home’s property line, extensions of backyard landscaping, and yard waste dumping. These uses should end so as not to conflict with community use of the site and water quality protection from phosphorus inputs.

Table 2: Common and notable species observed in Unit 1

CANOPY TREES	MIDSTORY SHRUBS & TREES	GROUND COVER (WILDFLOWERS, GRASSES, SEDGES, FERNS, VINES)
None	**Siberian elm**	**Smooth brome**
	White mulberry	**Kentucky bluegrass**
	Box elder	**White sweet clover**
	Eastern cottonwood	**Canada thistle**
	American basswood	Canada goldenrod
	Quaking aspen	Early sunflower
	Willow species	Junegrass
		Side-oats grama
		Big bluestem

BOLDED: Non-native and/or invasive species

MANAGEMENT OBJECTIVES AND GOALS

OBJECTIVE 1: Reduce or eliminate non-native, invasive plants and trees and reduce aggressive native plant species.

Primary Goals:

- Reduce cover of non-native woody species such as Siberian elm and white mulberry through mechanical and chemical removal methods.
- Reduce cover of herbaceous, non-native, invasive species through mechanical and chemical removal methods.
- Minimize impacts to existing herbaceous native plant community.

OBJECTIVE 2: Enhance habitat through native planting and seeding and adaptive management.

Primary Goals:

- Increase native vegetation cover, diversity, and habitat structure.
- Increase habitat suitability of grassland areas for Species of Greatest Conservation Need (SGCN) and other wildlife such as Henslow’s sparrow, loggerhead shrike, rusty patched bumblebee, and leadplant flower moth.

DESIRED FUTURE CONDITIONS

A reasonable trajectory for the communities in MU1 is towards a B-quality dry-mesic native prairie plant community with reduced cover of non-native/invasive species. Woody cover should be eliminated to support the establishment of prairie plants and the use of periodic prescribed burning, which is essential to the persistence of prairies and grasslands. Native plant communities to consider include Southern Mesic Prairie (UPs23), and if moisture regimes trend drier, Southern Dry Prairie (UPs13).

Based on MNDNR Native Plant Community guidelines, desired vegetation composition may include:
Continuous graminoid cover of 75–100% with tallgrasses dominating, but several midheight grasses also present. Species composition is fairly uniform, although relative abundances shift across the moisture gradient within the community. Big bluestem (*Andropogon gerardii)* and yellow prairie grass (*Sorghastrum nutans*) are the dominant tallgrasses, with prairie dropseed (*Sporobolus heterolepis*) either a codominant or subdominant component. On the drier end of the gradient, little bluestem (*Schizachyrium scoparium*), porcupine grass (*Hesperostipa spartea*), and side-oats grama (*Bouteloua curtipendula*) are important. On moister sites, switchgrass (*Panicum virgatum*) may be common, and prairie cordgrass (*Spartina pectinata*) is usually present. Leiberg's panic grass (*Panicum leibergii)* is distinctive, although usually minor in terms of cover. Forb cover is sparse to patchy (5–50%). Forb species composition also responds to moisture. A number of species are common across the moisture gradient, including heart-leaved alexanders (*Zizia aptera*), heath aster (*Aster ericoides*), stiff and Canada goldenrods (*Solidago rigida* and *S. canadensis*), purple and white prairie clovers (*Dalea purpurea* and *D. candida*), silverleaf scurfpea (*Pediomelum argophyllum*), stiff sunflower (*Helianthus pauciflorus*), white sage (*Artemisia ludoviciana*), northern bedstraw (*Galium boreale*), and smooth blue aster (*Aster laevis*). Maximilian's sunflower (*Helianthus maximiliani*), tall meadow-rue (*Thalictrum dasycarpum*), prairie phlox (*Phlox pilosa*), and gray-headed coneflower (*Ratibida pinnata*) are most common on the moister end of the gradient. Rough blazing star *(Liatris aspera*), Missouri and gray goldenrods (*Solidago missouriensis* and *S. nemoralis*), and bird's foot coreopsis (*Coreopsis palmata*) are common in the drier end. Rattlesnake master (*Eryngium yuccifolium*) and compass plant (*Silphium laciniatum*) are typical species in southeastern Minnesota but rare to absent in the community elsewhere.

The shrub layer is sparse (5–25% cover). The low semi-shrubs leadplant (*Amorpha canescens*) and prairie rose (*Rosa arkansana*) are generally common. Sparse patches of wolfberry (*Symphoricarpos occidentalis*) are occasional. Gray dogwood (*Cornus racemosa*), American hazelnut (*Corylus americana*), and wild plum (*Prunus americana*) are rare.

MANAGEMENT ACTIONS

The following section summarizes the various actions that will support the Management Objectives for Management Unit 1. The table below identifies the timeline and likely

trajectory of the habitats associated with various actions, and the following paragraphs describe the sequence of management, expected outcomes, and potential methods of adaptive management given site conditions. Specific tasks, timing, and costs are summarized for all Management Units in Table 10.

Table 3: Management Unit 1 Potential Management Actions.

MANAGEMENT NEED	MANAGEMENT ACTIONS	LIKELY TRAJECTORY	TIMELINE
Reduce or eliminate non-native, invasive herbaceous species.	Broadcast herbicide application followed by spot herbicide application followed by site mowing or prescribed burning.	Target invasive species will diminish over time with some persistent perennial weeds requiring additional spot treatments.	3 years
Eliminate invasive woody species.	Extraction or cutting and stump-treating of Siberian elm and white mulberry. Follow-up foliar spot herbicide application to control seedlings and resprouts.	Target invasive woody species will be greatly reduced with initial treatments, and follow-up herbicide work will further reduce woody encroachment. Prescribed fire will further suppress woody encroachment.	3-4 years
Establish native mesic prairie species.	Spring drill seeding or fall broadcast seeding depending on woody removal method.	Germination of 3-4 forb species and 1-3 graminoid species in first growing season after seeding with progressively greater plant diversity over successive years.	3-4 years
Maintain newly establishing native mesic prairie species.	Full unit establishment mowing.	Mowing to a height of 4-5” twice during the first two growing seasons will suppress aggressive, cool season weeds and allow sunlight to reach seedlings of native plants.	2 years
Reintroduce fire through prescribed burning.	Prescribed burn of Subunits 1a and 1b.	In spring of third growing season after seeding, burn western grassland subunits to suppress woody encroachment, diminish weedy cool season grasses, accelerate soil nutrient cycling, and stimulate further germination of seeded species.	1 year at Year 3
Reintroduce fire through prescribed burning.	Prescribed burn of Subunits 1c and 1d.	In spring of fourth growing season after seeding, burn eastern grassland subunits to suppress woody encroachment, diminish weedy cool season grasses, accelerate soil nutrient cycling, and stimulate further germination of seeded species.	1 year at Year 4

MANAGEMENT UNIT 2: Wet Meadow-Shrub Carr

Photo 4. MU2 Basin.

Management Unit 2 (MU2) is a single contiguous constructed stormwater basin that receives piped stormwater runoff from the neighborhood to the north via two inlets at the northwest and northeast corners of the unit. The unit's topography is tied to its use as a stormwater basin with edges that blend into the contours of the surrounding grassland Subunits 1c and 1d and gently slope to the center of the basin with an elevation change of approximately 6 feet. In addition to piped stormwater, the basin also receives overland flow and, during periods of high water, flood flows from the Crow River. The basin discharges treated stormwater to the river through an outlet at the southeastern edge of the park. Given the elevation of this outlet below the ordinary high-water level of the Crow River, it can be assumed that flood flows from the river flow into the outlet and back up into the basin during periods of high water.

Although this unit functions as part of the neighborhood's stormwater management system and does not fall into a standard native plant community type, the vegetation composition is most like a wet meadow-shrub carr cover type with moisture-tolerant woody and herbaceous

species present and still holds high potential for habitat value. Fluctuating water levels and consistent inputs of weedy propagules carried in stormwater have resulted in a non-native plant-dominated community within the unit. Reed canary grass and hybrid cattail are abundant. The existing plant communities are graded 'D' based on low native plant diversity and high non-native and invasive species presence. The nearby Crow River's floodplain has many large cottonwood trees, which have dispersed seed into the unit, and dense cottonwood saplings and small trees are present in the basin, which, over time can decrease the basin's function and limit its habitat potential for pollinators.

Table 4: Common and notable species observed in Unit 2

CANOPY TREES	MIDSTORY SHRUBS & TREES	GROUND COVER (WILDFLOWERS, GRASSES, SEDGES, FERNS, VINES)
None	Eastern cottonwood	**Reed canary grass**
	Willow species	**Hybrid/narrow-leaf cattail**
	Box elder	**Red clover**
		Dark green bulrush
		Canada goldenrod
		Broad-leaf arrowhead

BOLDED: Non-native and/or invasive species

MANAGEMENT OBJECTIVES AND GOALS

OBJECTIVE 1: Reduce or eliminate non-native, invasive plants and reduce aggressive native plant species.

Primary Goals:

- Reduce cover of herbaceous, non-native, invasive species through mechanical and chemical removal methods.
- Minimize impacts to existing herbaceous native plant community.
- Eliminate native woody cover to maintain stormwater management function and preserve habitat benefits

OBJECTIVE 2: Enhance habitat through native seeding and planting and long-term adaptive management.

Primary Goals:

- Increase native vegetation cover, diversity, and habitat structure.
- Increase habitat suitability of wet meadow for Species of Greatest Conservation Need (SGCN) and other wildlife such as American bittern, black-crowned night heron, sedge wren, and declining damselflies and dragonflies.

DESIRED FUTURE CONDITION

A reasonable trajectory for the plant communities in MU2 is towards a B-quality wet meadow-shrub carr with reduced cover of non-native/invasive species. Although this unit was not historically this cover type, its current soil moisture level and species assemblages resemble a wet meadow and is the best analog for targeting a native plant community through restoration. Non-native and invasive plant species should be reduced to a level that allows for establishment and dominance of native plants that provide higher habitat value. A native plant community to consider is Southern Wet Meadow/Shrub Carr (WMs92). WMs92 has become uncommon across much of its range as a result of invasion by non-native species, especially reed canary grass, following alterations in wetland hydrology. General guidelines for desired vegetation composition include:

WMs92

- Continuous graminoid cover (75–100%); typically dominated by slough sedge, sometimes with bluejoint, prairie cordgrass, red-stalked spikerush, or lake sedge.
- Forb cover is variable, ranging from absent to sparse (< 25%); common species include water smartweed, cattails, common mint, rough bugleweed, water parsnip, and swamp milkweed.
- Shrub cover is sparse; pussy willow, slender willow, and red-osier dogwood may be present.

MANAGEMENT ACTIONS

The following section summarizes the various actions that will support the Management Objectives for Management Unit 2. Table 5 below identifies the timeline and likely trajectory of the habitats associated with various actions, and the following paragraphs describe the sequence of management, expected outcomes, and potential methods of adaptive management given site conditions. Specific tasks, timing, and costs are summarized for all Management Units in Table 10.

Table 5: Management Unit 2 Potential Management Actions.

MANAGEMENT NEED	MANAGEMENT ACTIONS	LIKELY TRAJECTORY	TIMELINE
Reduction of non-native, invasive herbaceous plants.	Successive years of mowing in late spring and early fall to suppress growth of reed canary grass and cattail followed by spot herbicide application to suppress established plants.	Because of weedy propagules entering the unit in stormwater, weedy species will continue to reestablish in the basin. Consistent management will reduce the cover of these species and allow for the establishment of native vegetation to enhance habitat value and stormwater management.	4+ years
Establishment of native plants tolerant of soil moisture fluctuations and competitive with invasive wetland species.	As pockets of bare ground open with invasive species management, seeding and planting to supplement native species that may return from the seedbank.	Native plant establishment will be slow in response to effective invasive species management. Better outcomes will be realized if planted and seeded species are selected for their tolerance of moisture gradients and ability to compete with aggressive invasive species.	4+ years
Elimination of native woody cover.	Removal of trees and saplings by forestry mulching.	Trees will continue to establish in the basin given its proximity to moisture-tolerant tree species in the Crow River floodplain. Increasing shade in the basin will limit herbaceous species establishment and restrict plant diversity. Reduced herbaceous cover will lead to areas of bare ground which can be vulnerable to washout, and lack of vegetative cover limits stormwater pollutant filtration. Eliminating tree cover will remove these negative effects and promote a more diverse cover type and habitat and better stormwater management.	Long-term
Removal of sediment.	Periodic excavation of sediment deposits at stormwater inlets.	Over time, maintenance of the basin should include periodic removal of sediments at the inlets as to allow unobstructed flow across the basin and appropriate stormwater residence time.	Periodic, long-term

Restoration of Management Unit 2 will require native woody vegetation management followed by herbaceous non-native vegetation management. The quick establishment of native tree species is a result of recent disturbances from construction and flooding, which created bare ground. There is also a ready seed source for these trees from nearby floodplain trees such as eastern cottonwood and box elder. Many priorities were considered when determining the appropriate level of tree removal in the basin. Dense woody cover will prevent the persistence of a more diverse herbaceous layer, and the result will be diminished pollutant removal and weediness. Poor herbaceous cover will also result in gullies and

washouts as stormwater floods the basin during heavy precipitation events. A conflicting concern is that the initial removal of the existing trees would be quite costly and dramatically change the appearance of the park for neighbors and park users that have grown accustomed to the landscape.

FMR ecologists and Otsego Parks and Recreation staff weighed these costs and benefits. Together, it was decided that the long-term benefits provided by tree removal outweighed the labor and cost of removal and that the aesthetics of a diverse, pollinator-supporting wet meadow may be equally valuable to the community. Parks and Recreation staff will remove the trees with a forestry mulcher as an in-kind contribution to future state grant-funded restoration.

Management of invasive herbaceous vegetation, specifically reed canary grass and hybrid cattail, will be a significant undertaking requiring multiple years of management and follow-up work as stormwater brings new weed seeds into the basins. With persistence, a native herbaceous ground layer that will be competitive with weedy encroachment can be established by seeding and bare root or deep-rooted plug planting.

MANAGEMENT UNIT 3: Oak Forest

Photo 5. Bur oak in MU3, Oak Forest

Management Unit 3 (MU3) is the oak forest in the west-central portion of the park that has been present for over one hundred years, as evidenced by historical aerial photos and the estimated age of some bur oaks in the canopy that exceed 30 inches in diameter. The oak forest was likely grazed at various times over the last century, given the composition of the understory vegetation, which includes Missouri gooseberry and white snakeroot—telltale species indicative of historic grazing. Historic aerial imagery also tells the story of increasing buckthorn abundance in woodlands and forests in the Upper Midwest during the 1970s and 1980s. Imagery from 1963 shows a relatively open understory indicative of an oak woodland cover type, but by 2008, just 45 years later, the understory had a continuous shrub layer.

Today, the oak forest has a moderately dense understory below towering oaks. In addition to moderately dense buckthorn, the shrub layer includes native shrub species such as black cherry, pin cherry, prickly ash, red osier dogwood, gray dogwood, and American plum.

The herbaceous layer has moderate to high diversity, which has persisted despite the cover of buckthorn and the allelopathy of garlic mustard, an invasive species present in this unit. Native species in the ground layer include Virginia waterleaf, Solomon's seal, Jack-in-the-pulpit, wood sedge, graceful sedge, starry false Solomon's seal, and wood violet. Unlike many woodlands and forests in Minnesota, this oak forest does not show evidence of invasive earthworms. A thick duff layer of slowly decomposing leaves and twigs is distributed across the soil surface, and the ground has a "spongy" quality, which was noticed while walking through the unit.

Table 6: Common and notable species observed in Unit 3

CANOPY TREES	MIDSTORY SHRUBS & TREES	GROUND COVER (WILDFLOWERS, GRASSES, SEDGES, FERNS, VINES)
Bur oak	Missouri gooseberry	Virginia waterleaf
White oak	Black cherry	Jewelweed
American basswood	Prickly ash	Solomon's seal
Hackberry	Red-osier dogwood	Jack-in-the-pulpit
American elm	Arrowwood viburnum	White snakeroot
Box elder	American plum	Graceful sedge
	Northern white cedar	Virginia creeper
	Pin cherry	Hog peanut
	Hackberry	Starry false Solomon's seal
	Ironwood	**Garlic mustard**
	Green ash	**Common buckthorn**
	Common buckthorn	

BOLDED: Non-native and/or invasive species

MANAGEMENT OBJECTIVES AND GOALS

OBJECTIVE 1: Reduce or eliminate non-native, invasive plants and shrubs

Primary Goals:

- Reduce cover of non-native woody species such as common buckthorn through mechanical and chemical removal methods.
- Reduce cover of herbaceous, non-native, invasive species such as garlic mustard through mechanical methods.
- Minimize impacts to existing herbaceous native plant community.

OBJECTIVE 2: Enhance habitat through native planting and seeding and adaptive management.

Primary Goals:

- Increase native vegetation cover, diversity, and habitat structure.
- Increase habitat suitability of woodland for Species of Greatest Conservation Need (SGCN) and other wildlife such as big brown bats, tricolored bats, red-shouldered hawks, many warblers, and eastern spotted salamanders.

DESIRED FUTURE CONDITION

A reasonable trajectory for the communities in MU3 is to work towards a B-quality oak forest plant community with reduced cover of non-native/invasive species. Native plant communities to consider are Southern Mesic Oak-Basswood Forest (MHs38) or, possibly more fitting, the subtype Basswood-Bur Oak-(Green Ash) Forest (MHs38b). MHs38b includes mesic hardwood forests on hummocky topography or near lakes on till plains and stagnation moraines with slopes that are generally not steep, which nearly perfectly describes the geologic history of the site. General guidelines for desired vegetation composition in this plant community include:

- The ground layer is patchy to continuous (25-100%) with plants such as zig-zag goldenrod, large-flowered bellwort, Virginia waterleaf, Clayton's sweet cicely, Virginia creeper, bloodroot, common enchanter's nightshade, early meadow-rue, wild sarsaparilla, Pennsylvania sedge, honewort, yellow violet, wild leek, blue cohosh, cut-leaved toothwort, dutchman's breeches, blue phlox, Virginia spring beauty, white bear sedge, cleavers, wood nettle, tall coneflower. The ground layer often has abundant Virginia waterleaf, starry false Solomon's seal and nodding trillium.
- The sub-canopy is variable with shrub cover of species such as chokecherry and gooseberry. Ironwood is often abundant.
- The canopy is interrupted to continuous and dominated by basswood, bur oak, or green ash. It is further distinguished by a lower frequency of northern red oak and an almost complete lack of sugar maple in the canopy.

MANAGEMENT ACTIONS

The following section summarizes the various actions that will support the Management Objectives for Management Unit 3. The table below identifies the timeline and likely trajectory of the habitats associated with various actions, and the following paragraphs describe the sequence of management, expected outcomes, and potential methods of adaptive management given site conditions. Specific tasks, timing, and costs are summarized for all Management Units in Table 10.

Table 7: Management Unit 3 Potential Management Actions.

MANAGEMENT NEED	MANAGEMENT ACTIONS	LIKELY TRAJECTORY	TIMELINE
Reduction or elimination of non-native, invasive herbaceous plants.	Through hand-pulling or mowing or spot herbicide application, manage garlic mustard, motherwort, and creeping Charlie while avoiding off-target damage to native plants.	Of the three primary invasive plants in the unit, garlic mustard is the primary target. Garlic mustard seed can remain viable in the seedbank for up to 10 years, and a single plant can produce up to 12,500 plants. Motherwort is in the mint family and is quite aggressive. Creeping Charlie can be pervasive and difficult to fully eradicate. Because of these characteristics, management will require several years.	5-6 years with reduced inputs over time.
Elimination of common buckthorn.	Cut all mature buckthorn to ground level and treat stumps with a triclopyr-based herbicide to prevent resprouts. Buckthorn under 1" diameter should be treated with a foliar application of triclopyr in late September or early October when plants are actively photosynthesizing.	Common buckthorn seed remains viable for 3-4 years in the seedbank. After initial removal of mature plants, 2-3 years of follow-up foliar herbicide applications will be needed to eliminate new buckthorn germinants.	4 years
Enhancement of native plant diversity in the herbaceous layer.	Through seeding after buckthorn removal and targeted enhancement deep-rooted plug planting, enhance the herbaceous/ground-layer.	Seeding with a simple, shade-tolerant graminoid-dominated native mix will help to establish a more continuous ground layer that will be more resistant to future invasive plant issues and reduce buckthorn resprouts. Targeted deep-rooted plug planting will further diversify the plant community supporting improved habitat especially for pollinators.	2 years
Potential reduction of duplicative internal trails	Blocking and seeding internal trails within the unit to create more contiguous habitat.	Large logs could be laid across two internal trails that are duplicates of other trails that provide access throughout the unit. Reseeding and planting of trees and shrubs in these trails could prevent further use if the routes become unpassable with vegetation.	3 years

Restoration of MU3 will require woody non-native vegetation management in conjunction with herbaceous non-native vegetation management. Common buckthorn is pervasive within MU3 and is a priority to manage to preserve the native forest diversity present within the unit. Cutting and treating stumps with herbicide is the best way to minimize chemical drift and avoid unnecessary impacts on the existing native plant community. After the initial clearing of buckthorn, garlic mustard may increase from its current known abundance. Given its current level of establishment, mechanical removal by hand-pulling or mowing second-year

garlic mustard plants is recommended. If populations expand to mass monocultures, chemical removal may be considered. Hand-pulling by a neighborhood group of volunteers would be very effective and build stewardship of the park.

After initial management of non-native and invasive species, re-establishment of a native herbaceous/ground layer is recommended. Mass planting of bare root plants or deep-rooted plugs within the understory will provide diversity and forest structure while ensuring some survival considering anticipated deer browse. Increased density of planting should be prioritized in areas adjacent to trails for improved aesthetics.

MANAGEMENT UNIT 4: Terrace Forest

Photo 6. South-central section of MU4, Terrace Forest

Management Unit 4 (MU4) is the narrow terrace forest that nearly rings the park along its southern perimeter between the uplands and floodplain. The width of the terrace forest is approximately 50 feet at its narrowest at the northwestern extent of the unit and around 250 feet at its widest at the east end of the unit. The plant community and soil moisture conditions in the unit are indicative of a “terrace” which is slightly higher in elevation than the

floodplain associated with the Crow River, but the line between these areas is indistinct and depends on seasonal and temporal water levels in the river and on microtopography, or small landform variation, across the unit.

The south-central portion of the unit is very sandy and silty where the terrace is flat and well-connected to the floodplain. Here, only pioneering plant species are present in the groundlayer as they re-establish after the most recent flood conditions in spring 2024. Typical floodplain/terrace canopy trees are present including massive eastern cottonwood and silver maple. American elm and hackberry are dominant in the subcanopy. The tree cover in this section of the unit is interrupted in two places. One location is adjacent to MU3 where a grassy opening extends toward the river and offers an open and gently sloped location for people to be near the water. The other location is at the stormwater outlet to the river, which is armored with articulated concrete block.

At the east end of the unit, the terrace features a steeper slope of 6-8 feet, and flood flows have a shorter residence time here. This leg of the unit is along a straight run in the river where the current is fast-moving. Here, some bank erosion is occurring with tree roots exposed, and large woody debris has accumulated on the banks. This area also has a former dump with considerable broken glass and metal fragments. Common buckthorn is the dominant plant in the understory, with many large, fruit-bearing trees present along the trail's edge.

The western leg of the unit is yet another terrace type, with a flat terrace perched above a sheer bluff with a 38-foot drop to the river below. The bluff has calved over time, with high river flows eroding sandy soils with little vegetative cover for stabilization. Common buckthorn is a minor component in the shrub layer, but Tatarian honeysuckle is prevalent, as is the native shrub prickly ash. Very large white oak and basswood are present in the western end of MU4, and the oaks are showing signs of oak wilt.

Photo 7: Eastern leg of MU4 Terrace Forest

Photo 8: Western leg of MU4, Terrace Forest

Table 8: Common and notable species observed in Unit 4

CANOPY TREES	MIDSTORY SHRUBS & TREES	GROUND COVER (WILDFLOWERS, GRASSES, SEDGES, FERNS, VINES)
White oak	**Siberian elm**	Virginia waterleaf
Bur oak	**Common buckthorn**	Jewelweed
American basswood	Box elder	Cut-leaf coneflower
Eastern cottonwood	Eastern cottonwood	Northern bedstraw
Silver maple	American basswood	Bristly greenbrier
Hackberry	Quaking aspen	Solomon's seal
Box elder	Nannyberry	Twisted stalk
	Red elderberry	Wood sedge
	Willow species	Woodland violet
		Wood nettle
		Poison ivy
		Virginia creeper
		Riverbank grape
		Garlic mustard
		Common buckthorn
		White sweet clover
		Motherwort
		Reed canary grass

BOLDED: Non-native and/or invasive species

MANAGEMENT OBJECTIVES AND GOALS

OBJECTIVE 1: Reduce or eliminate non-native, invasive herbaceous plants and shrubs

Primary Goals:

- Reduce cover of non-native, invasive woody species such as Siberian elm and common buckthorn through mechanical and chemical removal methods.
- Reduce cover of herbaceous, non-native, invasive species through mechanical and chemical removal methods.
- Minimize impacts to existing herbaceous native plant community.

OBJECTIVE 2: Enhance habitat through native planting and seeding and adaptive management.

Primary Goals:

- Increase native vegetation cover, diversity, and habitat structure.

- Increase the habitat suitability of grassland areas for Species of Greatest Conservation Need (SGCN) and other wildlife, such as the tricolored bat, big brown bat, and rusty patched bee.

DESIRED FUTURE CONDITION

A reasonable trajectory for the communities in MU4 is to work towards a B-quality terrace forest plant community with reduced cover of non-native/invasive species. Invasive woody cover consisting of Siberian elm in patches and common buckthorn, which is dominant in several areas of the understory, should be reduced to support the establishment of a native, habitat-supporting shrub layer. A shrub layer with some openings will allow for the development of a more continuous herbaceous layer that is more resistant to future invasion by weed species and protective against erosion and bluff/bank loss. Native plant communities to consider are Southern Terrace Forest (FFs59) in the more upland areas, and specifically, Silver Maple-Green Ash- Cottonwood Terrace Forest (FFs59a), which is typically present on terraces of medium to large rivers. Southern Floodplain Forest (FFs68) is a better target plant community in the lower areas more affected by flood flows and heavy rains.

FFs59

- Mostly interrupted to continuous ground layer cover (50–100%), often with abundant wood nettle. Other typical species include Virginia waterleaf, spotted touch-me-not, tall coneflower, stinging nettle, cleavers, common blue violet, honewort, aniseroot, Virginia bluebells, and eastern narrowleaf sedge. Reed canary grass is highly invasive on sites where the canopy has been opened by disturbance.
- Woody vines are sparse to patchy (5–50% cover), mostly present in lower strata. Virginia creeper and riverbank grape are typical.
- Shrub layer and subcanopy are sparse to patchy (5–50% cover); typical species include American elm, hackberry, box elder, Missouri gooseberry, prickly ash, and chokecherry.
- Canopy is interrupted to continuous (50–100% cover). Species composition is variable, but American elm, green ash, hackberry, basswood, box elder, silver maple, black ash, and cottonwood are often com

FFs59a

- The most common canopy trees are American elm, silver maple, box elder, and green ash, with occasional cottonwood and hackberry. Most of these species are also important in the understory. Important shrubs include eastern wahoo, red-berried elder, hawthorns, and prickly gooseberry. Important ground-layer species include Ontario aster, jack-in-the-pulpit, Maryland black snakeroot, Clayton's sweet cicely, early meadow-rue, and virgin's bower.

FFs68

- Ground-layer cover is generally very sparse during spring due to inundation and scouring by floodwaters, becoming variable by midsummer (5–50% cover) and characterized by annual or flood-tolerant perennial species. Important herbaceous

species include false nettle, clearweeds, Ontario aster, Virginia wild rye, cut grasses, hop umbrella sedge, and cattail sedge. Wood nettle often forms dense patches. Species typical of wetland communities are also often present, including mad dog skullcap, southern blue flag, and *Bidens* species. The invasive species kidney-leaved buttercup, creeping Charlie, moneywort, motherwort, yellow wood sorrels, garlic mustard, and reed canary grass are present in many stands and sometimes abundant.

- Climbing plants and vines are important in this community. Characteristic are climbing poison ivy, riverbank grape, and moonseed.
- Shrub layer and subcanopy are mostly sparse (0–25% cover) and occasionally patchy (25–50% cover). Silver maple, green ash, American elm, and hackberry are most common. Climbing poison ivy is occasionally present in the tall shrub layer. Silver maple seedlings are often abundant.
- Canopy is interrupted to continuous (50–100% cover) and strongly dominated by silver maple with occasional green ash, cottonwood, or American elm.

MANAGEMENT ACTIONS

The following section summarizes the various actions that will support the Management Objectives for Management Unit 4. The table below identifies the timeline and likely trajectory of the habitats associated with various actions, and the following paragraphs describe the sequence of management, expected outcomes, and potential methods of adaptive management given site conditions. Specific tasks, timing, and costs are summarized for all Management Units in Table 10.

Table 9: Management Unit 4 Potential Management Actions

MANAGEMENT NEED	MANAGEMENT ACTIONS	LIKELY TRAJECTORY	TIMELINE
Reduction or elimination of non-native, invasive herbaceous plants.	Through hand-pulling or mowing or spot herbicide application, manage garlic mustard, motherwort, white sweet clover, reed canary grass, and buckthorn seedlings while avoiding off-target damage to native plants.	Of the three primary invasive plants in the unit, garlic mustard is the primary target. Garlic mustard seed can remain viable in the seedbank for up to 10 years, and a single plant can produce up to 12,500 plants. Motherwort is in the mint family and is quite aggressive. Reed canary grass is extremely aggressive and will become dominant especially in canopy gaps. Because of these characteristics, management will require several years.	5-6 years with reduced inputs over time.
Elimination of common buckthorn.	Cut all mature buckthorn to ground level and treat stumps with a triclopyr-based herbicide to prevent resprouts. Buckthorn under 1" diameter should be treated with a foliar application of triclopyr in late September or early October when plants are actively photosynthesizing.	Common buckthorn seed remains viable for 3-4 years in the seedbank. After initial removal of mature plants, 2-3 years of follow-up foliar herbicide applications will be needed to eliminate new buckthorn germinants.	4 years
Elimination of Tatarian honeysuckle.	Cut all honeysuckle to ground level and treat stumps with a 20% concentration of glyphosate to prevent resprouts.	Tatarian honeysuckle can completely shade understory herbaceous vegetation causing soil erosion and loss of habitat. The species responds well to treatment and can be eradicated where it is abundant.	3 years
Enhancement of native plant diversity in the herbaceous layer.	Through seeding after buckthorn and honeysuckle removal and targeted enhancement deep-rooted plug planting, enhance the herbaceous/ground-layer.	Seeding with a simple, shade-tolerant graminoid-dominated native mix will help to establish a more continuous ground layer that will be more resistant to future invasive plant issues and reduce buckthorn resprouts. Targeted deep-rooted plug planting will further diversify the plant community supporting improved habitat especially for pollinators.	2 years

MANAGEMENT NEED	MANAGEMENT ACTIONS	LIKELY TRAJECTORY	TIMELINE
Potential removal of white oak affected by oak wilt.	Remove single trees confirmed to be infected by oak wilt during winter months.	While oak is not a dominant species in MU4, it is dominant in MU3 where specimen white and bur oaks are present. Removal of trees confirmed to be infected will reduce the spread and limit the loss of other oaks within the park.	1-2 years
Removal of farm dump/trash.	Organize a community clean-up supported by Otsego Parks and Recreation to remove garbage on the riverbank.	Garbage is concentrated in the eastern leg of the unit which appears to be the site of a former farm dump. Floodwaters may also be contributing to the debris here. A one-day clean up with follow-up maintenance could greatly improve the situation.	Ongoing after initial clean-up

Restoration of Management Unit 4 will require woody non-native vegetation management followed by herbaceous non-native vegetation management. Common buckthorn and Tatarian honeysuckle are pervasive within MU4 in distinct areas and are a priority to manage to preserve the native forest diversity present within the unit, especially in the herbaceous ground layer. Cutting and treating stumps with a water-safe herbicide is the best way to minimize chemical drift and avoid unnecessary impacts on the existing native plant community. The stumps and their roots will also aid in maintaining stabilization of the riverbank. After the initial clearing of buckthorn, garlic mustard and reed canary grass may increase in abundance. Given its current level of establishment, mechanical removal by hand-pulling or mowing second-year garlic mustard plants is recommended. If populations expand to mass monocultures, chemical removal may be considered. Repeated early- and late-season mowing of reed canary grass followed by spot herbicide application is the best course of action.

After initial management of non-native and invasive species, reestablishment of native shrub and ground layers is recommended. Mass planting of bare root shrubs within the understory will provide diversity and forest structure while ensuring some survival in light of anticipated deer browse. Targeted revegetation in areas of new canopy openings and a higher likelihood of erosion should be prioritized.

MANAGEMENT UNIT 5: Open Water

Management Unit 5 (MU5) is 10.2 acres of open water on the Crow River within the park property's parcel boundary. This management unit is only designated to account for those acres in the overall delineation of management units and in consideration of the total property acreage of 61.8 acres. No specific management is prescribed in open water areas.

WORKPLAN

The following tasks and budget are based on known costs and project needs at the time of the natural resource management plan writing. All parties will agree upon additional future tasks prior to implementation. Management Units are shown in Figure 4.

WORKPLAN PRIORITIZATION

The highest priority for plant community restoration at HRP is MU1, the Upland Grassland. Here, remnant and restored native plant communities are imperiled by invasive herbaceous plant species and heavy woody encroachment. Complete removal of invasive Siberian elm and Eastern cottonwood and willows established in the adjacent basins of MU2 is needed. These units should be maintained with both follow-up mowing and spot herbicide treatment, as well as prescribed fire on a 3-4-year rotation.

Secondly, invasive woody and herbaceous species (common buckthorn, Siberian elm, Tatarian honeysuckle, garlic mustard, and reed canary grass) should be eliminated from MU3 and MU4. This removal should be followed by seeding and planting to restore the native plant community.

5-YEAR WORK PLAN

These tables are proposed schedules and approximate costs of restoration and management tasks for HRP. Note that the timing and year for any given task may shift depending on the outcomes of previous steps and funding. Note also that the costs shown are estimates based on similar work at other sites bid at the prevailing wage for the State of Minnesota, but actual costs may be higher or lower depending on bids received.

Table 10. Restoration Schedule and Cost Estimates by Management Unit

Management units correspond with those shown in Figure 4.

MU1: UPLAND GRASSLAND (17.9 ACRES) TARGET: SOUTHERN MESIC PRAIRIE UPs23					
Year	Season	Activity	Acres	Unit cost	Total
1	Summer	Site prep broadcast spray. Avoid areas of high native diversity as indicated by project manager.	17.9	$ 490	$ 8,771
	Fall	Site prep broadcast spray. Avoid areas of high native diversity as indicated by project manager.	17.9	$ 490	$ 8,771
	Fall	Extract all Siberian elm.	4.5	$ 380	$ 1,710
	Winter	Pile pulled material and burn with at least 2" snow cover during the following winter.	9.5	$ 580	$ 5,510
	Winter	Forestry mow cottonwood, mulberry, and willow within unit boundaries not crossing into adjacent basins.	5.5	$ 3,600	$ 19,800
2	Spring	Site prep broadcast spray. Avoid areas of high native diversity as indicated by project manager.	17.9	$ 490	$ 8,771
	Spring	Spot mow reed canary grass.	0.5	$ 175	$ 88
	Late Spring/Early Summer	Spot herbicide application of reed canary grass. Avoid areas of high native diversity as indicated by project manager.	0.5	$ 375	$ 188
	Summer	Spot herbicide application of reed canary grass. Avoid areas of high native diversity as indicated by project manager.	0.5	$ 375	$ 188
	Early Fall	Spot herbicide treatment of persistent weeds and foliar herbicide application of woody resprouts.	10.5	$ 470	$ 4,935
	Fall	Spot herbicide application of reed canary grass. Avoid areas of high native diversity as indicated by project manager.	0.5	$ 375	$ 187.50
	Fall	Prescribed burn for site preparation.	17.9	$ 1,400	$ 25,060
	Fall	Broadcast seed native mesic prairie seed mix. Includes seed cost.	17.9	$ 1,560	$ 27,924
3	Spring	Establishment mow.	17.9	$ 330	$ 5,907
	Summer	Establishment mow.	17.9	$ 300	$ 5,370
	Late summer	Spot herbicide treatment of persistent weeds and foliar herbicide application of woody resprouts.	10.5	$ 375	$ 3,937

4	Spring	Establishment mow.	17.9	$ 300	$ 5,370
	Fall	Broadcast seeding of thin areas post-burn. Includes seed cost. Assume 1/4 of unit.	4.5	$ 390	$ 1,755
	Spring	Prescribed burn of 1/2 of unit.	9	$ 460	$ 4,140
5	Fall	Prescribed burn 1/2 of unit.	9	$ 460	$ 4,140
	Fall	Enhancement overseeding. Assumes 1/3 of unit needs overseeding.	6	$ 1,300	$ 7,800
MU1 TOTAL YEARS 1-5					**$150,325**

MU2: WET MEADOW/SHRUB CARR (12.2 ACRES) TARGET: SOUTHERN WET MEADOW/SHRUB CARR (WMs92)					
Year	Season	Activity	Acres	Unit cost	Total
1	Summer	Spot mow reed canary grass.	2.5	$ 175	$ 438
	Fall	Spot herbicide application of mowed and resprouted reed canary grass	2.5	$ 375	$ 938
	Winter	Forestry mow/mulch all trees and saplings in basins.	12.2		Otsego in-kind
2	Spring	Spot herbicide treatment of invasive perennial weeds.	12.2	$ 375	$ 4,575
	Spring	Spot mow reed canary grass.	2.5	$ 175	$ 438
	Summer	Spot herbicide treatment of persistent invasive weeds and reed canary grass.	12.2	$ 475	$ 5,795
	Fall	Spot herbicide application of mowed and resprouted reed canary grass.	2.5	$ 375	$ 938
	Fall	Follow up foliar treat invasive woody resprouts, new germinants and seedlings.	12.2	$ 460	$ 5,612
	Fall	Broadcast seed native wet meadow seed mix. Includes seed cost.	12.2	$ 2,360	$ 28,792
3	Spring	Establishment spot mow.	12.2	$ 175	$ 2,135
	Summer	Establishment spot mow.	12.2	$ 175	$ 2,135
	Fall	Follow up foliar treat invasive woody resprouts, new germinants and seedlings.	12.2	$ 460	$ 5,612

4	Early summer	Spot herbicide treatment of persistent invasive weeds.	12.2	$ 350	$ 4,270
	Late summer	Spot herbicide treatment of persistent invasive weeds.	12.2	$ 350	$ 4,270
MU2 TOTAL YEARS 1-5					**$65,948**

MU3: OAK FOREST (4.9 ACRES) TARGET: BASSWOOD-BUR OAK-(GREEN ASH) FOREST (MHs38B)					
Year	Season	Activity	Acres	Unit cost	Total
1	Summer	Spot herbicide application of perennial invasive plants.	4.9	$ 375	$ 1,838
	Fall / Winter	Cut/treat/pile/burn common buckthorn and Tatarian honeysuckle. Create no more than 4 burn piles in mowed turf area south of unit or in mowed trails. Alternatively, Otsego Parks staff handles disposal.	4.9	$ 1,470	$ 7,203
2	Spring	Hand pull or mow garlic mustard before seed set. Present within 2.5 acres of unit.	2.5	$ 3,000	$ 7,500
	Summer	Spot herbicide application of perennial invasive plants.	4.9	$ 375	$ 1,838
	Late Summer	Follow up foliar treat invasive woody resprouts, new germinants and seedlings.	4.9	$ 460	$ 2,254
	Fall / Winter	Broadcast seed graminoid/forb buckthorn replacement mix. Cost includes seed mix.	4.9	$ 1,659	$ 8,129
3	Spring	Mow garlic mustard before seed set.	2.5	$ 170	$ 425
	Late Summer	Follow up foliar treat invasive woody resprouts, new germinants and seedlings	4.9	$ 460	$ 2,254
4	Spring	Mow garlic mustard before seed set.	2.5	$ 170	$ 425
	Summer	Enhancement planting of 500 plugs along internal trails of unit.	500	$ 7	$ 3,500
5	Summer	Mow garlic mustard before seed set.	2.5	$ 170	$ 425
MU3 TOTAL YEARS 1-5					**$35,800**

MU4: TERRACE FOREST (16.6 ACRES) TARGET: SOUTHERN TERRACE FOREST FFs59					
Year	Season	Activity	Acres/Ea	Unit cost	Total
1	Early fall	Hand cut Tatarian honeysuckle; *immediately* treat stumps with 20% solution of glyphosate. Pile in adjacent grassland for winter burning. No more than 3 piles.	4.0	$ 2,730	$ 10,920
	Winter	Cut/treat/pile burn all buckthorn over 1" diameter. Burn cut honeysuckle piles with buckthorn piles.	4.5	$ 2,730	$ 12,285
2	Spring	Hand-pull 2nd year garlic mustard (optional volunteer event).	2.0	$ 3,000	$ 6,000
	Spring	Mow patches of smooth brome and reed canary grass at boot stage.	1.0	$ 175	$ 175
	Early Summer	Treat regrowth of smooth brome and reed canary grass with aquatic-approved glyphosate at 1.5% solution.	1.0	$ 375	$ 375
	Fall	Treat foliar resprouts of Tatarian honeysuckle with aquatic-approved glyphosate at 1.5% solution.	4.0	$ 470	$ 1,880
	Fall	Hand-broadcast moisture-tolerant woodland seed mix in open areas of unit assuming one-quarter of unit has bare ground; includes seed cost.	4.0	$ 1,835	$ 7,340
	Winter	Removal of hazard ash trees near trails.			$ 7,000
3	Spring	Hand-pull 2nd year garlic mustard (optional volunteer event).	2.0	$ 3,000	$ 6,000
	Fall	Plant 150 bare root shrubs in open areas of unit and along riverbank; protect with Plantra tree tubes (optional volunteer event)	150	$ 20	$ 3,000
4	Spring	Hand-pull 2nd year garlic mustard and water new trees (volunteer event)			$ 2,000
5	Fall	Hand-broadcast moisture-tolerant forb and graminoid seed mix in open areas where garlic mustard has been suppressed; includes seed cost.	2.0	$ 2,060	$ 4,120
		MU4 TOTAL YEARS 1-5			**$61,095**
		HIGHLANDS OF RIVERPOINTE PARK YEARS 1-5 TOTAL			**$ 313,168**

LONG TERM MONITORING AND MANAGEMENT

Restored areas will need to be regularly monitored to identify ecological issues, such as erosion and sedimentation, invasive species, and tree disease. Early detection of concerns enables quick, cost-effective responses to address them before significant problems evolve.

Once the primary restoration tasks are completed, the restoration process converts to an adaptive management phase. Long-term management for all units is an important piece of maintaining the habitat over time. It is difficult to predict specifically how these areas will change over time, so being flexible and responding to needs as they arise is important. Without continued monitoring and management, these areas will likely degrade rapidly, and efforts will be undone in 5-10 years. Three critical long-term management actions are described below.

SEEDING AND PLANTING (ALL UNITS, AS NEEDED)

Over time, it is likely that some areas may benefit from additional seeding and planting to maintain ground cover or increase species diversity. The sloped areas of the park are prone to erosion and may require occasional reseeding along trail edges. Additionally, as the tree canopy changes in the ag field and wooded field edge units, it may be necessary to seed with a mix more adapted to updated light conditions. Planting trees, shrubs, and plugs can be a faster way to increase diversity and respond to changing light conditions in units with tree canopy. If the primary park trail is rerouted, seeding and planting will be necessary to revegetate the slope.

INVASIVE SPECIES MONITORING AND MANAGEMENT (ALL UNITS)

Both herbaceous and woody invasive species are a continued threat to the ecosystem health of these restored areas. Seeds from invasive species are constantly being transported by wind, water, and wildlife, so there is no way to mitigate this threat. The best long-term strategy to prevent invasive species establishment is to both increase diversity at the site level and monitor the area to ensure any presence of invasive plants regularly can be caught early. It is relatively easy to manage a small population in the first or second year after arrival. If left to proliferate, invasive species can rapidly expand and have much larger ecological and monetary impacts over time.

PRESCRIBED BURNING (MU1 Upland Grassland)

The future prairie unit will be dependent upon regular prescribed fire. Prescribed burns are an essential tool for managing woody encroachment and controlling invasive species. Additionally, burns stimulate grass and herbaceous growth in the understory by warming the soil and encouraging early growth and regeneration of these plants. Prairie burns should be conducted every 3-4 years. Planning to burn a subset of the acres annually is a good long-term strategy to allow refuge for pollinators. Fires near homes often raise concerns about safety and risks to property. As natural areas are increasingly interfaced with residential and

commercial areas, prescribed burning training and operations have evolved to increase safety and create burn plans that move fire and smoke away from homes, businesses, and roadways. Prescribed fire in urban areas is increasingly common with even small residential prairies managed with fire.

Table 11: Long-Term Management Schedule and Cost Estimates

UNIT NAME	LONG-TERM MGMT TASK	FREQUENCY	COST RANGE
All Units	Seeding	As needed	Seed cost: $300 - $1,000 per acre. Contractor implementation cost: $600 per acre
All Units	Planting*	As needed	Plant material cost: $4 - $30. Volunteer event advised for implementation and follow-up watering.
Upland Grassland	Prescribed burning	Every 3-4 years. Half the acres should be burned at any given time.	$1,000 - $1,200 per acre
All Units	Invasive species monitoring	3x annually	$1,000 - $1,500 annually
All Units	Invasive species spot-treatment	As needed	Contractor cost: $1,000 per acre
All Units	Invasive species management/planting volunteer event	Annually, as needed	$2,000 - $2,500 for FMR-sponsored public event

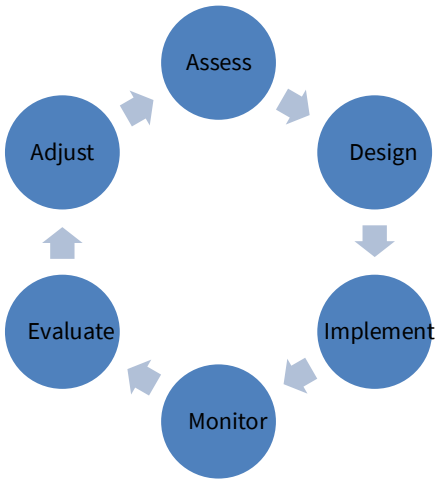
* Items with an asterisk are supplemental and should be undertaken only if funds and logistics allow.

OTHER CONSIDERATIONS

RESTORATION PROCESS

When embarking on natural areas restoration and management, it is essential to accept that restoration is a process that takes considerable time. Returning ecosystems to their former functionality and diversity is complex and can sometimes only be approximated. Restoration success or completion can also be difficult to measure.

For this reason, it is important to set specific and measurable restoration goals for stages of the restoration and to allow for flexibility in management if methods do not elicit intended outcomes. The goal is to achieve and maintain a diverse natural community at the site, though this will not always proceed in a linear fashion. Using the concept of *adaptive management* will be key to continual progress at HRP. Adaptive management is a strategy commonly used by land managers that integrates thought and action into the restoration process. It can be described as a strategy that uses evaluation, reflection, and communication while incorporating learning into planning and management. It is set up like a feedback loop and looks like this:



Thus, moving forward with restoration, each round of adaptive management refines and hones the process to better suit the site's changing conditions. This strategy should be emphasized at HRP.

RESTORATION GOALS

The restoration goals for HRP are to enhance the Priority Features and address the Priority Issues. The specific and measurable goals set forth below can be used to assess restoration outcomes and adaptively manage the site, if necessary.

1) Reduce invasive woody stems over ½ inch diameter to <10% on-site by the end of the second year.

2) Establish at least 25 native pollinator plant species in the grassland unit, including an abundance of milkweed species. These pollinator species will have at least 30% coverage in MU1 by the end of the fifth year.

3) Reduce cover of native shrubs to 5-10% in forest units and increase native species richness and abundance in the herbaceous layer.

4) Stabilize the eastern riverbank through erosion control practices and planting.

5) Explore options to increase community use of the park through signage and outreach.

6) Engage the community and local volunteers through restoration events, including plantings and invasive species removals.

Overall management practices to achieve those goals are:

- remove non-native, invasive, woody species,
- control non-native invasive herbaceous species,
- remove or thin out native woody species encroaching on grassland areas,
- restore ground layer diversity in prairie areas,
- conduct periodic prescribed burning to maintain prairie vegetation and reduce invasive shrubs and overabundant tree seedlings,
- monitor annually for potential erosion, as well as for non-native invasive woody and herbaceous species,
- institute a monitoring plan to track the effectiveness of management and restoration activities,
- follow guidelines to protect species of greatest conservation need,
- engage volunteers in restoration activities and educational events,
- explore other opportunities to create wildlife habitat, including but not limited to snake hibernaculum, osprey towers, bat houses, and turtle nesting exclosures.

Toward achieving these goals, restoration will aim to improve the diversity, composition, and structure of the plant communities throughout the property, which will also better reflect historical plant communities that provide improved habitat. This includes the addition of prairie habitat that has been lost throughout the state but restoration will not artificially convert current natural communities to what may have been present in the past. However, adding new habitat and restoring degraded areas will improve the ecological functions that both historic native plant communities and current healthy communities provide, including:

- habitat for a diversity of wildlife species,
- nutrient and water cycling,

- carbon storage,
- moderation of water-table levels,
- erosion control,
- filtration of nutrients, sediments and pollutants,
- development and enrichment of soils,
- local temperature moderation.

Though degraded by past uses, the existing plant cover retains a good variety of native species and could be readily improved. A healthy and diverse plant community can provide much greater wildlife value than a degraded one and tends to be much more stable and less susceptible to disease, invasive species, and other disturbances.

TREE DISEASE

Dutch Elm Disease and Emerald Ash Borer

There are many elms and large green ash trees growing within the floodplain forests along the Crow River at the site. These trees are not only ecologically valuable but are also at high risk to attack from non-native tree pests. Elms are susceptible to Dutch Elm Disease, and ash are susceptible to Emerald Ash Borer. These tree pests have caused widespread mortality of elms and ash throughout the eastern United States and in Minnesota.

Dutch Elm disease is a fungal infection caused by the fungus *Ceratocystis ulmi*, which is native to Asia, and is spread by both native and non-native bark beetles (family: Curculionidae). Once the fungus is introduced onto a tree, the tree reacts by sealing its own xylem tissues (conduits of water and nutrients) to prevent further spread. This effectively prevents water and nutrients from reaching the upper branches, causing gradual die-off as more and more of the xylem is sealed. Symptoms include a yellowing and browning of leaves that spreads from the outer crown toward the trunk. Dutch elm disease was first recorded in Minnesota near Monticello in 1961 and has since spread throughout the state. Minnesota relied heavily on American Elms (*Ulmus americana*) as shade trees on streets, with about 140 million in the state at the time of the outbreak. The disease is now present in all Minnesota counties, though elms remain an important component of many Minnesota forests.

Emerald ash borer (EAB) is a non-native wood-boring beetle from Asia that was first identified in the United States in the summer of 2002. Likely transported from Asia to Michigan in ash wood used for pallets and other shipping materials, the beetle has now been confirmed in 36 states, including Minnesota. The beetle works by depositing larvae under the bark of the tree; these larvae then feed on the wood, eventually disrupting enough of the phloem to prevent the transport of nutrients throughout the tree. While Minnesota's cold weather can stymie the spread of the beetle, it continues to infect and kill ash trees within the Metro area. At HRP, the removal of dying and dead ash trees can be focused on those trees nearest trails to maintain safety for park users.

When such large trees die, a pronounced effect will be apparent on the vegetation and the water in the river. These trees act to shade the water, provide habitat, and improve water quality for fish and other species. The loss of large trees also opens the canopy and creates gaps, which in turn releases the understory that was formerly suppressed by the shade from such trees. If desirable species like native forbs, grasses, sedges, and shrubs exist in the understory, then the impact can be positive since the result will probably be a net increase in bank stability and diversity. In the case of this property, these canopy gaps will likely be filled by buckthorn and Tatarian honeysuckle, which are poised to take advantage of such a situation. In order to avoid this undesirable scenario, active management is recommended. Removal of undesirable shrub species and replacing them with desirable native shrubs and herbaceous plant species is a recommended management strategy.

For green ash in particular, the situation is particularly important, as this species makes up over 30% of the canopy in many areas of the terrace forest. The principle of risk is highly applicable here. In the case of EAB, the consequences will be large and quite negative, as a loss of a third of the canopy along the river could have cascading consequences for invasive species, water quality, and wildlife. Ultimately, hazard removal should occur once invasive species are removed and could occur in stages (10-20% per year) to minimize disturbance to the community.

Oak Wilt and Bur Oak Blight

Oak wilt is an increasingly common tree disease caused by the fungus *Ceratocystis fagacearum*. While the disease is present in many eastern US states, it is most prevalent in the Midwest US. Within Minnesota, it is an issue of serious concern in and around the seven-county metro area, including Wright County. Oak wilt affects all of Minnesota's most common oak species (red oak [*Quercus rubra*], pin oak [*Q. ellipsoidalis*], bur oak [*Q. macrocarpa*], and white oak [*Q. alba*]), though it does not affect these species equally. Red and pin oak are the most susceptible species, with infected individuals wilting in six weeks or less. Bur and white oaks may take years to wilt completely and may only do so one branch at a time. The fungus can be transported from tree to tree by sap beetles, but most commonly spreads through root grafts. The beetles are attracted to the fungal mats created when mature oaks die from oak wilt, and also to wounds on uninfected oaks, providing a convenient pathway of spread for the fungus. Oaks commonly form root grafts between individuals, allowing direct transfer of the fungus from infected to healthy individuals.

While HRP has a moderate number of red oaks, there is a sizeable number of large bur oaks and midstory bur oaks, especially around and in MU3, the Oak Forest. While this provides some hope that an outbreak of oak wilt at the property is less likely, there is some suspected oak wilt in the canopy of MU3, and these trees should be carefully monitored. This monitoring will be necessary to identify and manage infected individuals. If infected individuals are found, root barriers may be installed around infected trees using a vibratory plow. Other

options include soil sterilization and inoculation of high value individual trees. Care should also be taken to avoid injuring trees during the early growing season (April to July) when trees are most susceptible to the fungal spread. If a tree is injured during this time, covering the wounds is recommended. If pruning or other activities must be done, waiting for the winter is the safest option.

Bur oak blight (BOB) may be a more serious threat to the oaks on the property. BOB affects only bur oaks and is most injurious to upland individuals in savanna remnants. Caused by a species of fungus in the *Tubaki* genus, BOB causes lesions and discoloration of the veins on the underside of the leaves, eventually causing large portions of the leaf to die. In many cases, severe infections will cause tree death, though individual susceptibility to the disease varies. The fungus can overwinter on leaf petioles that remain attached to trees and is primarily spread by rain droplets moving spores throughout the tree. Early results suggest that inoculation of trees with fungicide may help slow or stop the spread of the disease within individual trees. At HRP, monitoring existing oaks for symptoms will be an important first step; moreover, if oaks are planted in the future, it may be beneficial to avoid planting the variety *Q. macrocarpa var. oliviformis*, which has shown the most severe susceptibility to BOB.

COMMUNITY USE, SITE ACCESS AND SIGNAGE

As a newer park to the Otsego Parks and Recreation system, HRP is seemingly primarily used by residents of the adjacent neighborhood. No placemaking or wayfinding signage for the park is present, although property corners adjacent to residential lots are marked with “Park Boundary” signage. Simple park name signage and wayfinding signage would help to orient visitors to the site, and this will be especially important once the park is connected to the regional system.

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APPENDICES

APPENDIX A. MLCCS Units, Soil Types, and Restoration Target Plant Communities for Management Units

Management Unit	Soil Type(s)	Target Plant Community
MU 1a	1377E, 1379B, 1380B	UPs23: Southern Mesic Prairie
MU 1b	771, 1380B, 1381	UPs23: Southern Mesic Prairie
MU 1c	771, 1255,	UPs23: Southern Mesic Prairie
MU 1d	1255	UPs23: Southern Mesic Prairie
2	771, 1255,	WMs92: Southern Basin Wet Meadow/Carr
3	771, 1257	MHs38: Southern Mesic Oak-Basswood Forest
4	771, 1255, 1377D, 1377E	FFs59: Southern Terrace Forest

APPENDIX B. Plant Species for Restoration at Highlands of River Pointe Park

MU1 Upland Grassland (UPs23):

Forbs, Ferns & Fern Allies

Yarrow	*Achillea millefolium*	Virginia ground cherry	*Physalis virginiana*
Prairie wild onion	*Allium stellatum*	Tall cinquefoil	*Potentilla arguta*
Canada anemone	*Anemone canadensis*	Smooth rattlesnakeroot	*Prenanthes racemosa*
Long-headed thimbleweed	*Anemone cylindrica*	Virginia mountain mint	*Pycnanthemum virginianum*
Clasping dogbane	*Apocynum sibiricum*	Gray-headed coneflower	*Ratibida pinnata*
White sage	*Artemisia ludoviciana*	Canada goldenrod	*Solidago canadensis*
Common milkweed	*Asclepias syriaca*	Missouri goldenrod	*Solidago missouriensis*
Heath aster	*Aster ericoides*	Gray goldenrod	*Solidago nemoralis*
Smooth blue aster	*Aster laevis*	Stiff goldenrod	*Solidago rigida*
Skyblue aster	*Aster oolentangiensis*	Tall meadow-rue	*Thalictrum dasycarpum*
Silky aster	*Aster sericeus*	American vetch	*Vicia americana*
Ground plum	*Astragalus crassicarpus*	Bearded birdfoot violet	*Viola palmata*
Toothed evening primrose	*Calylophus serrulatus*	White camas	*Zigadenus elegans*
Flodman's thistle	*Cirsium flodmanii*	Heart-leaved alexanders	*Zizia aptera*
Bastard toadflax	*Comandra umbellata*		
Bird's foot coreopsis	*Coreopsis palmata*	***Grasses & Sedges***	
White prairie clover	*Dalea candida*	Big bluestem	*Andropogon gerardii*
Purple prairie clover	*Dalea purpurea*	Indian grass	*Sorghastrum nutans*
Canada tick trefoil	*Desmodium canadense*	Little bluestem	*Schizachyrium scoparium*
Narrow-leaved purple coneflower	*Echinacea pallida*	Prairie dropseed	*Sporobolus heterolepis*
Daisy fleabane	*Erigeron strigosus*	Porcupine grass	*Stipa spartea*
Rattlesnake master	*Eryngium yuccifolium*	Side-oats grama	*Bouteloua curtipendula*
Common strawberry	*Fragaria virginiana*	Switchgrass	*Panicum virgatum*
Northern bedstraw	*Galium boreale*	Junegrass	*Koeleria pyramidata*
Maximilian's sunflower	*Helianthus maximiliani*	Pennsylvania Sedge	*Carex pensylvanica*
Stiff sunflower	*Helianthus pauciflorus*	Leiberg's panic grass	*Panicum leibergii*

Ox-eye	*Heliopsis helianthoides*
Alumroot	*Heuchera richardsonii*
Rough blazing star	*Liatris aspera*
Northern plains blazing star	*Liatris ligulistylis*
Great blazing star	*Liatris pycnostachya*
Wood lily	*Lilium philadelphicum*
Hoary puccoon	*Lithospermum canescens*
Pale-spiked lobelia	*Lobelia spicata*
Wild bergamot	*Monarda fistulosa*
Wood betony	*Pedicularis canadensis*
Silverleaf scurfpea	*Pediomelum argophyllum*
Prairie turnip	*Pediomelum esculentum*
Prairie phlox	*Phlox pilosa*
Prairie cordgrass	*Spartina pectinata*

Semi-Shrubs

Leadplant	*Amorpha canescens*
Prairie rose	*Rosa arkansana*

Shrubs

Wolfberry	*Symphoricarpos occidentalis*
Dogwood (wet areas)	*Cornus spp.*
Chokecherry (edges)	*Prunus virginiana*

Trees

Bur oak	*Quercus macrocarpa*
Pin oak	*Quercus ellipsoidalis*

MU2 Wet Meadow/Shrub Carr (WMs92)

Grasses & Sedges

Slough sedge	*Carex atherodes*
Bluejoint	*Calamagrostis canadensis*
Whitetop	*Scolochloa festucacea*
Prairie cordgrass	*Spartina pectinata*
Red-stalked spikerush	*Eleocharis palustris*
Lake sedge	*Carex lacustris*
Beaked sedge	*Carex utriculata*
Aquatic sedge	*Carex aquatilis*
Tussock sedge	*Carex stricta*
Tall manna grass	*Glyceria grandis*
River bulrush	*Scirpus fluviatilis*
Common reed grass	*Phragmites australis*
Woolly sedge	*Carex pellita*
Fowl bluegrass	*Poa palustris*
Soft stem bulrush	*Scirpus validus*
Small-fruited bulrush	*Scirpus microcarpus*

Forbs, Ferns & Fern Allies

Water smartweed	*Polygonum amphibium*
Rough bugleweed	*Lycopus asper*
Common mint	*Mentha arvensis*
Water parsnip	*Sium suave*
Swamp milkweed	*Asclepias incarnata*
Tufted loosestrife	*ysimachia thyrsiflora*
Marsh skullcap	*Scutellaria galericulata*
Germander	*Teucrium canadense*
Spotted Joe pye weed	*Eupatorium maculatum*
Eastern panicled aster	*Aster lanceolatus*
Cut-leaved bugleweed	*Lycopus americanus*
Great water dock	*Rumex orbiculatus*
Willow-herbs	*Epilobium spp.*
Giant bur reed	*Sparganium eurycarpum*
Woundwort	*Stachys palustris*
Marsh vetchling	*Lathyrus palustris*
Clasping dogbane	*Apocynum sibiricum*
Canada goldenrod	*Solidago canadensis*
Marsh bellflower	*Campanula aparinoides*
Bur marigold and Beggarticks	*Bidens spp.*
Red-stemmed aster	*Aster puniceus*
Bulb-bearing water hemlock	*Cicuta bulbifera*
Sweet flag	*Acorus calamus*
Touch-me-not	*Impatiens spp.*
Stinging nettle	*Urtica dioica*
Large yellow water crowfoot	*Ranunculus flabellaris*
Bog aster	*Aster borealis*
Spotted water hemlock	*Cicuta maculata*
Bristly buttercup	*Ranunculus pensylvanicus*
Arrow-leaved sweet coltsfoot	*Petasites sagittatus*
Arum-leaved arrowhead	*Sagittaria cuneata*
Spring water starwort	*Callitriche palustris*
Giant goldenrod	*Solidago gigantea*
Common marsh marigold	*Caltha palustris*
Golden dock	*Rumex maritimus*

Tall Shrubs

Pussy willow	*Salix discolor*
Slender willow	*Salix petiolaris*
Red-osier dogwood	*Cornus sericea*
Prickly wild rose	*Rosa acicularis*

MU3 Oak Forest (MHs38)

Forbs, Ferns & Fern Allies

Zigzag goldenrod	*Solidago flexicaulis*
Red baneberry	*Actaea rubra*
Maidenhair fern	*Adiantum pedatum*
Hog peanut	*Amphicarpaea bracteata*
Sharp-lobed hepatica	*Anemone acutiloba*
Wood anemone	*Anemone quinquefolia*
Wild sarsaparilla	*Aralia nudicaulis*
Jack-in-the-pulpit	*Arisaema triphyllum*
Wild ginger	*Asarum canadense*
Lady fern	*Athyrium filix-femina*
Rattlesnake fern	*Botrychium virginianum*
Blue cohosh	*Caulophyllum thalictroides*
Common enchanter's nightshade	*Circaea lutetiana*
Honewort	*Cryptotaenia canadensis*
Pointed-leaved tick trefoil	*Desmodium glutinosum*
Cleavers	*Galium aparine*
Shining bedstraw	*Galium concinnum*
Sweet-scented bedstraw	*Galium triflorum*
Wild geranium	*Geranium maculatum*
White avens	*Geum canadense*
Virginia waterleaf	*Hydrophyllum virginianum*
Canada mayflower	*Maianthemum canadense*
Clayton's sweet cicely	*Osmorhiza claytonii*
Lopseed	*Phryma leptostachya*
Bloodroot	*Sanguinaria canadensis*
Maryland black snakeroot	*Sanicula marilandica*
Common false Solomon's seal	*Smilacina racemosa*
Erect, Smooth, or Illinois carrion-flower	*Smilax spp.*
Early meadow-rue	*Thalictrum dioicum*
Large-flowered bellwort	*Uvularia grandiflora*
Yellow violet	*Viola pubescens*

Woody Vines

Virginia creeper	*Parthenocissus spp.*
Riverbank grape	*Vitis riparia*

Grasses & Sedges

Bearded shorthusk	*Brachyelytrum erectum*
Bland sedge	*Carex blanda*
Long-stalked sedge	*Carex pedunculata*
Pennsylvania sedge	*Carex pensylvanica*
Starry sedge	*Carex rosea*
Bottlebrush grass	*Elymus hystrix*
Nodding fescue	*Festuca subverticillata*

Shrubs

Pagoda dogwood	*Cornus alternifolia*
American hazelnut	*Corylus americana*
Chokecherry	*Prunus virginiana*
Prickly gooseberry	*Ribes cynosbati*
Missouri gooseberry	*Ribes missouriense*
Poison ivy	*Toxicodendron rydbergii*
Nannyberry	*Viburnum lentago*
Downy arrowwood	*Viburnum rafinesquianum*
Prickly ash	*Zanthoxylum americanum*

Trees Canopy Subcanopy Shrub Layer

Basswood
Northern red oak
Sugar maple
Ironwood
Green ash
Bur oak
White oak
American elm
Paper birch
Bitternut hickory
Red elm
White pine
Black cherry

MU4 Terrace Forest (FFs59)

Forbs, Ferns & Fern Allies

Wood nettle	*Laportea canadensis*
Touch-me-not	*Impatiens spp.*
Virginia waterleaf	*Hydrophyllum virginianum*
Tall coneflower	*Rudbeckia laciniata*
Stinging nettle	*Urtica dioica*
Cleavers	*Galium aparine*
Honewort	*Cryptotaenia canadensis*
White avens	*Geum canadense*
Aniseroot	*Osmorhiza longistylis*
Blue phlox	*Phlox divaricata*
Virginia knotweed	*Polygonum virginianum*
Ontario aster	*Aster ontarionis*
Gregarious black snakeroot	*Sanicula gregaria*
Rugulose or Yellow violet	*Viola canadensis or V. pubescens*
False rue anemone	*Enemion biternatum*
Poison ivy	*Toxicodendron rydbergii*
Clearweed	*Pilea spp.*
Hispid buttercup	*Ranunculus hispidus*
Common enchanter's nightshade	*Circaea lutetiana*
Maryland black snakeroot	*Sanicula marilandica*
Cow parsnip	*Heracleum lanatum*
Sweet-scented bedstraw	*Galium triflorum*
Hog peanut	*Amphicarpaea bracteata*
Woodmint	*Blephilia hirsuta*
Early meadow-rue	*Thalictrum dioicum*
Starry false Solomon's seal	*Smilacina stellata*
Virginia bluebells	*Mertensia virginica•*
Ostrich fern	*Matteuccia struthiopteris*
Wild geranium	*Geranium maculatum*
Jack-in-the-pulpit	*Arisaema triphyllum*
Clayton's sweet cicely	*Osmorhiza claytonii*

Grasses & Sedges

Ambiguous sedge	*Carex amphibola*
Gray's sedge	*Carex grayi*
Starry sedge	*Carex rosea*
Bland sedge	*Carex blanda*
Nodding fescue	*Festuca subverticillata*
White grass	*Leersia virginica*
Starry sedge	*Carex rosea*
Gray's sedge	*Carex grayi*
Virginia wild rye	*Elymus virginicus*

Woody Vines

Canada moonseed	*Menispermum canadense*
Virginia creeper	*Parthenocissus spp.*
Greenbrier	*Smilax tamnoides*

Shrubs

Hawthorn	*Crataegus spp.*
Chokecherry	*Prunus virginiana*
Prickly gooseberry	*Ribes cynosbati*
Missouri gooseberry	*Ribes missouriense*
Common elder	*Sambucus canadensis*
Carrion-flowers	*Smilax ecirrata et al.*
Nannyberry	*Viburnum lentago*
Riverbank grape	*Vitis riparia*
Prickly ash	*Zanthoxylum americanum*

Trees Canopy

Subcanopy Shrub Layer

American elm
Box elder
Silver maple
Green ash
Hackberry
Basswood
Cottonwood
Black ash
Red elm
Swamp white oak
Bitternut hickory
Black walnut

APPENDIX C. Methods for Controlling Non-native and Invasive Plant Species

Trees and Shrubs

Common buckthorn, Tatarian honeysuckle, Siberian elm, and black locust are some of the most common invasive woody species likely to establish in woodlands, forests, and prairies in Minnesota. Buckthorn and honeysuckle are European species that escaped cultivation and became dominant in woodlands in many parts of the country. They are exceedingly aggressive and, lacking natural diseases and predators, can out-compete native species. They remain photosynthetically active longer than most other native shrubs and trees, which gives them a competitive advantage. The seeds are disseminated by birds, which makes the species especially problematic in open woodlands, savannas, and overgrown prairies. They also benefit from the net actions of invasive earthworms, fire suppression, and high deer populations, forming a symbiosis that helps set the stage for their establishment and abundance. These plants eventually result in dense, impenetrable brush thickets that greatly reduce ground-level light availability and can cause declines in native species abundance and diversity.

Siberian elm, native to eastern Asia, grows vigorously, especially in disturbed and low-nutrient soils with low moisture. Seed germination is high, and seedlings establish quickly in sparse vegetation. It can invade and dominate disturbed areas in just a few years. Black locust is native to the southeastern United States and the very southeastern corner of Minnesota. It has been planted outside its natural range (it was promoted as an erosion control species and a soil stabilizer partly because it was falsely assumed to be a nitrogen fixer) and it quickly colonizes bare slopes, so it readily invades disturbed areas. It reproduces vigorously by root suckering and can form monotypic stands.

Biological Control

Currently there are no biological control agents for non-native woody plants in Minnesota. Recently, an 11-year study conducted by the MNDNR and the University of Minnesota resulted in the conclusion that there were no viable biological control agents for common or glossy buckthorn, based in part on the lack of damage to the host plants and a lack of host specificity (http://www.dnr.state.mn.us/invasives/terrestrialplants/woody/buckthorn/biocontrol.html). Newer research in Winnipeg, Canada, using the fungus *Chondrostereum purpureum* has led to the approval of a biological herbicide for cut-stump and girdling applications, but this herbicide has not yet been approved for use in the U.S.

Chemical Control

The most efficient way to remove woody plants that are 1/2 inch or more in diameter is to cut the stems close to the ground and treat the cut stumps with herbicide immediately after they are cut, when the stumps are fresh, and the chemicals are most readily absorbed. Failure to treat the stumps will result in resprouting, creating the need for future management interventions.

In non-freezing temperatures, a glyphosate herbicide such as *Roundup* can be used for most woody species. It is important to obtain the concentrated formula and dilute it with water to achieve 20% glyphosate concentration. Adding a marker dye helps to make treated stumps more visible, improving accuracy and overall efficiency. An herbicide with the active ingredient triclopyr must be used in the winter months. *Garlon 4* is a common brand name, and it must be mixed with a penetrating oil, such as diluent blue. *Garlon 4* will also work throughout the year. Do not use diesel fuel, as it is much more toxic in the environment and to humans.

Brush removal work can be done at any time of year except during spring sap flow, but late fall is often ideal because buckthorn retains its leaves longer than other species and is more readily identified. Moreover, once native plants have senesced, the herbicide will have fewer non-target effects on native vegetation. Cutting can be accomplished with loppers or handsaws in many cases. Larger shrubs may require brush cutters and chainsaws, used only by properly trained professionals.

For plants in the pea family, such as black locust, an herbicide with the active ingredient clopyralid can be more effective than glyphosate. Common brand names for clopyralid herbicides are *Transline, Stinger,* and *Reclaim*.

In the year following initial cutting and stump treatment, there will be a flush of new seedlings as well as possible resprouting from some of the cut plants. Herbicide can be applied to the foliage of these plants. Early fall is the best time to do this, when desirable native plants are dormant and when the plant is pulling resources from the leaves down into the roots. Glyphosate, triclopyr and *Krenite* (active ingredient – fosamine ammonium) are the most used herbicides for foliar application. *Krenite* prevents bud formation, so the plants do not grow in the spring. This herbicide can be effective, but results are highly variable. Glyphosate or a triclopyr herbicide such as *Garlon* can also be used. Glyphosate is non-specific and will kill anything green, while triclopyr targets broadleaf plants and does not harm graminoids. Licensed applicators should apply all herbicides, and applications should occur in low-wind conditions. Care should be taken to avoid application to other plants. “Weed Wands” or other devices that allow dabbing of the product can be used rather than spraying, especially for stump treatment. Basal bark herbicide treatment is another effective control method. A triclopyr herbicide such as *Garlon 4*, mixed with penetrating oil, is applied all around the lower 6-12 inches of the tree or shrub, taking care so that it does not run off. If the herbicide runs off, it can kill other plants nearby. More herbicide is needed for effective treatment of plants that are four inches or more in diameter.

Undesirable trees and shrubs can also be destroyed without cutting them down. Girdling is a method suitable for small numbers of large trees. Bark is removed in a band around the tree, just to the outside of the wood. If girdled too deeply, the tree will respond by resprouting from the roots. Girdled trees die slowly over the course of one to two years. Girdling should be

done in late spring to mid-summer when the sap is flowing, and the bark easily peels away from the sapwood. Herbicide can also be used in combination with girdling for a more effective treatment. Girdling has the added benefit of creating snags for wildlife habitat. While girdling many trees is not feasible, girdling the occasional large tree will provide a matrix of habitat for species that depend on standing dead trees for food or nesting opportunities.

Mechanical Control

Three mechanical methods for woody plant removal are hand pulling (only useful on small seedlings and only if few), weed wrenching (using a weed wrench tool to pull stems of one to two inches diameter), and repeated or "critical" cutting. Pulling and weed wrenching can be done any time when the soil is moist and not frozen. The disadvantage to both methods is that they are somewhat time-consuming, as the soil from each stem should be shaken off. Weed wrenching also creates a great deal of soil disturbance and should not be used on steep slopes or anywhere that desirable native forbs are growing. The soil disturbance also creates opportunities for colonization by other non-native plants. This method is the least preferable and is probably best used in areas that have hardly any desirable native plant cover.

Repeated cutting consists of cutting the plants (by hand or with a brush cutter) at critical stages in its growth cycle, typically twice per growing season. Cutting in mid-spring (late May) intercepts the flow of nutrients from the roots to the leaves, and cutting in fall (about mid-October) intercepts the flow of nutrients from the leaves to the roots. Depending on the size of the stem, the plants typically die within three years, with two cuttings per year.

Prescribed Fire

Prescribed burning is the most efficient, cost-effective, and least harmful way to control very small stems, seedlings, and resprouts of all woody plants. It also restores an important natural process to fire-dependent natural communities (oak forests, for example). Burning can only be accomplished if adequate fuel (leaf litter) is present and can be done in late fall or early spring, depending on site conditions.

Native Shrubs

Prickly Ash

A common native shrub, prickly ash can become excessively abundant, especially in areas that have been disturbed or grazed. Complete eradication may not be necessary, but management may target reducing the extent of a population. Removal is most easily accomplished in the same manner as for buckthorn – cutting shrubs and treating cut stumps with glyphosate herbicide. Cutting can be completed at any time of the year.

Smooth Sumac

Like prickly ash, smooth sumac can become excessively abundant, especially in areas where fire has been suppressed for long periods of time. It can form dense, clonal stands that dominate other vegetation. Unlike prickly ash or buckthorn, however, controlling smooth sumac does not require herbicide applications since that would require a tremendous

amount of herbicide, be quite labor intensive, and probably cause heavy damage to surrounding plants. Control of smooth sumac can be easily accomplished by cutting and burning or a combination of these two methods. To be effective, the sumac must be burned or cut twice a year: the first time in the late spring, just after it has fully leafed out (expended maximum energy), and the second time in late summer, after it has re-sprouted. Repeat this method annually for two to five years to deplete the clone of its energy, working back at the edges of the clone and reducing cover from the outside of the area towards the center. If cutting or burning is performed only once a season, the clone will persist since this will not be enough to drain the root system of stored energy. Cutting twice a year without burning will be effective, but burning is doubly so since fire tends to benefit herbaceous plants and suppress woody ones.

Disposal

The easiest and most cost-effective method to handle large amounts of woody brush is usually to stack it and burn it. This is most typically done during winter to lessen the impacts on soil (compaction, erosion, rutting, etc.), though often, brush will be piled soon after the removal and burned during the winter. In areas where brush is not dense, it can be cut up into smaller pieces, scattered, and left on the ground where it will decompose in one to three years (this method is especially useful on slopes to reduce erosion potential). Small brush piles can also be left in the woods as wildlife cover. Where there is an abundance of larger trees, cut trees may be hauled and chipped and used for mulch or as a biofuel. Alternatively, the wood can be cut and used for firewood, if a recipient can be found, or perhaps saved to be used later as waterbars for slope stabilization.

FORBS

Spotted knapweed

Knapweed is a perennial species that has become a troublesome prairie invader. Of all the typical prairie weeds, spotted knapweed is probably the most difficult to manage. It cannot be controlled with burning—like sweet clover, it increases with fire. Hand-pulling individuals or small groups of individuals can be effective for small infestations and is often a good volunteer group task. However, knapweed has a large tap root and can be difficult to pull. Pulling is typically more difficult when soil is hard (dry), clayey, or compacted but easier when soil is wet (following a rain), sandy, and friable. A biocontrol (knapweed beetles--weevils) is recommended for large knapweed populations. Knapweed beetles (weevils) are released during the summer. Weevils can be purchased online, and they are sent via mail. Knapweed populations should be monitored each year to keep a record of the effectiveness of the biocontrol.

Weevils are effective for long-term control but not a good short-term control option. Spot treatment with a systemic herbicide such as *Milestone* or *Transline* can be effective for short-term control. Applying herbicide to prairie restoration areas should be done with care. Remnants with high diversity should be spot-treated, not broadcast-treated. It is recommended to treat first with the least impactful chemical, monitor to see if that works,

and then try another if it does not work. Degraded and highly disturbed areas can be treated a little less gently, perhaps using broadcast applications. Always follow the product label when using any chemical for weed control. Treatment should be done before the target plants form seed, so late spring and early summer are best. Professional pesticide applicators are required for herbicide treatment.

Canada thistle

While native thistles are not generally problematic, non-native thistles such as Canada thistle are clone-forming perennials that can greatly reduce species diversity in old fields and restoration areas (Hoffman and Kearns 1997). A combination of chemical and mechanical control methods may be needed. Chemical control is most effective when the plants are in the rosette stage and least effective when the plants are flowering. Where native grasses and sedges are present, the use of a broadleaf herbicide such as 2,4-D is recommended since 2,4-D only affects dicots. 2,4-D is most effective when applied 10-14 days before the flowering stems bolt. It is applied at a rate of 2-4 pounds/acre using a backpack or tractor-mounted sprayer or in granular form. Dicamba could also be used, with the advantage that it can be applied earlier in the spring at a rate of 1 pound/acre. Another chemical that has been used for thistles is aminopyralid ("*Milestone*"), which can be applied at bud stage. Aminopyralid will affect other species, and it has longer residual activity than some other chemicals, so use with caution—typically use it on large patches/clones of thistles and avoid areas of higher diversity. Plants that do not respond to treatment or that are more widely dispersed could be controlled mechanically.

Mechanical control, involving several cuttings per year for three or four years, can reduce an infestation if timed correctly. The best time to cut is when the plants are just beginning to bud because their food reserves are at their lowest. If plants are cut after flowers have opened, the cut plants should be removed because the seed may be viable. Plants should be cut at least three times throughout the season. Late spring burns can also discourage this species, but early spring burns can encourage it. Burning may be more effective in an established prairie, where competition from other species is strong, rather than in an old field, where competition is likely to be weaker.

Sweet clover

White and yellow sweet clover are very aggressive biennial species that *increase* with fire. Where sweet clover is found, it should be controlled in conjunction with treatment that attempts to eliminate smooth brome if prairie restoration occurs. Sweet clovers are common plants in agricultural areas, so if restoration is implemented, the project area should be surveyed for this species on an annual basis. Oftentimes, following initial brush removal and/or burning, a flush of weedy annuals and biennials, such as sweet clover, can occur. Well-timed mows and burnings are usually adequate to control these species. Mowing the site, as is typically prescribed for prairie restoration maintenance, should occur when all plants on the site (including sweet clovers) are approximately 12 inches in height. Sweet clover can bloom even at a height of 6 inches, but if it is burned or mowed in the following year in the

late spring, it should be controlled. On steep sites, brush cutting can be substituted for mowing. Individual plants or small populations can be removed by hand-pulling. If seed production occurs, prodigious amounts of seed can be produced and spread, so pull before seeds appear or bag seed-producing plants. Competition from native species also helps control sweet clovers and other weedy annuals and biennials.

To some extent, *Common burdock* and *common mullein* can be treated similarly to sweet clover, since they are both non-native, biennial forbs that are typically found in disturbed areas or restoration projects.

Garlic mustard

Garlic mustard is a non-native biennial forb of woodlands and edges that is invasive and aggressive. After just a few plants are introduced, populations can rapidly increase, and a dramatic "explosion" of garlic mustard plants can occur. In some areas, it can form monotypic stands that crowd out other species, while recent studies have shown that in other locations, it may simply occupy open ecological niches. Nevertheless, garlic mustard can be very invasive in woodlands, and monitoring and removing it as soon as it is detected (early detection and rapid response) is recommended. Garlic mustard also produces a flavonoid (root exudate) that suppresses mycorrhizal inoculation. Thus, mycorrhizae-dependent species, like oaks, will become stunted and easily outcompeted by garlic mustard. The flavonoid persists in the soil years after garlic mustard plants are removed, which is a good reason to keep woodlands garlic mustard-free.

Probably the best way to control garlic mustard is to monitor your site closely, and if garlic mustard is found, hand-pull it before it spreads. Hand-pulling should occur before siliques (seed pods) form. Once siliques form, removed plants should be bagged and transported from the site since the plant may have enough energy in the stem and root to make viable seeds, even though it is not growing in the ground. If bagging and transporting are not an option, making weed piles is an option, but prepare to deal with garlic mustard plants in the future at each pile. Garlic mustard plants produce hundreds of seeds per plant—they are very prolific. When pulling garlic mustard plants, take care to remove the entire root, since they may re-sprout if part of the root is left in the ground. This can be difficult since roots are "S-shaped" and tend to break off at ground level.

Chemical control is not recommended except in cases where garlic mustard is growing in large monoculture patches. In such cases, a systemic herbicide may be appropriate. Glyphosate is non-specific and will kill any actively growing plant. One technique that has been effective is applying a water-soluble herbicide during warm days in the winter when no snow cover or only a thin snow cover exists. Garlic mustard rosettes (first-year plants) remain green mostly all year round and can be killed during the winter when nearly all other plants are dormant. Another successful technique is to use an herbicide specific to broadleaved plants, like triclopyr (*Garlon*), but one that is water soluble, which can be dispensed with a backpack sprayer or the like; this will not kill grasses or sedges.

Studies underway by the MNDNR and the University of Minnesota show good potential for biocontrol of garlic mustard via an introduced weevil (http://www.legacy.leg.mn/projects/biological-control-european-buckthorn-and-garlic-mustard). The testing phase is complete, but the approval process still needs to be performed. If approved, this method could revolutionize garlic mustard control. However, whether it will be effective or not on a landscape scale is yet to be determined.

GRASSES

Smooth brome

Smooth brome is a cool season grass —active early in the growing season in southern Minnesota (April-May-June) and then going semi-dormant in July-September. It reproduces by means of underground stems (stolons and rhizomes) called "tillers". The most effective treatment is timed to occur at the same time as the brome is "tillering"—mid to late May in southern Minnesota. Burning two years in a row (late-season burns in June) followed by seeding has been shown to be effective in controlling smooth brome. Consider that this timing may be a week or two earlier on steep south-facing slopes or in very sandy or sand-gravel soils. Following this method will usually be sufficient to control smooth brome. Seeding following burns, preferably with native seed collected on-site, or purchased from a seller that provides local ecotypes, is important for restoring cover at the site. Evaluation can occur each year, and especially after two years. If this is not working, perhaps try a cool-season overspray of a grass-specific herbicide either in the spring (April) or in the fall (October). Using glyphosate as a cool-season overspray herbicide application is a last resort, since it is non-specific.

Kentucky bluegrass and *creeping fescue* can be treated similarly to smooth brome, since like smooth brome, they are both non-native, stoloniferous, cool-season grasses. Spring burns are the most effective tool against all of these species.

Reed canary grass

This species is extremely difficult to eradicate and requires repeated treatment over a period of one to three years. A combination of burning, chemical treatment and mowing can be used in accessible areas, or chemical treatment alone in inaccessible areas. The combination method starts by burning in late spring to remove dead vegetation and to stimulate new growth. When new sprouts have reached a height of 4 to 6 inches, the site can be sprayed with a 5% solution of a glyphosate herbicide appropriate for wetland habitat (e.g., *Rodeo*). The site is then mowed in late summer, followed by chemical application after re-growth. This treatment will stimulate new growth and germination to deplete the seed bank. The sequence of chemical treatment and mowing is repeated for at least a second season and possibly a third until the grass is completely eradicated. Then, native grass and forb seed can be broadcast or drilled.

If reed canary grass is eradicated from an area, future management of the grassland, namely burning, will likely keep the reed canary in check. However, monitoring and mapping new individuals or clumps should continue, and those individuals should be treated if burning is not adequately controlling them. If the plants are small, they can be removed by digging out the entire root. Generally, though, chemical treatment is more feasible. If plants are clumped, they can be treated by tying them together, cutting the blades, and treating the cut surface with herbicide. Otherwise, herbicide should only be applied in native planted areas on very calm days to avoid drift to non-target plants.

APPENDIX D. Ecological Contractors

Following is a list of contractors to consider for implementing management plans. While this is not an exhaustive list, it does include firms with ecologists who are very knowledgeable with natural resource management. Unless otherwise noted, all firms perform prescribed burning. Many other brush removal companies are found online (searching tree care), but most do not have knowledge or understanding of native plant communities. We recommend hiring firms that can provide ecological expertise.

Friends of the Mississippi River (FMR) has extensive experience working with landowners to implement natural resource management plans. FMR can assist landowners with obtaining funding for restoration and management projects and providing project management, including contractor negotiations, coordinating restoration and management work, and site monitoring and evaluation.

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60 Plato Blvd E Ste 210
Saint Paul, MN 55107
(651) 209-9900
www.conservationcorps.org

Great River Greening
251 Starkey St #2200
St Paul, MN 55107
(651) 665-9500
www.greatrivergreening.org

Minnesota Native Landscapes (MNL)
8740 77th St NE
Otsego, MN 55362
(763) 295-0010
www.mnlcorp.com

Prairie Restorations, Inc.
31646 128th St.
Princeton, MN 55371
(763) 389-4342
www.prairieresto.com

Stantec
733 Marquette Avenue, Suite 1000
Minneapolis, MN 55402
(612) 712-2000
www.stantec.com

Resource Environmental Solutions, LLC (RES)
20276 Delaware Avenue
Jordan, MN 55352
(217) 979-2415
www.res.us

Native Resource Preservation
260 Wentworth Ave E Suite 155
West St Paul, MN 55118
(320) 413-0015
www.nativeresourcepreservation.com

Landbridge Ecological, Inc.
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