# Lake Byllesby Regional Park Natural Resource Management Plan

## Adopted by the Dakota County Board on January 23, 2018





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## **EXECUTIVE SUMMARY**

Lake Byllesby Regional Park (Park), located in southern Dakota County along the boundary with Goodhue County, is part of the extensive Cannon River Valley and associated 946,000- acre watershed. The primary feature of the Park is Lake Byllesby which is a 1,365-acre reservoir formed when a dam was constructed on the Cannon River in 1910. The Park also includes portions of the Cannon River both above the reservoir and below the dam, as well as a portion of Chub Creek. The Park consists of two geographically based units: East Byllesby which contains most of the recreational developments of the Park; and West Byllesby which contains mostly undeveloped land. The Park is 620 acres, of which 455 acres are private inholdings (private owed land within the park boundary). The 2018 Master Plan expands the park boundary by 79 acres, all of which are private inholdings. The Natural Resources Management Plan does not address the 79 acres added to the official park boundary in the 2018 Master Plan.

The area including the Park has drastically changed since European settlement. Information from various sources such as soils, geology, original public land surveys, and historical aerial photography help us formulate a picture of what the site would have been like presettlement. The park's landscape was likely dominated by prairie, with river bottom forest along the Cannon River, and small areas of oak openings and barrens. The Cannon River of old was a highly sinuous channel, and a small cascade called Big Falls was located near what is the dam today. However, little remains of the pre-European settlement landscape today. Plowing and intensive grazing by domestic livestock have significantly altered ecological processes and the construction of the hydroelectric dam in 1910 created the reservoir known as Lake Byllesby.

The Park was established in 1971. Previous natural resource management efforts included approximately 12 acres short and tallgrass prairie restoration in the West Byllesby and 20 acres of shortgrass prairie restoration in East Byllesby.

Surveys and field visits conducted in 2016 to support the Park Natural Resource Management Plan (NRMP) identified a diversity of natural and disturbed/developed vegetative communities including grassland/prairie, savanna-brushland, woodland-brushland, deciduous forest, wet forest/swamp, floodplain forest, emergent marsh, lake/pond, river/stream, abandoned nursery, developed parkland, gravel pits, and cropland within the Park. The majority of the vegetative communities identified within the Park were considered disturbed or having low vegetative diversity. Only a few forested and wetland areas were characterized as being of good or fair quality.

The Park NRMP was developed to inform the 2018 Park Master Plan and includes detailed descriptions of existing natural resource conditions, desired improvements and action items. In addition to ecological benefits, natural resource improvements throughout the Park will provide layers of function such as improving the overall setting, creating transitions between uses, providing demonstration opportunities, and modeling stewardship for educational and interpretive purposes. Natural resource improvements will include the conversion of turf grasses

to prairie, naturalization of shoreland, management of invasive species, and restoration of natural communities.

The primary natural resource issues identified for the Park are a lack of high quality and connected natural areas and degraded water quality. Specific vegetative concerns include invasive species, habitat fragmentation due to infrastructure, amenities, and agricultural areas; invasive species; stormwater management; and human-caused pollution. Management efforts should focus on mitigating the aforementioned issues. Specifically, intensive efforts to manage prolific invasive species like buckthorn will be critical in in restoring more native vegetation communities within the Park. Vegetative restoration efforts should include oak savanna, native prairie and grasslands, non-forested wetlands, as these communities are essential for rare and sensitive wildlife species and pollinators. Habitat restoration will help decrease the fragmented nature of the Park and foster an ecosystem more resilient to invasive and non-native species.

An ongoing issue for the Park and local residents is the water quality and sedimentation of Lake Byllesby and the Cannon River. Community concern was expressed repeatedly during the public engagement process for this Plan. Water quality issues such as excessive nutrients and bacteria, sedimentation, turbidity are the cumulative result of land use practices within the extensive watersheds that extend miles from the Park. Adoption and implementation of the "One Watershed One Plan" for the Cannon River currently being developed will provide a comprehensive and strategic approach to addressing these problems. Sedimentation in Lake Byllesby's East Bay is of particular interest to the County, as it affects recreation (boating, fishing and visual quality) and dam operations. Within the Park, shoreland naturalization and stabilization and other improvements to shoreline vegetation will help improve water quality and aquatic wildlife habitat. Stormwater Best Management Practices (BMPs) should be considered during initial design changes and implementation of all recreational development planned for the Park.

The Plan divides the Park into a number management units based on location and unifying characteristics. Existing conditions, issues, opportunities, and recommendations are described for each Unit.



Natural Resource Management Units of Lake Byllesby Regional Park

## **Natural Resource Management Goals**

The following vision statement for Lake Byllesby Park is built on the principals and vision outlined in the county-wide NRMSP and also an understanding of the Park conditions and uses:

Management of Lake Byllesby Regional Park will focus on maintaining, restoring, and enhancing the quality and resiliency of natural resources in order to provide a variety of ecosystem services and an outstanding setting for nature-based outdoor recreation.

Natural resource management goals for the Park are as follows:

### **Vegetation**

- Control invasive species and restore and enhance highest quality and previously restored areas.
- Focus new restoration on cultivated areas, high recreational use (current and future) areas, areas which provide critical habitat connectivity and areas that provide habitat for wildlife Species of Greatest Conservation Need.
- Use primarily native species to provide internal and external Park landscape buffers.
- Maintain restored areas by sufficiently installing native seed and using appropriate invasive species management techniques.
- Monitor progress, and facilitate adaptive management based on best management practices and scientific methods.

## Water Resources

- Work with partners, as appropriate, on watershed related water quality improvement projects.
- Improve shoreland vegetation to reduce erosion and surface water runoff, and to provide both upland and submerged wildlife habitat.
- Focus on management of aquatic invasive species within wetlands and other water features, especially in areas with potential to spread invasion to adjacent waterbodies.
- Utilize stormwater best management practices to improve water management and address listed impairments.
- Develop educational signage and programing to inform visitors of invasive species and water protection efforts.

## <u>Wildlife</u>

- Restore and maintain vegetative communities to attract insects and wildlife associated with native plant communities.
- Conduct surveys to monitor indicator species and inform adaptive management.
- Mitigate negative impacts of overabundant wildlife to protect native vegetation and wildlife.

## **Natural Resource Management Recommendations**

Short-term natural resource management recommendations for the Park include native plant community restoration and promoting native vegetation, controlling invasive species, and managing existing restored prairie areas. Near-term projects include restoration of 160 acres of native vegetation, controlling invasive species on 136 acres, and restoring shoreline. See the table and maps of proposed natural resource project recommendations on the following pages.

Mitigation, restoration, and other management activities should be continuously monitored and assessed. Furthermore, the NRMP will be reviewed and updated every five years or as needed to maintain its relevancy. Through the recommended efforts, Lake Byllesby Park should become both a regional recreation hub for exploring and observing nature but also a place of great habitat diversity and value to a variety of wildlife.

Site Name	Priority	Timing	Size (ac)	Primary Goal	Main Steps	Cost Estimates	Notes					
East – Lake Byllesby												
Lakeside												
Reservoir Shoreline	1	Yrs 1-3	8.2	Construct lakeshore habitat	Assess/evaluate Reshape the bank where slopes are too steep and erosion is a concern Install partially submerged logs along shoreline ("fish stick" idea) Spot herbicide treatments; re- vegetate with appropriate native plant species mix (seed and plugs); install turtle basking logs. Establishment management of vegetation Monitor SUB-TOTAL (lines 7-11)	\$91,620	\$60 per lineal foot of shoreline					

#### Short-Term (5- Year) Schedule and Costs for East and West – Lake Byllesby

Site Name	Priority	Timing	Size (ac)	Primary Goal	Main Steps	Cost Estimates	Notes				
Cannon Gorge											
River Shore.	1	Yrs 1-3	0.4	Restore	Assess/evaluate	\$ 300					
downstream of dam				sandy river	Install root wads	\$20,000					
or uan				habitat	Spot herbicide	\$ 500					
					Re-vegetate with appropriate native plant species mix (seed and plugs)	\$ 5,000					
					Establishment management of vegetation	\$18,000	\$60 per lineal foot				
					Monitor	\$ 500					
					TOTAL	\$ 44,300					
			1				1				
River Bank,	1	Yrs 1-3	4.6	Restore oak	Assess/evaluate						
downstream of dam				woodland and seepage meadow.	Re-vegetate with appropriate native plant species mix (seed and plugs)	\$23,000					
					Establishment management	\$6,440					
					Monitor	\$ 500					
					TOTAL	\$29,940					
Echo Point	1	Yrs 1-3	5	Reconstruct dry oak	Woody plant removal and follow up	\$5,000					
				savanna	Herbaceous plant control	\$3,500					
					Rx burn	\$2,500	If possible				
							Seeding of native savanna community ground layer species	\$5,000			
					Plant shrubs	\$1,000					
					Establishment management	\$4,500					
					TOTAL	\$21,500					
Echo Chann	el and Up	lands									
Crop Field	1	Yrs 1-3	24.4	Reconstruct native	Plant and harvest soybeans	\$ -	Partner with a local farmer.				

Site Name	Priority	Timing	Size (ac)	Primary Goal	Main Steps	Cost Estimates	Notes
				prairie	Prepare soil	\$12,200	
					Seed and establish prairie	\$48,800	
					Monitor and adaptively manage.	\$500	
					TOTAL	\$61,500	
					<u> </u>		
E.L.	2	Yrs 2-4	15.7	Restore	Site prep	\$ 12,560	
Echo Channel				wetland	Seed	\$ 23,550	
				community	Plug/plant	\$8,000	
					Establishment management	\$21,980	
				Monitor and adaptively manage	\$500		
					TOTAL	\$66,590	
	I	1		1			
Old Tree Farm	3	Yrs 3-5	11.2	Restore oak woodland	Woody plant removal and follow up	\$20,000	50-80% canopy removal
				Herbaceous plant control	\$2 <i>,</i> 920		
					Rx burn	\$1,500	
					Seeding	\$18,400	Includes direct hardwood seeding
					Establishment management	\$ 15,680	
					TOTAL	\$ 58,500	
Overgrown Prairie	1	Yrs 1-3	38.7	Restore dry oak savanna	Woody plant removal and follow up	\$57,400	Stockpile junipers for shoreline revetment
					Herbaceous plant control	\$22,090	
					Herbaceous plant control Rx Burn	\$22,090 \$19,350	

Site Name	Priority	Timing	Size (ac)	Primary Goal	Main Steps	Cost Estimates	Notes
		Side			Planting	\$5,000	
		acres			Establishment management	\$27,090	
					TOTAL	\$170,930	
					EAST TOTAL	\$544,880	
West – Lak	e Byllesby	1					
Byllesby Bl	uff						
Near the Cemetery,	3	Yrs 4-5	8.6	Woody invasive	Cut & treat stumps; remove cut material	\$8,600	
NW Reservoir Shoreline				plant removal; shoreline	Follow up resprout and seedling control	\$6,020	
Shoreline				restoration	Shoreline restoration	\$30,000	\$10 per lineal foot
					TOTAL	\$44,620	
Restored Prairie, NW Reservoir	2	Yrs 2-4	4.9	Remove woody veg between two	Woody plant removal	\$12,250	Lots of large cottonwoods on site. Very dense BT.
				reconstructe d prairies	Follow up resprout and seedling control	\$2,940	
	restore prairie so that the			restore	Herbaceous plant control	\$3,430	
		prairie so that the	Seed	\$9,800			
				entire area is one prairie	Establishment management	\$6,860	
				system.	Rx burn	\$2,450	
					IUIAL	\$37,730	
Chub Creek		1	1				
Chub Creek Mouth	2	Yrs 2-4	13.4	Woody invasive removal	Cut & treat stumps; remove cut material	\$6,030	Very dense BT. Plan to use ICWC.
					Follow up control of resprouts and seedlings	\$9,380	
					TOTAL	\$15,410	
Byllesby De	lta			·	·		·

Site Name	Priority	Timing	Size (ac)	Primary Goal	Main Steps	Cost Estimates	Notes
Peninsula (former house site)	1	Yrs 1-4	10.2	Mesic savanna and wet prairie restoration	Remove invasive woody plants	\$ 10,200	Very dense BT, but could use forestry mower.
					Follow up control of resprouts and seedlings	\$6,120	
					Herbaceous plant control	\$7,140	
					Seed	\$15,300	
					Establishment management	\$14,280	
					Rx burn	\$5,100	
					TOTAL	\$58,140	
	1	1	I	1		L	I
Former Mudflat Areas	3	Yrs 3-5	23.6	Remove invasive woody plants	Cut & treat stumps; remove cut tops; follow up resprout and seedling control	\$10,620	Access difficult. Islands. Plan to use ICWC.
					Follow up control of resprouts and seedlings	\$14,160	
					TOTAL	\$24,780	
Chub Creek							
Floodplain and Upland Forest Areas between Randolph Blvd and Dixie Ave.	2	Yrs 2-4	7.8	Remove invasive woody plants	Cut & treat stumps; remove cut tops; follow up resprout and seedling control	\$3,510	Access difficultnot a good place to park. Plan to use ICWC.
					Follow up control of resprouts and seedlings	\$4,680	
					TOTAL	\$3,510	
Oxbow							
Floodplain and Upland Forest Areas West of Dixie Ave.	2	Yrs 2-4	41.2	Remove invasive woody plants	Cut & treat stumps; remove cut tops	\$18,540	Plan to use ICWC.
					Follow up control of resprouts and seedlings	\$24,720	
					TOTAL	\$43,260	
Cannon Cas	cades					· 	·
Floodplain Area and Upland Area at West End	3	Yrs 3-5	26.2	Remove invasive woody plants	Cut & treat stumps; remove cut tops	\$11,790	Fairly steep slopes; very dense BT. Plan to use ICWC.

Site Name	Priority	Timing	Size (ac)	Primary Goal	Main Steps	Cost Estimates	Notes
					Follow up control of re- sprouts and seedlings	\$15,720	
					TOTAL	\$27,510	
							•
Crop Field at West End	2	Yrs 2-4 9	9	9 Reconstruct to dry prairie	Ensure that the field is planted to soybeans in the last year prior to reconstruction	\$3,150	
					Prepare site	\$2,250	
		West side acres	144.9		Seed	\$13,500	
					Mow, spot treat multiple times	\$12,600	
					Rx burn	\$4,500	
					TOTAL	\$36,000	
WEST TOTAL					\$290,960	1	

	EAST TOTAL	\$544,880
COST SUMMARY	WEST TOTAL	\$290,960
	TOTAL EAST + WEST	\$835,840
	TOTAL COST PER ACRE	\$3,302.41





## 1. INTRODUCTION

#### 1.1. Natural Resource Public Values



Sigurd Olson, a famous Minnesota author and member of the Wilderness Society stated, "wilderness to the people of America is a spiritual necessity, an antidote to the high pressure of modern life, a means of regaining serenity and equilibrium." The natural world is a powerful influence in the lives of many, and has been for millennia. Simultaneously, people have had profound impact on natural systems through resource exploitation and modification for the purpose of settlement and industry. For its residents, county parks can be an antidote to a fast-paced, technologically connected. buildings-and-road centered lifestyle.

Lake Byllesby Regional Park is one of three designated

regional parks in Dakota County and attracts visitors from other counties and communities. According to Metropolitan Council, *Regional Parks* should contain diverse natural resources and the ability to provide for a wide range of natural resource related recreational opportunities, provide access to water bodies suitable for recreation is particularly important, be large enough to accommodate a variety of activities, and preserve a pleasant natural aspect and buffer activity areas from each other. Lake Byllesby Park is an excellent example of a place people can patronize to explore diverse natural resources as well as enjoy a variety of recreation activities, including access the Lake Byllesby – a reservoir now popular for boating, fishing and swimming.

County residents in survey after survey have expressed their desire to have nearby natural places that are out of the ordinary where they can be close to and even fully immersed in the natural world. Dakota County Parks recently released a questionnaire about Lake Byllesby Regional Park inquiring about current and potential uses of the Park and what people would like to see implemented in future park management. The vast majority of respondents shared a resounding desire for improved water quality, aquatic recreation, diversified trail systems, invasive species management, and restoration of degraded areas. Improvements in these key areas will indeed have a positive impact on current and future park users and will benefit the natural communities of the Park.

## 1.2. Regional Natural Resource Conservation Context

Lake Byllesby Park is located in Dakota County, adjacent to the Cannon River and Lake Byllesby Reservoir (Figure 1) and in a predominantly agricultural area of the state. It provides important habitat and natural respite from a fairly monotypic landscape. Although much of the surrounding area is developed or utilized for agricultural purposes, several natural areas (e.g., Sites of Biodiversity Significance, conservation easements, and Regionally Significant Ecological Areas) are mapped adjacent to and within a mile of the Park. In addition, the Park is within five miles of several Scientific and Natural Areas, Wildlife Management Areas, and a State Park. As such, Lake Byllesby Park provides an important connector between surrounding mapped ecological areas in a highly fragmented landscape.

Lake Byllesby Park itself contains a variety of natural communities and features including prairie remnants, woodland, floodplain forest, wetland, lakeshore, and bedrock outcrops. Unfortunately many of the existing natural areas are degraded and contain invasive species. Through proper site management and restoration, the Park has the potential to develop diverse native plant communities and support a robust native animal assemblage.



Image of Byllesby Reservoir overlooking the Cannon River delta, West Byllesby



## 2. PRECEDENT PLANNING EFFORTS

This NRMP builds on previous natural resource management efforts associated with Lake Byllesby, while incorporating goals outlined in the 2017 Dakota County Natural Resource Management Systems Plan (NRMSP) the 2017 Parks Visitors Service Plan (VSP) and the 2030 Park System Plan.

Natural resource planning efforts targeted at protecting Lake Byllesby reservoir first began on January 14<sup>th</sup>, 1967 when a group of concerned residents formed the Lake Byllesby Improvement Association in response to an editorial in the Cannon Falls Newspaper- BEACON stating that the Northern States Power (NSP) Company intended to drain the reservoir and abandon the dam (www.lakebyllesbyassociation.org). In 1969, NSP deeded the dam, powerhouse, and all its land holdings under and around the reservoir to Goodhue and Dakota Counties. Soon after receiving the deed for the dam, Dakota County received a federal Housing Urban Development grant which was used to purchase 873 acres of land adjacent to Lake Byllesby which would officially become Lake Byllesby Regional Park in 1971(www.lakebyllesbyassociation.org). Since then, Dakota and Goodhue Counties have incorporated specific master plans for the reservoir and the Regional Park into their County Park System Plans with a goal of maximizing the potential of the Park and attracting residents and visitors to the Park. The following sections highlight previous planning efforts.

## 2.1. 1987 Lake Byllesby Regional Park Master Plan – Dakota County

The 1987 Park Master Plan (PMP) was written with a primary philosophy of designing a park for active recreation use with limited focus on protection of a natural environment or wildlife habitat. The major goal of this plan was to develop a recreational facility that met the recreational needs of residents of Dakota County and the surrounding metropolitan areas within a 45 minute drive of the Park. Eight recreational development areas were established as a result of this plan. Proposed implementation activities and costs were detailed for each of these areas, many of which are still in place today.

A second major component of this plan was to divide the western and eastern portions of the Park into three management districts including the Marsh-Wetland Unit, the Recreational Development Unit, and the Natural Environment and Trails Unit. Each district was to be managed separately with designated uses assigned to each. The Marsh-Wetland Unit consisted of areas not suitable for developing recreation facilities, these areas were generally left as undeveloped natural areas. The Marsh-Wetland Unit was located on the western section of the Park in areas immediately adjacent to Byllesby reservoir and its associated wetlands and mudflats.

The Recreational Development Unit was located across both the East and West Sections. In the East Section, the Recreational Development Unit included areas identified as Echo Channel, Harry Avenue, East Lake, and Lilac Landing. In the West Section, areas identified as Chub Creek, Cascades, Deer Bay, and West Lake were identified. The Recreational Development Unit consisted of accessible areas not prone to flooding and were targeted for horseback riding trails, camping sites, picnic sites, parking facilities, and other related facilities.

The Natural Environment and Trails Unit was as a transitionary area between the Recreational Development Unit and the Marsh/Wetland Unit and consisted of more natural areas including steeply sloped wooded uplands and other forested areas. This portion of the Park was intended to provide a sense of seclusion and place to enjoy nature. The Natural Environment and Trails Unit was located in the forested and savanna areas of the Park.

Proposed vegetation management strategies were tailored to each of the three Management Units described above with an overarching goal of providing park users with an experience of being surrounded by the natural environment. Other aspects of the vegetation management plan included soil erosion control, planting of windbreaks, and tree planting programs focused on drought tolerant species.

Proposed wildlife management planning efforts focused on providing habitat and forage for a self-sustaining ring-necked pheasant population through coordination with the DNR Area Wildlife Manager. Other habitat improvements such as upland forest management were designed to create forests dominated by oak, walnut and butternut trees to provide food and habitat for deer, squirrels and raccoons however, there was no discussion regarding the restoration of native plant and animal communities.

Proposed fish management activities focused on providing well-lit fishing piers and boat launches to facilitate angler access to the reservoir under low light conditions for those wishing to target walleye (*Sander vitreus*) and white/ black crappie (*Pomoxis spp.*). Extensive effort was placed on stocking the reservoir with channel catfish (*Ictalurus punctatus*) and educating park users on how to catch and prepare them. However efforts to control rough fish numbers were not recommended given the Cannon River represented a constant supply of these species as they descended to the reservoir from upstream waterbodies.

## 2.2. 1994 Byllesby Park Management Plan – Goodhue County

The 1994 Park Management Plan was developed to provide Goodhue County with a decision making tool to assist in budgeting for future Byllesby Park improvements. Overarching goals included a plan to increase opportunities for family recreation, land acquisition opportunities, and plans to connect bike trails to the Cannon Valley Trail and Dakota County Lake Byllesby Trail. Other recommended park upgrades included a beach house with changing rooms, toilet and shower facilities, a concession space and an outdoor patio, recreational courts (basketball, volleyball), and boat and canoe launch upgrades. The plan also included a recommendation for boating restrictions due to concerns over high usage, a rules enforcement program, and a park maintenance program.

While the major emphasis of this planning effort was on devoting different areas of Byllesby Park to recreational uses, the plan also mentions the development of a nature area at the west end complete with native prairie, wetland and woodland habitat for wildlife. Additionally, a stormwater retention pond was planned to collect runoff from the parking lot.

### 2.3. Lake Byllesby Regional Park Master Plan (2005)



Image from 1987 Lake Byllesby Park Master Plan Document

The 2005 LBRP Master Plan is consistent with Dakota County Park's Policy Plan which identifies goals, policies, and strategies for improvement for all parks in the County. The 2005 PMP plan builds on the 1987 Master Plan by incorporating a more contemporary look at the trends, user groups, and issues that were most relevant to the regional park by incorporating input from Dakota County staff, potential Park users in the Twin Cities, and natural resource professionals from the DNR, Dakota County Soil and Water Conservation District (SWCD), and Metropolitan Council. This inclusive 128 page plan included the following chapters: Recreational Needs

Forecast, Vision and Guiding Principles, Cultural Resources Stewardship, Natural Resources Stewardship, Development Master Plan, Park Boundary and Acquisition, Outdoor Education, and Implementation and Management. Each chapter is briefly summarized below.

#### **Recreational Needs Forecast**

This chapter identifies demographic increases projected to use County Parks as a result of intense population growth in Dakota County. The most popular natural resource based activities included hiking, biking, swimming, and canoeing. These uses were compared with available facilities at County Parks to assess the greatest needs for improvement. Enhancing water quality, especially during the late summer, was identified as a key issue in influencing Park visitors' overall experience.

#### **Cultural Resources Stewardship**

The Master Plan details the discovery of pre-European archaeological remnants suggesting that the Cannon River likely attracted humans to this area for thousands of years. Results from an archaeological assessment conducted in 2004 are discussed in detail along with several maps that depict the areas with the highest potential for locating archaeological sites. A thorough review of the Park's history is outlined, describing the changes that have occurred in the area since the first European settlers arrived in the area in the mid nineteenth century. The Plan recommends incorporating important historical themes into outdoor education programming at the Park.

#### **Natural Resources Stewardship**

This portion of the Master Plan highlighted the significant impacts of converting native prairie and woodland in a predominately agricultural setting; focusing on impacts to plant and animal diversity, as well as water quality. Remaining high quality natural areas were mapped along with the location of invasive species. These maps accompanied action plans that outlined recommended implementation activities focused on controlling invasive species, restoring native vegetation along rip-rapped shorelines, and targeted plant community protection and restoration efforts.

Existing vegetative cover types within the Park were evaluated and organized into several cover types for the Western and Eastern Sections of the Park. Vegetative cover types included disturbed native forest, floodplain forest, oak/red cedar woodland, disturbed temporarily flooded shrubland, cultivated/planted fields, old field community, and wetlands.

#### **Development Master Plan**

This chapter provided illustrated details of proposed improvements for the Park including all capital investments proposed over the life span of the Plan in response to known issues discussed in the preceding chapters. Key issues discussed addressed conflicts between park use and residential uses on Echo Point, improving lake water quality, and Park beautification.

#### **Park Boundary and Acquisition**

This chapter outlined County parkland acquisition policies, and their application to LBRP. The chapter discusses alternatives to parkland acquisition, why boundary adjustments are warranted, and identified lands for potential acquisition.

#### **Outdoor Education**

This Chapter closely aligns with the strategies of the Dakota County Comprehensive Outdoor Education Plan (COEP), which addresses different aspects of outdoor education including environmental, historical, cultural and recreational program. The purpose of this chapter was to identify educational opportunities in the Park and leverage capital investments in ways that enhance the strategies identified in the COEP.

#### **Implementation and Management**

This section outlined a plan for allocating resources, reviewing pertinent ordinances and assigning responsibility for proposed improvements, maintenance and enforcement as it relates to the Park.

## 2.4. Dakota County 2030 Park System Plan (2008)

The 2008 Park System Plan (System Plan) provides a comprehensive description of the existing status of Dakota County's Park System, a vision for the County's parks going forward, and a strategy for how to achieve this vision. The System Plan also identifies immediate priorities for the next ten years. Below is a brief summary of Chapters 2-4: System Vision for 2030, Ten-Year Implementation Priorities, and Delivering the Vision.

## 2030 Park System Vision

The overall park system vision included three main components:

Great Places: More to see and do at Dakota County Parks

- a) Hiking, Walking, Biking, Picnicking, lake-based activities, overnight camping
- b) Improve swimming (water quality) and more water access sites.

<u>Connected Places</u>: Incorporate city and county greenways, stream corridors, and identify ways to connect residential areas to the Park

<u>Protected Places:</u> Protect and focus management efforts on high quality restored prairies and savannas, with minimal management in areas with low restoration potential.

#### **Ten-Year Implementation Priorities**

The ten-year priorities for implementing the master plan projects included the following three recreational objectives for all County parks:

<u>Objective 1:</u> Provide **Popular Recreation Basics** at all parks including walking, biking, hiking, picnicking, fishing, programming, and events. Implementation efforts under this objective include adding short paved trails at all parks that are feasible to visitors of all abilities and adding picnicking areas to Lake Byllesby Park.

<u>Objective 2</u>: Provide **Popular Opportunity-Based Recreation** using water features, terrain and seasons, with a focus on areas of high popularity or need (e.g., canoe/kayak access points, cross-country skiing sites, and off-leash dog areas). Implementation efforts under this objective focus on prioritizing the addition of areas with demonstrated popularity or need such as canoe/kayak access points, cross-country skiing sites, and off-leash dog areas.

<u>Objective 3:</u> Add or expand **Signature Use Recreation** to reflect each park's natural resources, location and unique qualities. For Lake Byllesby Regional Park, this means putting emphasis on the following activities with the Cannon River Valley serving as the recreational attraction.

- Echo Point Area: Improving the lawn, pavilion, piers, parking and picnicking areas
- Cannon Valley Trail: Increasing biking opportunities by linking to Cannon River Ped/Bike Bridge
- Lake and water activities: Splash Pad at the Beach including a zero-depth area.
- Shoreline Paved Trail: Easy 1.4 mile paved trail with informational kiosks and entry signs.

The total amount budgeted for implementation of these facilities for the subsequent 10 years was \$4 million.

## **Delivering the Vision**

Broad implementation strategies and an overview of the care, maintenance, resource management, planning, program and service delivery, and administration required to keep the Park system operating were described in this chapter. Policies, goals and strategies discussed included: building awareness and informing and engaging the public through targeted marketing efforts and identifying needs, establishing expectations and building capacity.

## 2.5. Natural Resource Management System Plan (2017)

The County recently developed a Natural Resource Management System Plan (NRMSP) to guide natural resource management in county parks, greenways and conservation easements over the next 20 years. Combined with the Visitors Service Plan (VSSOP), near and long term operations for the Park System will be determined in the context of the existing or new master plans.

Development of the NRMSP required an extensive review process, including public workshops/open houses and public input to a dedicated NRMSP webpage on the County's website; and a Technical Advisory Committee comprised of members from academia, non-profit conservation organizations, private landowners, community leaders, Soil and Water Conservation District, and State Agency staff. The Plan was presented to the County Planning Commission and County Board at several points, and the County Board approved the NRMSP in May 2017.

The following tables (Table 1 and Table 2) summarize the initiatives for each of the major service areas (vegetation, water, and wildlife) for the first five years of implementing the NRMSP.

#### Table 1. Major NRMSP Service Area Initiatives

Vegetation Management Activities	Acres	Estimated Cost
<ol> <li>Control/manage most highly invasive species on all County lands</li> </ol>	403	\$869K
2. Restore/enhance important natural areas and high- use/educational areas	763*	\$3.2M
3. Maintain all existing and newly restored areas (annually)	1,434	\$2.9M
4. Stabilize invasive plant species control areas (every 5 years)	900	\$728K
5. Collect baseline and trend data	4,000	\$33K
6. Develop individual NRMPs for each park	-	\$0 (in CIP)
7. Develop a new Private Sector Funding Program	-	\$54K
SUBTOTAL	<b>4,700</b> (3,500 managed and 1,200 not managed)	\$7.8M
Water Management Activities	Metric	Estimated Cost
<ol> <li>Restore, enhance and manage highest quality/most-used park waters via park projects</li> </ol>	4 projects	\$305K
2. Control the most harmful aquatic invasive species (AIS)	200 acres	\$0 (already underway via external funds)
3. Work with partners to protect and manage areas outside of parks that benefit park waters	15 projects	\$1.3M
4. Collect baseline and trend data (annually)	5 parks	\$145K
5. Prevent new AIS from invading surface waters	300 acres	\$0 (already underway via external funds)
SUBTOTAL		\$1.7M
Wildlife Management Activities	Metric	Estimated Cost
1. Collect baseline and trend data (every other year)	6 parks	\$489K
2. Work with partners outside of parks	5 sites	\$323K
3. Focus on rare and endangered wildlife that are Group 1 species	3 to 5 species	\$107K
4. Protect other important wildlife and improve populations	10 sites	\$211K
5. Control problem wildlife	6 parks	\$111K
SUBTOTAL		\$1.1M

Wildlife Management Group	Definition and Implications for Management	
Group I	<b>Park-specific or very local species</b> . Populations of individual species whose habitat and range are almost entirely within a park, and hence can be managed and sustained inside a park. Butterflies, dragonflies, damselflies, some small mammals, and some reptiles and amphibians are in this group.	
Group 2	Local to regional species. Populations of individual species that regularly use County parkland, but to persist long-term must also use lands outside parks. Large mammals, many bird species, large reptiles and amphibians, many fish species, many aquatic macroinvertebrates, and freshwater mussels are in this group. Managing species in this group requires partnerships with others, often at a regional level.	
Group 3	<b>Migratory</b> . Populations of individual species that use County park habitat in the spring and fall migration, but do not breed there. Managing these species can occur at a continental scale, with some b migrants travelling from southern South America to the Arctic tundra each year.	

#### Table 2. NRMSP Wildlife Management groups and Implications

## 2.6. Other Management Plans and Conservation Initiatives with Implications for Lake Byllesby Park

It is the intention of this NRMP to coordinate the goals and objectives such that the management efforts are in line with other conservation initiatives administered by other entities. One such example is the Technical Guidance for Floodplain Management along the Vermillion and Cannon Rivers prepared by the MN Department of Natural Resources (MN DNR). Goals discussed in the document pertinent to the Byllesby NRMP include:

- 1. Maintaining or increasing acreage of forested lands within multiple age classes to prevent massive canopy die-off.
- 2. Controlling reed canary grass and other invasive species and pathogens so as to promote forest regeneration.
- 3. Supporting increased habitat and native plant diversity including diverse tree composition and structure.
- 4. Forest management aimed at the support of breeding bird populations, including bird species found in floodplain forests and those considered "at risk."
- 5. Consolidation and acquisition of land to reduce fragmentation.
- 6. Supporting hydrology practices and management that resemble the natural hydrology conditions prior to locks and dams.
- 7. Management aimed at protecting wildlife of special concern.

## 3. HISTORICAL VEGETATION AND LAND USE

Vegetation cover and types are dynamic and respond to many factors. The vegetation found in the Park today is the result not only of thousands of years of geologic and evolutionary processes, but also of more recent effects, especially altered land use and altered ecosystem processes that have occurred since European settlement (c. 1850's). Vegetation responds to a variety of changing conditions such as: physical site conditions (topography, soils and hydrology); historic and current land use; climate; invasive species; and wildlife. It is also affected by natural processes such as succession or natural events that create change and variation. Abrupt changes (disturbances) and their cumulative effects, including wildfires, high winds and floods can quickly change vegetative structure and composition. There is a spectrum of disturbance intensity from light, frequent events to catastrophic, uncommon events, which, depending on their frequency and return interval, will affect vegetation types, quality and location. Historical vegetation and land use have profound impact on the current conditions of the Park and are paramount in determining appropriate management strategies and understanding what is both appropriate and practicable for the Park.

## 3.1. Pre-European Settlement Vegetation

According to field notes compiled from the original U.S. General Land Office (territorial surveys conducted during the 1840s-1860s), the northern and western portions of Dakota County consisted primarily of hardwood forests set among rolling hills and moraines and many glacial lakes. American basswood, sugar maple, elm, red oak, and an understory of shade-loving wildflowers persisted in moist areas protected from fire. Bur and white oak, aspen and black cherry were



the dominant tree species in the drier, more fire-prone areas.

The southern two-thirds of the County consisted primarily of prairie and savanna (Figure 2). Savannas with scattered oak trees formed transitional plant communities between grasslands and forests. Depending on soils, topography and hydrology, tallgrass prairie (with dominant grass species measuring as high as eight feet, with a diverse mix of other grasses and wildflowers [forbs]) would have been the prominent vegetation type. Shorter grasses and a wide variety of other forbs would have been found on sandy and gravelly areas on steep slopes. Depending on the frequency of fire, those areas that burned less often would have consisted of brush-prairie, including a diversity of prairie species mixed with scrubby shrubs and short trees.

A large number of wetlands once existed in the southwestern portion of the County, most of which no longer exist today. In fact, the County has lost approximately 85% of its pre-settlement wetlands. Wet prairies were common on wetter soils where the water table was close to the surface. Wet meadows and marshes occupied soils with regular saturation or inundation in areas that also experienced frequent fire disturbance. Fire played a role in sustaining open wetlands by preventing trees and shrubs from becoming dominant and by aiding germination of many prairie plants. Near smaller rivers, prairie or savanna would have often been found growing even up to the water's edge. Forested floodplains were often found in wider river valleys, since they were prone to flooding and were far less apt to burn. Common tree species found in forest floodplains include cottonwood, silver maple, willow, and American elm.

#### Potential Native Plant Communities within the Park

Based on historic vegetation mapping data, the Park is located in an area that was dominated by prairie (Figure 2). Oak openings and barrens may have been found in a small southern sliver of the East Park Unit. Historical mapping denotes river bottom forest may have occurred along portions of the river that formed the reservoir Wet prairie and aspen-oak land were also mapped in areas surrounding the Park.



Orb spider found in restored prairie, East Byllesby



Figure 2. Predominant, pre-settlement plant communities of the Park

Prairie areas were likely dominated by big bluestem, Indian grass, little bluestem, side-oats gramma, prairie cordgrass, bluejoint grass, and sedges and rushes in wetter areas. River bottom/floodplain forest was likely dominated by silver maple, American elm, green ash, black willow, and cottonwood with a variety of wet-loving forbs, grasses and swedges (graminoids) in the understory. Oak Openings and Barrens likely consisted of tree groves intermixed with prairie and chaparral of scrub forest and shrub thicket. Bur oak and northern pin oak were likely dominant species. Both prairies and savanna areas are very dependent on fire as the most influential pressure on the extent and development of these community types.

Although it is difficult to know exactly what native plant communities historically occupied the Park, some assumptions can be made based on: historical mapping and imagery, mapped occurrences of existing native plant communities, and the physical and natural history of the area. Described below are MN DNR Native Plant Communities that most likely occurred within the Park at the time of pre-settlement. More detailed descriptions and plant list for each community can be found in **Appendix A**.

#### Sand/Gravel/Cobble River Shore (RVx32a/b)

This community has a distinct upper and lower zone. The upper zone is inundated during high water periods and the lower zone is exposed only during normal or low water periods. Vegetation that may occupy the upper zone includes sandbar willow, false indigo, cottonwood and silver maple, ironweed, blue vervain, swamp milkweed, horseweed, and Emory's sedge. The lower zone may contain lovegrasses, awned umbrella sedge, witch grass, spike rushes, blue monkey flower, panic grass, river bulrush, and arrowheads. This community would likely have occurred along the Cannon river edge and areas currently impounded by Lake Byllesby Reservoir.

#### Southern Floodplain Forest (FFs68)

Southern floodplain forest communities are found in areas along medium and large rivers characterized by frequent flooding with sandy and silty alluvium substrates. These forests typically have 50-100% canopy cover of silver maple, green ash, hackberry, cottonwood, and/or American elm. Shrub and ground layers are typically sparse and populated with wood nettle, Ontario aster, mad dog skullcap, clearweed, beggarticks, touch-me-not, tall coneflower, stinging nettle, and poison ivy. This community would have most likely been found in floodplain areas along the Cannon River and tributaries.

#### Southern Terrace Forest (FFs59)

This community is very similar to FFs68 and is often found along the same rivers and can grade into one another. FFs59 typically is flooded less frequently, located on terraces and typically receiving much less alluvial and sand deposits. The FFs59 has a canopy dominated more by basswood, bur oak, swamp white oak, hackberry, black ash, and black walnut. This community is also more likely to have a robust cover of ground-layer vegetation including wood-nettle, touch-me-not, Virginia waterleaf, tall cone flower, stinging nettle, cleavers, honewort, white avens, aniseroot, and blue phlox. This

community also would have most likely been found on terraces along the Cannon River and tributaries.

#### Southern Wet Ash Swamp (WFs57a)

Wet hardwood forests are often found as small inclusions of larger forested areas in areas of groundwater seepage and the bases of steep slopes. This would have been most-likely along the steep slopes of East-Lake Byllesby near the seepages. The canopy, shrub and herbaceous layers are relatively sparse and include species such as back ash, basswood, sugar maple, American elm, wild currant, nannyberry, marsh marigold, touch-me-nots, fowl mannagrass, Jack-in-the-pulpit, wood nettle, wild geranium, and tall coneflower. Both the Back Ash- (Red maple) and the Black Ash – Sugar Maple – Basswood – (Blue Beech) seepage swamp communities would have existed on these slopes. They are distinguished primarily by the dominant canopy species.

#### Northern Mixed Cattail Marsh (MRn83)

Cattails dominate the cover of this plant community but marsh skull-cap and other emergent species may be present. Lake sedge and bristly sedge and submergent vegetation such as bladderwort and coontail may also be present. MRn83 communities are usually found adjacent to lakes, streams, and in backwater areas.

#### Northern Bulrush-Spikerush Marsh (MRn93)

This native plant community includes variable forb and graminoid cover and includes species such as broad-leaved arrowhead, water smartweed, bur reed, bulrushes, spikerushes, and rice cut grass. Floating and submergent plants include duckweed, and pondweeds. These communities typically occur in shallow waters adjacent to streams and lakes. This community was likely found along the Cannon River and tributaries.

#### Southern Dry-Mesic Oak Forest (MHs37)

Several patches of this plant community are mapped south of the Park, across the Cannon River. They are found typically on Upper slopes of bedrock bluffs and wind-deposited silt crests. Canopy cover is typically interrupted to continuous with a fairly dense understory and herbaceous layer. Common trees include red oak, white oak, and basswood with occasional shagbark hickory. Common understory plants include American hazelnut, chokecherry, gooseberry, pagoda dogwood, lady fern, wild geranium, hog peanut, white snakeroot, Clayton's sweet cicely. Both the Red Oak – White Oak Forest and Red Oak-White Oak – (Sugar Maple) Forest community types could have been found in the Park. They are distinguished primarily by the abundance and species in the understory and herbaceous layers.

#### Southern Mesic Oak-Basswood Forest (MHs38)

The Southern Mesic Oak-Basswood Forest community is very similar to MHs37 and often occurs in the same areas. MHs38 is more likely to be found in moister habitats and less likely to have abundant sugar maple in the canopy. This community also has robust canopy and ground cover and is home to many similar species including basswood, red

oak, sugar maple, ironwood, blue beech, elm, prickly gooseberry, zigzag goldenrod, largeflowered bellwort, and Virginia waterleaf. White Pine – Oak – Sugar maple and Red Oak – Sugar Maple- Basswood –(Bitternut Hickory) Forests would have been located on areas of steeper slopes in the Park while Basswood –Bur Oak –(green Ash) forests could have occupied areas of more rolling terrain.

#### Southern Dry-Mesic Pine-Oak Woodland - White Pine-Oak Woodland (FDs27b)

This community has patchy to interrupted canopy cover dominated by white pine and northern red oak found primarily in the blufflands of Southeast Minnesota and is heavily dependent on fire. Herbaceous plants typically consist of wild sarsaparilla, zigzag goldenrod, common enchanter's nightshade, bastard toadflax, and carrion flowers. Other plants may include hazelnut, black raspberry, Virginia creeper, Pennsylvania sedge, northern bedstraw, columbine, and hog peanut.

## Southern Dry Mesic-Oak (Maple) Woodland (FDs37a and b)

This plant community is common in areas of glacial lake plains, river bluffs, and occasionally in stagnation moraines. Fires were common throughout the range of this community. Younger forests recovering from fire were dominated by bur oak, red oak, white oak, and aspen. Mature forests were dominated by, bur oak, white oak, northern pin oak, northern red oak, and occasional American elm. The Pin Oak-Bur Oak and Oak (Red Maple) woodland community types are disguised primarily by the predominance of tree species in the canopy.

## Southern Mesic Prairie (UPs23) and Southern Mesic Savanna (UPs24)

Mesic prairie and savanna were dominant community types within the Oak Savanna Subregion of Minnesota. Mesic Savannas and Prairies were typically found on poorly to well-drained soils on level to gently rolling sites. These communities experienced irregular drought, frequent fire, and grazing by large ungulates. Ups23 and 24 communities may have persisted in norther portions of the Park that have rolling topography and higher elevation.

UPs23 had little to no tree cover and sparse shrub cover including leadplant, and prairie rose. Herbaceous vegetation found in this community includes tall and mid-height grasses like big bluestem, Indian grass, little bluestem, porcupine grass, prairie cord grass, switchgrass, side-oats grama, and prairie dropseed and many forbs such as heart-leaved alexanders, heath aster, stiff and Canada goldenrod, purple and white prairie clover, white sage, sunflower, prairie phlox, grey-headed coneflower and northern bedstraw.

Southern Mesic Savanna is differentiated from the prairie by an increase in tree and shrub cover (25-50%). Trees are typically scatted throughout individually and in groves; bur oak and northern pin oak being the most common species. Dominant shrubs include leadplant, prairie rose, chokecherry, American hazelnut, smooth sumac, gray dogwood, gray dogwood, and wild plum. Grasses and forbs consists of mainly the same species as UPs23.
It is possible Southern Dry Prairie (i.e., Dry hill prairie, Dry Savanna, and Sand –Gravel Prairie) community types were located within the Park given these plant communities are mapped by the DNR in the surrounding region, however soils within the Park are not typical of these communities and more likely suited for mesic systems, so these communities would have been small inclusions located on steep sandy-gravelly slopes.

## 3.2. Historic Wildlife



Located in a diverse landscape with an abundance of rivers, streams, lakes and wetlands; and diverse plant communities, several distinct ecoregions converge in Dakota County. As result, the County was home to a highly diverse wildlife community.

European settlement, over time, brought many changes to the landscape. The deep, fertile soils of most prairies were converted to agricultural

(Bison; MN DNR 2017)

fields. Forests were logged, wetlands were drained and the courses and flows of streams and rivers were altered. Overhunting was also a major issue and many wildlife populations declined precipitously.

Large mammal species such as bison, elk, black bear, wolves, and mountain lion were once found in the County. In the 1800s, early explorers and settlers from Radisson to Hennepin documented bison grazing the prairie terraces near Fort Snelling. These animals fed on the abundant forbs and grasses and also played an important role in the pollination and distribution of seed. By 1860, bison were nearly extirpated from all of North America. During the drought years in the 1930s, numerous elk antlers were retrieved from shallow lakes in southern Minnesota; evidence of their historical presence on the landscape. Black bears, among other predators, were common throughout the 18th and 19th centuries, demonstrating that the animal diversity in both the state and the County could support a variety of large predators.

Smaller mammals were also likely more abundant during the pre-settlement era within the County. From fur traders' records in the 1930s, it is evident that beaver, muskrats, and mink were killed for their furs, and populations of these species declined precipitously. Populations of beaver and other species began to improve in the 1930s, due to improved regulations. Prairie species such as Franklin's ground squirrel, American badger, and a number of vole and mice species declined with the conversion of prairie and savanna to agriculture, though these declines are mostly anecdotal.

Hunting and land use changes also affected bird populations. The extinction of the passenger pigeon highlights the extreme pressure that hunting had on many of the County's wildlife species, while species such as prairie chickens were locally extirpated as prairie was converted to agriculture. Waterfowl populations declined as well, due to both hunting and wetland drainage

for agriculture and development. During the mid-20th century, predators such as hawks eagles and owls were negatively impacted by hunting and human-caused pollution. Chemicals such as DDT caused declines in populations of species like bald eagles, as the chemical weakened egg shells and led to low brood success. This particular species was listed as threatened on the first state endangered species list published in 1984. Hundreds of other bird species nested in or migrated through the County. Today, many of these species have dwindled. Species of greatest conservation need (SGCN) such as the upland sandpiper, loggerhead shrike, grasshopper sparrow, American bittern, red-shouldered hawk, red-headed woodpecker, bobolink, black tern, Virginia rail, and eastern towhee were once abundant in the County.

Largely anecdotal information exists regarding the declines of reptiles and amphibians in the County. Many reptiles, such as eastern racers and six-lined racerunners, depend on prairie habitat – particularly bluff prairies – and have likely experienced precipitous declines given historical habitat conversion. Wetland drainage and pollution by fertilizers and other chemicals has led to declines in wetland species, including amphibians such as Blanchard's cricket frog and reptiles such as Blanding's turtles. These more amphibious species are not only tied to both land and water habitats, but are also often sensitive to pollution of these habitats as well.

Soil erosion from agricultural operations and intense land use increased sediment loads to rivers and streams, negatively affecting aquatic ecosystems. Suburban development resulted in more warm water runoff into cool streams, which led to adverse thermal effects and stressed aquatic life. These land use changes had many negative effects on wildlife. Frog and salamander species, sensitive to chemicals and changes in hydrology, declined. As runoff and pollution flowed into rivers like the Vermillion, it resulted in declines in many types of aquatic species. Brook trout, for example, are sensitive to warm water, and rivers like the Vermillion saw declines in trout populations as runoff, pollution, sediment, and warm water flowed into the river. While there is conflicting evidence as to whether brook trout were native to the river, having potentially been stocked in the 1800s, their decline throughout the 20th century is a clear example of the effects of development on wildlife. Brook trout are now restricted to only three streams in the entire County. See Section 5.7-5.8 for further discussion.

# 3.3. Pre-European History

Archaeological remnants have been found in the Cannon River Valley dating back to the Ceramic/Mound stage (3,000-900 years ago). These relics suggest that the Cannon River has likely attracted humans to the area for thousands of years. Historically, the Cannon River was used as a navigation corridor by the Oneota, a tribe of Native Americans who lived in large villages along the Cannon River (DNR 1979). The area was probably used as a hunting ground by the Mdewakanton Band of the Dakota, who were based primarily to the East in the Red Wing area. Since the Cannon River was historically a sinuous river, it would have provided Native Americans with ample food (fish, clams, etc.) and water. The robust floodplain forests were home to deer, beaver, and other wildlife. Expansive prairies and savannas, extending for miles on the flat lands outside of Cannon River valley, provided habitat for bison and other large animals.

Numerous mounds found near Prairie Creek on the southwest side of Lake Byllesby suggest that the area was at one time heavily populated by bands of native peoples at one time.

French trappers and traders traveled between the Mississippi River and inland via the Cannon River. When they arrived in the area, they saw a great number of canoes along the river banks and so named the river "La Riviere aux Canots" meaning "the river of canoes".

# 3.4. Post-European Settlement Land Use



Old Mill along Cannon River (MN DNR 1979)

The first Europeans to arrive in the area included French fur traders attracted to the region's abundant natural resources. When the traders who often traveled between the Mississippi River and inland via the Cannon River, they saw a great number of canoes along the river banks and so named the river "La Riviere aux Canots" meaning "the river of canoes".

The 1785 Land Ordinance parsed the landscape into a grid of square mile parcels Parcels were then auctioned off to European settlers who harvested the forests for firewood and plowed the prairies for agricultural production. Encouraged by flour and saw mill construction and production

along the Cannon River, the first nearby city, Cannon Falls, was incorporated in 1855. The Lake Byllesby reservoir was formed by the construction of a dam across the Cannon River cascades in 1910 which flooded the then existing river bottom for miles upstream. This hydroelectric dam provided one of the earliest examples of "rural electrification" in the country.

Following WWII, residential and commercial development replaced much of the agricultural land that covered the northern one-third of the County. The while the southern two-thirds of the County remained dominated by agriculture. Aerial photography from the 1930's shows areas adjacent to the reservoir were used primarily for agriculture. Many of these cultivated fields exist today in the areas within and adjacent to the western portion of the Park. Areas that were not cropped, including river bottoms and floodplains, were often grazed. These areas remained largely in agricultural production until the 1950's when they gave way to residential developments primarily on the north side of the reservoir. In 1951, State Highway 56 was completed, crossing the Cannon River near its outflow into the reservoir, and diverting the flow of Chub Creek from the reservoir to the river. Areas in the western section of the Park, formerly used for grazing, were largely abandoned in the 1960's and they began transitioning to early successional forests.

The 1970's marked a period of continued residential development on the north side of the reservoir. In general, residential growth around the Park has slowed since the 1970's. Woodland areas have matured and expanded slightly. Most areas within the Park have undergone a partial or complete conversion from pre-European settlement vegetation.

Some of the best evidence of land use change is depicted through a series of historical aerial photographs from 1938 through 2014 found in **Appendix B** and **Appendix C** One of the most prominent changes in these photos is the progressive expansion of the "delta" within the western portion of the reservoir. This massive area of deposited sediment is a result of soil erosion occurring in the upstream watershed. Ironically, these mudflats provide critical migratory habitat for a variety of shorebirds.

## 3.5. Consequences

Due to significant changes in land use, and the dramatic loss of wetland, savanna, and prairie habitat, many species that were historically abundant within Dakota County have since declined or been extirpated. The Minnesota DNR State Wildlife Action Plan identifies 93 SGCN within the Oak Savanna Subsection, 36 of which are listed as state or federally endangered, threatened, or special concern (MN DNR 2006). See Section 5.7-5.8 for further discussion.





### SGCN BY TAXONOMIC GROUP

Taxa	# of	Percentage	Examples of SGCN	
	SGCN	of SGCN Set		
		by Taxon		
Amphibians	2	33.3	Common Mudpuppy	
Birds	48	49.5	Bobolink	
Fish	12	25.5	Slender madtom	
Insects	7	12.5	None documented since 1990	
Mammals	7	31.8	Western harvest mouse	
Mollusks	9	23.1	Spike	
Reptiles	8	47.1	Eastern fox snake	
Spiders	0	0	NA	

Quick facts Acres: 1,819,571 (3.4% of state)			Population der	
		Ownership	)	Current
Publ	ic	Private	Tribal	
1.89	6	98.2%	0.0%	117

Population	density	(people/	sq.	mi.)
			_	

Current	Change	
	(2000-2010)	
117	+19.5	

Excerpts above from Tomorrow's habitat for the Wild and Rare: An Action Plan for Minnesota Wildlife (MN DNR 2006)

# 4. ECOLOGICAL CONTEXT AND CHARACTERIZATION

### 4.1. Location

Lake Byllesby Regional Park is located in southern Dakota County along the boundary with Goodhue County and south of the City of Randolph and west of the City of Cannon Falls, is part of the extensive Cannon River Valley and associated 900,000- acre watershed. The Park has been divided into two geographically based units: East Byllesby which contains most of the recreational developments of the Park; and West Byllesby which contains mostly undeveloped land. The East and West sections are further divided into Management Units based on usage, natural history, location, and distinctive features (Figure 4 and Figure 3).

Management Units within West Lake Byllesby Section include Cannon Cascades, Oxbow, Chub Creek, Byllesby Delta, and Byllesby Bluff. Management Units in East Lake Byllesby Section include Lilac Landing, Lakeside, Echo Channel & Uplands, and Cannon Gorge.



Lake Byllesby shoreline near campground, East Byllesby.



Figure 3. Management Units of East Lake Byllesby



Figure 4. Management Units of West Lake Byllesby

## 4.2. Surrounding Land Use

When identifying potential and appropriate natural resource management activities, it is important to consider surrounding land use. Nearby and adjacent land use can affect vegetation, water, and wildlife management options. It may also present opportunities to enlarge existing habitat areas, create corridors for wildlife movement, and determine the characteristics of local surface water hydrology.

According to the National Land Cover Dataset (NLCD) 2011 land cover data the majority of adjacent land use is cultivated cropland (Figure 5 and Figure 6). Developed space associated with the adjacent City of Randolph and private properties located along the north edge of Lake Byllesby also constitute significant adjacent acreage. The remaining adjacent areas are comprised of natural areas consisting of deciduous forest, wooded wetland, herbaceous areas, and open water associated with the reservoir. In addition, several County conservation easements and areas mapped as Regionally Significant Ecological Areas (RSEA) and Minnesota County Biological Survey (MCBS) Sites of Biodiversity Significance are located within five miles of the Park (Figure 7). Both RSEAs and MCBS sites identify areas with native biological diversity or ecological significance and provide a guide for conservation and management initiatives.

Sites surveyed by the MCBS are assigned ranks based on the presence of rare species populations, the size and condition of native plant communities within the site, and the landscape context of the site. According the MN DNR sites are classified as *outstanding*, *high*, *moderate*, or *below* based on the following criteria:

- "Outstanding" sites contain the best occurrences of the rarest species, the most outstanding examples of the rarest native plant communities, and/or the largest, most ecologically intact or functional landscapes.
- "*High*" sites contain very good quality occurrences of the rarest species, highquality examples of rare native plant communities, and/or important functional landscapes.
- "Moderate" sites contain occurrences of rare species, moderately disturbed native plant communities, and/or landscapes that have strong potential for recovery of native plant communities and characteristic ecological processes.
- "Below" sites lack occurrences of rare species and natural features or do not meet MBS standards for outstanding, high, or moderate rank. These sites may include areas of conservation value at the local level, such as habitat for native plants and animals, corridors for animal movement, buffers surrounding higher-quality natural areas, areas with high potential for restoration of native habitat, or open space.

(MN DNR 2017)

RSEAs are areas identified as ecologically important natural areas in the seven county metro through land cover-based habitat models and aerial photo assessment. The MN DNR identifies RSEAs based on the following six attributes:

- 1. Natural land cover
  - Less than 4% imperviousness
  - No maintained vegetation (agricultural or short grass)
- 2. Size of the natural area
- 3. Shape of the natural area
- 4. Adjacent land cover/use
- 5. Connectivity to other natural areas
- 6. All native plant communities mapped by the Minnesota County Biological Survey that have not been destroyed since the survey was completed were identified as regionally significant regardless of size, shape and adjacent land use.

### (MN DNR 2017)

Adjacent land use and human activities may present management issues such as sedimentation and runoff pollution from agricultural fields; chemical drift; invasive species; and salt, noise, and nutrient pollution coming from developed areas and adjacent roads. Managing the Park to reduce these impacts and restore predominantly native plant communities will not only help mitigate the impacts of surrounding land uses on plants and wildlife within the Park, it can facilitate an important corridor connections between management and conservation areas northeast and south of the Park by attracting wildlife from the surrounding areas.



Wetland habitat, West Byllesby









Figure 6. University of MN Land Classification and Impervious Surfaces for East – Lake Byllesby





## 4.3. Ecological Classification

The Minnesota Department of Natural Resources (MN DNR) and U.S. Forest Service Ecological Classification System (ECS) identify contiguous areas of increasingly uniform physiological and ecological features based on the National Ecological Unit Hierarchy design criteria. The ECS in Minnesota is described by the MN DNR as a three-tier hierarchy of Provinces, Sections, and Subsections. Provinces are large units of land defined primarily by climate zones and potential native vegetation. Sections are units of land defined primarily by geology, regional climate, soils, and potential native communities. Subsections are the most resolute level of classification, covering smaller and more congruent ecological areas with similar geologic processes, vegetation, local climate, topography, and soils.

The Park is located within the northern peninsula of the Oak Savanna Subsection, between the Blufflands and Big Woods subsections, near the border of the Minnesota and Northeast Iowa Morainal and Paleozoic Plateau Sections, within the Eastern Broadleaf Forest Province (Figure 8). The Oak Savanna Subsection is characterized by gently rolling plains with few lakes, well developed drainage networks, and fertile soil. Geologic and topographic conditions (further described below) resulted in historic vegetation communities dominated by bur oak savanna and tallgrass prairie. In the far eastern areas of the subsection, rolling plain broken by steeply dissected ravines, provided fire break conditions that supported maple-basswood forest communities. The subsection today is dominated primarily by agriculture and urbanization that is increasing along its northern boundary.



Location of former farmstead near west end of Byllesby Reservoir, West Byllesby.





# 4.4. Physical Conditions

The natural resources within the Park are affected by a number of physical conditions that influence their origin, current status and future condition. These features include local geology, topography and soils.

## 4.4.1. Geology

The uppermost bedrock found within the Park boundary is the Prairie du Chien Formation. The Prairie du Chien formation is a dolostone with thin beds of sandstone and chert. The sandstone hill located east of Lake Byllesby and prominent cliffs of the south side of the reservoir are comprised of St. Peter Sandstone and the Platteville-Glenwood shale (MGS, 2000; Figure 9).



Exposed rock ledges on south shore of Byllesby Reservoir, Goodhue County.

Glacial deposits formed much of the current landscape. The Pre-Michigan advance of the Superior Lobe glaciation extended south approximately as far as the Cannon River about 20,000 years ago (Figure 10), area are mapped primarily as outwash: sand and gravel that was deposited at the margins of a melting glacier from about 13,000 years ago. Upon receding, Superior Lobe sediment filled in previously existing bedrock valleys that ran parallel to the Cannon River Then the Des Moines Lobe glacier, which advanced through southern Minnesota about 13,000 years ago, deposited the outwash (sand and gravel) that is prevalent throughout the Park today.

The valley in which the Park is situated formed approximately 8,000 years ago when glacial Lake Agassiz (a massive lake that formed from glacial meltwater following the Wisconsin glaciation about 12,000 years ago) flooded the Mississippi River Valley. The floodwaters backed up the Cannon River Valley, forming a large lake that covered all of present day Randolph Township, portions of Hampton Township, and Sciota Townships. Reduced stream flow dumped large amounts of sand and gravel, which would normally have been carried to the Mississippi River forming the "Randolph Flat". When Mississippi River flood waters receded, this unblocked the Cannon River, which released a torrent of water that carved out the valley within the Randolph Flats in which Lake Byllesby is now found. Echo Point is a remnant of Randolph Flats. Reduced flows, as a consequence of the Byllesby Dam, has prevented further erosion of Echo Point by the Cannon River





Lake Byllesby Natural Resource Management Plan

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### 4.4.2. Soils

The "Soil Survey of Dakota County Minnesota," (April 1983 and updated in May 1994), provides a generalized depiction and description of soils found in the County. Soil formation is the result of interactions between parent material, climate, organisms, topographic position or slope, and time. Collectively, these factors help determine the dominant plant and animal communities, which in turn influences future soil development. Soil units/types can also inform the most appropriate use and management of the land.

The primary parent materials within the Park consist of sands and gravels, and sedimentary bedrock, and loess and alluvial deposits in areas next to the Cannon Rivers and tributary streams. Kalmarville silt loams dominate the areas adjacent to the Cannon River in the western most portion of the Park. Kalmarville soils are coarse silt-loam soils that consist of very deep, poorly drained and very poorly drained soils that formed in recent alluvium on floodplains. Kalmarville soils are associated with flat or concave depressions historically associated with bottom land deciduous forests, which have largely been converted to support pasture/hay or row crop agriculture.

Soil types covering the majority of the western portion of the Park include Kanaranzi loams, Zumbro loamy fine sands, Hubbard loamy sands, Kalmarville silt loams, Wadena, Houghton muck, and Aquolls/Histosols. Kanaranzi loams consist of very deep, well drained, fine-textured loams over sandy substratum. Historically, native tall grass prairies dominated these soils which today largely support row crop agriculture. Hubbard loamy sands consist of deep, well drained soils that formed in glacial outwash or alluvial sediments from the Late Wisconsin glaciation. Hubbard soils are typically located on concave or convex slopes on outwash plains that historically supported oak-savannahs with big and little bluestem, Indian grass, switchgrass and scattered bur oak trees and American hazelnut shrubs. Other dominant soils in the western most portion of the Park include Zumbro loamy fine sands and Zumbro fine sandy loam. Zumbro loamy fine sand soil series consist of deep well drained soils often associated with floodplain terraces. Historical vegetative types on these soils included mixed deciduous forests which have been predominately replaced by row crop agriculture.

The eastern portion of the Park predominantly consists of Estherville sandy loams and Wadena loams. Estherville sandy loams consist of deep, excessively drained soils that formed in loamy sediment over sandy and gravelly outwash. Estherville soils are typically located on outwash plains, stream terraces, and moraines that historically supported tall grass prairie species. Wadena loams consist of well drained soils with 24 to 40 inches of loamy material overlaying a sandy substratum. Wadena soils are typically located on outwash plains, stream terraces, and valley trains that historically supported tall grass prairie species which have been replaced almost exclusively by corn, soybean and small grains.

Table 3, Figure 11, Figure 12, and Figure 13 identify the soil units mapped within the Park boundary. Loams and sandy loams are the predominant soil texture. All-hydric soils mapped within the Park include Kalmarville loam, Houghton muck, Haplaquolls and Histosols. In additional several partially hydric units are mapped within the Park including Dickinson fine sandy loam, Kalmarville-Radford complex, Marshan silt loam, and Wadena loams. Remaining soil units are classified as not hydric or unknown. Several soil units, located along the steep slopes of the east park Unit, are considered moderate to severe potential for erosion and include Hawick coarse sandy loam (moderate), Salida gravelly sandy loam (moderate), Wadena loam (moderate), and Marlean loam (severe).

Map Unit Symbol	Map Unit Name	Potential Erosion Hazard	Hydric Classification	Acres
27A	Dickinson fine sandy loam, 0 to 2 percent slopes	Slight	Partially hydric	21.96
41A	Estherville sandy loam, 0 to 2 percent slopes	Slight	Not hydric	124.26
41B	Estherville sandy loam, 2 to 6 percent slopes	Slight	Not hydric	59.16
1055	Haplaquolls and Histosols, ponded	Not rated	All hydric	55.19
611C	Hawick coarse sandy loam, 6 to 12 percent slopes	Moderate	Not hydric	18.77
611E	Hawick loamy sand, 18 to 25 percent slopes	Severe	Not hydric	0.71
N636A	Houghton muck, ponded, 0 to 1 percent slopes	Slight	All hydric	28.12
7A	Hubbard loamy sand, 0 to 2 percent slopes	Slight	Not hydric	20.41
465	Kalmarville loam, frequently flooded	Slight	All hydric	97.91
N614A	Kalmarville-Radford complex, 0 to 3 percent slopes, frequently flooded	Slight	Partially hydric	0.15
415A	Kanaranzi loam, 0 to 2 percent slopes	Slight	Not hydric	0.15
415B	Kanaranzi loam, 2 to 6 percent slopes	Slight	Not hydric	7.71
251E	Marlean loam, 18 to 25 percent slopes	Severe	Not hydric	5.95
252	Marshan silt loam	Slight	Partially hydric	4.29
1029	Pits, gravel	Not rated	Unknown	25.71
42C	Salida gravelly sandy loam, 2 to 12 percent slopes	Moderate	Not hydric	0.04
39A	Wadena loam, 0 to 2 percent slopes	Slight	Partially hydric	31.46
39B	Wadena loam, 2 to 6 percent slopes	Moderate	Partially hydric	12.70
w	Water	Not rated	Unknown	58.52
1815	Zumbro loamy fine sand	Slight	Not hydric	19.08
495	Zumbro loamy sand	Slight	Not hydric	17.91

Table 3. Natural Resource Conservation Service soil unit	ts mapped within the Park boundaries.
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### 4.4.3. Topography



Topography and aspect (slope orientation relative to north, south, east, and west) are important factors in the development and formation of soil, soil erosion potential, and the type and stability of vegetation for a given location. The primary factors involved with topography, as it concerns natural features, are relief and variation.

The difference from the highest to the lowest elevation is referred to as "relief". The differences in contours from place to place across the landscape determine the amount of topographic variation. Taken together with variation in soil type, these factors help determine overall site heterogeneity.

Aspect can have a strong influence on soil temperature and moisture. In the northern hemisphere, north- and east-facing slopes are often shaded or cooler, while south- to west-facing slopes are hotter and receive more solar radiation. Aspect can significantly influence the local climate (microclimate). Soil temperatures and soil moisture on south- to west-facing slopes are typically warmer and dryer than those on north- to east-facing slopes, due in part to the increased solar radiation and direction of the prevailing winds in the summer. Likewise, soils on north- to east-facing slopes tend to be cooler and wetter, due to diminished solar energy and late afternoon shading during the hottest part of the day.

As a result of glacial and alluvial deposition, the vast majority of the Park is very flat, ranging in elevation from 863 to 865 feet above sea level (Figure 14, Figure 15, and Figure 16). Exceptions in the west section of the Park include areas on the north and east sides of Oxbow pond where a 30 foot high bluff forms the western edge of the pond. This bluff marks the edges of old river channels that have been cut off from the main river channel over time. Areas south and west of Echo Point on the southeast side of the reservoir rise to elevations of over 1,000 feet above sea level. These steeply sloped forested areas provide some of the most impressive and picturesque views from the Park. Areas of more significant topographic relief on the eastern portion of the Park include Sandstone Hill which rises 80 feet above the surrounding lands and those areas downstream of the dam where 60 foot high bluffs along the Cannon River can be observed.











## 4.5. Water Resources

One of the unique and attractive features of Dakota County is the amount and diversity of its water resources. Major riverine systems, including the Mississippi, Minnesota, Cannon, and Vermillion Rivers create the borders or flow within the County. A number of smaller creeks, streams and brooks are found in the southern portion of the County. Numerous small lakes are found in the northern and western portions of the County as a result of previous glaciation. The two largest lakes, Crystal and Marion, are highly desirable for their scenic beauty and recreation. Different types of wetlands are scattered throughout the County and several unique wetlands, known as fens, are found in the Minnesota River valley. Two large reservoirs, Lake Byllesby and Spring Lake were formed on the Cannon and Mississippi Rivers, respectively, with the construction of dams in the early part of the twentieth century.

The County has extensive groundwater resources that have accumulated below the surface of the land and is stored in complex, underground layers of sand, gravel and porous rock. Groundwater provides: drinking water for the majority of County citizens, irrigation water for agricultural crops (especially on the large area of sandy soils in the southeastern portion of the County), and process and cooling water for industrial and manufacturing companies. Groundwater also has a crucial role in the existence of ecological systems.

Over time, most of these surface waters have been significantly degraded due to agricultural and municipal stormwater run-off. Entire wetland complexes that were important for filtering, and retaining water and recharging the groundwater have been lost. Pollution often includes excess bacteria, sediment and nutrients (especially nitrogen and phosphorous from fertilizer), causing lower levels of dissolved oxygen that limits reproduction and survival of fish populations and other aquatic organisms. Although state and federal regulations and voluntary efforts have improved water conditions, protection and management of natural areas, especially those adjacent to water bodies, is an important strategy for achieving water quality goals.

Surficial and ground water resources have profound impact on plant communities and wildlife, providing both a habitat resource and a mechanism of natural disturbance. Water resources are an important aspect of habitat management and must be carefully considered for the Park.

# 4.5.1. Groundwater and Aquifer Sensitivity

If groundwater exists in suitable quantity and quality, it can be tapped for human use and has great economic value. In the northern portion of the County where the glacial deposits tend to be deeper, groundwater is often extracted from wells drilled into sand and gravel deposits. In the southern part of the County where the layer of glacial deposits is shallower, most wells extend into the porous bedrock of the Prairie du Chien and Jordan aquifers.

Although the amount of available groundwater for human use appears to be stable in the County, there is growing concern about the groundwater supply due to increased agricultural irrigation, suburban water use, and changing climate. Improved research also corroborates the connection

between groundwater supplies and ecosystem health. Increased groundwater use could have detrimental effects on these dependent natural systems.

At the same time, much of the County's groundwater is "highly sensitive" to surface contamination, since it may only take hours or months for contaminants to reach the aquifer. This is primarily due to the fact that many aquifers in the County are shallowly buried, or are located in geologic areas known as "Karst" where bedrock is close to the surface and is filled with cracks and fissures. Known surface water as groundwater interaction points, including seepages, sinkholes and springs, are also present. Once an aquifer is polluted, it takes a long time (often thousands of years) for contaminants to either leave or become immobilized. It is often prohibitively expensive to improve a polluted aquifer's quality to attain drinking water standards.

The land comprising Park is considered to be high or very highly susceptible to groundwater contamination based on characteristics of the rock and sediments that overlie the aquifers.

Soils in many places of the Park are comprised of highly porous sands with limited available water storage. In general, the groundwater table is very high throughout the Cannon River watershed; the presence of dam exacerbates this condition. Groundwater levels are so high in areas surrounding the reservoir that the reservoir must be drawn down each Spring to allow the planting of crops on adjacent farmland. There is some evidence of rising water levels over the past 50 to 100 years.

Vertical seepage of pollutants such as pesticides, herbicides and fertilizers (especially nitrogen), have the potential to contaminate the aquifers. Furthermore, TMDL studies suggest phosphorus is leaching into the reservoir from a portion of the 140 individual septic systems located around the reservoir. However, exact failure rates are unknown. Groundwater samples collected from both aquifers had nitrate concentrations that were less (better) than the State's drinking water standard of 10 mg/L. The Jordan Aquifer contained levels of nitrate less than 1 mg/L. Four wells from the Prairie du Chien Aquifer had nitrate levels above 5 mg/L. Unfortunately, detectable levels of pesticides and/or pesticide breakdown products were observed in these same four wells (North Cannon River Watershed Management Organization, 2013).

Due to groundwater sensitivity, practices should be implemented within the Park to reduce potential impacts to groundwater. Practices and plans should strongly consider how to best minimize impacts to the groundwater from restoration and management activities. Factors to consider during natural resource management activities are 1) depth to groundwater and 2) the ability of the overlying geologic materials to protect the groundwater aquifer (deeper and less porous soils are best—thinner and more porous soils are worse).

Best Management Practices (BMP) identified by the Minnesota Pollution Control Agency to limit potential groundwater contamination include:

- 1. Proper siting and maintenance of septic and wastewater systems,
- 2. Reduction in use of fertilizers,

- 3. Limiting use of salt and deicing materials (http://www.pca.state.mn.us/index.php/view-document.html?gid=22754), and
- 4. Providing training and outreach opportunities to educate surrounding landowners on ways to prevent groundwater contamination.

## 4.5.2. Cannon River Watersheds

The Park is located within the Cannon River Watershed (CRW) which drains 946,400 acres (1,460 square miles) in southeastern Minnesota and consists of two river systems: the Cannon River and the Straight River (Figure 17) From west to east, the Cannon River travels 112 miles between Shields Lake and the Mississippi River north of Red Wing. From south to north, the Straight River flows 56 miles through the cities of Owatonna and Medford before connecting with the Cannon River downstream of the dam in Faribault. The CRW spans a portion of nine counties The six counties with the largest land area in the watershed include Steele, Rice, Goodhue, Dakota, LeSueur, and Waseca while small portions of Scott, Blue Earth, and Freeborn dot the periphery of the watershed. Land use within the watershed is approximately 75 percent agricultural (cropland, pasture and forage; 12.5 percent wetland; 10 percent forest; and 8 percent developed land. (HUC 8. The Park is located within two sub-watersheds: The Middle Cannon River and Chub Creek. The West Lake Byllesby Unit is located within the boundaries of three minor watersheds. The eastern portion is located in the Lake Byllesby Watershed, the central "sliver" is within the Chub Creek Watershed, and the western portion is located within the City of Northfield-Cannon River Watershed. The East Lake Byllesby Unit of the Park is located in the Lake Byllesby Watershed. The Park is surrounded by several streams and a variety of wetlands (Figure 17), many of which are considered impaired. Details of surrounding water features are discussed in the following sections.



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### 4.5.3. Byllesby Reservoir



Lake Byllesby, named for Henry Byllesby whose company constructed the dam, is a large reservoir on the Cannon River with a surface area of 1,365 acres and an average depth of 9 feet. Nearly 50 percent of the reservoir is less than 10 feet deep with two-thirds of the reservoir less than 15 feet deep. A small 50 feet deep hole located near the north end of the dam is the deepest spot in the reservoir. Due to its depth profile Lake Byllesby meets the State of Minnesota's definition of a reservoir and a shallow lake (**Appendix H**).

As a result of Lake Byllesby's location in the watershed (approximately 76 percent of the CRW initially flows into the reservoir), it has a very high watershed to surface ratio. Consequently nutrient and sediment loading to Lake Byllesby is very high and water residency time is very short (10-40 days). Model results from the Lake Byllesby Total Maximum Daily Load (TMDL) study found that the Cannon River contributed 80 percent of the total annual water volume and 85 percent of the Total Phosphorus (TP) load to Byllesby Reservoir from 2003-2009. Chub Creek and Prairie River together contributed 17 percent of the total flow and 14 percent of the TP load. Direct overland flow from the immediate watershed and other nearshore sources (septic) comprised the remaining 3 percent of total flow and 1 percent of the external TP load to the system.

The <u>Trophic State Index (TSI)</u> is a number that summarizes a lake's overall nutrient richness. Nutrient richness ranges from clear lakes, low in nutrients (oligotrophic), to green lakes, with very high nutrient levels (hypereutrophic). Based on data collected between 2006 and 2015, Lake Byllesby has a score of 68 indicating the reservoir is hypereutrophic. This score is based on high chlorophyll *a* concentration, high total phosphorus concentrations, and a low transparency. Results from water quality data collected by the MPCA also indicate that the reservoir is an impaired waterbody on Minnesota's 2016 303d List of Impaired Waterbodies. The reservoir was identified as impaired for nutrients/eutrophication in 2007 and Mercury in fish tissue in 2009.

Site specific nutrient (phosphorus) criteria were developed by the MPCA in 2002. The site specific standards are unique to the reservoir and are based on the relatively shallow morphometry of the reservoir, large watershed, and short residence time. The proposed criteria for the reservoir are consistent with numeric criteria for shallow lakes in the Western Corn Belt Ecoregion and are focused on reducing the frequency and severity of nuisance algae blooms.

The 2013 Byllesby Reservoir Phosphorus Total Maximum Daily Load (TMDL) study suggests that significant reductions in both point and non-point sources of pollution would be required

before Lake Byllesby would reach these proposed criteria. Section 8.0 of the TMDL study outlines a general implementation strategy including the adoption of best management practices targeted at reducing non-point source pollution from agricultural and urban land uses as well as the implementation of Waste Water Treatment Facility permits to achieve point source reductions. The City of Randolph is currently working on developing a new sewer system to connect residents currently on septic systems to a city sewer line. Dakota County estimated 95 individual septic systems on the north shore of the reservoir with 45 systems in Goodhue County on the south shore. While exact compliance rates are unknown, the TMDL study suggests that it is likely that phosphorus is leaching into the reservoir from a portion of these systems which are not functioning properly.

### Sedimentation and Nutrient loading

Excessive nutrient and sediment loads from the largely agricultural Cannon River Watershed are the principal causes for the rapid filling of Byllesby Reservoir. The Cannon River carries an average of 236 million pounds of sediment into the Mississippi River each year, enough to fill 7,133 15-ton dump trucks (Metropolitan Council, 2014). Current sediment accumulation rates in Lake Pepin (Cannon River is a tributary to Lake Pepin) are ten times greater than estimated pre-European settlement rates (Schottler et al. 2010). Excessive sediment loads from the Cannon River watershed form mudflats on the mouth (west end) of the Reservoir as flow from the Cannon River slows and sediment particles drop out of stream water and fall to the bottom. A review of historical aerial imagery from 1938 to present shows considerable advancement of a sediment delta forming in the western most portion of the reservoir (**Appendix C**). In fact, sedimentation has occurred at such a rate that vast mudflats have formed across in this location of the reservoir. Although non-native invasive species including reed canary grass, purple loosestrife, and hybrid cattail thrive on these nutrient-rich mudflats, they happen to provide valuable habitat for shorebirds and migratory waterfowl that in turn attract bird watchers from across the state.

A study of internal phosphorus loading was completed in 2004 to quantify contributions to the overall phosphorous content from sediment in the reservoir (Cornwell and Owens, 2004). Results from this study identified portions that actually went anoxic—no oxygen available. Furthermore, an overabundant common carp (*Cyprinus carpio*) population exacerbates the internal loading problem by uprooting aquatic vegetation and stirring up loosely deposited sediments, which re-release nutrients back into the water column (internal loading). Contributions of phosphorus from lake sediments are expected to contribute between 7 and 16 percent of the total phosphorus load in the Byllesby Reservoir. This is significant, and a reduction in internal loading would help improve water quality. Nevertheless, external phosphorous loading is still a big problem. Consider that 1 pound of phosphorus will result in about 100 pound of algae in most lakes.

#### **Shoreline and Water Level Management**

The west end of the reservoir contains a mosaic of shallow wetlands and mudflats formed by the heavy sedimentation that is carved up by a steady inflow from the Cannon River. The north side of the reservoir consists primarily of residential housing while the southern edge is predominantly agriculture and deciduous forest within the lowland and floodplain areas adjacent to the river. A portion of the reservoir's shoreline, from the dam to Echo Point, is currently riprapped to prevent shoreline erosion. Unfortunately, rip-rapped shoreline is a barrier to wildlife and also restricts access to park users. Furthermore, the transitional areas between the shoreline and the road/camping area, adjacent to the rip-rapped area, are maintained as turf grass. Consequently there is little buffer for stormwater runoff from the nearby parking lots and developed spaces.



Manual operation of the Reservoir's water level plays a large role in influencing the Park's landscape. It creates unique habitats that are regionally important to wildlife (e.g., mudflats, wetlands, and floodplains), but at the same time does not allow the reservoir and surrounding riparian zones to function as a natural lake system. Existing reservoir operating plans require reservoir water levels to be lowered until May 15<sup>th</sup> to draw down groundwater levels to support agricultural production in the surrounding uplands. After May 15<sup>th</sup>, summer water levels are maintained at 856.7 feet until October 1<sup>st</sup> in accordance with permit requirements from the Minnesota Department of Natural Resources. Water levels are drawn down in the fall by three feet to a winter pool elevation of 853.7 feet where they are maintained until the following spring. During periods when the reservoir is drawn down at the dam (typically spring and fall), low water levels expose the mudflats on the west end. This reservoir management regime creates the critical mudflat habitat used by many migrating shorebirds but also creates water fluctuations in the reservoir and adjacent river floodplain. Large releases of water from the reservoir also have the potential to create unnatural flow regimes in the Cannon River downstream of the reservoir. Ill-timed water releases from the reservoir have the potential to negatively affect the riparian ecosystem and wildlife species dependent upon a natural riverine habitat.

### **Vegetation Communities and Invasive Species**

Vegetation communities vary significantly across the Byllesby Reservoir. A marsh delta found at the west end transitions to an open water, shallow lake in the middle portion to deep, open water near the dam at the East end. The delta area is vegetated with emergent plants, dominated by reed canary grass and hybrid cattail (both exotic, invasive species). Little submergent aquatic vegetation grows within the open water areas of the Reservoir. The MN DNR has identified flowering rush within Lake Byllesby (MN DNR 2016). Flowering rush is a prohibited invasive species that competes with native emergent vegetation such as native bulrushes. Additional invasive aquatic plants observed during field visits included reed canary grass, hybrid and narrow leaf cattails, and purple loosestrife.



Flowering Rush (Oneida County AIS), Reed canary grass observed within the Park.

### 4.5.4. Rivers and Streams

#### **Cannon River**



The Cannon River Watershed drains an area of approximately 1,460 square miles as the river flows for 112 miles between Shields Lake and the Mississippi River. The river falls in elevation an average of 4.8 feet per mile and has several mild rapids. The reach of the Cannon River from Faribault to the Mississippi River was designated as "Wild and Scenic" by the Minnesota Department of Natural Resources in 1987. This designation protects rivers with "...outstanding natural, scenic, geographic, historic, cultural, and recreational values (MN DNR 2017)." The Middle Cannon River (from Faribault to Lake Byllesby) is also classified as a "recreational river".

Historically, the Cannon River teamed with fish and wildlife. Today, although significantly diminished, much wildlife still occurs. Mink, weasel, otter, spotted skunk, coyote, and big brown bats are among a few of the 36 mammals known to occupy the river corridor. The river is home to water, shore, and game birds, and is habitat for colonial bird breeding colonies (see **Appendix H** for 2010 bird list). In addition, 26 species of amphibians and reptiles are known to occur along Cannon River including three uncommon turtles (wood, map, and Blanding's). Walleye, catfish, northern pike, smallmouth bass, crappies, and striped bass are all also fairly abundant in the Cannon River.

Prior to construction of the dam, the Cannon River was a highly sinuous channel with an expansive floodplain and most likely patches of mesic forest, woodland, and perhaps even savanna. Today it is a large, inundated, shallow lake. In addition, due to land use changes in the watershed, most of the Cannon River Watershed has lost 50-100% of its historical wetland acreage to agricultural operations and urbanization. Land use changes have had a negative impact on the health of the Cannon River. As such, the MPCA has identified the River as impaired for aquatic recreation and aquatic life throughout most of its reach. Near the Park, the river is specifically impaired for fecal coliform, PCB in fish tissue, fish biodiversity, and invertebrate biodiversity. Increased land protection along the Cannon River is listed as a priority management strategy for the Middle Cannon River to help mitigate the noted impairments. Management activities along the Cannon River within the Park should focus on this objective. Best management practices within the Park that minimize nutrient and sediment loading to the reservoir will help improve water quality and aquatic habitat.

#### **Chub Creek**



Chub Creek meandering through agricultural landscape area north of Lake Byllesby Park

Chub Creek originates in Chub Lake and drains a 90 square mile area comprised of farmland and marshland before entering the Cannon River just west of Highway 56 near Byllesby Marsh (Figure 17). Most of Chub Creek is well buffered by marshes that filter out nutrients and suspended solids from the agricultural portions of the watershed. Landowners in this watershed have historically employed conservation practices aimed at reducing soil loss from agricultural fields .As a result, Chub Creek water clarity and quality has historically been much better than the Cannon River. A mean total phosphorous (TP) concentration of (80  $\mu$ g/L) was reported in the Total Minimum Daily Load (TMDL) for Chub Creek which was approximately 65% less than the mean TP concentration of the Cannon River (230  $\mu$ g/L). However, Chub Creek is listed as impaired for fishes and invertebrates and fecal coliform.

Chub Creek and its adjacent wetlands have historically provided refuge and spawning grounds for various minnow species, northern pike, and redhorse suckers. While much of the lower portion of Chub Creek is considered high quality habitat, re-channelization of a portion of the creek, following construction of Highway 56, has resulted in well documented erosion concerns dating back to the 1987 Byllesby Lake Management Plan. The 2005 Master Plan (Chapter 6) indicates intent to coordinate with the Minnesota Department of Transportation and MN DNR to restore Chub Creek to its original channel. This plan includes a bridge passing underneath Highway 56 that would include a wildlife passageway under the road (North Cannon River Watershed Management Organization, 2013). This NRMP further supports this initiative.

### **Prairie Creek**

Prairie Creek originates in Rice County and drains a 68 square mile area comprised largely of agriculture. Forested and wetland areas near the stream form a valuable green corridor along much of its reach. Prairie Creek flows northeast through Goodhue County and enters the south side of Lake Byllesby in Stanton Township. Prairie Creek had the lowest (best) mean TP concentrations (54  $\mu$ g/L) of any tributary entering Lake Byllesby as reported in the TMDL, a testament to its buffering capacity. However, this stream is considered impaired for macro-invertebrates, fecal coliform, and temperature.
## 4.5.5. Wetlands

Wetlands perform a variety of important functions including flood abatement, nutrient retention, pollution filtration, and habitat for fish and wildlife. A total of 219 acres of National Wetland Inventory (NWI)-mapped wetlands are present within the Park. Most of the wetlands on the western portion of the Park are forested/shrub and emergent wetlands associated with riverine deposits from the Cannon River. In the eastern portion of the Park, wetlands include a linear shaped shallow marsh (Echo Channel) associated with a former channel of the Cannon River. Table 4 and Figure 19, Figure 18, Figure 20, and Figure 21 describe the mapped wetland types and existing acreages within the Park boundary.

Wetland Type	Total Area (Acres)
Freshwater Emergent Wetland	71.52
Freshwater Forested/ Shrub Wetland	111.12
Freshwater Pond	10.99
Lake	11.89
Riverine	13.71
Total	219.24

#### Table 4. Mapped NWI Wetlands (MN DNR 2016)



Wetland habitat, West Byllesby

### 4.5.6. Water Resource Regulation

Wetlands and waters within the Park fall under the jurisdiction of several regulatory authorities including the US Army Corps of Engineers (USACE), MN DNR, and local government authorities. Any construction activity that may directly or indirectly impact a water feature should be properly permitted through the correct regulatory authority. Wetlands may not be dredged, filled or drained without a permit. However, vegetation can be altered or even completely removed especially for the purpose of ecological restoration and invasive plant management. In addition, activities for most construction projects are subject to the requirements of the National Pollution Discharge Elimination System (NPDES) general permit and must establish a Stormwater Pollution Prevention Plan (SWPPP) that explains how stormwater will be managed. Since projects within the Park are located within one mile of Impaired Waters and Special Waters, additional best management practices (BMPs) are required and should be included in SWPPP development.





# 4.6. Vegetation and Assessment

Land cover mapping and assessment over the past few decades provides a recent history of vegetative communities within the Park. European settlement induced dramatic land use changes such as cultivation, draining, pasturing, logging, mining, and development which have created profound disruptions of natural cycles and processes. Identification of current vegetative communities and their condition helps to identify potential management areas and actions.



Building foundation adjacent to the Cannon River, West Byllesby.

### Past Land Cover Mapping and Assessment

The vegetation of the Park tells a story of transformation. Many of the factors already mentioned and described above, including the installation of the Byllesby dam, arrival of invasive species, agricultural activities (including plowing and over-grazing by domestic livestock), and changes to physical site conditions (topography, hydrography) have resulted in the development of less diverse, sustainable and resilient plant communities. Vegetation in the Park has also been affected by suppression of wildfires which has resulted in the transformation of open grasslands and savannas to closed woodlands, overgrown savanna, and brushy wetlands.

### 1987 Assessment

Predominant vegetation communities described in the 1987 Master Plan include grassland, cultivated field, lowland hardwood, upland hardwood, silver maple and marsh. Existing predominant vegetation was mapped for the western and eastern section of the Park. Documented tree and shrub species within the forested portions included cottonwood, silver maple, oak, basswood, pine, cedar, aspen, elm, black walnut, black cherry, hackberry, willow, boxelder, dogwood, prickly ash, and chokecherry. Grasses were also noted as covering significant portions of the Park. Unmowed grasslands were located in previously dropped and hayed fields and consisted primarily of ryegrass, wheatgrass, wild millet, bluegrass, clover, and broadleaf herbs.

#### 2005 Assessment

Existing vegetative cover types within the Park were evaluated and broken down into several cover types for the western (Figure 20) and eastern (Figure 21) portions of the Park in the 2005 Byllesby Park Management Plan. The following paragraphs summarize each plant community as described in this Plan.

#### "Disturbed" Native Forest

Surveys identified formerly pastured areas as primarily occupied by a mixture of box elder, green ash, and bur oak forest. Elm, hackberry, aspen, cottonwood and basswood are also present in limited numbers. Invasive buckthorn (*Rhamnus spp.*) and Tartarian honeysuckle (*Lonicera tatarica*) dominated the understory but native gooseberries (*Ribes spp.*) and elderberries (*Sambucus nigra*) were also present. Invasive species including motherwort (*Leonurus cardiac*) and garlic mustard (*Alliaria petiolata*) dominated the herbaceous layer Some native species including showy orchis (*Galearis spectabilis*), woodland phlox (*Phlox divaricata*), white snakeroot (*Ageratina altissima*), and Pennsylvania sedge (*Carex pensylvanica*) were still present from the former native communities. Invasive species control efforts were recommended to prevent further displacement of native plants This recommendation recognized some of the management issues, but did not go far enough to address the underlying causes and potential remedies.

#### Floodplain Forest

Common canopy species of floodplain forest included silver maple (*Acer saccharinum*), cottonwood (*Populus deltoides*), green ash (*Fraxinus pennsylvanica*), and bur oaks (*Quercus macrocarpa*). Valuable native species including woodland phlox, buttercup (*Ranunculus spp.*), and Virginia waterleaf (*Hydrophyllum virginianum*) covered the ground in the wettest portions of the forest. At the time of the 2005 survey, invasive buckthorn had become well-established in the Park. Buckthorn populations dominated the sub-canopy and extended into the canopy layer in the western portion of the Park. The Plan recommended focusing control measures on buckthorn "hotspots", but not attempting to manage the entire floodplain area. Use of all-terrain vehicles on unmarked trails was noted as an issue within floodplain forest areas.

#### Oak/Red Cedar Woodland

Surveys indicated that open areas were historically likely dominated by grassland and sparse tree cover now had fairly dense oak and cedar woodland cover. This overgrowth of trees is likely due to a lack of fire which had allowed for proliferation of shrubs and trees. Non-native species were reported to have replaced native prairie species in some of these areas of the Park.

### Disturbed Temporarily Flooded Shrubland

The report described two areas within the western portion of the Park with less than 30 percent tree cover and greater than 50 percent shrub cover. Glossy buckthorn dominated this area along with sandbar willow, red osier dogwood, and other native species. Overall, species diversity in this area was very low likely due to a prior history of cropping and over-grazing.

## Cultivated/Planted Fields

Portions of the Park still remained in row crop agriculture. Wind and water erosion problems were evident in these portions of the Park and species diversity was described as very low.

## **Old Field Community**

Areas of the Park occupied by abandoned crop fields were dominated by smooth brome grass. Early successional native species including box elder, red cedar, aspen, Canada goldenrod, and prickly ash were noted in these areas. Both boxelder/Siberian elm woodlands and red cedar/Siberian peashrub woodlands were observed. In general, old field areas of the Park contained low species diversity.

## Wetlands

Extensive wetland habitat associated with riverine deposits at the mouth of Lake Byllesby represents a unique quality of Lake Byllesby Regional Park. While these habitats are regionally important to migrating waterfowl and shorebirds, the marshes are dominated by non-native plant species including reed canary grass, hybrid cattail, and purple loosestrife. Wetlands on the east Unit of the Park include a shallow marsh that occupies a former channel of the Cannon River ("Echo Channel"); this wetland was primarily vegetated by reed canary grass.

### **Ecological Quality Assessment**

Ecologists assigned a quality ranking of high, medium, or low for each vegetation type based on an assessment of the nativity of the plant community and disturbance levels. Criteria for each ranking are as follows:

- *High quality areas* included those areas with:
  - 1. less than five percent invasive species,
  - 2. little or no evidence of human disturbance,
  - 3. few weedy plants, and
  - 4. appropriate natural disturbances occurring such as fire and flooding.
- *Medium quality areas*:
  - 1. lacked many of the plant species found in a natural community, but natives were still more prevalent then exotics

- 2. showed human disturbance was often apparent but the plant community had not been altered past a point of recognition.
- *Low quality areas* included sites:
  - 1. where more than 40 percent of the plant community was comprised of invasive species,
  - 2. that exhibited prevalent anthropogenic disturbance, and
  - 3. that failed to resemble any type of native community.

Results from the 2005 Byllesby Park Management Plan clearly depicted that the majority of the Park consisted of low quality habitat with a high degree of human disturbance. The forest downstream of the dam represents the single area within the Park that was given a medium quality ranking. This underscores the importance of restoring and managing the natural resources of the entire park.



Restored short grass prairie, West Byllesby

# 4.6.1. 2016 Vegetation Communities and Assessment

EOR and County staff conducted multiple onsite surveys of the existing natural resources and plant communities within the Park between June and August of 2016. Site surveys were conducted to identify vegetative communities within the park and assign quality rankings. This effort was completed in order to develop an understanding of how recent best management practices (e.g. prairie restorations), natural succession, and the arrival of new invasive species has changed the Park's plant communities since 2005. In addition, EOR inventoried wildlife, described/observed water quality, and classified wetlands within the Park. These items are discussed in detail in subsequent sections.

The following vegetative community categories, based upon the community types outlined in the Dakota County 2017 NRMSP template and the 2016 field visits, were identified within the Park.

Community Category	Definition
Grassland	Old field and other areas dominated by forbs and grasses. Thesereas were distinguished from
er abbilanta	prairies by predominance of exotic grasses (e.g, Kentucky bluegrass, smooth brome).
Prairie	Areas of predominantly native grasses and forbs including active prairie restorations
Savanna Brushland	Areas of grassland or prairie with intermittent (<50% cover) occurrences of shrubs and/or
Savarina-Brusinanu	small trees including eastern red cedar and honey locust.
Woodland-Brushland	Areas transitioning to woodland, dominated by dense shrub cover and abundant tree cover.
Deciduous Forest	Deciduous forests with high canopy cover.
Wet Forest/Swamp	High canopy cover but differentiated by increasingly wet hydrologic regime
Floodplain Forest	High canopy cover, wet hydrologic regime, and hydrologic connection to river or stream.
Emergent Marsh	Wetland areas with high abundance of emergent plants, including the delta area.
Lake/Pond	Open lentic water
River/Stream	Open lotic water
Developed (Disturbed	Areas with high infrastructure and impervious surfaces manicured and abandoned lawns and
Developed/Disturbed	gardens, excavated areas, and cultivated cropland.

Table 5. Vegetative Community Categories

Further classification was provided within each vegetative community category to provide a clearer picture of the communities within each Management Unit. Figure 20 and Figure 21 and Table 5 and Table 7 below identify the community types and specific classifications assigned to each within each Management Unit. Quality rankings were based on the guidelines provided in the 2017 Dakota County NRMSP (Table 6).



West Lake Byllesby Park

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Rank (General Quality)	Guidelines for Assigning Ranks			
A (Excellent)	No evidence of ecologically disruptive disturbance or evidence of appropriate disturbance (e.g., single tree death, fire in fire-requiring ecosystem). Species richness is high for the type of ecosystem and species of mature vegetation conditions are present (e.g., uncommon species). Wetland systems experience little increase or drop in water level regardless of rainfall amount; generally the watershed has less than ten percent agricultural plus developed lands, or runoff is controlled to pre-development levels.			
B (Good)	Some evidence of ecologically disruptive disturbance or some indication of appropriate disturbance. Species richness may be high for the type of ecosystem, but some weedy and invasive species are present and expected uncommon species are absent. Wetland systems experience some increase in water levels with less than 1 inch of rainfall; generally the watershed has 10-20 percent agricultural plus developed lands, or runoff is mostly controlled to pre- development levels.			
C (Fair)	Evidence of ecologically disruptive disturbance is obvious, or little evidence of appropriate disturbance is seen. Species richness is moderate to low for the type, few uncommon species are present. Weedy and invasive plants are evident, but do not dominate any vegetation layer. Wetland systems experience a noticeable increase in water levels after less than 1 inch of rainfall; generally the watershed has more than 20 percent agricultural plus developed lands, or runoff is partially controlled to pre- development levels.			
D (Poor)	Severely altered by ecologically disruptive disturbance or no evidence of appropriate disturbance. Species richness is low for the type of ecosystem and uncommon species are absent. Weedy and invasive species are a large part of the biomass in one or more vegetation layers (e.g., complete buckthorn coverage in the shrub layer). Wetland systems experience large rises and falls in water levels with less than one inch of rainfall; the watershed has more than 25 percent agricultural plus developed lands and runoff not controlled to pre- development levels.			
NR (Not Ranked)	No rank is needed because the land cover is cultural (agricultural land, cool- season hay meadow and/or developed)			

### Table 6. Quality Ranking Guidelines for Vegetative Communities

Note: Intermediate ranks can be assigned for a range of quality, e.g., A/B, C/D. Sourced from Dakota County NRMSP (2017)

Vegetative Community Category	Community Classification	Management Units	Invasive, Non-Native, and Weedy Plants	Native plants	Important Notes	Condition Rank	
	Grassland	Byllesby Bluff	Thistle, burdock, smooth brome, buckthorn	Milkweed	Smooth brome dominated old field with scattered trees.	D	
		Byllesby Bluff - north restoration	Smooth brome, thistle,	Diverse prairie species	Restored short grass prairie	В	
Grassland/ Prairie	Restored	Byllesby Bluff - south restoration	Thistle, burdock	Diverse prairie species	Diverse tall grass prairie	В	
	Prairie	Cannon Gorge	Buckthorn, Siberian elm, smooth brome	Native tall grass prairie species	The restored prairie portion of this area is very diverse and in very good condition.	В	
		Echo Channel & Uplands	Canada thistle, woody species	Very diverse grasses and forbs	Restored Tall Grass Prairie	A/B	
Savanna- Brushland	Savanna	Lakeside	Amur maple, smooth brome, buckthorn, Siberian pea shrub, Siberian elm	Bur oak, northern pin oak, American basswood	Unmaintained grassland with planted and volunteer trees. Bur Oak and prairie remnants scattered throughout	D	
	Juniper Savanna	Echo Channel & Uplands	Blue spruce, Canada thistle, smooth brome, common juniper, honey locust	Black-eyed Susan's, tway blade, rose, figwort, primrose, heath aster, goldenrod, pussytoes, germander	Smooth brome dominated field with common juniper found scattered and in dense thickets. Random planted trees such as river birch, ash and spruce also present.	B/C	
	Old Homestead	Byllesby Delta	Smooth brome, spruce, lilac, cultivars	Basswood, bur oaks, silver maple	Old farmstead, remnant planted trees and garden plants	D	
Woodland- Brushland	Woodland	Cannon Gorge	Buckthorn, Siberian elm, garlic mustard, reed canary grass	Oak, Hackberry, Cherry,	Bur oak savanna transitioning downslope to mesic woodland, many active seeps along slope	С	
Deciduous Forest	Hardwood Forest	Chub Creek	Limited cover of buckthorn, reed canary grass	Walnut, snake root, golden glow, monarda, blue lobelia, snakeroot	Snowmobile trail and barbed wire fence parallel highway 56	B/C	
		Byllesby Bluff	Buckthorn	Cottonwoods, boxelder	Very poor quality woodland, seepage wetland	D	
	Woodland	Oxbow	Buckthorn	Bur oak, green ash	None Noted	D	
		vvoodiand	Cannon Cascades	Buckthorn	Bur oak, hackberry, green ash	Steep wooded slopes with soybeans planted in fields	D

Vegetative Community Category	Community Classification	Management Units	Invasive, Non-Native, and Weedy Plants	Native plants	Important Notes	Condition Rank
Wet Forest/ Swamp	Lowland Forest	Byllesby Delta	Buckthorn, queen Anne's, wild parsnip, reed canary	Green ash, walnut, cup plant, sedges, burreed, arrowhead, bluejoint, cottonwood, black willow	Low forest and marshes, heavy buckthorn in forested areas.	С
		Oxbow	None Noted	Green Ash, wood nettle	Area slightly less flood prone than floodplain forest	В
		Chub Creek	Buckthorn	Green ash, cottonwood	Hardwood lowland forest/swamp	С
Floodplain Forest	Floodplain Forest	Oxbow	Buckthorn	Green ash, cottonwood, silver maple	Floodplain forest with open water wetlands in former river channels	С
		Cannon Cascades	Buckthorn	Green ash, cottonwood, silver maple	Floodplain forest	С
Emergent Marsh	Wetland	Echo Channel & Uplands	Reed canary grass, stinging nettle	Jewelweed, sedges, duckweed	Old river channel that flows NE and dead ends. Water flows at a quick pace and disappears in pond on NE end. Possible recharge area for seeps in Cannon Gorge.	С
	Abandoned Chub Creek	Chub Creek	Reed canary grass, cattail	Arrowhead	Former Chub Creek channel is now a wetland	С
	Marsh & Delta	Byllesby Delta	Purple loosestrife, cattail, reed canary grass, carp	Sandbar willow, arrowhead,	River delta with multiple channels and floodplain wetlands	С
Lake/Pond	Shoreline	Lilac Landing	Smooth brome, locust, buckthorn, honeysuckle, ground ivy	Walnut, boxelder, cottonwood	Mowed grass parking area with small boat access, disturbed woodlot, wooded shoreline	D
		Lakeside	High % of Siberian elm in NE portion of shoreline (immediately W of boat ramp)	None Noted	Entire campground shoreline is rocked (contiguous ~2,700' west of boat landing)	D
		Lake Byllesby	Carp, flowering rush	Diverse fish assemblage	Reservoir	D
River/Stream	River Access	Chub Creek	None Noted	None Noted	Public access point along highway, excavated Chub Creek Channel, heavily degraded	D
	River Channel	Cannon Cascades	None Noted	None Noted	None Noted	D
		Oxbow	None Noted	None Noted	None Noted	D
Abandoned Nursery	Planted Trees	Echo Channel & Uplands	Amur maple, buckthorn, wild parsnip, locust, Norway maple, cultivars & ornamentals	Northern pin oak, walnut, white pine, cottonwood, green ash, cherry, bur oak, dogwood	Diverse mix of native & nonnative trees and shrubs in plantations and scattered throughout woodlands and openings.	D

Vegetative Community Category	Community Classification	Management Units	Invasive, Non-Native, and Weedy Plants	Native plants	Important Notes	Condition Rank		
Developed Parkland	Utility Area	Lakosida	Buckthorn, Siberian elm, alfalfa, honeysuckle	Bur Oak	Disturbed area adjacent to bridge trail and maintenance building.	D		
	Developed	Lakeside	Smooth brome, spotted knapweed, thistle	Side oats grama, little blue stem, leadplant, ash trees	Parking lot area with mowed turf, un-mowed grasses & forbs, scattered planted trees	NR		
	Cemetery		Turf grass	None Noted	Existing cemetery	NR		
	Powerline and Railroad Corridor	Byllesby Bluff	Thistle, wild parsnip, buckthorn, tansy, Siberian elm	None Noted	Utility and RR right- of-way extremely infested with invasive species.	D		
Gravel Pits	Oxbow Gravel Pit Echo Channel & Uplands			Oxbow	Buckthorn	Bur Oak	Dry gravel area with planted pines, bur oak and prairie species	D
		Buckthorn, Siberian elm, smooth brome, bird's foot trefoil	Cottonwoods, porcupine grass, sky blue aster, silky dogwood	Former gravel mine now used for soil and woody debris dumping. Groundwater close to surface in some areas, likely recharge area for seeps in Cannon Gorge MU	D			
Cropland		Byllesby Delta	Alfalfa	None Noted	None Noted	NR		
	Cropland	Cannon Cascades	None Noted	None Noted	None Noted	NR		
		Echo Channel & Uplands	Soybeans	None Noted	None Noted	NR		
			Chub Creek None Noted	None Noted	None Noted	None Noted	NR	



Former farmstead location on the west end of Byllesby Reservoir.

The majority of the vegetative communities identified within the Park are considered disturbed and given rankings of D (Poor) and C (Fair). These areas have low vegetative diversity, and/or invasive species are the dominant species. A few forested and wetland areas were identified as B/C (Good/Fair) as they had a lower percentage of invasive species. Recently restored tall grass and short grass prairie communities in previously degraded or cropped areas were the only areas rated B (Good).

Invasive species observed during 2016 site visits include European and glossy buckthorn, amur maple, Siberian elm, Norway maple, spotted knapweed, common tansy, garlic mustard, bird's foot trefoil, alfalfa, Canada thistle, ground ivy, purple loosestrife, flowering rush, wild parsnip, reed canary grass, and smooth brome. European buckthorn was particularly abundant and very dense in wooded areas of the Park with the exception of the floodplain forest. Additional plant species observed that are considered weedy cultivars, or not native to the Oak Savanna Subsection were: stinging nettle, honey locust, and a variety of cultivated trees and shrubs.

# 4.7. Animal Assemblage

Although the Park is predominantly surrounded by disturbed and fragmented habitat and has limited high quality native vegetative communities, the Park maintains a fairly robust wildlife population and is one of the regions finest places to observe migratory shorebirds. The river corridor in this agricultural landscape creates a reasonably well connected patchwork of habitat including several larger core areas.



Wild turkey nest, West Byllesby

The area lies along a migratory flight path used by numerous species migrating to and from their breeding grounds and is a vital stopover site for resting and replenishing of bird's energy reserves. Subsequently; it has been classified as an Import Bird Area (IBA) and is considered one of the best places in Minnesota to view shorebirds. The shallow nature of the lake, and exposed alluvial mudflats represent important resting and feeding sites that are found in very limited supply in this part of the state. The lowering of water levels reveals alluvial mudflats adjacent to shallow water wetlands and marshes that represent the preferred habitat of shorebirds, ducks, geese, swans, and herons amongst others.

Seventy-eight percent of Minnesota's shorebird species and 70 percent of Minnesota's recorded waterfowl species have been identified in Byllesby reservoir. Regionally important species observed in Byllesby Reservoir include Caspian Tern, Black Tern, American White Pelican, White-fronted Geese, Piping Plover (Federally Endangered), Wilson's phalarope, Common Tern,

Canvasbacks, American Avocet, Marbled and Hudsonian Godwits and others (<u>http://mn.audubon.org/conservation/minnesota-important-bird-areas</u>).

Field visits and prior records also indicate several species of mammals, reptiles, amphibians, fish, and invertebrates inhabit the Park (Table 8). For instance, wildlife documented in the 1987 Master Plan included thirteen-lined ground squirrel, beaver, muskrat, fox squirrel, franklin's ground squirrel, red fox, grey fox, grey squirrel, cottontail, jackrabbit, striped skunk, woodchuck, white-footed mouse, chipmunk, pocket gopher, and white-tailed deer. The table below outlines wildlife observed across different plant communities during 2016 field visits. It is likely that increased native habitat and improved habitat corridors within the park and to adjacent areas will likely attract more birds and other wildlife to the Park.



near Echo Channel, East Byllesby.

Vegetation Type	Wildlife Observed	
Grassland/Prairie	Monarch and Monarch Caterpillar, Orb spiders, Gray Catbird, Rock Pigeon, Clay-collared Sparrow, Wild Turkey	
Savanna-Brushland	Eastern Cottontail, Brown Thrasher, Eastern Bluebird, Blue Jay, Northern Flicker, Yellow- bellied Sapsucker, Northern Oriole, White-breasted Nuthatch, Wood Duck, American Pelican, Chipping Sparrow, Black-capped Chickadee, Eastern Kingbird, Eastern Bluebird, Field Sparrow, Tree Swallow, Red Squirrel, Chorus Frog, American Toad	
Woodland-Brushland	Blue jay, Song sparrow, Cerulean warbler	
Deciduous Forest	Yellow-rumped Warbler, Eastern Wood Peewee, Gray Catbird, Wild Turkey, Northern Cardinal	
Wet Forest/Swamp	Gray Catbird, Canada Goose	
Floodplain Forest	Garter snake, Green Frog, Painted Turtle, Red squirrel, White-tailed Deer	
Emergent Marsh	Tree frogs, Tadpoles, American Pelican, Green Heron, Tree Swallow, Barn Swallow, Great Blue Heron, Great Egret	
Lake/Pond	Diverse Fish Assemblage	
River/Stream	Diverse Mussel Species	
Abandoned Nursery	Common Yellowthroat	
Developed Parkland	13-lined Ground Squirrel, American robin, American Crow, Eastern Kingbird, House Wren, House Sparrow, Mourning Dove, Chipping sparrow, Purple Martin, Eastern Phoebe, Downy Woodpecker, Ruby-throated Hummingbird, Indigo Bunting	
Gravel Pit	Black-capped Chickadee, Northern Cardinal, American Robin, White-tailed Deer	
Cropland	None	

#### Table 8. 2016 observed wildlife by vegetative community

# 4.8. Rare Natural Features

The US Fish and Wildlife Service (USFWS) identifies four federally-listed species within Dakota county including the northern long-eared bat, Higgens eye pearlymussel, rusty patch bumble bee, and the prairie bush clover. None of these species are known to currently occur within the Park (Table 9). Improving the likelihood of establishing these species in the Park will require species-specific management strategies such as protection of critical roost trees for the northern long-eared bat, reconnecting fish migratory routes to the Mississippi River for the Higgins eye pearly mussel, reestablishing pollinator-friendly forb species and managing insecticide use to support the rusty-patched bumble bee, and reestablishing dry prairie that could support a population of prairie bush clover

Species Common Name (Latin Name)	Status	Habitat
Northern long-eared bat (Myotis septentrionalis)	Threatened	Hibernates in caves and mines - swarming in surrounding wooded areas in autumn. Roosts and forages in upland forests during spring and summer. Townships containing northern long-eared bat roost trees and hibernacula - links to Minnesota DNR PDF
Higgins eye pearlymussel (Lampsilis higginsii)	Endangered	Mississippi River
Rusty patched bumble bee (Bombus affinis)	Endangered	Grasslands with flowering plants from April through October. underground and abandoned rodent cavities or clumps of grasses above ground as nesting sites, and undisturbed soil for hibernating queens to overwinter.
Prairie bush clover (Lespedeza leptostachya)	Threatened	Native prairie on well-drained soils

Sourced from USFWS (https://www.fws.gov/midwest/endangered/lists/minnesot-cty.html)

The MN DNR identifies 113 species of plants, fungus, invertebrates, fish, amphibians, reptiles, birds, and mammals as endangered, threatened, or of special concern within Dakota County. Research of the MN DNR's Natural Heritage Database for rare natural feature records within one mile of the Park boundary identified the rare natural features described in Table 10 below.

#### Table 10. (MN DNR NHIS Data 2017)

Common	Scientific	State/	Last Date
Name	Name	Federal Status	Observed
Vertebrate Animal			
Blanding's Turtle	Emydoidea blandingii	THR/None	7/19/1989
North American Racer (Snake)	Coluber constrictor	SPC/None	7/8/1993
Paddlefish	Polyodon spathula	THR	2/21/2010
Plains Pocket Mouse	Perognathus flavescens	SPC/None	4/?/1972
Prairie Vole	Microtus ochrogaster	SPC/None	10/?/1971
Western Harvest Mouse	Reithrodontomys megalotis	SPC/None	10/?/1971
Invertebrate Animal			
Black Sandshell (Mussel)	Ligumia recta	SPC/None	8/9/2007
Creek Heelsplitter (Mussel)	Lasmigona compressa	SPC/None	7/30/2007
Fluted-shell (Mussel)	Lasmigona costata	THR/None	8/3/2007
Mucket (Mussel	Actinonaias ligamentina	THR/None	8/3/2007

Common Name	Scientific Name	State/ Federal Status	Last Date Observed
Regal Fritillary (Butterfly)	Speyeria idalia	SPC/None	8/18/2011
Vascular Plant			
Kitten-tails	Besseya bullii	THR/None	7/7/2015
Prairie Bush Clover	Lespedeza leptostachya	THR/THR	8/?/2006

Other than American white pelicans (state-listed special concern), no other state- or federallylisted species were observed during 2016 field visits. Sandhill cranes were observed within the park in 2003.In addition; the Audubon Society has compiled all available data and reported that 114 bird species have been recorded at the Lake Byllesby IBA, many of which are SGCN. The complete list is found in Appendix H

Within the Oak Savanna Subsection, 96 species are considered of Greatest Conservation Need (SGCN) (**Appendix D** Highlights all SGCN and rare species that are known to or may occur within Dakota County). Of these 96 species 48 are birds, 12 are fish, nine are mollusks, eight are reptiles, seven are mammals and insects, and two are amphibians. According to the MN DNR Wildlife Action Plan for the Oak Savanna Subsection, primary threats to these species include habitat degradation and loss of bur oak savanna, tallgrass prairie, wetlands, and maple-basswood forests. Oak savanna, prairie, wet prairie, grassland, and large rivers are key habitats for SGCN in the Oak Savanna Subsection.

Interestingly, the Park is home to many of the key habitats and plant communities important to SGCN in the Oak Savanna Subregion. Although many of these areas are highly degraded and fragmented, they provide an exceptional opportunity to restore a suite of very important habitat areas within the context of one park. Restoration of prairie, savanna, wet meadow and emergent wetland, woodland areas, and improved water quality within the Cannon River and the reservoir would result in core habitat for many species of wildlife.

The Park, according the Dakota County NRMSP, is the least natural and most developed of all the regional parks in the County. This characterization, in combination with a surrounding, predominately agricultural and residential landscape, reduces the potential that rare and sensitive species will utilize the park, but it also impacts their ability to migrate to the park to begin with. Specific management efforts that could be implemented within the Park to support listed species and SGCN in the Oak Savanna Subsection are identified below.

# Oak Savanna

Protecting savannas and bedrock outcrops from dense shrubland encroachment (eastern hog-nosed snake), restoring fire regime to overgrown savannas and brush-prairies, maintaining shrubby edge habitat (brown thrasher), and preserving snags and fallen trees (tree roosting bats and red-headed woodpeckers

### • Native Prairie and Grasslands

Reduce fragmentation of grasslands (Henslow's sparrow and prairie vole), avoid and reduce soil compaction, prevent tree and shrub invasion through the use of prescribed fire, cutting, mowing, and spot herbicide treatment, and increase native plant abundance and microhabitat structure (regal fritillary and red-tailed leafhopper).

### • Non-forested Wetland

Restore wetlands and wetland complexes (American bittern), avoid flooding wet meadows (sedge wren and two spotted skipper), and manage invasive species.

### • Stream

Restore, if possible, natural flow regimes and the removals of dams or other movement barriers, and support the maintenance of native vegetation in riparian corridors (least darter and mussels).



Clockwise from top-left: Landscape north of Echo Channel, East Byllesby; Byllesby Reservoir shoreline near Lilac Landing; native prairie species observed in the Park.

# 5. PARK MANAGEMENT UNITS

The Park is divided into two separate sections, East Lake Byllesby at the east end of the reservoir and West Lake Byllesby, located on the west end of the reservoir. Each section is further divided into Management Units based on usage, location, and distinctive features (Figure 20, Figure 21). Within each Management Unit, vegetation categories were identified and mapped, as discussed in section 4.6.1, to provide further resolution on potential issues and management plans. The following sections outline the observed plant communities and wildlife, observed invasive species, management recommendations, and current and planned recreational amenities within each Management Unit. Natural resource implications of invasive species, pests, and existing and planned amenities are further covered in section 6.1 and possible management and mitigation strategies are discussed in 6.2.

# 5.1. West Lake Byllesby Management Units

West Lake Byllesby is divided into five Management Units: Cannon Cascades, Oxbow, Chub Creek, Byllesby Delta, and Byllesby Bluff.



Cannon River at high flow conditions, West Byllesby.

# 5.1.1. Cannon Cascades

The Cannon Cascades Management Unit is located on the far west end of West-Lake Byllesby. Some areas of this Unit are privately owned and currently under agricultural production.



Figure 22. Cannon Cascades Management Unit (91.5 acres)

# Plant Communities and Wildlife

The Cannon Cascades Management Unit contains four plant communities: floodplain forest, woodland, river channel, and cropland. The Cannon River and adjacent floodplain forest creates the southern edge of this Unit. Woodland areas occupy steep slopes within the Unit and cropland areas fill in the remaining area. Green ash, cottonwood, and silver maple are common in the floodplain forest while bur oak, hackberry, and green ash were predominant in the woodland. Wildlife observed, during 2016 site visits, included green frog, painted turtle, red squirrel, and deer within the floodplain forest area and a wild turkey was observed in the woodland area.

### **Invasive Species**

Buckthorn was found within this Unit and is pervasive in wooded and floodplain forest areas. Removal of dense buckthorn is an important action item for this Unit in order to allow the regrowth of native understory shrubs, saplings, and forbs.



Floodplain forest, West Byllesby

### **Management Recommendations**

Additional management goals include promoting the natural succession of former cropland to native prairie and evaluating the cost-benefit of removing or partially removing river embankments to increase floodplain interaction and restore historic hydrology. The restoration of agricultural areas to native ground cover will have some positive impact on adjacent water quality by providing perennial cover and reducing overland flow and runoff to the Cannon River. Furthermore, restored upland and wetland prairie are likely to attract pollinators, birds, and other wildlife to the area. Floodplain forests are found within occasionally flooded riparian areas. The vegetative community is adapted for periodic inundation that often discourages competition from upland species. Participating in watershed-based management and planning activities that focus on preserving natural river hydrology will help ensure floodplain forests are preserved. Efforts to restore and manage vegetation should try to mimic FFs68, FFs59, MHs38, and UPs23 or similar native plant communities. Additional information on each of these native plant communities is included in Appendix A and a discussion on plant communities found in the Park is in Section 5.

### **Recreational Amenities**

Although no current amenities exist in this Unit, Spring Overlook, is planned as part of the Preferred Concept Plan for the Park. Spring Overlook will be located on the northeast end of this Unit and will include parking, picnic tables, and access to the proposed Mill Town's Trail. In addition, six canoe/kayak-in campsites are planned along the river edge.



Lowland Hardwood Forest, West Byllesby



Agricultural field within flood prone area, West Byllesby.

# 5.1.2. Oxbow

The Oxbow Unit is located just east of Cannon Cascades and encompasses Oxbow Lake. The northeast portions of this Unit are privately owned and used for agricultural practices.



Figure 23. Oxbow Management Unit (87.4 acres)

### **Plant Communities**

The Oxbow Management Unit is home to five plant communities: mixed woodland, lowland hardwood forest, floodplain forest, and emergent wetland associated with Oxbow Lake. The mixed woodland area is situated north of Oxbow Lake and contains planted pines and bur oak and a variety of prairie species. Floodplain forest covers most of this Unit, comprising the southern two-thirds along the Cannon River. The floodplain forest is a matrix of wooded areas and open water wetlands in a former river channel. Plants observed in the floodplain forest include green ash, cottonwood, silver maple, and buckthorn. Understory plants in the floodplain forest include wood nettle, Virginia waterleaf, buttercup and jewelweed. A small sliver of lowland forest also exists in this Unit and is populated with green ash, buckthorn, and wood nettle.

#### **Invasive Species**

Buckthorn was identified within the Unit and is abundant in wooded areas. Removal of dense buckthorn and pine trees is an important action item for this Unit in order to restore a more native forest community.

### **Management Recommendations**



High summer flow in the Cannon River support floodplain forests.

The Oxbow Unit has the potential for restoration of prairie and savanna habitat along its east boundary, within the mixed woodland area. This portion of the Unit is currently overgrown with buckthorn and planted pine. Bur oak regeneration along with several species of prairie plants are found in this Unit and would provide a good starting point for a savanna restoration. Current agricultural areas also provide future opportunities to reestablish savanna/prairie. Similar to the Cannon Cascades Unit, the floodplain forest portions of Oxbow would benefit from an increase floodplain interaction. Efforts to restore and manage vegetation should work towards the following plant communities; FFs68, FFs59, MHs38, FDs37, and MRn83 or similar native plant communities. Additional information on

each of these native plant communities is included in Appendix A and a discussion on plant communities found in the Park is in Section 5.

### **Recreational Amenities**

This Unit does not currently have any recreational amenities. However, the Master Plan identifies Cannon Cascades as a place of interest which will include a small parking lot and access to the Cannon River and Oxbow Lake. Two additional canoe/kayak campsites are planned along the river within this Unit and one primitive group campsite is planned in the northwest corner of the Unit.

# 5.1.3. Chub Creek

The Chub Creek Management Unit is located east of the Oxbow Management Unit, bound to the east by Highway 56 (Randolph Boulevard) and to the west by Highway 83 (Dixie Avenue). This Unit is dissected by Chub Creek, a tributary to the Cannon River. Across the central section of this Unit is an area of row crop agriculture and a homestead.



Figure 24. Chub Creek Management Unit (35.8 acres)

# Plant Communities and Wildlife

The Chub Creek Management Unit consists of several plant communities: hardwood forest, riverine, floodplain forest, emergent wetland, and agriculture. Floodplain forest occupies the southern quarter of this Unit adjacent to the Cannon River and is also found adjacent to Chub Creek and the abandoned Chub Creek channel (the former Chub Creek channel is currently connected to Lake Byllesby via a 24-inch wide pipe under Highway 56). The floodplain forest near the river is similar to the floodplain forest found in management units to the west. Representative plant species include cottonwood, green ash, silver maple, wood nettle, Virginia waterleaf and jewelweed. The abandoned Chub Creek channel was vegetated primarily by reed canary grass, native and hybrid cattail, and arrowhead. Hardwood forest covers the northern half Lake Byllesby Natural Resource Management Plan

of the Unit, abutting County Highway 83 and Highway 56 and a parallel snowmobile trail. There is a good representation of native shrubs such as gray dogwood, but also dense stand of buckthorn. Black walnut is found in this area and may have been planted or naturally regenerated. Ground layer plants observed in the hardwood forest include; reed canary grass, white snake root, wild golden glow, bee balm, and blue lobelia. An old barbed wire fence was encountered in the hardwood forest indicating a history of grazing. The mix of plant species found in this portion of the Unit also support the past land use.



Garter snake taking refuge from the flooded Cannon River, West Byllesby

#### **Invasive Species**

Reed canary grass is a predominant invasive along Chub Creek and limited amounts of buckthorn and reed canary grass were observed in the floodplain forest and hardwood forest sections. Management for both species would be beneficial and would require considerable effort to control.

#### **Management Recommendations**

Heavy human usage along the Cannon River shoreline has degraded and eroded the river shoreline. Management opportunities in this Unit consist of improving access to the creek and Cannon River in order to prevent further erosion and damage to the banks. Some bank restoration/stabilization in areas of concentrated access is recommended. Areas currently under agricultural production should be restored to native savanna/prairie habitat. Similar to the other Units in West Byllesby, the floodplain forest portions of Chub Creek would benefit from an increase floodplain interaction. Efforts to restore and manage vegetation should work towards the following plant communities FFs68, FFs59, MHs38, FDs37, UPs23/24 and MRn83 or similar native plant communities. Additional information on each of these native plant communities is included in Appendix A and a discussion on plant communities found in the Park is in Section 5.

### **Recreational Amenities**

The Unit is also currently lacking any park amenities and in some areas is privately owned and used for row crop agriculture and single-family homes. The Park Master Plan indicates two areas of interest. Dixie Avenue is located on the west side of the Unit and will include a small parking lot and access to the Cannon River and water trail loop. This location will also have an information kiosk and parking. A proposed Chub Creek Trailhead would be located east of Dixie Avenue.



Wetland near old Chub Creek Channel, West Byllesby.

# 5.1.4. Byllesby Delta

The Byllesby Delta Management Unit encompasses in the inflow of the Cannon River to the reservoir. The central section of this Unit is currently utilized for row crop agriculture and is also the location of an old homestead.



Figure 25. Byllesby Delta Management Unit (124.4 acres)

# Plant Communities and Wildlife

The Byllesby Delta Management Unit contains four plant communities: lowland forest, delta marsh, cropland, and disturbed grassland associated with an old homestead. The lowland forest covers the western third of this Unit and is interspersed with wetlands which support green ash, walnut, cup plant, burr reed, arrowheads, bluejoint grass, a variety of sedges, cottonwood, black willow, and several common invasive species. Gray catbird and Canada goose were also observed in this area during field visits, which represents a low amount of diversity. The delta marsh is located on the east edge of this Unit and is dominated by sandbar willow, arrowhead and invasive species such as reed canary grass and purple loosestrife. Observed wildlife in this area included American pelican, green heron, tree swallow, bald eagle, great blue heron, great egret, and several mussel species. Even at first glance, this community seems to support a greater variety and Lake Byllesby Natural Resource Management Plan

diversity of wildlife than the other ones. The old homestead area was populated with smooth brome, spruce, lilac, basswood, bur oak, silver maple, and a variety of cultivars, as well as an abundance of European buckthorn. A good deal of wildlife was observed in this Unit, including chipping sparrow, black-capped chickadee, eastern kingbird, and eastern bluebird.



American White Pelicans observed near the Byllesby Delta, West Byllesby.

### **Invasive Species**

Invasive species found in the Unit included Queen Anne's lace, wild parsnip, reed canary grass, and a robust population of buckthorn in the lowland forest areas. Purple loosestrife, hybrid cattail, reed canary grass and carp were prevalent in the marsh portion of the delta. Primary management recommendations for the Unit include vegetation management in the delta to control invasive species, and carp harvesting to minimize their impact to aquatic vegetation and water quality. It is also important to control dense stands of fruiting buckthorn in the lowland forest areas. This buckthorn population is a major source of seed to the area as birds eat berries and disperse the seed through droppings.

### Water

The Unit is primarily comprised of emergent wetland associated with the Cannon River delta. Heavy sedimentation from upstream eroding crop land (due to poor land use practices) has accumulated since 1970 to form the delta. Although heavy sedimentation is damaging to the Cannon River and the reservoir as a whole, the delta provides excellent habitat for migratory shore and water birds. Efforts to minimize continued sedimentation should be encouraged in surrounding areas to improve overall water quality. However, continued drawdowns of the reservoir will be important for maintaining the exposed mudflats that are very important to birds. These spring and fall drawdowns create mudflat habitat for invertebrates that intern provide forage for birds on the migratory routes.

### **Management Recommendations**

Additional management opportunities for this Unit could include exploring the potential for a wildlife crossing where Chub Creek formerly crossed the highway. An underpass would provide connectivity for wildlife and would also create the opportunity for a water trail loop within the Park and an extension of Mill Town's trail to the Delta. Studies could be done to investigate wildlife usage to better inform the location and number of potential crossings. Managing water level to promote bird habitat and birding opportunities is of high priority for the marsh area. This could also include construction of birding blinds and better trail access. Additionally, monitoring sedimentation rates and changes is recommended to help inform upstream and downstream management practices. Restoration of the old farm to native oak savanna is suggested given the current growth of species native to the oak savanna plant community. This area could provide a great potential birding and outreach activity area. Efforts to restore and manage vegetation should try to mimic FFs59, FDs37, UPs23/24 and MRn83/93 or similar native plant communities. Additional information on each of these native plant communities is included in Appendix A and a discussion on plant communities found in the Park is in Section 5.



View from former farmstead west of the Byllesby Reservoir overlooking the Cannon River delta, West Byllesby.

### **Recreational Amenities**

Current recreational amenities in this Unit include only a small road. Amenities identified in the Park Master Plan include one area of interest, the Delta, which will have parking, picnic tables, access to the proposed Mill Towns Trail, natural surface trails with access to an observation platform on the delta, access to water trail loop, and space for outreach and interpretation programing. In addition, another primitive campsite is planned in the central area of this Unit.

# 5.1.5. Byllesby Bluff

The Byllesby Bluff Management Unit is located in the northeast corner of West-Lake Byllesby. This Unit is bound to the north by 292<sup>nd</sup> Street East. A cemetery occupies the far, east section of this Unit.



Figure 26. Byllesby Bluff Management Unit (30.7 acres)

# Plant Communities and Wildlife

This Unit contains three distinct vegetation communities: restored prairie, woodland, and disturbed herbaceous upland. Two separate sub-nits of restored prairie separated by a band of woodland (primarily cottonwoods and boxelder) are located along the western edge. Both restored areas are home to a diverse mix of native prairie species: short grass prairie species in the northern sub-unit and tallgrass prairie species in the southern sub-unit. Wildlife observed in the restored prairie areas included rock pigeon, clay-colored sparrow, and wild turkey in the northern sub-unit and monarch caterpillars in the southern sub-unit.

In addition to the restored prairie areas this Unit also contained several disturbed herbaceous upland areas. Disturbed grasslands, located in the central area of the Unit and within the powerline and railroad corridor, were vegetated predominantly with smooth brome, and invasive species such as Canada thistle, buckthorn, wild parsnip, common tansy, and Siberian elm. An indigo bunting was observed along the herbaceous corridor. A cemetery is also located in the far northeast arm of the Unit and is currently vegetated by turf grass.



View of Byllesby Reservoir from restored prairie, West Byllesby.

The highly degraded woodland that separates the two reconstructed prairies was comprised primarily of boxelder, cottonwood, and buckthorn. This wooded area contains seepage wetlands as groundwater surface along the steep slopes of the bluff, and should be restored to a seepage community. It is recommended that most of the woody species be completely removed and the area managed as prairie and wet prairie. Field observation of yellow-rumped warbler, eastern wood peewee, and gray catbird were noted in the woodland areas.

### **Invasive Species**

Invasive plant species observed in the restored native prairie areas included Canada thistle, burdock, and smooth brome. Continued active mowing and burning of these areas will be important to prevent further spread of these invasive plants and to help maintain a disturbance regime more closely resembling that of a native prairie ecosystem. Canada thistle, wild parsnip, common tansy, burdock, smooth brome, buckthorn, and Siberian elm were found in the

herbaceous corridor and grassland areas. Management of the dense invasive population in the herbaceous corridor is a high priority in order to prevent further establishment of invasive plants within park boundaries. The grassland areas should be managed for native prairie species which includes burning, mowing, herbicide treatment, hand-pulling, and native seeding. Management of buckthorn in the wooded area is also a high priority. Clearing of the understory is necessary to reestablish a native savanna habitat with an herbaceous understory.

### **Management Recommendations**

Several additional management opportunities exist within the Unit. The restored prairie areas have potential to be excellent areas for educating people about prairie ecosystems and perhaps conducting native seed collection via volunteers. In addition, native planting and increased species diversity along the shoreline would further opportunities to diversify the habitat, including areas of wet prairie and emergent marsh. Efforts to restore and manage vegetation should try to mimic MHs37/38, FDs27/37, UPs23/24 and MRn83 or similar native plant communities. To incorporate both an increase in native vegetation and the opportunity to provide park patrons with a snapshot of historic settlement in the area, planting the cemetery border with native prairie plants is another potential initiative.

Improved access to lake and wildlife viewing can be achieved by 1) creating parking and access to the lake in the grassland area 2) providing lake access and designated bird viewing points in the woodland area, and 3) providing an access point to the North Unit restored native prairie through the herbaceous corridor.

### **Recreational Amenities**



This Unit does not currently anv recreational have amenities. Planned amenities include a parking area with shelters, picnic restrooms, tables, and access to the proposed Mill Towns Trail, and natural surface trails to Lake Byllesby. Additional amenities include birding platforms. monuments and interpretative signage.

View of overgrown prairie and tree plantation area, East Byllesby.

# 5.2. East - Lake Byllesby Management Units

East - Lake Byllesby is divided into four Management Units including Lilac Landing, Echo Channel and Uplands, Lakeside, and Cannon Gorge.



View of trail winding through overgrown prairie and eastern red cedars, East Byllesby.

# 5.2.1. Lilac Landing

The Lilac Landing Management Unit is a small section of the Park northwest of the contiguous East – Lake Byllesby Unit. Lake Byllesby forms the southern edge of this Unit. No water resources are found within this Unit.



Figure 27. Lilac Landing Management Unit (2.0 acres)

# **Plant Communities and Wildlife**

Vegetation observed along the wooded shoreline and disturbed woodland of the Unit included walnut, boxelder, cottonwood, several invasive and weedy shrubs and forbs, and turf. Wildlife species observed included Common Yellowthroat, a warbler typically found at the edges of woodlands and savannas.

### **Invasive Species**

Invasive species included smooth brome, buckthorn, honeysuckle, and ground ivy. Given the high disturbance level of this Unit, vegetation management is not a high priority.
### **Additional Management Recommendations**

Actions that would benefit lake management goals and recreational enjoyment include enhanced in-lake habitat for shore fishing (i.e., installation of coarse woody debris, emergent vegetation, willows or other shoreline tress) and stabilization and reinforcement of the boat launch to prevent and minimize erosion of the shoreline. Native plantings along the shoreline may help improve fish habitat and reduce erosion. However, native plant community restoration may be difficult due to the adjacency of development. Native planting should incorporate plants common to MRn83 and 93, but not cattails.

### **Recreational Amenities**

This Unit contains picnic tables, a non-motorized boat launch, and a place for shore-fishing.



Lilac Landing boat access, East Byllesby

## 5.2.2. Echo Channel and Uplands

The Echo Channel and Uplands Management Unit is located in the central portion of East-Lake Byllesby, and comprises the largest area of East Lake Byllesby Park. 259<sup>th</sup> Street Southeast and Harry Avenue create the north and west boundaries of this Unit. Lake Byllesby and private residential development borders this Unit to the east. The southeastern quarter of this Unit is occupied by an abandoned gravel pit and adjacent rented cropland.



Figure 28. Echo Channel & Uplands Management Unit (169.8 acres)

## **Plant Communities and Wildlife**

Five distinct vegetative communities within the Echo Channel and Uplands Management Unit include: restored prairie, overgrown shortgrass prairie, wetland, cropland, and disturbed upland including an abandoned gravel pit and an overgrown tree and shrub nursery. The restored prairie area is located within the northeast corner of the Unit and consists of diverse forbs and grasses native to tallgrass prairies. Juniper savanna exists through the center of this Unit, separated north/south by wetland. This community consisted of a large swath/field dominated by smooth brome with scattered eastern red cedar and dense shrub thickets. Groupings of



landscaped trees including river birch, ash, and spruce are also scattered throughout this area. A variety of herbaceous prairie vegetation comprised of Black-eyed Susan's, lily-leaved tway blade. wild rose, figwort, evening primrose, heath aster, goldenrods, germander, blue pussytoes, spruce seedlings, honey locust seedlings, and Canada thistle were found beneath the From investigation with red cedars. Dakota County staff and historical records, it appears that these are prairie

remnants, since there is no record of seeding or restoration in this area. This area is home to the most diverse assemblage of wildlife observed during 2016 field visits, including red squirrels, chorus frogs, American toads, field sparrow, and tree swallow.

The abandoned gravel pit is vegetated with cottonwood, Siberian elm, buckthorn, silky dogwood, sky blue aster, bird's foot trefoil, and porcupine grass. White-tailed deer, black capped chickadee, northern cardinal, and American robin were observed. The area resembling an overgrown nursery or botanical garden contains a variety of cultivars and ornamentals, northern pin oak, walnut, white pine, cottonwood, green ash, cherry, bur oak, dogwood, honey locust, Norway maple, amur maple, buckthorn, and wild parsnip. Common yellowthroat was also observed in this Unit.

## **Invasive Species**

Canada thistle was observed in the restored prairie area and should be actively managed. Management of the prairie should include burning and mowing to thwart persistence or emergence of invasive species and to maintain a disturbance regime similar to that of a native tallgrass prairie. Vegetative management within the overgrown shortgrass prairie Juniper savanna area should include prescribed fire and native seeding to reduce non-native grasses and shrubs and assist in reestablishing native shortgrass prairie species. Although Eastern red cedar in this area is more dense than historically found in savanna habitats, these trees provide valuable cover and habitat space for birds, especially in the winter. Furthermore, species like the brown thrasher rely on dense shrubby fringes. Until shrubs and trees native to the oak savanna plant community can be installed, removal of cedars should be selective and focused on central portions of this community. Even with the establishment of native shrubs, interspersed dense patches of eastern red cedars should remain to provide essential winter habitat cover.

Reed canary grass found in and along the wetland should be actively managed Herbicide use is discouraged, since the wetland is likely infiltrating directly to groundwater and recharging sidehill seeps in the Cannon Gorge Management Unit (page 112). The gravel pit area should incur removal of all Siberian elm and buckthorn and management for smooth brome. Similarly, the horticultural species found within the former tree plantation should be managed to remove invasive species and cultivars and promote regeneration of native flora. Specifically, attention should be given to the removal of amur maple trees and seedlings.



Eastern red cedar and remnant prairie species in East Byllesby

#### Water



A large emergent wetland located in an old river channel flows east from the reservoir and abruptly ends in the northeast portion of the Unit. Jewelweed, sedges, duckweed, stinging nettle, and reed canary grass were predominant plants observed in the wetland. Tree frogs and tadpoles were also observed in the wetland. A management initiative that could take place near the wetland is promoting the site as a point of interest where visitors can learn about groundwater recharge and aquifer sensitivity in the surrounding region. Vegetation management should focus on sustaining a community similar to MRn83 and MRn93 with an in-water depth of about 20-60 inches, and in shallower water depth areas WMs92.

### **Management Recommendations**

Additional management opportunities should be considered for several of the identified vegetation communities. For instance, the gravel pit area could be graded to create a more natural landscape and be actively seeded with native prairie species. Native planting should

Lake Byllesby Natural Resource Management Plan

incorporate plants common to UPs23 and 24. Furthermore, the sand and rocky substrate may provide an opportunity to grow native sand-gravel species in targeted locations. As with other areas of restored prairie, native seed collection could take place in this Unit.



Given the proposed development of the main campground, large scale restoration of the southern savanna areas may not be initially practical due to pending disturbance. construction However, once constructed. management opportunities include removal of invasive species and management for savanna habitat. Buffers could be created to provide privacy

between individual campsites and the campsites surrounding development. Renderings in **Appendix E** demonstrate several possibilities using native species and topography modifications. It may also be valuable to plant a tree buffer around the entire campground and other highly trafficked areas to buffer noise. Studies have indicated wildlife is negatively impacted by anthropogenic noises because it inhibits their ability to hear natural noises like water, mating calls, and approaching predators. Tree buffers that use a variety of heights and foliage types are best suited for noise abatement. On the other hand, trees in close proximity to prairies give cowbirds and raptors easy access to predating grassland species.

Cropland within this Unit also has the potential for prairie restoration, but may also serve as a place for edible gardens and other food production. Production could focus on edible native plants, and/or historically foraged and cultivated foods, such as prairie turnip (*Psoralea esculenta*). It is also an opportune place to manage for pollinators and focus outreach activities in this area on the importance of pollinators to our local and regional economies and for our current agricultural systems.

## **Recreational Amenities**

Recreational amenities already existing in this Unit of the Park include 3 miles of hiking trails and paved trails. The Master Plan for the Park identifies numerous amenities which primarily include infrastructure associated with camping and overnight stays at the Park. Specific amenities include 55 water and electric camp sites, 20 electric camp sites, 33 tent sites, restroom building, boat trailer parking, dump station, and parking lots. In addition, amenities are located along the Lake Byllesby shoreline east of the campground. Amenities along this shoreline include an unstructured interpretive nature play loop, and natural surface trails.

In addition, the Master Plan includes the relocation of the maintenance building north, adjacent to Harry Avenue within the Unit.

## 5.2.3. Lakeside

The Lakeside Management Unit is located on the southwest peninsula of East-Lake Byllesby.



Figure 29. Lakeside Management Unit (54.4 acres)

## **Plant Communities and Wildlife**

Vegetation communities found in the Lakeside Management Unit include disturbed upland, lakeshore, and savanna. The savanna is described as disturbed bur oak-savanna and prairie remnant and is located on Echo Point at the west end of this Unit. Plant species occurring in this area included bur oak, northern pin oak, American basswood, amur maple, smooth brome, buckthorn, Siberian pea shrub, and Siberian elm. Cottontail rabbit, brown thrasher, eastern bluebird, northern flicker, yellow-bellied sapsucker, northern oriole, white-breasted nuthatch, and wood duck were all observed in this area. Lakeshore habitat along Lake Byllesby is characterized as highly altered, featuring a contiguous rock embankment (rip-rap) extending approximately 2,700 feet west of the boat launch. Vegetation near the boat launch is dominated by (a very high percentage of) Siberian elm.



The developed parkland areas, located across the remaining portions of this Unit, contain large areas of disturbed herbaceous upland interspersed with infrastructure in the form of manicured lawn and un-maintained areas with forbs and scattered planted trees including the following: many ash trees, side oats grama, little bluestem, leadplant, smooth brome, spotted knapweed, and Canada thistle. Wildlife observed in the disturbed and developed areas of this Unit included American robin, American

crow, eastern kingbird, house wren, house sparrow, mourning dove, chipping sparrow, purple Martin, and a thirteen-lined ground squirrel. The utility area is another disturbed location located adjacent to the bridge trail and maintenance building, forming the east border of this Unit. This spot is populated with bur oaks, Siberian elm, buckthorn, alfalfa, and honeysuckle. Eastern phoebe, downy woodpecker, and ruby-throated hummingbird were observed in this location.

## **Invasive Species**

Invasive species observed in the Lakeside Unit included smooth brome, spotted knapweed, Canada thistle, buckthorn, amur maple, Siberian elm, Siberian pea shrub, alfalfa, and honeysuckle. Management activities should include the selective removal and replacement of non-native trees with native savanna species such as bur oak. Removal of amur maple and buckthorn along with controlled burns and over-seeding should be used in grassland areas to promote conversion to oak savanna habitat.

## **Management Recommendations**

Intensive and wide-scale restoration is not recommended around Sunset Beach or North Byllesby Bay Picnic Area given the existing and planned infrastructure, pending construction disturbance, desire to maintain intermittent areas of manicured lawn, and heavy visitor usage. Given the sterile and heavily manipulated state of the shoreline, options for greening the rock-embanked areas and increasing visitor accessibility should be considered. Concurrently, an operations and maintenance plan for vegetation along this shore should be developed to reduce the current efforts and improve the quality. In addition, coarse woody debris distributed along the shoreline ("fish sticks") could provide quality fishing habitat and improve park visitor experience. Currently, erosion issues are persistent near the utilities along the trail and steep slope east of the bridge. Stormwater management BMP's should be considered to mitigate the issue. Furthermore, rerouting of the current pedestrian path may help with stormwater management while simultaneously increasing the aesthetics of this area. Given the predominance of ash trees in the developed park space, emerald ash borer planning and canopy diversification is a high priority for this area. This could include the planting of less well-represented trees and shrubs such as Kentucky coffeetree, blue beech, serviceberry, and hawthorn, among others.

### **Recreational Amenities**

Existing recreational amenities include several parking lots, restrooms, shelters, picnic tables, boat launches, playground, paved trail, beach, and 53 campsites. Planned amenities for this Unit are associated with the four major activity The Lodge, located along the areas. southeast shoreline of the peninsula, includes camp check-in, restrooms, concessions, an emergency shelter, fire oven, great lawn area, 20 boat slips, camper rentals, three - five houseboat cabins, and a parking lot. Echo Point, located at the southwest end of the peninsula, contains a fishing pier, two sun shelters, picnic tables



and fire pits, dock, and paved trails. <u>Sunset Beach</u>, located on the north shoreline of the peninsula, hosts a non-motorized boat launch, beach building with restrooms, splash pad, sand play area, volleyball courts, swimming lagoon, fire pit, picnic lawn, beach parking, and three - five lakeside cottages. The <u>Byllesby Bay Picnic Area</u>, located on the far-east end of the Unit, will be the location of a motorized boat launch, fishing pier, interpretive playground, 150-person picnic shelter, restrooms, 75-person picnic shelter, and parking lot.

## 5.2.4. Cannon Gorge

The Cannon Gorge Management Unit is located on the far southeast corner of East – Lake Byllesby.



Figure 30. Cannon Gorge Management Unit (14.9 acres)

## Plant Communities and Wildlife

Two plant communities are present in the Unit, a restored prairie and degraded woodland. The restored prairie is very diverse; populated with various native tallgrass prairie species and in good condition. This community is located in the north half of this Unit. Monarchs, orb spiders, and gray catbird were observed in this area. The woodland is located in the southern half of this Unit and is characterized as a bur oak savanna; with a downslope transition to mesic woodland interspersed with seeps. This community was populated with oak, hackberry, cherry, buckthorn, Siberian elm, garlic mustard, and reed canary grass. No obligate seepage community plants were found in the seeps, which may indicate their relatively "young" age for the seeps with, time to have developed a signature community. Blue jay, song sparrow, and cedar waxwing were all observed in the Unit.



Trail through restored prairie north of Cannon Gorge, East Byllesby.

### **Invasive Species**

Invasive species observed in the Unit included reed canary grass, garlic mustard, and buckthorn in the woodland areas, with buckthorn, Siberian elm, and smooth brome in the restored prairie. Management activities should include removal of all Siberian elm and buckthorn from each plant community; burning and mowing as needed within the two sub-units. Consider reaching out to the adjacent landowners at the golf course to control Siberian elm on their property also. In addition management efforts should be devoted to reduction of reed canary grass along steep slopes and management of garlic mustard in the woodland.



Cannon Gorge-photo taken from walking bridge, East Byllesby.

### **Management Recommendations**

In addition to management of invasive species, propagation of bur oak along the prairie fringes, especially to the north to provide a native buffer. Restoration and maintenance of lower quality grassland areas are high priorities for this Unit. Native planting within the savanna area should incorporate plants common to FDs27b, FDs37, WFs57a, and UPs23 and 24, as well as mimic ecosystem processes essential to sustaining these communities.

### **Recreational Amenities**

Current recreational amenities include a park building and trail to a new bridge. Planned amenities within the Unit include a parking area with shelter and picnic tables, two yurts, and a canoe/kayak launch.

# 5.3. Lake Byllesby Reservoir and the Cannon River

Lake Byllesby is located in between the East and West Park Units and is a 1,365+ acre reservoir created by a hydroelectric dam constructed across the Cannon River at the east end of the Lake in 1910. The Cannon River is a large tributary river to the Mississippi River. It flows into Lake Byllesby and creates the southern boundary for much of both the East- and West-Lake Byllesby Park Units. The reservoir and Cannon River are discussed in much greater detail above in Section 3.3.4. The lake is high in nutrients (hypereutrophic) and suspended sediment received from upstream land uses carried in by the Cannon River, or re-suspended from the bottom sediments. Sedimentation is a problem where the Cannon River enters at the west side of the reservoir and a vast plume of sediment has formed a delta here through which the river cuts a meandering channel. A Total Maximum Daily Load (TMDL) study was prepared and site-specific nutrient standards proposed. The lake is used for boating, fishing and swimming. It is drawn down 3 feet from fall until spring, exposing mudflats that attract a variety of shorebirds and, along with them, many birders.



View of Lake Byllesby

## 5.3.1. Plant Communities

Lake Byllesby is a large and predominantly shallow reservoir with a limited submergent and emergent plant community. Vegetation is predominantly limited to areas of the delta as described in the Byllesby Delta Management Unit. Any effort to restore native plant communities within the Reservoir or the Cannon River should include species native to mMRn83 and 93, Lki32, and RVx32, respectively.

## 5.3.2. Invasive Species

Although the fish assemblage is generally diverse, Lake Byllesby has a high population of carp which stir up bottom sediments and remove vegetation. Rough fish are removed through regular commercial seining which resumed in 2010. Previous efforts to remove rough fish occurred in the mid 1900's. Private harvest of the carp is being used to actively manage the population. This

form of harvest is effective at reducing carp populations but is not effective at eradicating them. Lake Byllesby also has a documented population of flowering rush. Monitoring should include checking for flowering rush, and if it is found within the park, its location should be marked and reported to the DNR. Flowering rush can disrupt fish predation pressures and can impede recreation when dense colonies form. Flowering-rush can be treated mechanically via hand digging and herbicide application.

## 5.3.3. Wildlife

As discussed in previous sections, both the Cannon River and Lake Byllesby provide habitat for a variety of benthivorous (detritus-eating) and piscivorous (fish-eating) fishes and a wide array of birds and other wildlife. Fish species include: black bullhead, black crappie, bluegill, channel catfish, largemouth bass, northern pike, smallmouth bass, walleye, white bass, white crappie, yellow bullhead, yellow perch, bigmouth buffalo, bowfin (dogfish), common carp, freshwater drum, golden redhorse, greater redhorse, quillback, shorthead redhorse, white sucker, bluntnose DNR shiner, golden shiner (MN Lake Finder minnow, emerald website at http://www.dnr.state.mn.us/lakefind/lake.html?id=19000600). The DNR stocked walleve fingerlings (1-6 months old, 1-12 inches long) in the lake in 2006, 2008, 2010, 2013, and 2014.

The reservoir and Cannon River also provides habitat for a variety of birds including numerous shorebird species attracted to the delta, colonial nesting birds like herons and egrets, birds of prey such as bald eagles, and waterfowl like ducks, geese, and swans. In addition, 36 mammals and 26 species of amphibians and reptiles, and a variety of mussels and aquatic invertebrates are known to occur along Cannon River and within Lake Byllesby.

## 5.3.4. Management Recommendations

Management priorities for the reservoir include a focus on aquatic invasive species education and prevention efforts and active participation in watershed planning initiatives and protection strategies. Continue to draw down water levels, effectively providing mud flat habitat for shore birds while simultaneously supporting healthy a macrophyte community. In addition, investigating options for reducing sedimentation downstream of the dam and identifying the longevity and viability of hydroelectric power generation of the Byllesby Dam given the rapid filling of the reservoir due to upstream sedimentation should be priorities.



Byllesby Reservoir shoreline.

# 6. NATURAL RESOURCES ISSUES AND OPPORTUNITIES

## 6.1. Issues

According to findings identified in the 2017 Dakota County Natural Resource management System plan, Lake Byllesby Regional Park has the second highest impervious cover among all Dakota County parks, and also has the least natural and semi-natural vegetation cover of all the county parks. Due to its management and disturbance history and location in a highly agricultural and fragmented setting, the Park's primary issue is a lack of high quality and connected natural areas. Specific issues within that overarching problem include invasive species, habitat fragmentation, pests, stormwater management, anthropogenic pollution, and potential impacts of Park amenities.

## 6.1.1. Habitat Fragmentation

As previously indicated, the Park is situated in a highly fragmented landscape. Furthermore, the Park itself is fragmented by developed land, roads, and park infrastructure. Habitat fragmentation simultaneously reduces migration and gene flow (disbursement of alleles and genetic information across populations), it also increases fringe habitat and reduces core habitat. Fringe habitat is beneficial for some species like white-tailed deer and some small rodents however, it is typically not advantageous to sensitive and specialist species, most of which are rare. Fringe areas are often subject to greater disturbance and are therefore also prone to invasion by non-native and weedy plant species.

## 6.1.2. Stormwater Management

Erosion and stormwater management issues are occurring near boat access points and the utility area. Park plans also include an increase in infrastructure and impervious surfaces (i.e. parking lots and buildings) which will likely increase the amount of runoff and pollution coming from the Park. Furthermore, existing and future trails have potential to erode if not maintained and constructed properly. General stormwater issues are likely to be exacerbated by with increasing urbanization in the surrounding area. Stormwater best management practices and Low impact design should be considered to mitigate these effects.

## 6.1.3. Noise Pollution

Anthropogenic noise, namely from cars and generators, produce significant ambient noise. Roadways around the Park, as well as plans for increased roads and camping areas, especially electric camping sites, will likely contribute increasing anthropogenic noise pollution within the park. Research has indicated that noise pollution is impacting survivorship and behaviors of a range of animals across many habitats. Frequency and decibel of surrounding noise impacts things such as mating calls and timing, decreased foraging efficacy, reduced social interactions and predator vigilance. It can also have greater effect on the ecosystem as a whole when animals selectively avoid noisy areas (NOVA 2016).

### 6.1.4. Invasive Plants

Although birds and other animals have potential to distribute invasive terrestrial and aquatic plant seeds and reproductive fragments, the greatest introduction method is through human distribution. Construction vehicles, boats, cars, camping gear, and shoes can all be vectors for invasive plant introduction. Managing invasive species is a formidable challenge in both terrestrial and aquatic environments but efforts to control invasive populations can increase plant and wildlife diversity and improve ecosystem resilience. Locations and relative abundances of the aforementioned invasive species are outlined in previous sections. Invasive species identified within the Park during 2016 field visits include:



Amur maples are prevalent in Lake Byllesby Park.

- Amur Maple
- Norway maple
- Siberian elm
- Buckthorn
- Tartarian honeysuckle
- Siberian pea shrub
- Smooth brome
- Reed canary grass
- Spotted Knapweed
- Canada thistle
- Garlic mustard
- Bird's foot trefoil
- wild parsnip
- Ground ivy
- Common tansy
- Queen Anne's lace
- Purple loosestrife
- Narrow-leaf/hybrid cattail
- Carp



## 6.1.5. Emerald Ash Borer, Oak Wilt, & Gypsy Moth

Emerald ash borer (EAB), oak wilt, and gypsy moth are all present within Dakota County and they continue to spread. EAB is an invasive forest insect that feed on all types of ash trees native to North America. Oak wilt is caused by an invasive fungus that affects all types of oak trees. Red oaks are most susceptible followed by bur oak and white oaks. The fungus can spread via root grafting or through sap-feeding beetles. Given the abundance of ash and oak trees within the park, EAB and oak wilt are potential issues. Gypsy moth is an invasive pest whose caterpillars feed on the leave of deciduous trees and can be incredibly destructive, even defoliating entire trees. They have not yet invaded Minnesota very heavily, due to a "Slow the Spread" campaign waged by the United States Forest Service, but inevitably they will come. It is important to prepare for that eventuality.

# 6.2. Natural Resource Recommendations

The aforementioned issues also provide a suite of potential management recommendations for the Park, including the following:

- Buffering existing native plant communities
- Increasing habitat connectivity,
- Providing pollinator habitat,
- Improving stormwater management,
- Mitigating noise pollution and other human disturbances,
- Increasing nativity of plant communities, and
- Protecting against pests

## 6.2.1. Increase Habitat Connectivity

Restoring disturbed and cropped areas within the Park will help increase habitat connectivity both within the Park and throughout the greater landscape. This is especially true in West – Lake Byllesby as several cropped areas and houses interrupt natural areas and habitats. Restoration of cropland in West Lake Byllesby would increase habitat connectivity between floodplain and upland areas as well as increase east-west connectivity across the Section. Furthermore, Dixie Avenue and Randolph Boulevard bisect West Lake Byllesby effectively inhibiting wildlife migration. Wildlife tunnels or waterways under or over the roads would provide a much needed connector to the delta.

In areas suggested to be restored to forest, it should be noted that restoration of forest can take decades to accomplish and can be a fairly expensive endeavor. The least time consuming and most cost-effective method for forest restoration involves planting cover crops and allowing forest regeneration to take place through natural succession. Cover crops should contain native forbs and grasses and may also include pioneer tree species such as jack pine, poplar, pin oak, and green ash. Restoration can be assisted through collection and dispersion of seeds from the surrounding forest (MN DNR 2017). Detailed information on forest restoration can be found through the <u>MN DNR</u>.

Given the planned improvements and amenities in East Lake Byllesby, increasing habitat connectivity will be a challenge. Creating native buffers adjacent to amenities and infrastructure is one way to reduce fragmentation and would help mitigate impacts of human activity around restoration areas and native plant communities. It may also be most appropriate to focus connectivity efforts initially in the West Section and northern portion of the East Section, where limited infrastructure is planned. For instance, restoring the cropland located in the southeast corner of the Echo Channel and Uplands Management Unit would provide a large connected core habitat of savanna and prairie.

# 6.2.2. Provide Native Habitat for Pollinators

Approximately 90 percent of the world's flowering plants rely on animal pollinators for fertilization, including many agricultural crops. Native prairie is the preferred habitat for many of Minnesota's native pollinator species, including over 400 species of bees and over 2,500 species of butterflies and moths. Unfortunately only about 2percent of Minnesota's prairie habitat remains. This habitat loss in association with pesticides and disease has led many species to decline in population, including the recently listed-endangered, rusty patch bumble bee.

The majority of Minnesota's native bees are cavity and soils dwellers. Thus, when restoring habitat to support native bees, it is not only important to emphasize a diverse flowering plant community, it is also important to promote soil health and provide suitable nesting cavities (e.g., old plant stems), and avoid the use of insecticides and herbicides when possible. Although still in draft form, the MN DNR's Pollinator Resource Values for Upland and Wetland Prairies document provides insight to what native plants are especially valuable to pollinators in a variety of Minnesota's native prairie and savanna communities.

(http://files.dnr.state.mn.us/natural\_resources/npc/pollinator\_booklet\_single.pdf).

# 6.2.3. Improve Stormwater Management

A goal of Dakota County parks is to ensure water leaving a park is as good as or better than when it entered the park. Park development planning should incorporate management of potential soil erosion and compaction as a result of construction and park amenities, BMPs, and green infrastructure to reduce stormwater runoff from new impervious areas. This could include use of proper construction BMPs and timing of construction to minimize impacts to soils and water resources, use of pervious or permeable pavement and pavers, rain gardens, cisterns, dry swales, tree trenches, or even a water reuse system. BMPs incorporated into the park infrastructure also provide an excellent educational opportunity to inform visitors about the effects of stormwater and how BMPs they are utilized within the park to improve water quality. This, in turn, can inform visitors how they can use similar BMPs in their own backyards.

# 6.2.4. Reduce Noise Pollution and Disturbance

Using tree and other vegetative buffers around heavily trafficked areas may help reduce some ambient noise. According the UK forestry Service, 30m of woodland can reduce noise by 10 decibels. Recommended guidelines include planting buffers close to the noise, planting a combination of taller and shorter species with dense foliage include evergreen so to mitigate for noise during winter months, and plant species close together (UK Forestry Service 2017). It may also be valuable to consider contacting the County Transportation Department to construct noise barrier(s). Furthermore, maintaining quiet hours at the campground could help reduce noise late evening through early morning when wildlife is highly active.

Educating visitor through signage and outreach to minimize their impacts to wildlife and native plant communities will also help mitigate human disturbance in the park. Encourage visitors to view wildlife at a distance using binoculars or spotting scopes and to stay on designated trails.

# 6.2.5. Increase Nativity of Plant Communities

Management of invasive plant species starts with controlling the spread or introduction of invasive plants to new areas and detecting populations early. Once an invasive species is established, management objectives are often eradication, or if that is unfeasible, focusing on minimizing the spread and minimizing the invasive plant's effect on native plants and plant communities. Management actions must also be adaptive, responding to unique conditions of the site and changing conditions.

Park patrons may unknowingly introduce invasive seeds that hitchhiked on their clothing, shoes, or other gear. Maintaining trails and signage to prevent patrons from wondering off trial and providing invasive plant education and outreach to Park visitors may help visitors identify populations of invasive plants and understand how to prevent their spread. Monitoring along roads, trails, building envelopes, habitat edges, and aquatic communities will be important to identify new invasive species and encroachment at early stages. It is also recommended to follow MN DNR aquatic and terrestrial invasive species guidelines in order to prevent the further spread and introduction of new aquatic invasive plants. Prevention and early detection is paramount in preventing the spread of additional invasive species Specific actions and practices that should be implemented within the Park to prevent the spread and introduction of invasive species include the following (MN DNR 2017b and 2017c):

- 1. Prior to travel to the Protected Properties, wash and clear belongings, equipment (boats, gear, mowers, etc.), and pets of any mud/soil, plant debris/seeds, or animals.
- 2. Do not use or transport soil, gravel, mulch, wood, or hay that is not locally sourced and/or certified invasive free.
- 3. Do not transport water, organisms, or plant material from infested waterbodies to the Protected Properties.
- 4. Use only soil/mulch/gravel that is free of invasive plants and animals.

Invasive plant management can involve a combination of physical removal, cutting, mowing, and herbicide treatment. Treatment and management techniques should be specific to the plants being treated and take into account any nearby water features. Information on terrestrial weed treatment can be found online through the Univ. of MN Extension Office Website (http://www.extension.umn.edu/garden/diagnose/weed/idlist.html).

Goat grazing can be an effective management tool for controlling invasive shrubs such as buckthorn. The County has experience using goats for buckthorn management on other county lands and should consider using goats in the Park, particularly in the West Lake Byllesby Unit where buckthorn density is the highest and human use is less intensive. The Minnesota Department of Transportation (Mn/Dot) and the United States Department of Agriculture also provide guidance documents that serve as good references for management of the most common invasive plant species.

- <a href="http://www.dot.state.mn.us/roadsides/vegetation/pdf/noxiousweeds.pdf">http://www.dot.state.mn.us/roadsides/vegetation/pdf/noxiousweeds.pdf</a>
- <u>https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/plantsanimals/plants/</u>

More information regarding weed identification and management can be found through the MN DNR and Mn/DOT. Below are links to resources for Identification of Noxious weeds.

- <u>http://www.dnr.state.mn.us/invasives/terrestrialplants/index.html</u>
- <u>http://www.dot.state.mn.us/roadsides/vegetation/pdf/noxiousweeds.pdf</u>
- <u>http://www.extension.umn.edu/garden/diagnose/weed/broadleaf/</u>

In addition to the treatment and removal of invasive species, effective management plans must follow treatment activities with seeding and planting of native species. This may involve a combination of seeding and planting of plugs for forbs and grasses and may also include installation of larger trees and shrubs. Seed mixes and plantings should be selected and/or designed to meet the Park's environmental conditions and restoration goals which include restoring current habitats to more native conditions.

Seed and plant selection should first be guided by the plant communities outlined in previous sections of this management plan and should include a diverse mix of native flowers, bunch grasses, and shrubs, where appropriate, to attract a broad range of pollinators (MN DNR 2014). When selecting plants and seed mixes, avoid selecting plants treated with neonicotinoid insecticides and source plants and seed from MN DNR approved native plant suppliers in the same ecoregion as the Park. Seeds and plants sourced closer to the Park will be best adapted to local conditions; the closer to the center of the circle (Dakota County), the better (**Appendix F)**!

Furthermore, chemical and mechanical treatment of invasive and nuisance plants should follow the guidelines identified by the MN DNR in order to reduce impacts to native plants and pollinators. For instance, herbicide treatment should be conducted in a targeted fashion to prevent incidental impacts to native plants and pollinators; spot spraying only the species identified for control. Herbicide treatment should be done only in low wind conditions (below 10 mph) and in early morning when insects are less active. Similarly, mowing should be done in a targeted fashion to limit impacts to native plants, birds, and pollinators. The MN NDR recommends that no more than one-third of a given habitat type be mowed per year to provide refugia to wildlife, especially pollinators (MN DNR 2014).

## 6.2.6. Protect Against Potential Pests

Managing forest areas for diversity in species, ages, and sizes of trees, supplying and using local firewood, not transporting wood from infested areas, and inspecting vehicles, belongings and imported goods limits the susceptibility of forests for infestation by invasive animals and native

pests. Following MN DNR recommended actions for <u>recreation</u> and <u>shoreland owners</u> will be paramount to prevent introduction of aquatic invasive animals and periodic surveys for invasive animals, native pests, and signs of infestations throughout the Park will be important to identify and treat invasions early. If invasive animals, insects, or native pests are observed within the Park contact the local conservation officer or MN DNR Invasive Species Coordinator or MN Department of Agriculture Arrest the Pest Hotline. Specific management options for EAB, Oak wilt, and Gypsy moth and discussed below.

### **Emerald Ash Borer**

Methods to treat EAB include the selective removal of ash trees, diversification of tree stands, and chemical tree injections. The pesticide used to kill EAB is a neonicotinoid insecticide. Recent research by the Xerces Society has identified this category of insecticides as being particularity harmful to bees. Studies have indicated these chemicals can move through the environment via wind erosion and spray drift, can persist in long-lived plants, and can leach into the soils and into surface and ground waters (Figure 31). Every effort should be made to avoid chemical treatment of EAB within the park, especially since providing habitat for pollinators is a management opportunity and priority and the park lies within a very sensitive groundwater recharge area. (Note: Stem injections are allowable because the insecticide gets primarily contained inside the tree, and the portion that gets translocated to the flowers will not harm insects or animals since ash trees are a wind pollinated species).

### Oak Wilt

The most effective means to control the spread of oak wilt is a combination of root graft disruption and tree removal. Infected trees should be removed after root grafts have been disrupted and before April 1, when the fungus begins to fruit and the beetles begin to feed.

### Gypsy Moth

State and federal programs are available to provide technical and financial assistance for the control of gypsy moths. Eradication and treatment methods include a combination of mechanical removal, chemical treatments, and forestry management practices. Month management strategies can be found on the MN DNR website.

### **Neonicotinoid Movement in the Environment**

Neonicotinoids are being found throughout the landscape in areas where they were not applied. This figure illustrates some of the main pathways for neonicotinoid movement in the environment and also shows how this movement could expose beneficial insects.



#### Dust

Neonicotinoids can be released as dust from coated seeds during mechanized planting. This dust can move off-site exposing bees or contaminating non-target sites.

#### **Spray Drift**

When applied as a spray, neonicotinoids can drift off-site directly exposing bees or contaminating non-target sites.



Plants take up neonicotinoids, allowing the chemical to spread through the plant's tissues potentially exposing insects that eat pollen, nectar, or other plant tissue.

#### Persistence

25

Most neonicotinoids are long-lived. As such they can persist in the environment for months to years after an application.

#### Leaching

Neonicotinoids can leach into subsurface water where they can enter ground water or be taken up by neighboring plants.

#### Watershed Contamination

Neonicotinoids are water-soluble by design. This means they can move with shallow subsurface flow or with surface runoff into local waterbodies.

#### Movement Into Habitat of Ground Nesting Insects

70% of native bees are ground nesting. The habitat of ground nesting insects could become contaminated, especially when neonicotinoids are applied as a soil drench.



#### Wind Erosion

Neonicotinoids have been found in soil and soil dust. Contaminated soil can be dispersed by wind.

Illustration by the Xerces Society / Justin Wheeler from the report *How Neonicotinoids Can Kill Bees* xerces.org/pesticides

Figure 31. Neonicotinoid Movement in the Environment (Xerces Society 2017)

# 7. NATURAL RESOURCE VISION AND GOALS

The vision and goals of Lake Byllesby Park are derived from the Working Principles and Vision statement of the Dakota County Natural Resource Management Systems Plan (NRMSP). The NRMSP outlined the following for principals to guide the short- and long-term implementation of natural resource management in the County:

- Natural resource management is necessary to halt and reverse degradation to natural systems, and requires long-term commitment.
- Natural resource management should improve and sustain interrelated natural resource systems (especially for rare and declining native species).
- Natural resource management should address historic, current and adjacent land uses.
- Natural resource management on protected private lands (easements) improves resource quality and provides public benefits.

# 7.1. Vision for Lake Byllesby Park

The NRMSP also identified the following as the vision statement by which management goals and actions are guided:

The Water, vegetation, and wildlife of Dakota County parks, greenways, and easement will be managed to conserve biodiversity, restore native habitats, improve public benefit, and achieve resilience and regionally outstanding quality, now and for future generations.

The following vision statement for Lake Byllesby Park is built on the principals and vision outlined in the county-wide NRMSP and also an understanding of the Park conditions and uses:

Management of Lake Byllesby Regional Park will focus on maintaining, restoring, and enhancing the quality and resiliency of natural resources in order to provide a variety of ecosystem services and an outstanding setting for nature-based outdoor recreation.

# 7.2. Goals for Lake Byllesby Park

Goals for Lake Byllesby Park are described below. The goals are described relative to short- (5 years) and long-term (20 years) planning. Figure 32 and Figure 33 below identify the Long Term Preferred Concept for the Park in term of amenities and improvements as well as vegetation management.



Figure 32. Preferred Concept East – Lake Byllesby



Lake Byllesby Natural Resource Management Plan

## 7.2.1. Long-term Park Management Goals

Described below are the overarching management goals for Lake Byllesby Park in regard to vegetation, water resources and wildlife.

### Vegetation:

- Focus on invasive species control especially in high quality areas.
- Perpetually maintain restored areas by reinstating or mimicking appropriate ecosystem processes (e.g., fire, flooding, etc.), sufficiently installing native seed, and using appropriate invasive species management techniques.
- Identify and prioritize high quality areas where use and management is focused on natural resource integrity and connectivity.
- Monitor progress, and facilitate adaptive management based on best management practices and scientific methods.

### Water Resources:

- Participate in the watershed planning process (e.g., "One Watershed, One Plan") and the implementation of watershed planning goals and objectives.
- Work with partners outside of the park to achieve water quality improvements
- Focus on management of aquatic invasive species within wetlands and other water features, especially in areas with potential to spread invasion to adjacent waterbodies.
- Utilize stormwater best management practices to improve water management and address listed impairments.
- Develop educational signage and programing to inform visitors of invasive species and water protection efforts.
- Monitor progress, and facilitate adaptive management based on best management practices and scientific methods.

### Wildlife:

- Restore and maintain native plant communities to provide food and cover for a wide variety of wildlife.
- Conduct surveys to monitor indicator species and inform adaptive management.
- Consider strategies to mitigate impact of over-abundant wildlife to protect native vegetation and wildlife (i.e., exclosures, harvest, removal).
- Monitor progress, and facilitate adaptive management based on best management practices and scientific methods

# 7.2.2. Specific Goals

Specific Goals for Management Units and vegetative communities within the East and West park sections were described in Section 6 and further goals for rare wildlife habitat improvement were detailed in Section 5.7. Below is a breakdown of specific short-term goals for the Park. Timing and acreage of projects are identified in Table 12.

# East – Lake Byllesby Regional Park Goals

## <u>Lakeside</u>

Reservoir Shoreline (8.2 acres)

- Primary Goal: Construct lakeshore habitat (LKi 32 and LKI54).
- **Primary Implementation Steps and Cost Estimates**: Assess/evaluate; regrade/reshape the lakeshore bank where slopes are too steep and erosion is a concern; install partially submerged logs along shoreline; spot herbicide treatments; re-vegetate with appropriate native plant species mix (seed and plugs); establishment management of vegetation; monitor.

## Cannon Gorge

## River Shore, downstream of dam

- **Primary Goal**: Restore sandy river shore habitat (RVx32).
- **Primary Implementation Steps:** Assess/evaluate; reshape the bank where slopes are too steep and erosion is a concern; install root wads, if necessary; install partially submerged logs along shoreline; spot herbicide treatments; re-vegetate with appropriate native plant species mix (seed and plugs); establishment management of vegetation; monitor.

## River Bank, downstream of dam (0.4 acres)

- **Primary Goal**: Restore oak woodland and seepage wetland (MHs37 and MHs38; FFs59 and WFs57a).
- **Primary Implementation Steps:** Assess/evaluate; reshape the bank where slopes are too steep and erosion is a concern; spot herbicide treatments; re-vegetate with appropriate native plant species mix (seed and plugs); establishment management of vegetation; monitor.

## Echo Point (5.0 acres)

- **Primary Goal:** Restore mesic oak savanna (UPs24).
- **Primary Implementation Steps:** Woody plant removal; herbaceous plant control; control burn, if possible; seeding native woodland community ground layer species; planting shrubs; establishment management; controlled burn.

## Echo Channels and Uplands

Crop Field (24.4 acres)

- **Primary Goal**: Reconstruct native prairie (UPS23).
- **Primary Implementation Steps**: 1) Plant with soy beans prior, 2) harvest soy beans, 3) prepare soil, 4) seed with seed drill, 5) monitor and adapt management as necessary.

Echo Channel (15.7 acres)

- **Primary Goal:** Restore wetland community (MRn83 and MRn93)
- **Primary Implementation Steps:** Site prep; seed; plug; establishment management; monitor and adjust management as necessary.

## Old Tree Farm (11.2 acres)

- Primary Goal: Restore oak woodland (FDs27b and MHs37).
- **Primary Implementation Steps:** Woody plant removal (80% canopy removal); herbaceous plant control; control burn, if possible; seeding native woodland community ground layer species; planting shrubs; establishment management; controlled burn

## Overgrown Prairie (38.7 acres)

- **Primary Goal:** Restore dry oak savanna (FDs37a and b).
- **Primary Implementation Steps:** Select woody plant removal (85% of juniper, 100% of rest); herbaceous plant control; control burn, if possible; seeding native savanna community ground layer species; planting some shrubs; establishment management; controlled burn (protect new plantings).

# <u> West - Lake Byllesby Regional Park Goals</u>

## Byllesby Bluff

## Near the Cemetery, NW Reservoir (8.6 acres)

- **Primary Goal:** Remove Woody Invasive Plants/Species; restore shoreline by restoring plant communities and historic hydrologic conditions (LKi32 and LKi54).
- **Primary Implementation Steps:** Cut, treat stumps, monitor and seedling control.

## Restored Prairie, NW Reservoir (4.9 acres)

- **Primary Goal:** Restore Mesic-Dry Prairie (Ups23 and UPs24).
- **Primary Implementation Steps:** Remove invasive woody plants; control herbaceous exotic plant species; perform a prescribed burn, if possible; seed native prairie species; mow and spot spray; perform prescribed burn after prairie plants have become established.

## <u>Chub Creek</u>

## Chub Creek Mouth (13.4 acres)

- **Primary Goal:** Remove Woody Invasive Species (Plan to use ICWC; could consider goat browsing).
- **Primary Implementation Steps:** Cut, treat stumps, monitor and seedling control. Install wildlife crossings.

## **Byllesby Delta**

## Byllesby Delta - Peninsula (former house site) (10.2 acres)

• **Primary Goal:** Restore to Mesic Savanna and Wet Prairie (UPs23 and UPs24; WPs54).

• **Primary Implementation Steps:** Remove invasive woody plants (plan to use forestry mower); control herbaceous exotic plant species; perform a prescribed burn, if possible; seed native prairie species; mow and spot spray; perform prescribed burn after prairie plants have become established.

Former Mud Flat Areas (23.6 acres)

- **Primary Goal:** Remove invasive woody plants (Plan to use ICWC).
- **Primary Implementation Steps:** Cut, treat stumps, monitor and seedling control.

## Chub Creek

Floodplain and Upland Forest Areas between Randolph Blvd and Dixie Avenue (7.8 acres)

- **Primary Goal:** Remove Invasive Woody Plants (Plan to use ICWC; could consider goat browsing).
- **Primary Implementation Steps:** Cut, treat stumps, monitor and seedling control.

## <u>Oxbow</u>

Floodplain and Upland Forest Areas West of Dixie Avenue (41.2 acres)

- **Primary Goal:** Remove Woody Invasive Plants (Plan to use ICWC; could consider goat browsing).
- **Primary Implementation Steps:** Cut, treat stumps, monitor and seedling control

## Cannon Cascades

Floodplain Area and Upland Area at West End (26.2 acres)

- **Primary Goal:** Remove Woody Invasive Plants (Plan to use ICWC; could consider goat browsing).
- **Primary Implementation Steps :** Cut, treat stumps, monitor and seedling control.

Crop Field at West End (9.0 acres)

• **Primary Goal:** Reconstruct Dry/Mesic Prairie (UPs23 and UPs13)

**Primary Implementation Steps :** Ensure that the field is planted to soybeans the last year prior to reconstruction; prepare site; seed with native dry prairie mix; mow, spot treat multiple times; prescribed burn if possible.

# 8. PRIORITIZATION, SCHEDULING AND COSTS

## 8.1. Prioritization

It is important that potential projects are evaluated individually to ensure that they are soundly conceived and designed, and that they are actually a high priority project. High priority Units contain one or more of the following:

- rare or uncommon features such as rare plant populations, rare animal populations or observations, high quality native plant communities, unusual or unique geologic features, etc.,
- high quality natural communities or high biodiversity areas
- areas that could or do provide important buffer habitat
- areas that could or do effectively connect rare or unique features
- high recreational use areas that merit attention, mitigation, or restoration e.g., Visitor/Gathering Centers or highly used trails
- areas of erosion (degraded streambanks, lakeshores, ravines or slopes)
- areas that have been previously restored
- areas that are particularly sensitive or threatened (e.g. high sensitivity to groundwater contamination
- areas that provide crucial habitat to declining wildlife species e.g. hibernacula for snakes and bats, shoreland/mudflats for shore birds, prairie-wetland complexes for Blanding's turtles, milkweed for monarch butterflies, etc.)
- steep slopes or bluffs
- groundwater infiltration areas
- Important Bird Areas (IBAs)



Floodplain forest, West Byllesby

Table 11 breaks down each Management Unit into its vegetative components and ranks each vegetative component as High (H), Medium (M), or Low (L) for a suit of potential management activities and restoration efforts. Blank spaces are intentional as not all management activities are appropriate for all areas.

Table 11. Ranking of vegetation communities within each Management Unit in regard to natural resource value,potential management activities and restoration efforts, and acquisition.

		Large Quality & Intact Natural Areas					Shoreline Enhance- ment Natural Landscape			Lake WQ*/ Sediment		Unique Habitats					
Management Unit Name	Vegetation Description	Acquisition	Connectivity	Restoration	Reestablishment	Invasive Species	Core/Signature Landscape	<b>Rip Rap Softening</b>	Fish sticks/FAD	Education / Interpretation	Food Forest	Insects / Pollinators	Watershed Education	WQ projects	Mudflats	GW** Seeps	Floodplain
	Echo Point			Μ		Μ	Μ		Н	Н		Μ	L				
Lakosido	Shoreline					Н		Н	Н	Н		Μ	Н	Н			
(54.4 acres)	Developed Parkland					Μ				н	н	Н	н	Н			
	Utility Area			Μ		M				Μ		Μ	н	Н			
Cannon Gorge	Restored Prairie			Μ		н	М			н		М					
(14.9 acres)	Woodland			Н		Н	Μ			Н			Μ			Н	
	Gravel Pit			Μ	Н	Н				Н	Н	Н					
	Cropland		Н		Н		Н			М		Μ					
Echo Channel & Uplands (169.8 acres)	Restored Prairie						н			М		Μ					
	Overgrown Prairie			н	н	н	н			М	м	М					
	Wetland			Μ	Μ	Μ	Μ			Н			Н			Н	
	Planted Trees			Μ	Μ	Н				Μ	Μ						
Lilac Landing (2 acres)	Lake Access			L		L		L	L				М	L			
	Restored Prairie (North Unit)					М	Μ			М							
	Woodland		Н	Н	Н	Н	Μ						Μ		Н		
Byllesby	Grassland		Μ	Н		Μ	Μ										
Bluff (30.7 acres)	Restored Prairie (South Unit)	н	н			Μ	М										
	Powerline and RR Corridor			н		н				М							
	Cemetery																
	Lowland Forest		н	н		Н	н										М
Byllesby Delta (124.4 acres)	Marsh & Delta					L	Н			н			н		н		
	Old Homestead			Н	н	Μ	М			н			Н				
	Cropland	Н	Н		Н	Н	Н			Н							
Lake Byllesby	Lake Byllesby								Н	Н			Н				
	Abandoned Chub Creek	н	н	н		н	н			М			L				
(91.5 acres)	Hardwood Forest	н	н	L		Μ	н										
	River Access									Н			Н	Μ			

Lake Byllesby Natural Resource Management Plan

	Vegetation Description	Large Quality & Intact Natural Areas					Shoi Enh m	reline ance- ent	Multi-Functional Natural Landscape		Lake WQ*/ Sediment		Unique Habitats				
Management Unit Name		Acquisition	Connectivity	Restoration	Reestablishment	Invasive Species	Core/Signature Landscape	<b>Rip Rap Softening</b>	Fish sticks/FAD	Education / Interpretation	Food Forest	Insects / Pollinators	Watershed Education	WQ projects	Mudflats	GW** Seeps	Floodplain
	Floodplain Forest	н	н	L		L	н										н
	Cropland																
	Woodland	Н		Н	Н	Н	Н			Μ							
	River Channel																
Oxbow (87.4 acres)	Lowland Forest	н		L		L	н										
	Floodplain Forest	н	М	L		L	н										Н
Cannon Cascades (35.8 acres)	Floodplain Forest	Н	Н	Μ		L	н										Н
	Woodland	Н		Μ		Н	Μ										
	Cropland	Н		Н	Н		Μ			Μ							Μ
	River Channel																

H=High, M=Moderate, L=Low

\*Water quality

\*\*Ground water



Chanterelle mushroom found near Byllesby Reservoir.

# 8.1. Initial and Long-term Implementation Schedule and Costs

Table 12 outlines the implementation schedules and priorities for the short term (5-year plan). Figure 34 and Figure 35 depict the implementation activities identified in Table 12. Table 13 outlines the long-term (20-year) work plan and Figure 36, and Figure 37 depicts the suggested plant future community structure of the Park.

Site Name	Priority	Timing	Size (ac)	Primary Goal	Main Steps	Cost Estimates	Notes
East – Lake	Byllesby						
Lakeside							
Reservoir Shoreline	1	Yrs 1-3	8.2	Construct lakeshore	Assess/evaluate		
			habitat	habitat	Reshape the bank where slopes are too steep and erosion is a concern		
					logs along shoreline ("fish stick" idea)		
					Spot herbicide treatments; re- vegetate with appropriate native plant species mix (seed and plugs); install turtle basking logs.		
					Establishment management of vegetation		
					Monitor		
				SUB-TOTA (lines 7-11		\$91 <b>,320</b>	\$60 per lineal foot of shoreline
					TOTAL	\$91,620	
Cannon Gor	ge						
River Shore,	1	Yrs 1-3	0.4	Restore	Assess/evaluate	\$ 300	
of dam				shore	Install root wads	\$20,000	
				habitat	Spot herbicide	\$ 500	
					Re-vegetate with appropriate native plant species mix (seed and plugs)	\$ 5,000	
					Establishment management of vegetation	\$18,000	\$60 per lineal foot
					Monitor	\$ 500	
					TOTAL	\$ 44,300	
River Bank, downstream	1	Yrs 1-3	4.6	Restore oak	Assess/evaluate		
aomisticali				and seepage	Re-vegetate with appropriate	\$23,000	

Table 12. Short-Term	(5-Year)	Schedule and	Costs for East a	and West –	Lake Byllesby
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Lake Byllesby Natural Resource Management Plan

Site Name	Priority	Timing	Size (ac)	Primary Goal	Main Steps	Cost Estimates	Notes
of dam				meadow.	native plant species mix (seed and plugs)		
					Establishment management	\$6,440	
					Monitor	\$ 500	
					TOTAL	\$29,940	
Echo Point	1 Yrs 1-3 5 Reconstru dry oak savanna		Reconstruct dry oak savanna	Woody plant removal and follow up	\$5,000		
					Herbaceous plant control	\$3,500	
					Rx burn	\$2 <i>,</i> 500	If possible
					Seeding of native savanna community ground layer species	\$5,000	
					Plant shrubs	\$1,000	
					Establishment management	\$4,500	
					TOTAL	\$21,500	
Echo Chann	el and Up	lands					
Crop Field	1	Yrs 1-3	24.4	Reconstruct native prairie	Plant and harvest soybeans	\$ -	Partner with a local farmer.
					Prepare soil	\$12,200	
					Seed and establish prairie	\$48,800	
					Monitor and adaptively manage.	\$500	
					TOTAL	\$61,500	
	I	1	1		I		I
Echo Channel	2	Yrs 2-4	15.7	Restore	Site prep	\$ 12,560	
enamer				community	Seed	\$ 23 <i>,</i> 550	
					Plug/plant	\$8,000	
					Establishment management	\$21,980	
					Monitor and adaptively manage	\$500	
					TOTAL	\$66,590	
Old Tree	3	Yrs 3-5	11.2	Restore oak woodland	Woody plant removal and follow up	\$20,000	50-80% canopy removal

Site Name	Priority	Timing	Size (ac)	Primary Goal	Main Steps	Cost Estimates	Notes
Farm					Herbaceous plant control	\$2,920	
					Rx burn	\$1,500	
					Seeding	\$18,400	Includes direct hardwood seeding
					Establishment management	\$ 15,680	
					TOTAL	\$ 58,500	
Overgrown Prairie	1 Yrs 1-3	Yrs 1-3	38.7	Restore dry oak savanna	Woody plant removal and follow up	\$57,400	Stockpile junipers for shoreline revetment
					Herbaceous plant control	\$22,090	
					Rx Burn	\$19,350	
		East	108.2		Seeding	\$40,000	
		acres			Planting	\$5,000	
					Establishment management	\$27,090	
					TOTAL	\$170,930	
					EAST TOTAL	\$544,880	
West – Lak	e Byllesby	1					
Bullochy Pl							
Бушезбу Бі	un						
Near the Cemetery,	3	Yrs 4-5	8.6	Woody invasive	Cut & treat stumps; remove cut material	\$8,600	
NW Reservoir				plant removal:	Follow up resprout and seedling control	\$6,020	
Shoreline				shoreline restoration	Shoreline restoration	\$30,000	\$10 per lineal foot
					TOTAL	\$44,620	
Restored	2	Vrs 2.4	10	Remove			Lots of large
Restored 2 Prairie, NW Reservoir	2	113 2-4	4.5	woody veg between two	Woody plant removal	\$12,250	cottonwoods on site. Very dense BT.
			reconstructe d prairies	Follow up resprout and seedling control	\$2,940		
				and then restore	Herbaceous plant control	\$3,430	
			prairie so	Seed	\$9,800		

Site Name	Priority	Timing	Size (ac)	Primary Goal	Main Steps	Cost Estimates	Notes				
				that the	Establishment management	\$6,860					
				is one prairie	Rx burn	\$2,450					
				system.	TOTAL	\$37,730					
Chub Creek											
Chub Creek Mouth	2	Yrs 2-4	13.4	Woody invasive removal	Cut & treat stumps; remove cut material	\$6,030	Very dense BT. Plan to use ICWC.				
					Follow up control of resprouts and seedlings	\$9,380					
					TOTAL	\$15,410					
Byllesby Delta											
Peninsula (former house site)	Peninsula 1 Yrs 1-4 (former house site)	Yrs 1-4	10.2	Mesic savanna and wet prairie restoration	Remove invasive woody plants	\$ 10,200	Very dense BT, but could use forestry mower.				
				-	Follow up control of resprouts and seedlings	\$6,120					
					Herbaceous plant control	\$7,140					
				Seed	\$15,300						
					Establishment management	\$14,280					
					Rx burn	\$5,100					
					TOTAL	\$58,140					
Former Mudflat Areas	3	Yrs 3-5	23.6	Remove invasive woody plants	Cut & treat stumps; remove cut tops; follow up resprout and seedling control	\$10,620	Access difficult. Islands. Plan				
					Follow up control of resprouts and seedlings	\$14,160					
					TOTAL	\$24,780					
Chub Creek											
Floodplain and Upland Forest Areas between Randolph	2	Yrs 2-4		Remove invasive woody plants	Cut & treat stumps; remove cut tops; follow up resprout and seedling control	\$3,510	Access difficultnot a good place to park. Plan to use ICWC.				
Bivd and Dixie Ave.					Follow up control of resprouts and seedlings	\$4,680					
					TOTAL	\$3,510					
Oxbow											
Floodplain and Upland	2	Yrs 2-4	41.2	Remove invasive	Cut & treat stumps; remove cut tops	\$18,540	Plan to use ICWC.				

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Site Name	Priority	Timing	Size (ac)	Primary Goal	Main Steps	Cost Estimates	Notes				
Forest Areas West of				woody plants	Follow up control of resprouts and seedlings	\$24,720					
Dixie Ave.					TOTAL	\$43,260					
Cannon Cascades											
Floodplain 3 Area and Upland Area at West End	3 Yrs 3-5	26.2	Remove invasive woody plants	Cut & treat stumps; remove cut tops	\$11,790	Fairly steep slopes; very dense BT. Plan to use ICWC.					
					Follow up control of re- sprouts and seedlings	\$15,720					
					TOTAL	\$27,510					
Crop Field at	2	Vrc 2.4	0	Decenstruct			[				
West End	2 Yrs 2-4	115 2-4	9	to dry prairie	planted to soybeans in the last year prior to reconstruction	\$3,150					
					Prepare site	\$2,250					
		West side acres	144.9		Seed	\$13,500					
					Mow, spot treat multiple times	\$12,600					
					Rx burn	\$4,500					
					TOTAL	\$36,000					
					WEST TOTAL	\$290,960					

	EAST TOTAL	\$544,880
COST SUMMARY	WEST TOTAL	\$290,960
	TOTAL EAST + WEST	\$835,840
	TOTAL COST PER ACRE	\$3,302.41






Existing (	Conditions	Mgmt.	Total	Mgmt. Goal	Mgmt.	Implementation Estimate	Annualized	Acquisition Priority
Vegetative Community Category	Community Classification	onits	0-20-YR {0to5-YR}	Goal	Activities	Estimate	Maintenance	
	Grassland	Byllesby Bluff	5.44	Restore to native prairie	Control/ removal of invasive herbaceous and woody plants, prescribed burning, native seeding	\$5,000/acre Includes site preparation (spraying, disking, and harrowing), materials, seed (6± grass and 12± wildflower) and seeding, as well as three years of maintenance.	\$250/acre Includes	NA
Grassland/ Prairie		Byllesby Bluff	12.67		Prescribed Burns, Invasive plant management as	NA	burns, mowing, spot herbicide treatment and	NA
	Restored Prairie	Cannon Gorge	5.33	Enhance existing native prairie	needed		overseeding.	NA
		Echo Channel & Uplands	22.33					NA
	Savanna	Lakeside	12.44 {5.17}		Control/remove invasive plants, prescribed burning, native seeding	\$6,000/acre Includes site preparation (select tree &	\$250/acre Includes prescribed burns,	NA
Savanna- Brushland	Overgrown Prairie	Echo Channel & Uplands	73.57 {38.7}	Restore to native savanna	Selective removal of cedars, control/remove invasive plants, prescribed burning, native seeding	shrub removal via forestry mowing, spraying, disking, and harrowing), materials, seed (6± grass and 12± wildflower) and seeding, as well	mowing, spot herbicide treatment and selective overseeding.	NA
	Old Homestead	Byllesby Delta	2.19 {2.19}		Removal of non-native trees and shrubs, native seeding	as three years of maintenance.		High

Existing (	Conditions	Mgmt.	Total	Mgmt.	Mgmt.	Implementation	Annualized	Acquisition
Vegetative Community Category	Community Classification	Units	O-20-YR {Oto5-YR}	Goal	Activities	Estimate	Maintenance	Phoney
Woodland- Brushland	Woodland	Cannon Gorge	6.31 {4.64}	Restore to native hardwood forest	Management of herbaceous and woody invasive Species	\$8,500/acre Includes site preparation (selective tree removal and woody invasive species removal via forestry mower and spraying), materials, seed (BWSR Pilot Forest Groundcover East or Equal) and overseeding seeding, as well as three years of maintenance.	\$300/acre Includes prescribed burns, mowing, spot herbicide treatment and selective overseeding.	NA
	Hardwood Forest	Chub Creek	34.67 {7.70}		Buckthorn removal	\$8,500/acre Includes site preparation (selective tree	\$300/acre Includes prescribed burns,	High
Deciduous Forest		Byllesby Bluff	10.54 {10.54}	Restore to native	Buckthorn removal	woody invasive species removal via forestry mower and spraying), materials, seed (BWSR Pilot	herbicide treatment and selective overseeding.	NA
	Woodland	Oxbow	23.37	forest	Buckthorn removal, selective removal of pine trees	Forest Groundcover East or Equal) and overseeding seeding, as well as three years of maintenance.		High
		Cannon Cascades	5.21 {5.21}		Buckthorn removal			NA

Existing (	Conditions	Mgmt.	Total	Mgmt. Goal	Mgmt. Activities	Implementation Estimate	Annualized Extended	Acquisition Priority
Vegetative Community Category	Community Classification		0-20-YR {0to5-YR}	0001	Addition	Listinute	Maintenance	- nonty
Wet Forest/	Lowland	Byllesby Delta	33.11 {29.31}	Restore to	Herbaceous and woody shrub invasive species management	\$8,500/acre Includes site preparation (selective tree removal and woody invasive species removal via forestry mower and spraying),	\$450/acre Includes prescribed burns, mowing, spot herbicide treatment and selective overseeding.	NA
Wet Forest/ Swamp	Forest	Oxbow	5.63	forest	Buckthorn removal	materials, seed (BWSR Pilot Early Successional Floodplain General or Equal) and overseeding seeding, as well as three years of maintenance.		NA
		Chub Creek	15.78			\$8,500/acre Includes site preparation (selective tree removal and woody invasive species removal	\$450/acre Includes prescribed burns, mowing, spot herbicide treatment and	Moderate
Floodplain Forest	Floodplain Forest	ain <sup>it</sup> Oxbow 55.02		Restore to native floodplain forest	Buckthorn removal	via forestry mower and spraying), materials, seed (BWSR Pilot Early Successional Floodplain General or Equal) and overseeding seeding as well	selective overseeding.	NA
		Cannon Cascades	26.21 {26.21}			as three years of maintenance.		Moderate

Existing (	Conditions	Mgmt. Units	Total Acres	Mgmt. Goal	Mgmt. Activities	Implementation Estimate	Annualized Extended	Acquisition Priority	
Vegetative Community Category	Community Classification		0-20-YR {0to5-YR}				Maintenance		
	Wetland	Echo Channel & Uplands	Echo Channel 15.74 & {15.74} Uplands		Management of reed canary grass	\$7,5000/acre Includes site preparation	\$300/acre Includes prescribed	NA	
Emergent Marsh	Abandoned Chub Creek	Chub Creek	1.97 {1.97}	native vegetation	Management of reed canary and buckthorn	(spraying and/or burning), materials, seed and seeding, as well as three years of maintenance	burns, mowing, spot herbicide treatment and selective overseeding.	NA	
	Marsh & Delta	Byllesby Delta	206.65	Maintain delta as high quality bird habitat & reduce non- native plant abundance	Management of purple loosestrife and other invasive species			NA	
		Lilac Landing	2.27	Reduce sedimen- tation, improve fish	naturalize shoreline and install woody structures for habitat	\$100/linear foot		NA	
Lake/Pond	Shoreline	Lakeside	{7.48}	habitat, restore more natural shoreline	Remove rip rap, naturalize shoreline and install woody structures for habitat	\$250/linear foot		Low	
Abandoned Nursery	Planted Trees	Echo Channel & Uplands	17.27 {11.17}	Restore to native woodland	Removal or woody invasive/ cultivars	\$8,500/acre Includes site preparation (selective tree removal and woody invasive species removal via forestry mower and spraying), materials, seed (BWSR Pilot Forest Groundcover East or Equal) and overseeding seeding, as well as three years of maintenance.	\$300/acre Includes prescribed burns, mowing, spot herbicide treatment and selective overseeding.	NA	

Existing (	Conditions	Mgmt.	Total	Mgmt.	Mgmt.	Implementation Estimate	Annualized	Acquisition Priority	
Vegetative Community Category	Community Classification	Units	0-20-YR {0to5-YR}	Guai	Activities	Estimate	Maintenance	Phoney	
	Utility Area	Lakeside	7.48		Invasive species management, native seeding	\$8,500/acre Includes site preparation (selective tree removal and woody invasive species removal via forestry mower and spraying), materials, seed (BWSR Pilot	\$300/acre Includes prescribed burns, mowing, spot herbicide treatment and selective overseeding.	NA	
						Forest Groundcover East or Equal) and overseeding seeding, as well as three years of maintenance.			
Developed Parkland	Developed	Lakeside/ Echo Channel & Uplands	50.86	Increase native vegetation, minimize habitat fragment- ation, manage stormwater	Wooded and native savanna/prairie buffers,	\$5,500/acre Includes site preparation (select tree & shrub removal via forestry mowing, spraying, disking, and harrowing), materials, seed (6± grass and 12± wildflower) and seeding, as well as three years of maintenance.	\$300/acre Includes prescribed burns, mowing, spot herbicide treatment and selective overseeding.	NA	
	Cemetery Byllesby		2.25 {2.25}		Native plant border	\$5,000/acre Includes site preparation (spraying, disking, and barrowing)	\$250/acre Includes prescribed burns, mowing, spot berbicide	NA	
	Powerline and Railroad Corridor	Bluff	6.09		Invasive species management, native seeding	materials, seed (6± grass and 12± wildflower) and seeding, as well as three years of maintenance.	treatment and selective overseeding.	NA	

Existing (	Conditions	Mgmt.	Total	Mgmt. Goal	Mgmt. Activities	Implementation Estimate	Annualized Extended	Acquisition Priority
Vegetative Community Category	Community Classification		0-20-YR {0to5-YR}	Cour		Listinute	Maintenance	, noncy
Gravel		Oxbow	3.29	Restore to native savanna/ prairie	Grading, native	\$5,500/acre Includes site preparation (select tree & shrub removal via forestry mowing, dicking	\$300/acre Includes prescribed burns, mowing, spot herbicide treatment and colorities	Low
Gravel Pits	Gravel Pit	Echo Channel & Uplands	15.33	Restore to native savanna/ prairie, bike course	invasive species management	and harrowing), materials, seed (6± grass and 12± wildflower) and seeding, as well as three years of maintenance.	overseeding.	NA
		Byllesby Delta	9.00 {9.00}			5,000/acre Includes site preparation	\$250/acre Includes prescribed	High
		Cannon Cascades	9.87 {8.95}		soil amendment	(spraying, disking, and harrowing), materials, seed (6± grass and 12± wildflower) and seeding, as well as three years of maintenance.	burns, mowing, spot herbicide treatment and selective	High
Cropland	Cropland	Echo Channel & Uplands	24.67 {24.67}	Restore to native wet and upland prairie	to reduce compaction, native seeding, vegetation management		overseeding.	NA
		Oxbow	4.85					High
		Chub Creek	16.34					High
	Single-	Chub Creek	5.33 {1.11}	Acquisition	investigate acquisition	TBD	TBD	Moderate
Homes	Tamily Homes	Oxbow	13.15	and restoration	possibilities, purchase property	TBD	TBD	Low





Figure 37. West Lake Byllesby Park Suggested Future Vegetation

### 9. MONITORING AND REPORTING

Ecological restoration is a long-term process. It takes time to restore ecosystems to their former functionality and diversity. And even under the best circumstances and human abilities, generally, this can only be approximated. It took many decades to degrade the ecosystem and biological communities on the property, so it will not be restored overnight. Many steps are typically involved in a successful restoration; even deciding when a restoration is complete/successful can be very difficult. Restoration should be viewed as a process and not as an end point. The ultimate 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 the key to continual progress at the site. Adaptive management is a strategy commonly used by land managers, which integrates thought and action into the restoration process. It can be described as a strategy that uses evaluation, reflection, communication, and also incorporates learning into planning and management. It is set up like a feedback loop and looks like this: Assess Problem  $\rightarrow$  Design  $\rightarrow$  Implement  $\rightarrow$  Monitor  $\rightarrow$  Evaluate  $\rightarrow$  Adjust  $\rightarrow$  Assess Problem  $\rightarrow$  and so forth. Thus, moving forward with restoration, each round of adaptive management refines and hones the process to better fit the conditions of the site.

### 9.1. Monitoring

Ecological Monitoring is the process of obtaining reliable information regarding changes in environmental and habitat quality and identify the causes those changes. It can also be used to check whether remedial actions have been successful and why or why not. By identifying conditions and stressors, adaptive management strategies can be utilized to implement appropriate actions going forward.

Monitoring review should focus on the specific goals for each of the identified management projects within the park. For instance, if the focus of a management activity is to reduce invasive plant cover, review of that initiative should address that goal and assess area of invasive cover over the course of management activity. Monitoring will require field visits and review by knowledgeable professionals and/or well trained volunteers. For instance, the Dakota County Wetland Health Evaluation Program is a volunteer monitoring program focused on the assessment of wetlands. Use of this or other similar programs to monitor wetland and upland restoration projects could be both cost-effective and provide a way for park visitors to connect with the ongoing management efforts within the park.

### 9.2. Reporting

Prior to any management activities, a baseline should be established for each area selected for management activity. Monitoring reports should be completed each year, at minimum, for active management projects and should review the same criteria. Reporting worksheets, such as the one in **Appendix G** adopted from the MN DNR's Legacy Fund Restoration Evaluation Form, or the assessment worksheet developed by the Xerces society could be used to track progress of projects. The latter may be most useful for the specific assessment of native prairie and pollinator habitat projects.

### **10. REFERENCES**

Dakota County. Natural Resource Management System Plan. May 2017. <u>https://www.co.dakota.mn.us/parks/Planning/NaturalResources/Documents/NaturalResourcesM</u> <u>anagementReport.pdf</u>

Dakota County. 2005. Lake Byllesby Regional Park. Master Plan.

Dakota County. November 1987. Lake Byllesby Regional Park Master Plan.

Dakota County Soil and Water Conservation District; prepared on behalf of the North Cannon River Watershed Management Organization. November 2013. Watershed Management Plan.

Minnesota Department of Natural Resources (MN DNR). 2017. Rare Species Guide: Dakota County. http://www.dnr.state.mn.us/rsg/filter\_search.html. Accessed June 2017.

MN DNR. 2017. Minnesota Native Plant Communities Factsheets. <u>http://www.dnr.state.mn.us/npc/index.html</u>. Accessed June 2017.

Minnesota Department of Natural Resources, Division of Ecological Services. 2006. Tomorrow's Habitat for the Wild and Rare: An Action Plan for Minnesota Wildlife, Comprehensive Wildlife Conservation Strategy.

http://files.dnr.state.mn.us/assistance/nrplanning/bigpicture/cwcs/profiles/oak\_savanna.pdf. Accessed June 2017.

MN DNR. 2017. Ecological Classification System: Oak Savanna Subsection. http://www.dnr.state.mn.us/ecs/222Me/index.html. Accessed June 2016.

MN DNR. 2017. Invasive Species: Emerald ash borer (EAB). <u>http://www.dnr.state.mn.us/invasives/terrestrialanimals/eab/index.html</u>. Accessed June 2017.

MN DNR. 2017. Invasive Species: Gypsy moth.

http://www.dnr.state.mn.us/invasives/terrestrialanimals/gypsymoth/index.html. Accessed June 2017.

MN DNR. 2017. Forest Health: Oak wilt. <u>http://www.dnr.state.mn.us/treecare/forest\_health/oakwilt/index.html</u>. Accessed June 2017.

MN DNR Minnesota Biological Society. 2014. Pollinator Resource Values for Upland and Wetland Prairies. <u>http://files.dnr.state.mn.us/natural\_resources/npc/pollinator\_booklet\_single.pdf</u>. Accessed June 2017.

MN DNR, Wild and Scenic Rivers Program. April 1979. Cannon River Resource Analysis.

Lake Byllesby Natural Resource Management Plan

Minnesota Geological Survey (MGS), 2000. "Bedrock Geology and Structure of the Seven-County Twin Cities Metropolitan Area, Minnesota." Miscellaneous Map Series M-104.

Minnesota Geological Survey (MGS), 2007. "Surficial Geology of the Twin Cities." Open File Report OFR 07-2.

Minnesota Pollution Control Agency (MPCA). 2017. Construction Stormwater Special and Impaired Waters Search tool. <u>http://pca-gis02.pca.state.mn.us/CSW/index.html</u>. Accessed June 2017.

MPCA. May 2013. Byllesby Reservoir Phosphorus TMDL Report.

Parris, Dr. Kirsten and Dr. Robert McCauley. Noise pollution and the environment. NOVA. <u>http://www.nova.org.au/earth-environment/noise-pollution-and-environment</u>. Accessed June 2017.

United Kingdom Forestry Service. 2017. Forest Research: Noise abatement. <u>https://www.forestry.gov.uk/fr/infd-8aefl5</u>. Accessed 2017.

University of Minnesota Extension. Weed management http://www.extension.umn.edu/garden/diagnose/weed/

Woodcock, B.A.; J.M. Bullock; and R.F. Shore; et al. Country-specific effects of neonicotinoid pesticides on honey bees and wild bees. Science. June 2017. Vol. 356, pp. 1393-1395

Vos, P., E. Meelis, and W.J. Ter Keurs. A Framework for the design of ecological monitoring programs as a tool for environmental and nature management. 2000. Environmental Monitoring and Assessment. Vol 61, pp. 317-344.

Xerces Society for Invertebrate Conservation (Xerces Society). 2011. Pollinator Conservation in Minnesota and Wisconsin. <u>http://www.xerces.org/wp-content/uploads/2011/01/pollinator-conservation-in-minnesota-and-wisconsin.pdf</u>. Accessed June 2017.

### APPENDIX A. NATIVE PLANT COMMUNITY DESCRIPTIONS



### Southern Dry-Mesic Pine-Oak Woodland

Dry-mesic (or dry) hardwood or pine-hardwood woodlands on sand deposits, primarily in the blufflands of southeastern Minnesota.

### Vegetation Structure & Composition

Description is based on summary of vegetation data from 13 plots (relevés).

• Ground-layer cover is variable, ranging from sparse to interrupted (5-75%), with prairie species often present. Important species include flowering spurge (Euphorbia corollata), pussytoes (Antennaria spp.), harebell (Campanula rotundifolia), elliptic shinleaf (Pyrola elliptica), white rattlesnakeroot (Prenanthes alba), round-lobed hepatica (Anemone americana), downy rattlesnake plantain (Goodyera pubescens), heart-leaved aster (Aster cordifolius), and yarrow (Achillea millefolium). Other common species include northern bedstraw (Galium boreale), Clayton's sweet cicely (Osmorhiza claytonii), lopseed (Phryma leptostachva), columbine (Aquilegia canadensis), hog



peanut (Amphicarpaea bracteata), white snakeroot (Eupatorium rugosum), bracken (Pteridium aquilinum), and Pennsylvania sedge (Carex pensylvanica). The community provides important habitat for several rare sand-loving plants, especially Canada forked chickweed (Paronychia canadensis) and marginal shield fern (Dryopteris marginalis) and also rough-seeded fameflower (Talinum rugospermum), goat's rue (Tephrosia virginiana), ebony spleenwort (Asplenium platyneuron), and seaside three-awn (Aristida tuberculosa).

• Climbing plants and vines are common but generally short. Common species include Virginia creeper (*Parthenocissus vitacea*) and wild grape (*Vitis riparia*).

• Shrub-layer cover is mostly patchy to interrupted (25–75%). White pine, bitternut hickory, white oak, pin cherry, and eastern red cedar are important tree saplings, while ninebark (*Physocarpus opulifolius*), bush juniper (*Juniperus communis*), and black raspberry (*Rubus occidentalis*) are important shrubs. Other common shrub-layer species include American hazelnut (*Corylus americana*), prickly ash (*Zanthoxylum americanum*), black cherry, gray dogwood (*Cornus racemosa*), and common poison ivy (*Toxicodendron rydbergii*). Pipsissewa (*Chimaphila umbellata*) and leadplant (*Amorpha canescens*) are typical half-shrubs.

• **Subcanopy** is sparse to patchy (25–100% cover) and often poorly differentiated from the canopy. White pine, eastern red cedar, black cherry, black oak, and white oak are often present.

• **Canopy** cover is patchy to interrupted (25–75%). Canopy is typically dominated by one or more of the following: white pine, jack pine, black oak, or bitternut hickory. Other common species include bur oak, northern pin oak, white oak, and paper birch. Northern red oak, black cherry, quaking aspen, and basswood are occasional.

### Landscape Setting & Soils

• Sand terraces and other sand deposits—Uncommon. Present on deep sands that have accumulated on valley floors of tributary streams or rivers of the Mississippi River south of the Twin Cities metropolitan area. Most of the sands originate from stream dissection and disintegration of local sandstone, but a few stream bottoms have sands derived from glacial outwash and from stream dissection of glacial till above the sandstone bedrock. Because of the mantle of silty loess that covers the uplands of the PPL, it is likely that fine sands were deposited in the area by wind as well. The sands





are deposited in a variety of landforms including stream terraces, alluvial fans, ramps created by sand blown from valley floors onto adjacent slopes, and mixed deposits of sand and rocks (colluvium) at bases of sandstone outcrops. Although the bedrock from which sands are derived initially contained some carbonates, soils are poor and acidic. Soils tend to be uniformly sandy, lacking subsoil horizons or textural bands that can help to hold or perch snowmelt and rainfall. Soils are excessively drained. Soil-moisture regime is moderately dry. (Blufflands and Rochester Plateau in PPL; very local in Oak Savanna in MIM)

### **Natural History**

In the past, fires were very common throughout the range of FDs27. An analysis of Public Land Survey (PLS) records indicates that the rotation of catastrophic fires was about 135 years, and the rotation of mild surface fires about 15 years. The rotation of all fires combined is estimated to be 14 years. Windthrow was not reported in the surveyors' notes for this community. (The PLS data for this community are too limited to propose growth stages. Most (97%) of the bearing trees within the primary range of this community were oak trees. Bur oak was by far the most abundant, black oak was occasional, and northern pin oak and white oak were infrequent. The surveyors described this community mostly as scattered timber or oak openings. Jack pine and white pine are present in some modern stands; however, no pine bearing trees were reported by land surveyors.)

### Similar Native Plant Community Classes

• FDs38 Southern Dry-Mesic Oak-Hickory Woodland

The ranges of FDs38 and FDs27 overlap in the Bufflands Subsection of the PPL, and both communities have prairie plants in the understory. FDs38 is much more common, occurring on silty soils on upper portions of south- to west-facing bluffs rather than on sandy soils.

EDo27 Indiantor Spanion	(fre	q%)	EDo29 Indicator Spacios	(free	q%)
ruszi indicator species	FDs27	FDs38	PDS36 Indicator Species	FDs27	FDs38
White pine (C,U)	54	-	Shagbark hickory (C)	-	76
Canada mayflower (Maianthemum canadense)	46	-	Smooth sumac (Rhus glabra)	-	24
Downy rattlesnake plantain (Goodyera pubescens,	) 38	-	Jack-in-the-pulpit (Arisaema triphyllum)	-	24
Pipsissewa (Chimaphila umbellata)	31	-	Heart-leaved alexanders (Zizia aptera)	-	24
Yarrow (Achillea millefolium)	31	-	Prickly gooseberry (Ribes cynosbati)	15	71
Pin cherry (Prunus pensylvanica)	23	-	Black walnut (C,U)	8	35
Flowering spurge (Euphorbia corollata)	62	6	Horse gentian (Triosteum perfoliatum)	8	35
Black oak (C,U)	31	6	Woodland sunflower (Helianthus strumosus)	15	59

### • FDs37 Southern Dry-Mesic Oak (Maple) Forest

FDs37 is similar to FDs27 but has not been documented as far south as the PPL. The ranges of the two classes may overlap in southern parts of the MIM, where minimal plant community surveys have been done.

EDe27 Indiantes Species	(fre	q%)	EDe27 Indicator Species	(fred	<b>1%</b> )
FDS27 Indicator Species	FDs27	FDs37	PDS37 Indicator Species	FDs27	FDs37
Flowering spurge (Euphorbia corollata)	62	-	Red maple (C,U)	-	67
Heart-leaved aster (Aster cordifolius)	46	-	Pale bellwort (Uvularia sessilifolia)	-	62
Downy rattlesnake plantain (Goodyera pubescens	) 38	-	Large-leaved aster (Aster macrophyllus)	-	51
Elm-leaved goldenrod (Solidago ulmifolia)	38	-	Mountain rice grass (Oryzopsis asperifolia)	-	42
Black oak (C,U)	31	-	Beaked hazelnut (Corylus cornuta)	-	24
White pine (C)	46	2	Starflower (Trientalis borealis)	-	22
Bitternut hickory (C,U)	62	4	Downy arrowwood (Viburnum rafinesquianum)	8	49
Eastern red cedar (C,U)	62	4	Bush honeysuckle (Diervilla lonicera)	8	36

### • UPs14 Southern Dry Savanna

UPs14 can be similar to FDs27, especially occurrences on windblown sand (UPs14a). UPs14 often grades into FDs27 on areas of sand deposits with northerly aspects or without periodic fire, and the two classes share a number of prairie and woodland plants. UPs14 has a sparse to patchy canopy (5–25% cover), little woody vegetation in the understory, and more prairie species (especially grasses) and fewer woodland herbs in the ground layer. FDs27 has a patchy to interrupted canopy (25–75% cover), at least some woody understory vegetation present, and a ground layer dominated by woodland grasses and forbs with prairie species generally restricted to small canopy openings.



### FIRE-DEPENDENT FOREST/WOODLAND SYSTEM Southern Floristic Region

EDo27 Indicator Spacios	(fre	q%)	11De14 Indicator Species	(free	<b>1%</b> )
FDS27 Indicator Species	FDs27	UPs14	UPS14 Indicator Species	Ds27	UPs14
Clayton's sweet cicely (Osmorhiza claytonii)	85	-	Junegrass (Koeleria pyramidata)	-	80
Basswood (U)	62	-	Western ragweed (Ambrosia psilostachya)	-	80
White oak (C,U)	54	-	Porcupine grass (Stipa spartea)	-	73
Paper birch (C,U)	46	-	Virginia ground cherry (Physalis virginiana)	-	73
Ironwood (C,U)	46	-	Bearded birdfoot violet (Viola palmata)	-	53
Pagoda dogwood (Cornus alternifolia)	46	-	Schweinitz's nut sedge (Cyperus schweinitzii)	-	47
Elliptic shinleaf (Pyrola elliptica)	46	-	Green-flowered peppergrass (Lepidium densiflorum	) -	40
Lopseed (Phryma leptostachya)	69	3	Rough blazing star (Liatris aspera)	-	33

### Native Plant Community Types in Class • FDs27a Jack Pine - Oak Woodland (Sand)

Dry to dry-mesic pine-hardwood woodlands. The presence of jack pine in the canopy and understory differentiate FDs27a from the other types in this class. Important halfshrub and ground-layer plants include pipsissewa, lowbush blueberry (*Vaccinium angustifolium*), pussytoes, bluets (*Hedyotis longifolia*), round-headed bush-clover (*Lespedeza capitata*), hairy puccoon (*Lithospermum carolinense*), and starry false Solomon's seal (*Smilacina stellata*). FDs27a is rare and has been documented at only three sites in the Blufflands Subsection of the PPL. Description is based on summary of vegetation data from 2 plots.

### • FDs27b White Pine - Oak Woodland (Sand)

Dry-mesic pine-hardwood woodlands. The presence of white pine and northern red oak in the canopy and understory helps to distinguish FDs27b from the other types in this class. Important herbaceous plants include wild sarsaparilla (*Aralia nudicaulis*), zigzag goldenrod (*Solidago flexicaulis*), common enchanter's nightshade (*Circaea lutetiana*), harebell, bastard toadflax (*Comandra umbellata*), and carrion flowers (*Smilax* spp.). FDs27b is uncommon. Description is based on summary of vegetation data from 6 plots.

### • FDs27c Black Oak - White Oak Woodland (Sand)

Dry to dry-mesic hardwood woodlands. The presence of northern pin oak or black oak as canopy dominants helps to distinguish FDs27c from the other types in this class. Pin cherry is also more likely to occur in FDs27c. Important ground-layer plants include woodland sunflower (*Helianthus strumosus*), Indian pipe (*Monotropa uniflora*), wild strawberries (*Fragaria virginiana* and *F. vesca*), and elm-leaved goldenrod (*Solidago ulmifolia*). FDs27c is the most common of the three community types in this class. Description is based on summary of vegetation data from 5 plots.



Rushford Sand Barrens Scientific and Natural Area, Fillmore County, MN

## FDs27 Southern Dry-Mesic Pine-Oak Woodland – Species Frequency & Cover

Pennsvlvania sedoe (Carex pensvlvanica) 100	Grasses & Sedges	Lady fern (Athyrium filix-femina) 31	Rattlesnake fern (Botrychium virginianum) 31	Yarrow (Achillea millefolium) 31	Shining bedstraw (Galium concinnum) 31	Wild geranium (Geranium maculatum) 31	Wood anemone (Anemone quinquefolia) 31	Round-lobed hepatica (Anemone americana) 31	Spreading dogbane (Apocynum androsaemifolium) 31	White avens (Geum canadense) 38	Sweet-scented bedstraw (Galium triflorum) 38	Downy rattlesnake plantain (Goodyera pubescens) 38	Pussytoes (Antennaria spp.) 38	Gregarious black snakeroot (Sanicula gregaria) 38	Harebell (Campanula rotundifolia) 38	Common strawberry (Fragaria virginiana) 38	Elm-leaved goldenrod (Solidago ulmifolia) 38	Wild sarsaparilla (Aralia nudicaulis) 46	Canada mayflower (Maianthemum canadense) 46	Common enchanter's nightshade (Circaea lutetiana) 46	Elliptic shinleaf (Pyrola elliptica) 46	Heart-leaved aster (Aster corditolius) 46	White rattlesnakeroot (Prenanthes alba) 46	Pointed-leaved tick trefoil (Desmodium glutinosum) 54	Common false Solomon's seal (Smilacina racemosa) 62	Flowering spurge (Euphorbia corollata) 62	White snakeroot (Eupatorium rugosum) 69	Bracken (Pteridium aquilinum) 69	Lopseed (Phryma leptostachya) 69	Hog peanut (Amphicarpaea bracteata) 77	Columbine (Aquilegia canadensis) 77	Northern bedstraw (Galium boreale) 85	Clayton's sweet cicely (Osmorhiza claytonii) 85	Forbs, Ferns & Fern Allies	freq%
:		•	•	•		•	•	•		•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•		:		•		•	•		cover
Eastern	Jack pi	Ironwo	Bassw	Black	Bitterr	Northe	Black of	White o	Northe	Bur oak	Paper I	White		Trees	I	Pin che	Pagoda	Choke	Gray d	Poison	Prickly	Missou	America	Shrubs	Lowbus	Leadpl	Pipsiss	Red ra	Black	Low St	Green	Wild gra	Virginia	Climbing	
red cedar	ne	ōđ	ood	cherry	nut hickory	ern red oak	bak	bak	rn pin oak		oirch	pine				rry (Prunus pensylv	dogwood (Cornus	cherry (Prunus virgii	logwood (Cornus rac	ivy (Toxicodendron	ash (Zanthoxylum a	ri gooseberry (Ribe	an hazelnut <i>(Corylu</i>		h blueberry (Vaccii	ant (Amorpha cane:	ewa (Chimaphila ur	spberry (Rubus idae	raspberry (Rubus oc	nrubs	brier (Smilax tamnoi	tpe (Vitis riparia)	creeper (Partheno	y Plants	•
red cedar 15 •	ne 15 •	od 15 •••	ood 23 •	cherry 23 •	nut hickory 23 •	ern red oak 31 •••	bak 31 ●●●●	bak 38 ●●●	rn pin oak 46 ●●●●	46 ●●	birch 46 ●●	pine 46 •••••	freq% cover	Canopy		rry (Prunus pensylvanica)	dogwood (Cornus alternifolia)	cherry (Prunus virginiana)	logwood (Cornus racemosa)	i ivy (Toxicodendron rydbergii)	ash (Zanthoxylum americanum)	ri gooseberry (Ribes missouriense)	an hazelnut <i>(Corylus americana)</i>		h blueberry (Vaccinium angustifolium)	ant (Amorpha canescens)	ewa (Chimaphila umbellata)	spberry (Rubus idaeus)	raspberry (Rubus occidentalis)	nrubs	brier (Smilax tamnoides)	tpe (Vitis riparia)	creeper (Parthenocissus spp.)	y Plants	•
red cedar 15 ● 46 ●	ne 15 • 8 •	od 15 ••• 38 •••	ood 23 • 46 •	cherry 23 ● 62 ●●	nut hickory 23 • 23 •	ern red oak 31 ••• 23 •••	oak 31 ●●●● 31 ●●●●	bak 38 ●●● 46 ●●	rn pin oak 46 ●●●●● 31 ●●●	α 46 ●● 15 ●●	birch 46 ●● 23 ●	pine 46 •••• 46 •••	freq% cover freq% cover	Canopy Subcanopy		rry (Prunus pensylvanica)	dogwood (Cornus alternifolia)	cherry (Prunus virginiana)	logwood (Cornus racemosa)	i ivy (Toxicodendron rydbergii)	ash (Zanthoxylum americanum)	ri gooseberry (Ribes missouriense)	an hazelnut <i>(Corylus americana)</i>		h blueberry (Vaccinium angustifolium)	ant (Amorpha canescens)	ewa (Chimaphila umbellata)	spberry (Rubus idaeus)	raspberry (Rubus occidentalis)	nrubs	brier (Smilax tamnoides)	tpe (Vitis riparia)	creeper (Parthenocissus spp.)	y Plants	•





### Southern Dry-Mesic Oak (Maple) Woodland

Dry-mesic hardwood forests on undulating sand flats, hummocky moraines, and river bluffs. Present mostly on fine sand or sand-gravel soils. Often on south- or west-facing slopes but common also on flat to undulating sandy lake plains. Historically, fires were common in this community, and many stands are on sites occupied by brushlands 100–150 years ago.

### **Vegetation Structure & Composition**

Description is based on summary of vegetation data from 43 plots (relevés).

• **Ground-layer** cover is patchy to continuous (25–100%). Pointed-leaved tick trefoil (*Desmodium glutinosum*), Clayton's sweet cicely (*Osmorhiza claytonii*), hog peanut (*Amphicarpaea bracteata*), Canada mayflower (*Maianthemum canadense*), and wild geranium (*Geranium maculatum*) are commonly present. Pennsylvania sedge (*Carex pensylvanica*) is the most abundant graminoid. Dewey's sedge (*Carex deweyana*) and starry sedge (*Carex rosea*) may also be present.

• **Shrub-layer** cover is patchy to continuous (25–100%). Common species include black cherry, red maple, chokecherry (*Prunus virginiana*), American hazelnut (*Corylus* 



americana), gray dogwood (Cornus racemosa), prickly ash (Zanthoxylum americanum), Virginia creeper (Parthenocissus spp.), and poison ivy (Toxicodendron rydbergii).

• **Subcanopy** cover is patchy to interrupted (25–75%). The most common species are black cherry, red maple, and bur oak.

• **Canopy** cover is usually interrupted to continuous (50–100%). Bur oak and northern pin oak are the most common species. Northern red oak, white oak, and red maple are occasionally present. Older trees are often open grown, indicating previously more open conditions on the site.

• Note: Red maple and white oak are generally absent from occurrences in the CGP.

### Landscape Setting & Soils

• Glacial lake plains—Common. Present on undulating sand flats that were deposited in the shallow waters of Glacial Lake Grantsburg. Parent material is stoneless, well-sorted fine sand. It was initially calcareous, but soils are now leached of carbonates. Subsoil horizons capable of perching snowmelt are lacking, but general fine-sand texture and occasional bands of silt and gravel can help to retain some soil moisture. Densely cemented layers of sand that may reflect past positions of the water table occur at depth and can help hold water for deeply rooted plants. Soils are excessively drained and the soil-moisture regime is moderately dry. (Anoka Sand Plain in MIM)

• Stagnation moraines—Occasional. Present on hummocky moraines, often adjacent to fire-prone outwash plains and tunnel valleys that were occupied in the past by brushland or prairie. Parent material is a discontinuous cap of partially sorted gravelly sand over a base of denser till and is often complexly stratified. Parent material can be calcareous or noncalcareous; when calcareous, soils are leached of free carbonates to at least 30in (75cm). Although some clays have accumulated in the subsoil, clays are insufficient to perch snowmelt and rainfall. The complex stratification allows these sites to retain some rainfall, and water is available to deeply rooted plants just above the dense till. Where the sandy cap is thick, the soils are excessively drained, and the soilmoisture regime is moderately dry. Where the cap is thinner, the soils are well drained, and the soilmoisture regime is fresh. (St. Paul-Baldwin Plains and Hardwood Hills in MIM; locally in Pine Moraines and Outwash Plains in MDL; and Minnesota River Prairie in CGP)





• River bluffs—Common. Present on steep (20–50%) south- or west-facing slopes along the Minnesota River valley and other major streams. Soils are developed on eroded calcareous till or cut-faces of gravelly terraces well above modern alluvium. Free carbonates are present at or close to the surface and topsoil layers are thin because of surface erosion. Soils are somewhat excessively to excessively drained. Soil moisture regime is dry to moderately fresh. (Minnesota River Prairie in CGP)

### **Natural History**

In the past, fires were very common throughout the range of FDs37. An analysis of Public Land Survey records indicates that the rotation of catastrophic fires was about 110 years, and the rotation of mild surface fires about 10 years.<sup>1</sup> The rotation of all fires combined is estimated to be 9 years. Windthrow was not common, with an estimated rotation exceeding 1,000 years. Based on the historic composition and age structure of these forests, FDs37 had two growth stages.

• 0-75 years—Young forests recovering from fire, dominated by bur oak with some northern red oak or white oak. Quaking aspen, northern pin oak, and black cherry are minor components.

• > 75 years—Mature forests dominated by a mixture of bur oak, white oak, northern pin oak, and some northern red oak, with minor amounts of American elm. (In the past, sites now occupied by FDs37 typically supported more open communities, including brush-prairie or savanna. Air photos from the 1930s show these sites to have scattered oaks rather than forest canopies. With suppression of wildfires since the mid-1800s, these sites have developed denser tree canopies and herbs typical of mesic forests have become common in the understory. The examples of FDs37 used in this classification are best described by the mature forest growth stage.)

### Similar Native Plant Community Classes • FDs36 Southern Dry-Mesic Oak-Aspen Forest

FDs36 can be similar to FDs37, and the ranges of the two communities overlap in the central part of the Hardwood Hills Subsection in the MIM and adjacent parts of the RRV. FDs36 tends to occur on loamy rather than fine sand or sand-gravel soils.

EDo27 Indiantor Spanion	(fre	q%)	EDo26 Indicator Spacios	(free	1%)	
FDS37 Indicator Species	FDs37	FDs36	PD\$36 Indicator Species	FDs37	FDs36	
Northern pin oak (C,U)	60	-	Canada goldenrod (Solidago canadensis)	2	32	
Tall blackberries*	53	-	Tall coneflower (Rudbeckia laciniata)	2	28	
Large-leaved aster (Aster macrophyllus)	51	-	Golden alexanders (Zizia aurea)	2	28	
Wild geranium (Geranium maculatum)	71	4	Basswood (C)	4	40	
Red maple (C,U)	67	4	American elm (C)	7	36	
Lady fern (Athyrium filix-femina)	53	8	Large-flowered bellwort (Uvularia grandiflora)	20	88	
Black cherry (C,U)	87	16	Lindley's aster (Aster ciliolatus)	16	64	
Northern bedstraw (Galium boreale)	40	8	Bloodroot (Sanguinaria canadensis)	9	32	

\*Tall blackberries (Rubus allegheniensis and similar Rubus spp.)

### • MHc26 Central Dry-Mesic Oak-Aspen Forest

MHc26 generally occurs to the north and east of FDs37, although the ranges of the two classes overlap along the border between the EBF and LMF Provinces. The presence of sugar maple, especially in the canopy, differentiates MHc26 from FDs37.

EDo27 Indiantar Engaine	(fre	q%)	MUa26 Indiantar Spania	(free	<b>1%</b> )
FDS37 Indicator Species	FDs37	MHc26	MILC20 Indicator Species	FDs37	MHc26
Box elder (U)	42	-	Fly honeysuckle (Lonicera canadensis)	-	32
Prickly ash (Zanthoxylum americanum)	67	4	Sugar maple (C,U)	4	71
Northern pin oak (C,U)	60	4	Large-flowered trillium (Trillium grandiflorum)	2	29
Black cherry (C)	29	3	Bluebead lily (Clintonia borealis)	2	27
Wild grape (Vitis riparia)	62	7	Basswood (C)	4	45
Giant Solomon's seal (Polygonatum biflorum)	27	4	Rose twistedstalk (Streptopus roseus)	7	54
Lopseed (Phryma leptostachya)	62	9	Round-lobed hepatica (Anemone americana)	7	47
Wild geranium (Geranium maculatum)	71	13	Pagoda dogwood (Cornus alternifolia)	13	61

<sup>1</sup>Forested communities that extend into the prairie regions of Minnesota tend to have shorter rotations of disturbance from fire (and often wind) on the western edge of their range compared with the eastern part. This probably results from drier climate in the west and being surrounded by prairie vegetation that burns frequently. Because estimated rotations of disturbance for forested communities are calculated from PLS bearing-tree records across the range of the community, and records in the prairie regions are often much sparser than those to the east, disturbance rotations may be much shorter for forest stands in the prairie regions than those presented for the class as a whole.



### FDc34 Central Dry-Mesic Pine-Hardwood Forest

FDc34 generally occurs north of FDs37; the presence of conifers almost always distinguishes FDc34 from FDs37.

EDo27 Indicator Spacing	(fre	q%)	EDo24 Indiantor Spanion	(free	<b>q%)</b>
FDS37 Indicator species	Ds37	FDc34	FDC34 Indicator Species	FDs37	FDc34
Prickly ash (Zanthoxylum americanum)	67	-	Red pine (C)	-	51
Box elder (U)	42	-	Bunchberry (Cornus canadensis)	-	39
Wild grape (Vitis riparia)	62	2	Bluebead lily (Clintonia borealis)	2	46
Lopseed (Phryma leptostachya)	62	2	Rose twistedstalk (Streptopus roseus)	7	68
Northern pin oak (C,U)	60	2	White pine (C,U)	4	41
Wild geranium (Geranium maculatum)	71	3	Paper birch (U)	7	51
Common enchanter's nightshade (Circaea lutetiana)	60	3	Round-lobed hepatica (Anemone americana)	7	39
Pointed-leaved tick trefoil (Desmodium glutinosum)	80	7	Lowbush blueberry (Vaccinium angustifolium)	13	61

### • MHc36 Central Mesic Hardwood Forest (Eastern)

MHc36 can be similar to FDs37 when FDs37 is dominated by northern red oak (FDs37a). FDs37, however, generally lacks sugar maple, which is prominent in MHc36.

EDo27 Indicator Spacios	(fre	q%)	MHo26 Indicator Spacing	(free	q%)
rDs37 indicator species	FDs37	MHc36	MILC30 Indicator Species	FDs37	MHc36
Northern pin oak (C,U)	50	2	Leatherwood (Dirca palustris)	-	38
Prickly or Smooth wild rose*	27	2	Zigzag goldenrod (Solidago flexicaulis)	4	79
Nannyberry (Viburnum lentago)	46	4	Long-stalked sedge (Carex pedunculata)	4	53
Black cherry (C)	38	4	Large-flowered trillium (Trillium grandiflorum)	4	52
Gray dogwood (Cornus racemosa)	62	7	Sugar maple (C,U)	8	91
Tall blackberries**	73	9	Basswood (C)	8	87
Wild grape (Vitis riparia)	69	10	Blue beech (U)	4	40
American hazelnut (Corylus americana)	85	12	Bloodroot (Sanguinaria canadensis)	8	58

\*Prickly or Smooth wild rose (Rosa acicularis or R. blanda) \*\*Tall blackberries (Rubus allegheniensis and similar Rubus spp.)

### • MHs37 Southern Dry-Mesic Oak Forest

MHs37 can be similar to FDs37 but is more likely to occur on loamy soils (at least in the upper soil layers) than on fine sand or sand-gravel soils. MHs37 occurs on sites less affected by fire in the recent past and therefore generally lacks the open-grown canopy trees often present in FDs37.

EDo27 Indicator Spacing	(fre	q%)	MHo27 Indiantor Spania	(free	<b>q%</b> )
russi inuicator species	FDs37	MHs37	winss/ indicator species	FDs37	MHs37
Mountain rice grass (Oryzopsis asperifolia)	42	-	Maidenhair fern (Adiantum pedatum)	-	56
Large-leaved aster (Aster macrophyllus)	51	2	Spreading Jacob's ladder (Polemonium reptans)	-	47
Bush honeysuckle (Diervilla lonicera)	36	2	Gregarious black snakeroot (Sanicula gregaria)	4	58
Red maple (C,U)	67	7	Bitternut hickory (C,U)	4	56
Pale bellwort (Uvularia sessilifolia)	62	7	Sugar maple (C,U)	4	51
Quaking aspen (C,U)	29	5	White snakeroot (Eupatorium rugosum)	7	65
Spreading dogbane (Apocynum androsaemifolium)	40	7	Hackberry (C,U)	9	60
Northern pin oak (C,U)	60	23	Honewort (Cryptotaenia canadensis)	13	72

### • FDs27 Southern Dry-Mesic Pine-Oak Woodland

The range of FDs27 occasionally overlaps with FDs37 in the area around the Twin Cities, where it occurs on deep sands that accumulate along valley walls of tributaries to the Mississippi River.

EDo27 Indiantar Spanian	(fre	q%)	EDo27 Indiantor Spanion	(fred	<b>1%</b> )
PDS37 Indicator species	FDs37	FDs27	FDSZ7 Indicator Species	FDs37	FDs27
Red maple (C,U)	67	-	Flowering spurge (Euphorbia corollata)	-	62
Pale bellwort (Uvularia sessilifolia)	62	-	Heart-leaved aster (Aster cordifolius)	-	46
Large-leaved aster (Aster macrophyllus)	51	-	Downy rattlesnake plantain (Goodyera pubescens)	-	38
Mountain rice grass (Oryzopsis asperifolia)	42	-	Bitternut hickory (C,U)	4	62
Beaked hazelnut (Corylus cornuta)	24	-	Eastern red cedar (C,U)	4	62
Starflower (Trientalis borealis)	22	-	White pine (C,U)	4	54
Downy arrowwood (Viburnum rafinesquianum)	49	8	White snakeroot (Eupatorium rugosum)	7	69
Nannyberry (Viburnum lentago)	42	8	Black raspberry (Rubus occidentalis)	9	54

### • FDc25 Central Dry Oak-Aspen (Pine) Woodland

The range of FDc25 overlaps with FDs37 in east-central Minnesota, where FDc25 occurs on level lake plains and on glacial river terraces. Species more commonly found in prairies are often present in FDc25 while generally absent from FDs37.



### FIRE-DEPENDENT FOREST/WOODLAND SYSTEM Southern Floristic Region

EDo27 Indicator Encoico	(fre	q%)	EDe2E Indianter Spanian	(fred	<b>1%</b> )
PDS37 Indicator Species	FDs37	FDc25	FDC25 Indicator Species	FDs37	FDc25
Box elder (U)	42	-	Wintergreen (Gaultheria procumbens)	-	47
Common enchanter's nightshade (Circaea lutetia	na) <b>60</b>	3	Wild bergamot (Monarda fistulosa)	-	37
Prickly ash (Zanthoxylum americanum)	67	7	Jack pine (C)	-	30
Lopseed (Phryma leptostachya)	62	7	Prairie willow (Salix humilis)	-	30
Black cherry (C)	29	3	Yarrow (Achillea millefolium)	2	43
Lady fern (Athyrium filix-femina)	53	7	Big-toothed aspen (U)	4	33
Missouri gooseberry (Ribes missouriense)	24	3	Lowbush blueberry (Vaccinium angustifolium)	13	93
Wild geranium (Geranium maculatum)	71	13	Veiny pea (Lathyrus venosus)	7	47

### Native Plant Community Types in Class • FDs37a Oak - (Red Maple) Woodland

Canopy is dominated by northern red oak, northern pin oak, and white oak with lesser amounts of bur oak and red maple. Red maple is also common in the subcanopy and shrub layers. Chokecherry, American hazelnut, gray dogwood, and prickly ash are common in the shrub layer. FDs37a is distinguished from FDs37b by the presence of northern red oak or white oak in the canopy or understory. Other species that can help to differentiate FDs37a from FDs37b include red maple, bush honeysuckle (*Diervilla lonicera*), lady fern (*Athyrium filix-femina*), interrupted fern (*Osmunda claytoniana*), and starflower (*Trientalis borealis*). FDs37a has been documented in the MIM and MDL; it is most common in the Anoka Sand Plain Subsection in the MIM. Description is based on summary of vegetation data from 26 plots.

### • FDs37b Pin Oak - Bur Oak Woodland

Canopy has abundant northern pin oak and bur oak. The subcanopy is not well differentiated from the canopy; bur oak, black cherry, and green ash are the most common subcanopy species. The shrub layer is often dense, with prickly ash, chokecherry, American hazelnut, gray dogwood, prickly gooseberry (Ribes cynosbati), and downy arrowwood (Viburnum rafinesquianum) all common. FDs37b is distinguished from FDs37a by the greater dominance of northern pin oak and bur oak in the canopy. Other species that help to differentiate FDs37b from FDs37a when present include green ash, wild honeysuckle (Lonicera dioica), snowberry or wolfberry (Symphoricarpos spp.), giant Solomon's seal (Polygonatum biflorum), Lindley's aster (Aster ciliolatus), and sideflowering aster (Aster lateriflorus). FDs37b has been documented in the MIM and CGP, where it is most common in the Hardwood Hills Subsection with occasional occurrences in the Anoka Sand Plain and Minnesota River Prairie Subsections. (Occurrences in the Minnesota River Prairie Subsection and other parts of southwestern Minnesota are included on the basis of field observations; few samples from FD communities are available for this part of the state.) Description is based on summary of vegetation data from 18 plots.



Boot Lake Scientific and Natural Area, Anoka County, MN

# FDs37 Southern Dry-Mesic Oak (Maple) Woodland – Species Frequency and Cover

<		-		-						-		_				-		-						-		-				-		-		-	
irginia creeper (Parthenocissus spp.)	Woody Vines	Bottlebrush grass (Elymus hystrix)	Nodding fescue (Festuca subverticillata)	Moutain rice grass (Oryzopsis asperifolia)	Pennsylvania sedge (Carex pensylvanica)	Grasses & Sedges	Tail-leaved aster (Aster sagittifolius)	Elliptic shinleaf (Pyrola elliptica)	Large-flowered bellwort (Uvularia grandiflora)	Interrupted fern (Osmunda claytoniana)	Starflower (Trientalis borealis)	Starry false Solomon's seal (Smilacina stellata)	Giant Solomon's seal (Polygonatum biflorum)	Early meadow-rue (Thalictrum dioicum)	Maryland black snakeroot (Sanicula marilandica)	Spreading dogbane (Apocynum androsaemifolium)	Wood anemone (Anemone quinquefolia)	Northern bedstraw (Galium boreale)	Columbine (Aquilegia canadensis)	Large-leaved aster (Aster macrophyllus)	Sweet-scented bedstraw (Galium triflorum)	Bracken (Pteridium aquilinum)	Lady fern (Athyrium filix-femina)	Pale bellwort (Uvularia sessilifolia)	Common false Solomon's seal (Smilacina racemosa)	Lopseed (Phryma leptostachya)	Wild sarsaparilla (Aralia nudicaulis)	Common enchanter's nightshade (Circaea lutetiana)	Wild geranium (Geranium maculatum)	Canada mayflower (Maianthemum canadense)	Hog peanut (Amphicarpaea bracteata)	Pointed-leaved tick trefoil (Desmodium glutinosum)	Clayton's sweet cicely (Osmorhiza claytonii)	Forbs, Ferns & Fern Allies	· · ·
91		11	11	40	84		18	20	20	20	20	22	27	31	36	38	40	40	40	49	51	51	51	60	60	60	60	60	69	73	76	78	78		freq%
•		•	•	•	:		•	•	:	:	•	•	•	•	•	•	•	•	•	:	•	:	•	:	•	•	•	•	:	•	:	:	:		cover
Ironwood	American elm	Green ash	Big-toothed aspe	Paper birch	Red maple	Quaking aspen	Black cherry	White oak	Northern red oal	Northern pin oal	Bur oak		Trees		Round-leave	Red-berried e	Snowberry o	Beaked haze	Missouri goos	Bush honeys	Nannyberry (	Juneberries (/	Downy arrowv	Prickly gooseb	Poison ivy (To	Prickly ash (Z	Gray dogwoo	American haz	Chokecherry	Tall Shrubs	Tall blackberi	Red raspberry	Low Shrubs	Wild grape (Vit	
			'n						Ŷ	Ŷ					d dogwood (	elder (Samb	r Wolfberry (	Inut (Corylu	seberry (Rib	uckle (Dierv	Viburnum le	Amelanchie	vood (Vibui	erry (Ribe	xicodendro	anthoxylum	d (Cornus n	elnut (Cory	(Prunus virg		ies (Rubus	(Rubus id		is riparia)	
		•	3n 11 ●	20	27	27	29	29 •	33 ••	60 ••	67 •	freq% co	Canopy		d dogwood (Cornus rugosa	Ider (Sambucus racemos:	r Wolfberry (Symphoricarpu	Inut (Corylus cornuta)	seberry (Ribes missouriens	uckle (Diervilla lonicera)	Viburnum lentago)	Amelanchier spp.)	vood (Viburnum rafinesqu	erry (Ribes cynosbati)	xicodendron rydbergii)	anthoxylum americanum)	d (Cornus racemosa)	elnut (Corylus americana)	(Prunus virginiana)		ies (Rubus allegheniensis	(Rubus idaeus)		is riparia)	
- 29 •••	31 •	9 ••• 31 ••	yn 11 ●●●	20 ••	27 •• 56 •••	27 •• 18 ••	29 • 58 •	29 ••• 9 ••	 33 •••• 13 •••	60 •••• 33 •••	67 ••• 58 ••	freq% cover freq% cover	Canopy Subcanopy		d dogwood (Cornus rugosa)	Ider (Sambucus racemosa)	r Wolfberry (Symphoricarpos albus or S. occidentalis)	Inut (Corylus cornuta)	seberry (Ribes missouriense)	uckle (Diervilla lonicera)	Viburnum lentago)	Amelanchier spp.)	vood (Viburnum rafinesquianum)	erry (Ribes cynosbati)	xicodendron rydbergii)	anthoxylum americanum)	d (Cornus racemosa)	elnut (Corylus americana)	(Prunus virginiana)		ies (Rubus allegheniensis and similar Rubus spp.)	(Rubus idaeus)		is riparia)	
29 ••• 18	31 •• 33	9 ••• 31 •• 36	yn 11 •••	20 ••	27 •• 56 ••• 53	27 •• 18 •• 18	29 • 58 • 69	29 ••• 9 •• 18	 33 •••• 13 ••• 22	<ul><li>60 •••• 33 ••• 38</li></ul>	67 ••• 58 •• 33	freq% cover freq% cover freq%	Canopy Subcanopy Shrub		d dogwood (Cornus rugosa) 16	Ider (Sambucus racemosa) 20	r Wolfberry (Symphoricarpos albus or S. occidentalis) 20	Inut (Corylus cornuta) 22	seberry (Ribes missouriense) 24	uckle (Diervilla lonicera) 33	Viburnum lentago) 42	Amelanchier spp.) 47	vood (Viburnum rafinesquianum) 49	erry (Ribes cynosbati) 49	xicodendron rydbergii) 64	anthoxylum americanum) 67	d (Cornus racemosa) 67	elnut (Corylus americana) 80	(Prunus virginiana) 82		ies (Rubus allegheniensis and similar Rubus spp.) 47	(Rubus idaeus) 64		is riparia) 62	- freq%





### Southern Terrace Forest

Wet-mesic deciduous forests on silty or sandy alluvium on level, occasionally flooded sites along small streams to large rivers in the southern half of Minnesota.

### **Vegetation Structure & Composition**

Description is based on summary of vegetation data from 43 plots (relevés).

• Ground-layer cover is mostly interrupted to continuous (50-100%); often with abundant wood nettle (Laportea canadensis). Other typical species include Virginia waterleaf (Hydrophyllum virginianum), spotted touchme-not (Impatiens capensis), tall coneflower (Rudbeckia laciniata), stinging nettle (Urtica dioica), cleavers (Galium aparine), common blue violet (Viola sororia), honewort (Cryptotaenia canadensis), aniseroot (Osmorhiza longistylis), Virginia bluebells (Mertensia virginica), and eastern narrowleaf sedge (Carex grisea). Reed canary grass (Phalaris arundinacea) 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 (*Parthenocissus* spp.) and wild grape (*Vitis riparia*) are typical.

• Shrub layer and subcanopy are sparse to patchy (5–50% cover); typical species include American elm, hackberry, box elder, Missouri gooseberry (*Ribes missouriensis*), prickly ash (*Zanthoxylum americanum*), and chokecherry (*Prunus virginiana*).

• **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 common. Swamp white oak is important in some stands in southeastern Minnesota.

### Landscape Setting & Soils

• Stream terraces—Common. Topography is flat to undulating. Parent material is complexly stratified silty or fine sandy alluvium. The parent material may have been calcareous originally, but soils now lack free carbonates. Biogenic carbonates such as snail shells are occasionally preserved. Often, old soil surfaces rich in organic matter are present beneath newer alluvium deposited during floods. Gray soil colors occur within 30–60in (75–150cm) of the surface and indicate permanently saturated conditions below. Flooding occurs only in wet years or following major rains. Soil drainage is dependent on the height of the terrace above river level and ranges from moderately well drained on higher terraces to poorly drained on lower terraces. Soil-moisture regime is moist to very moist. (PPL; MIM except for northern Hardwood Hills; locally in CGP.)

### **Natural History**

In the past, catastrophic disturbances were rare in FFs59. There are no references to fire in the Public Land Survey records, and the rotation of catastrophic windthrow was about 310 years. Events that result in partial loss of trees, especially flood damage (and possibly light surface fires), were much more common, with an estimated rotation of just 40 years. Based on the historic composition and age structure of these forests, FFs59 had three growth stages.

• **0–35 years**—Young forests recovering from severe flooding or wind, often dominated by elm (most often American elm, but red elm was present as well). Basswood, willows (*Salix amygdaloides* and *S. nigra*), and green ash are also present.



• **35–155 years**—Mature forests dominated by elm and ash, including American elm, red elm, green ash, and black ash. Basswood, bur oak, silver maple, hackberry, black walnut, and butternut are minor components. Willows are essentially absent.

• > 155 years—Old forests similar in composition to mature forests except walnuts, silver maple, and bur oak are more abundant, and basswood is mostly absent.

(Although not present in historic records, swamp white oak occurs in some stands along the lower Mississippi River. Many of these trees are quite old, and it is likely that references to bur oak along the lower Mississippi River included the quite similar swamp white oak.)

### Similar Native Plant Community Classes • FFs68 Southern Floodplain Forest

FFs68 occurs along many of the same rivers as FFs59, and the two communities can grade into one another. FFs68 generally is present on sites that are inundated every spring (and sometimes following heavy rain) for several days to several weeks and have regular deposition of silt and sand, while FFn57 is present on sites—such as terraces and levees—that flood only occasionally and usually for just a few days at most. Recently deposited sediment, windrowed debris, and ice scars on trees are all useful evidence for distinguishing active floodplain sites from sites where terrace forests occur. The canopy of FFs68 is strongly dominated by silver maple, while FFs59 is more likely to have basswood, bur oak, swamp white oak, hackberry, black ash, or black walnut, with silver maple sometimes present but rarely dominant.

EEoEO Indiantar Spanian	(fre	q%)	EEo69 Indicator Spacing	(fred	<b>q%</b> )
rrss9 mulcator species	FFs59	FFs68	rrsoo mulcator species	FFs59	FFs68
Missouri gooseberry (Ribes missouriense)	53	-	Bur marigold and Beggarticks (Bidens spp.)	5	44
Aniseroot (Osmorhiza longistylis)	37	-	Hop umbrella sedge (Carex lupulina)	2	22
Chokecherry (Prunus virginiana)	33	-	Mad dog skullcap (Scutellaria lateriflora)	7	56
Virginia waterleaf (Hydrophyllum virginianum)	70	4	Wild cucumber (Echinocystis lobata)	2	19
Cleavers (Galium aparine)	51	4	Northern bugleweed (Lycopus uniflorus)	2	19
White avens (Geum canadense)	40	4	Rice cut grass (Leersia oryzoides)	7	30
Blue phlox (Phlox divaricata)	37	4	False nettle (Boehmeria cylindrica)	7	26
Basswood (C,U)	37	4	Narrow-leaved hedge nettle (Stachys tenuifolia)	9	33

### • FFn57 Northern Terrace Forest

FFn57 also occurs on terraces, levees, and other occasionally flooded sites along medium and large rivers, and is similar to FFs59 but is restricted to the northern half of the state. The ranges of the two communities overlap in east-central and west-central Minnesota.

EESED Indicator Spanica	(tre	q%)	EEnEZ Indicator Spacios	(fred	<b>1%</b> )
rrss9 indicator species	FFs59	FFn57	FFIIST Indicator Species	FFs59	FFn57
Cleavers (Galium aparine)	51	-	Canada mayflower (Maianthemum canadense)	-	50
Blue phlox (Phlox divaricata)	37	-	Graceful sedge (Carex gracillima)	-	48
Missouri gooseberry (Ribes missouriense)	53	2	Spotted water hemlock (Cicuta maculata)	-	40
Aniseroot (Osmorhiza longistylis)	37	2	Bladder sedge (Carex intumescens)	2	48
Virginia knotweed (Polygonum virginianum)	35	2	Pale bellwort (Uvularia sessilifolia)	2	42
Cottonwood (C)	30	2	Tall meadow-rue (Thalictrum dasycarpum)	5	67
Hackberry (C,U)	65	8	Sensitive fern (Onoclea sensibilis)	9	63
Greenbrier (Smilax tamnoides)	47	8	Ostrich fern (Matteuccia struthiopteris)	16	79

### • MHs49 Southern Wet-Mesic Hardwood Forest

MHs49 also occurs on silty alluvium on stream terraces but is more often restricted to narrow valleys along small streams in rugged, bedrock-controlled terrain. Both communities often have abundant spring ephemeral species such as false rue anemone *(Enemion biternatum).* 

EEsEQ Indiastor Species	(fre	q%)	MHo40 Indiantor Spanion	(free	<b>1%</b> )
FFS59 Indicator Species	FFs59	MHs49	MIRS49 Indicator Species	FFs59	MHs49
White grass (Leersia virginica)	23	-	Zigzag goldenrod (Solidago flexicaulis)	-	46
Swamp white oak (C,U)	19	-	Large-flowered bellwort (Uvularia grandiflora)	-	36
Ontario aster (Aster ontarionis)	26	3	Ironwood (C,U)	2	56
Silver maple (C,U)	51	5	Blue cohosh (Caulophyllum thalictroides)	7	64
Virginia wild rye (Elymus virginicus)	44	5	Dutchman's breeches (Dicentra cucullaria)	7	46
Virginia knotweed (Polygonum virginianum)	35	5	White trout lily (Erythronium albidum)	7	44
Poison ivy (Toxicodendron rydbergii)	23	5	Sugar maple (C,U)	14	69
Cottonwood (C)	30	8	Wild leek (Allium tricoccum)	12	56



### WFs57 Southern Wet Ash Swamp

WFs57 and FFs59 share much of their range, and both commonly occur on stream terraces, where they can grade into one another. Evidence of groundwater seepage, such as rivulets and saturated raised peat mounds, is almost always present in WFs57 and absent from FFs59. The canopy of WFs57 is usually dominated by black ash and generally lacks other species common in FFs59 such as hackberry, silver maple, box elder, swamp white oak, or cottonwood.

EEsEQ Indicator Spacios	(fre	q%)	WESEZ Indicator Spacios	(fre	q%)
rrsss indicator species	FFs59	WFs57	WFS57 Indicator Species	FFs59	WFs57
Cottonwood (C)	31	-	Fowl manna grass (Glyceria striata)	-	68
Silver maple (C,U)	49	3	Awl-fruited sedge (Carex stipata)	-	52
Greenbrier (Smilax tamnoides)	34	3	Sensitive fern (Onoclea sensibilis)	-	48
Ontario aster (Aster ontarionis)	29	3	Michigan lily (Lilium michiganense)	-	39
Aniseroot (Osmorhiza longistylis)	46	6	Dwarf raspberry (Rubus pubescens)	-	39
Box elder (C)	66	10	Skunk cabbage (Symplocarpus foetidus)	-	35
Hackberry (C,U)	60	10	Common marsh marigold (Caltha palustris)	3	68
Woodmint (Blephilia hirsuta)	20	3	Lady fern (Athyrium filix-femina)	6	58

### Native Plant Community Types in Class

### • FFs59a Silver Maple - Green Ash - Cottonwood Terrace Forest

Present on terraces of medium to large rivers. 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 wahoo (*Euonymus atropurpureus*), red-berried elder (*Sambucus racemosa*), hawthorns (*Crataegus* spp.), and prickly gooseberry (*Ribes cynosbati*). Important ground-layer species include Ontario aster (*Aster ontarionis*), jack-in-the-pulpit (*Arisaema triphyllum*), Maryland black snakeroot (*Sanicula marilandica*), Clayton's sweet cicely (*Osmorhiza claytonii*), early meadow-rue (*Thalictrum dioicum*), and virgin's bower (*Clematis virginiana*). Documented in the Blufflands Subsection in the PPL and in the Anoka Sand Plain and Oak Savanna Subsections in the MIM. Description is based on summary of vegetation data from 13 plots.

### • FFs59b Swamp White Oak Terrace Forest

Present on terraces of the lower Mississippi River. Swamp white oak is diagnostic for this type, occurring in the canopy of all known examples and often in the understory as well. Other common canopy and understory trees are green ash, hackberry, silver maple, bitternut hickory, American elm, and basswood, with occasional cottonwood and river birch. Important shrubs include prickly ash, wild black currant (*Ribes americanum*), and gray dogwood (*Cornus racemosa*). Climbing poison ivy (*Toxicodendron radicans var. negundo*), greenbrier (*Smilax hispida*), wild grape (*Vitis riparia*), and Canada moonseed (*Menispermum canadense*) are important vining species. Important ground-layer species include Virginia knotweed, moneywort (*Lysimachia nummularia*), green dragon (*Arisaema dracontium*), sensitive fern (*Onoclea sensibilis*), rough bedstraw (*Galium asprellum*), obedient plant (*Physostegia virginiana*), false nettle (*Boehmeria cylindrica*), Virginia wild rye (*Elymus virginicus*), nodding fescue (*Festuca subverticillata*), Gray's sedge (*Carex grayi*), and muskingum sedge (*C. muskingumensis*). Restricted to the Blufflands Subsection in the PPL. Description is based on summary of vegetation data from 8 plots.

### • FFs59c Elm - Ash - Basswood Terrace Forest

Present on terraces of small to large rivers. The most common canopy trees are American elm, box elder, basswood, black ash, and red elm, with occasional cottonwood, hackberry, silver maple, black maple, black walnut, and rock elm. Most of these are likewise important in the understory. Important shrubs include Missouri gooseberry and chokecherry. Important ground-layer species include Virginia waterleaf, cleavers, stinging nettle, aniseroot, blue phlox (*Phlox divaricata*), false rue anemone (*Enemion biternatum*), stemless blue violets, hispid buttercup (*Ranunculus hispidus*), Virginia bluebells, cow parsnip (*Heracleum lanatum*), mayapple (*Podophyllum peltatum*), and yellow trout lily (*Erythronium americanum*). Documented in the PPL, the Anoka Sand Plain Subsection in the MIM, and locally in the CGP. Description is based on summary of vegetation data from 22 plots.



Somerset Wildlife Management Area, Steele County, MN

	freq%	cover				freq% c	over
Forbs, Ferns & Fern Allies			Ambiguous sedge (Carex amphi	bola)		30	•
Wood nettle (Laportea canadensis)	98	:	Bland sedge (Carex blanda)			30	•
Touch-me-not (Impatiens spp.)	77	•	Nodding fescue (Festuca subver	rticillata)		28	٠
Virginia waterleaf (Hydrophyllum virginianum)	70	:	White grass (Leersia virginica)			23	•
Tall coneflower (Rudbeckia laciniata)	67	•	Starry sedge (Carex rosea)			14	٠
Stinging nettle (Urtica dioica)	58	•	Gray's sedge (Carex grayi)			12	•
Cleavers (Galium aparine)	51	:	Woody Vines				
Honewort (Cryptotaenia canadensis)	49	:	Virginia creeper (Parthenocissus	s spp.)		53	•
White avens (Geum canadense)	40	•	Wild grape (Vitis riparia)			53	•
Aniseroot (Osmorhiza longistylis)	37	:	Greenbrier (Smilax tamnoides)			47	٠
Blue phlox (Phlox divaricata)	37	•	Canada moonseed (Menispermu	um canadense)		33	•
Virginia knotweed (Polygonum virginianum)	35	:	Shrubs				
Stemless blue violets*	35	•	Missouri gooseberry (Ribes miss	souriense)		53	٠
Erect, Smooth, or Illinois carrion-flower**	35	•	Prickly ash (Zanthoxylum americ	anum)		33	•
Jack-in-the-pulpit (Arisaema triphyllum)	33	•	Common elder (Sambucus cana	idensis)		33	٠
Rugulose or Yellow violet (Viola canadensis or V. pubescens)	30	٠	Chokecherry (Prunus virginiana)			33	:
False rue anemone (Enemion biternatum)	30	:	Poison ivy (Toxicodendron rydbe	ergii)		23	:
Clearweed (Pilea spp.)	28	:	Nannyberry (Viburnum lentago)			16	•
Hispid buttercup (Ranunculus hispidus)	28	•	Prickly gooseberry (Ribes cynos	bati)		16	•
Common enchanter's nightshade (Circaea lutetiana)	26	•	Hawthorn (Crataegus spp.)			14	•
Ontario aster (Aster ontarionis)	26	•	Turner				
Gregarious black snakeroot (Sanicula gregaria)	23	•	l rees	anopy	Subcanopy	Shrub L	ayer
Maryland black snakeroot (Sanicula marilandica)	23	•	freq	% cover fr	eq% cover	freq%	sover
Cow parsnip (Heracleum lanatum)	23	:	American elm 65	:	67 •••	44	•
Sweet-scented bedstraw (Galium triflorum)	21	•	Box elder 56	:	53	26	•
Clayton's sweet cicely (Osmorhiza claytonii)	19	:	Silver maple 51	:	21	6	•
Hog peanut (Amphicarpaea bracteata)	19	•	Green ash 44	:	40	30	•
Woodmint (Blephilia hirsuta)	16	•	Hackberry 40	:	58	33	•
Early meadow-rue (Thalictrum dioicum)	16	•	Basswood 37	:	26	12	•
Starry false Solomon's seal (Smilacina stellata)	16	•	Cottonwood 30	:	•	·	•
Virginia bluebells (Mertensia virginica)	16	:	Black ash 28	:	19	19	•
Ostrich fern (Matteuccia struthiopteris)	16	:	Red elm 26	:	12		١
Wild geranium (Geranium maculatum)	16	•	Swamp white oak 19	•	• 0	16	•
Grasses & Sedges			Bitternut hickory 14	:	•	14	•
Virginia wild rye (Elymus virginicus)	44	•	Black walnut 14	•••	•	ı	I
Ctomloss blue violete Alice acceria and similar Mala son ) **Erect Se		io oi o oi l	rrion flower (Smiley poirrate C ho	change or S illing	( operation		

### FFs59 Southern Terrace Forest - Species Frequency & Cover

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### Southern Floodplain Forest

Deciduous riparian forests on sandy or silty alluvium on low, level, annually flooded sites along medium and large rivers in the southern half of Minnesota. Community is characterized by evidence of recent flooding such as rows and piles of debris, ice scars on trees, high-water channels, and freshly deposited silt and sand.

### Vegetation Structure & Composition

Description is based on summary of vegetation data from 27 plots (relevés).

• 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 (Boehmeria cylindrica), clearweeds (Pilea spp.), Ontario aster (Aster ontarionis), Virginia wild rye (Elymus virginicus), cut grasses (Leersia virginica and L. oryzoides), hop umbrella sedge (Carex lupulina), and cattail sedge (C. typhina). Wood nettle (Laportea canadensis) often forms dense patches. Species typical of wetland communities are also often present, including mad dog skullcap (Scutellaria



*lateriflora*), southern blue flag (*Iris virginicus*), and beggarticks (*Bidens* spp.). The invasive species kidney-leaved buttercup (*Ranunculus abortivus*), creeping charlie, moneywort (*Lysimachia nummularia*), motherwort (*Leonurus cardiaca*), yellow wood sorrels (*Oxalis stricta* and *O. dillenii*), garlic mustard (*Alliaria petiolata*), and reed canary grass (*Phalaris arundinacea*) are present in many stands and sometimes abundant.

• **Climbing plants** and **vines** are important in this community; characteristic are climbing poison ivy (*Toxicodendron radicans var. negundo*), wild grape (*Vitis riparia*), and moonseed (*Menispermum canadense*).

• 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.

### Landscape Setting & Soils

• Floodplains—Common. Often the dominant vegetation on active floodplains of medium to large rivers in the deeply cut bedrock valleys of the Minnesota, lower St. Croix, and lower Mississippi rivers and their larger tributaries. Parent material is deep, complexly stratified sandy alluvium with a silty cap. The parent material may or may not have been calcareous originally, although free carbonates are rarely present now. Biogenic carbonates such as snail shells are occasionally present. Gray soil colors occur within 40in (100cm) of the surface and indicate permanently saturated conditions below. Annual flooding is typical. Soils are somewhat poorly or poorly drained. Soilmoisture regime is very moist. (PPL; Anoka Sand Plain, St. Paul Baldwin Plains, and Big Woods in MIM; Minnesota River Prairie in CGP)

### Natural History

• **0–35 years**—Young forests recovering from severe flooding or wind and dominated by American elm mixed with red elm, green ash, and willows (*Salix amygdaloides* and



S. nigra). Cottonwood and silver maple are minor components during this stage.

• 35–155 years—Mature forests consisting of mixtures of American elm, green ash, and silver maple. Willow is eliminated during this stage.

 > 155 years—Old forests dominated by American elm, mixed with silver maple and green ash. (True floodplain trees such as silver maple and cottonwood appear to be underrepresented in all growth stages in the historic records for this community. This could be due to difficulty in separating historic tree records for Southern Floodplain Forests from those for Southern Terrace Forests, which are less likely to have abundant silver maple or cottonwood and more likely to have abundant American elm. American elm probably was somewhat more important in true floodplain forests in the past but has largely been eliminated by Dutch elm disease. The composition of floodplain forests has also been affected by changes in river hydrolgy caused by dam construction along southern Minnesota's major rivers.)

### Similar Native Plant Community Classes • FFs59 Southern Terrace Forest

FFs59 occurs along many of the same rivers as FFs68, and the two communities grade into one another. FFs59 is generally present on elevated riparian sites-such as terraces and levees-that flood only occasionally and usually for just a few days at most, while FFs68 is present on sites that are flooded every spring (and sometimes following heavy rain) for several days to several weeks and have regular deposition of silt and sand. Recently deposited sediment, windrowed debris, and ice scars on trees are all useful evidence for distinguishing active floodplain sites from sites where terrace forests occur. FFs59 is more likely to have basswood, bur oak, swamp white oak, hackberry, black ash, or black walnut in the canopy, with silver maple sometimes present but rarely dominant. FFs68 tends to be strongly dominated by silver maple.

### FFn67 Northern Floodplain Forest

(fre	q%)	EEsEQ Indicator Spacing	(free	q%)
FFs68	FFs59	rrss9 indicator species	FFs68	FFs59
44	5	Missouri gooseberry (Ribes missouriense)	-	53
22	2	Aniseroot (Osmorhiza longistylis)	-	37
56	7	False rue anemone (Enemion biternatum)	-	30
19	2	Virginia waterleaf (Hydrophyllum virginianum)	4	70
19	2	Cleavers (Galium aparine)	4	51
30	7	White avens (Geum canadense)	4	40
26	7	Blue phlox (Phlox divaricata)	4	37
33	9	Basswood (C,U)	4	37
	(fre <b>FFs68</b> 44 22 56 19 19 30 26 33	(freq%) FFs68 FFs59 44 5 22 2 56 7 19 2 19 2 30 7 26 7 33 9	(freq%)         FFs59         FFs59           44         5         Missouri gooseberry (Ribes missouriense)           22         2         Aniseroot (Osmorhiza longistylis)           56         7         False rue anemone (Enemion biternatum)           19         2         Virginia waterleat (Hydrophyllum virginianum)           19         2         Cleavers (Galium aparine)           30         7         White avens (Geum canadense)           26         7         Blue phlox (Phlox divaricata)           33         9         Basswood (C,U)	(freq%)         FFs59         Indicator Species         (freq           44         5         Missouri gooseberry (Ribes missouriense)         -           22         2         Aniseroot (Osmorhiza longistylis)         -           56         7         False rue anemone (Enemion biternatum)         -           19         2         Virginia waterleaf (Hydrophyllum virginianum)         4           30         7         White avens (Galium aparine)         4           30         7         Blue phlox (Phlox divaricata)         4           33         9         Basswood (C,U)         4

FFn67 also occurs on annually flooded sites along medium to large rivers and is strongly dominated by silver maple but is restricted to northern Minnesota. The ranges of the two classes overlap in east-central and west-central Minnesota.

FFaCO Indicator Chaption	(fre	q%)	FFm67 Indiantes Spania	(free	<b>1%</b> )
FFS68 Indicator Species	FFs68	FFn67	FFN67 Indicator Species	FFs68	FFn67
Hackberry (C,U)	41	-	Small or Three-cleft bedstraw*	-	53
Greenbrier (Smilax tamnoides)	33	-	Retrorse sedge (Carex retrorsa)	-	53
Cottonwood (C)	30	-	Tuckerman's sedge (Carex tuckermanii)	-	47
Rice cut grass (Leersia oryzoides)	30	-	Yellow loosestrife (Lysimachia terrestris)	-	32
Honewort (Cryptotaenia canadensis)	26	-	Northern blue flag (Iris versicolor)	4	42
Canada moonseed (Menispermum canadense)	56	5	Sensitive fern (Onoclea sensibilis)	7	58
Tall coneflower (Rudbeckia laciniata)	41	5	Black ash (C,U)	7	53
Poison ivy (Toxicodendron rydbergii)	33	5	Fringed loosestrife (Lysimachia ciliata)	7	47
*Small or Three-cleft bedstraw (Galium tinctorium)	or G. trifi	dum)			

### Native Plant Community Types in Class • FFs68a Silver Maple - (Virginia Creeper) Floodplain Forest

FFs68a is the only type recognized in this class at present. Additional data collection, particularly focused on geographical differences or on wetter sites, may result in recognition of distinct types or subtypes.



Sherburne County, MN

Cottoil condace (Correctione)
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FFs68 Southern Floodplain Forest – Species Frequency & Cover

FFs68

FLOODPLAIN FOREST/SYSTEM Southern Floristic <u>Region</u>

### MHs37

### Southern Dry-Mesic Oak Forest

Dry-mesic hardwood forests occurring most often on thin, wind-deposited silt on crests and upper slopes of bedrock bluffs and less often on hummocky stagnation moraines in calcareous, partially sorted drift.

### **Vegetation Structure & Composition**

Description is based on summary of vegetation data from 43 plots (relevés).

• **Ground-layer** cover varies from patchy to continuous (25–100%); important species include lady fern (*Athyrium filix-femina*), pointed-leaved tick trefoil (*Desmodium glutinosum*), Clayton's sweet cicely (*Osmorhiza claytonii*), common enchanter's nightshade (*Circaea lutetiana*), wild geranium (*Geranium maculatum*), hog peanut (*Amphicarpaea bracteata*), and white snakeroot (*Eupatorium rugosum*).

• **Shrub-layer** cover is patchy to interrupted (25–75%); common species include northern red oak and black cherry saplings, choke-cherry (*Prunus virginiana*), American hazel-nut (*Corylus americana*), Missouri gooseberry (*Ribes missouriense*), and pagoda dogwood (*Cornus alternifolia*).



• **Subcanopy** cover is patchy to interrupted (25–75%); important species include basswood, black cherry, northern red oak, white oak, and shagbark hickory.

• **Canopy** cover is interrupted to continuous (50–100%); the most common species are northern red oak, white oak, and basswood. Shagbark hickory is occasionally present in the PPL.

### Landscape Setting & Soils

• Loess-covered bedrock hills—Common. Present mainly on crests and upper slopes of bedrock bluffs. Most common on north-facing aspects on steeper slopes but also present on west- or east-facing crests and middle to upper slopes. Parent material is a mantle of wind-deposited silt deeper than 30in (75cm) over older soils, with texture that reflects the composition of the underlying sedimentary bedrock. Depths to bedrock generally exceed 60in (150cm). The silt is typically stoneless, but the soil becomes very stony just above the bedrock. Soils have dark surface horizons, indicating former occupation of these sites by oak or aspen woodland. Soils are well drained, and the soil moisture regime is fresh. (Blufflands in PPL)

• Stagnation moraines & till plains—Rare. Present on hummocky stagnation moraines and rolling parts of till plains. Parent material is calcareous, partially sorted drift. The surface is generally loamy but soils become sandy and gravelly at depth. Soil surface horizons are dark, indicating former occupation of these sites by oak woodland or prairie. Soils are well drained, and the soil moisture regime is fresh. (Big Woods, St. Paul-Baldwin Plains and Moraines, and Oak Savanna in MIM; Rochester Plateau in PPL)

### **Natural History**

In the past, catastrophic disturbances were rare in MHs37. An analysis of Public Land Survey records indicates that the rotation of catastrophic fires was in excess of 1,000 years, and the rotation of catastrophic windthrow was about 390 years. Events that resulted in partial loss of trees, especially light surface fires, were much more common, with an estimated rotation of about 20 years. Based on the historic composition and age structure of these forests, MHs37 had two growth stages separated by a long period of transition.





• **55–95 years**—A transition period marked by a gradual decline in northern red oak and increases in basswood, white oak, American elm, and ironwood.

• > 95 years—Mature forests consisting of mixed stands of white oak, basswood, northern red oak, and American elm.

### Similar Native Plant Community Classes

MHs38 Southern Mesic Oak-Basswood Forest

MHs37 and MHs38 share many species and can be very similar. The ranges of the two classes overlap in east-central and southeastern Minnesota; MHs38 usually occurs on more mesic sites and is more likely to have abundant sugar maple in the canopy.

MHe27 Indicator Spacios	(fre	q%)	MHc29 Indicator Species	(free	q%)
minsor mulcator species	MHs37	MHs38	winsso indicator species	MHs37	MHs38
Shagbark hickory (C,U)	33	1	Bladdernut (Staphylea trifolia)	-	16
Clearweed (Pilea spp.)	28	3	Wild leek (Allium tricoccum)	2	27
Spinulose shield fern or Glandular wood fern*	26	3	Long-stalked sedge (Carex pedunculata)	2	27
Tall blackberries**	28	4	Blue beech (U)	2	23
Black raspberry (Rubus occidentalis)	30	5	Canada moonseed (Menispermum canadense)	2	21
Bracken (Pteridium aquilinum)	40	9	Nodding trillium (Trillium cernuum)	2	19
Woodland sunflower (Helianthus strumosus)	26	6	Sharp-lobed hepatica (Anemone acutiloba)	7	38
White snakeroot (Eupatorium rugosum)	65	19	Wild ginger (Asarum canadense)	14	43

\* Spinulose shield fern or Glandular wood fern (Dryopteris carthusiana or D. intermedia) \*\* Tall blackberries (Rubus allegheniensis and similar Rubus spp.)

### • FDs38 Southern Dry-Mesic Oak-Hickory Woodland

The range of FDs38 overlaps with MHs37 in the far southeastern part of Minnesota. FDs38 occurs on steep fire-prone slopes and is much more likely than MHs37 to contain species commonly found in prairies.

MHs27 Indicator Spacios	(fre	q%)	EDc29 Indicator Spacios	(frec	1%)
winssi mulcator species	MHs37	FDs38	PDS36 Indicator Species	MHs37	FDs38
Spreading Jacob's ladder (Polemonium reptans)	47	-	Eastern red cedar (U)	-	29
Bloodroot (Sanguinaria canadensis)	40	-	Canadian black snakeroot (Sanicula canadensis)	-	29
Early meadow-rue (Thalictrum dioicum)	35	-	Wild bergamot (Monarda fistulosa)	-	24
Round-leaved dogwood (Cornus rugosa)	30	-	Heart-leaved alexanders (Zizia aptera)	-	24
American spikenard (Aralia racemosa)	30	-	Northern pin oak (U)	7	53
Virginia waterleaf (Hydrophyllum virginianum)	30	-	Greenbrier (Smilax tamnoides)	9	59
Maidenhair fern (Adiantum pedatum)	56	6	Quaking aspen (C,U)	5	35
Blue cohosh (Caulophyllum thalictroides)	47	6	Elm-leaved goldenrod (Solidago ulmifolia)	14	53

### • MHc36 Central Mesic Hardwood Forest (Eastern)

MHc36 generally occurs north of MHs37, although the ranges of the two classes overlap in east-central Minnesota. MHc36 is more likely than MHs37 to occur on loamy rather than sandy or gravelly soils.

MHe27 Indicator Spacios	(fre	q%)	MHo26 Indicator Spacios	(fre	q%)
winssi indicator species	MHs37	MHc36	which species	MHs37	MHc36
Spreading Jacob's ladder (Polemonium reptans)	47	-	Mountain rice grass (Oryzopsis asperifolia)	-	60
Box elder (U)	79	1	Large-flowered trillium (Trillium grandiflorum)	-	52
White snakeroot (Eupatorium rugosum)	65	1	Leatherwood (Dirca palustris)	-	38
Missouri gooseberry (Ribes missouriense)	63	2	Large-leaved aster (Aster macrophyllus)	2	77
Hackberry (C,U)	60	2	Rose twistedstalk (Streptopus roseus)	2	56
Cleavers (Galium aparine)	40	5	Long-stalked sedge (Carex pedunculata)	2	56
Wild grape (Vitis riparia)	79	10	Blue beech (U)	2	40
White oak (C,U)	67	11	Pale bellwort (Uvularia sessilifolia)	7	54

### • FDs37 Southern Dry-Mesic Oak (Maple) Woodland

FDs37 can be similar to MHs37 but is more likely to occur on fine sand or sand-gravel soils than on loamy soils. FDs37 occurs on sites more affected by fire in the recent past and therefore is more likely than MHs37 to have open-grown trees in the canopy.

MUo27 Indicator Spacios	(fre	q%)	EDo27 Indicator Spacios	(free	<b>1%</b> )
winss/ indicator species	MHs37	FDs37	FDS37 Indicator Species	MHs37	FDs37
Maidenhair fern (Adiantum pedatum)	56	-	Mountain rice grass (Oryzopsis asperifolia)	-	42
Spreading Jacob's ladder (Polemonium reptans)	47	-	Large-leaved aster (Aster macrophyllus)	2	51
Gregarious black snakeroot (Sanicula gregaria)	58	4	Bush honeysuckle (Diervilla lonicera)	2	36
Bitternut hickory (C,U)	56	4	Red maple (C,U)	7	67
Sugar maple (C,U)	51	4	Pale bellwort (Uvularia sessilifolia)	7	62
White snakeroot (Eupatorium rugosum)	65	7	Quaking aspen (C,U)	5	29
Hackberry (C,U)	60	9	Spreading dogbane (Apocynum androsaemifolium)	7	40
Honewort (Cryptotaenia canadensis)	72	13	Northern pin oak (C,U)	23	60



### Native Plant Community Types in Class MHs37a Red Oak - White Oak Forest

Canopy is dominated by northern red oak, often with white oak and (in the PPL) shagbark hickory. Basswood and box elder are present in the subcanopy in most stands. Northern red oak, box elder, basswood, and black cherry are commonly present in the shrub layer with chokecherry, poison ivy (*Toxicodendron rydbergii*), prickly gooseberry (*Ribes cynosbati*), American hazelnut, and red raspberry (*Rubus idaeus*). MHs37a is distinguished from MHs37b by lower abundance of sugar maple. When present, round-leaved dogwood (*Cornus rugosa*), red-berried elder (*Sambucus racemosa*), American spikenard (*Aralia racemosa*), spinulose shield fern or glandular wood fern (*Dryopteris carthusiana* or *D. intermedia*), woodland sunflower (*Helianthus strumosus*), Canada mayflower (*Maianthemum canadense*), and wild lettuce (*Lactuca* spp.) also help to distinguish MHs37a from MHs37b. Documented in the PPL and MIM. Description is based on summary of vegetation data from 20 plots.

### • MHs37b Red Oak - White Oak - (Sugar Maple) Forest

Canopy is most often dominated by northern red oak or white oak. Some stands may have abundant northern pin oak, bur oak, or white pine. Ironwood is common in the understory, with occasional sugar maple, black cherry, basswood, and other tree species. Bitternut hickory and black cherry are frequently present in the shrub layer with American hazelnut, chokecherry, Missouri gooseberry, prickly ash (*Zanthoxylum americanum*), and pagoda dogwood. Species that can help to distinguish MHs37b from MHs37a include sugar maple or green ash in the canopy or subcanopy, along with prickly ash, black raspberry (*Rubus occidentalis*), stinging nettle (*Urtica dioica*), wood nettle (*Laportea canadensis*), rugulose or yellow violet (*Viola canadensis* or *V. pubescens*), touch-me-not (*Impatiens* spp.), and starry sedge (*Carex rosea*). Documented in the PPL and MIM. Description is based on summary of vegetation data from 23 plots.



Scott County, MN

	freq%	cover	1			freq% cove	er
orbs, Ferns & Fern Allies			Climbing Plants				
Lady fern (Athyrium filix-femina)	91	•	Virginia creeper (Partheno	cissus spp.)		<b>9</b> 8	•
Pointed-leaved tick trefoil (Desmodium glutinosum)	88	•	Wild grape (Vitis riparia)			62	٠
Clayton's sweet cicely (Osmorhiza claytonii)	86	•	Low Shrubs				
Common enchanter's nightshade (Circaea lutetiana)	81	•	Red raspberry (Rubus idae	ns)		42	٠
Wild geranium (Geranium maculatum)	79	٠	Black raspberry (Rubus occ	cidentalis)		30	٠
Honewort (Cryptotaenia canadensis)	72	•	Tall blackberries (Rubus all	egheniensis and	similar Rubus spp.)	28	•
White avens (Geum canadense)	72	٠	Shrubs				
Lopseed (Phryma leptostachya)	72	•	Chokecherry (Prunus virgin	iana)		• 62	•
Hog peanut (Amphicarpaea bracteata)	70	:	American hazelnut (Corylus	: americana)		72 •	•
White snakeroot (Eupatorium rugosum)	65	•	Missouri gooseberry (Ribes	missouriense)		•	•
Common false Solomon's seal (Smilacina racemosa)	65	٠	Poison ivy (Toxicodendron	rydbergii)		63	٠
Large-flowered bellwort (Uvularia grandiflora)	63	•	Pagoda dogwood (Cornus a	alternifolia)		• 58	•
Gregarious black snakeroot (Sanicula gregaria)	58	•	Prickly gooseberry (Ribes c	ynosbati)		51	
Maidenhair fern (Adiantum pedatum)	56	•	Gray dogwood (Cornus rac	emosa)		42	٠
Wild sarsaparilla (Aralia nudicaulis)	56	•	Round-leaved dogwood (Co	ornus rugosa)		• 30	•
Jack-in-the-pulpit (Arisaema triphyllum)	56	•	Nannyberry (Viburnum lenta	ago)		26	٠
Sweet-scented bedstraw (Galium triflorum)	53	•	-				
Rattlesnake fern (Botrychium virginianum)	51	•	Trees	Canopy	Subcanopy	Shrub Layer	~
Spreading Jacob's ladder (Polemonium reptans)	47	•		freq% cover	freq% cover	freq% cove	er
Blue cohosh (Caulophyllum thalictroides)	47	•	Northern red oak	91	35	72	٠
Erect, Smooth, or Illinois carrion-flower*	44	•	White oak	67	30	28	٠
Wood anemone (Anemone quinquefolia)	42	•	Basswood	51	74 ••	09	٠
Red baneberry (Actaea rubra)	42	•	American elm	40	51	40	٠
Bracken (Pteridium aquilinum)	40	•	Sugar maple	35	• •	28	٠
Cleavers (Galium aparine)	40	•	Black cherry	• 33	67 •	20	٠
Bloodroot (Sanguinaria canadensis)	40	•	Ironwood	<b>9</b> 30	56	35	٠
Early meadow-rue (Thalictrum dioicum)	35	•	Bur oak	30	12	12	٠
Maryland black snakeroot (Sanicula marilandica)	35	•	Red elm	30	51	51	•
Zigzag goldenrod (Solidago flexicaulis)	33	•	Shagbark hickory	- 28	30	28	٠
Clearweed (Pilea spp.)	28	•	Northern pin oak	23	•		
arasses & Sedges			Hackberry	53	47 •	37	•
Starry sedge (Carex rosea)	37	•	Paper birch	21	•		•
Pennsylvania sedge (Carex pensylvanica)	35	•	Bitternut hickory	•	37 •••	56	٠
Bland sedge (Carex blanda)	23	•	Box elder	14	56	67	٠

MHs37 Southern Dry-Mesic Oak Forest – Species Frequency & Cover

\* Erect, Smooth, or Illinois carrion-flower (Smilax ecirrata, S. herbacea, or S. illinoensis)

 $\langle \rangle$ 


# **MHs38**

### Southern Mesic Oak-Basswood Forest

Mesic hardwood or, occasionally, hardwood-conifer forests. Present on wind-deposited silt on bedrock bluffs, on calcareous till on rolling till plains, and, rarely, in association with natural fire breaks in prairie landscapes or on weakly calcareous till on stagnation moraines.

### **Vegetation Structure & Composition**

Description is based on summary of vegetation data from 128 plots (relevés).

• **Ground-layer** cover is patchy to interrupted (25–75%); important species include zigzag goldenrod (*Solidago flexicaulis*), large-flowered bellwort (*Uvularia grandiflora*), and Virginia waterleaf (*Hydrophyllum virginianum*). Other common species include Clayton's sweet cicely (*Osmorhiza claytonia*), Virginia creeper (*Parthenocissus* spp.), bloodroot (*Sanguinaria canadensis*), lopseed (*Phryma leptostachya*), common enchanter's nightshade (*Circaea lutetiana*), early meadow-rue (*Thalictrum dioicum*), wild sarsaparilla (*Aralia nudicaulis*), Pennsylvania sedge (*Carex pensylvanica*), and honewort (*Cryptotaenia canadensis*).



• Shrub-layer cover is patchy to interrupted

(25–75%); common species include sugar maple, ironwood, prickly gooseberry (*Ribes cynosbati*), and chokecherry (*Prunus virginiana*).

• **Subcanopy** cover is interrupted to continuous (50–100%); important species include ironwood, sugar maple, and basswood. American elm, red elm, and bitternut hickory are occasionally present, with blue beech occasional in southeastern and east-central Minnesota

• **Canopy** cover is interrupted to continuous (50–100%); the most common species are basswood, northern red oak, and sugar maple, with bur oak and green ash replacing northern red oak in importance in western Minnesota, especially in the CGP, and white oak abundant in some stands in eastern Minnesota. On rare occasions a supercanopy with abundant white pine is present.

### Landscape Setting & Soils

• Loess-covered bedrock bluffs—Common. Present mostly on middle and upper slopes on bedrock hills, with a strong affinity for north- and northeast-facing aspects on steeper slopes. Parent material is wind-deposited silt that is generally deeper than 60in (150cm) over sedimentary bedrock. Outcrops of bedrock and large colluvial boulders are common. Gravel-sized rock fragments are absent, while flagstone-sized rocks are common deeper in soils just above bedrock. Soils have dark, organic-rich surface horizons, indicating former occupation of these sites by oak woodland or prairie. Little clay is available for formation of subsoil horizons capable of perching snowmelt and rainfall. Soils are well drained. Soil moisture regime is fresh. (Blufflands in PPL)

• **Till plains**—Common. Landscape is rolling to hummocky. Parent material is finetextured, calcareous till with modest amounts of gravel and few stones. Soils have clayey subsoil horizons but lack evidence of prolonged saturation. Gray soil colors and deposits of free carbonates are common below the clay-loam horizon, indicating availability of water and nutrients below clay horizon. Soils are well drained. Soil moisture regime is fresh. (MIM; PPL; RRV; LAP; localized in Coteau Moraines and Minnesota River Prairie in CGP)

• **Stagnation moraines**—Rare. Present on coarse-textured till near lakes. Parent material is gravelly, partially sorted, noncalcareous or weakly calcareous drift. Subsoil horizons capable of perching snowmelt or rainfall are absent. Soils are well drained. Soil moisture regime is moderately dry to moderately fresh. (MIM; Rochester Plateau in PPL)



### Natural History

In the past, catastrophic disturbances were rare in MHs38. An analysis of Public Land Survey records indicates that the rotation of catastrophic fires was in excess of 1,000 years, and the rotation of catastrophic windthrow was about 360 years.<sup>1</sup> Events that resulted in partial loss of trees, especially light surface fires, were much more common, with an estimated rotation of 35 years. Based on the historic composition and age structure of these forests, MHs38 had two growth stages separated by a period of transition.

• **0–35 years**—Young forests recovering from fire or wind, dominated by northern red oak mixed with basswood, American elm, and some quaking aspen.

• **35–75 years**—A transition period marked by the gradual decline of northern red oak and its replacement by sugar maple. Basswood, American elm, and ironwood increase during this period, and white oak becomes established.

• > 75 years—Mature forests of sugar maple mixed evenly with basswood, American elm, ironwood, northern red oak, and white oak. (Green ash is more common in modern vegetation samples than in the historic records for MHs38.)

### Similar Native Plant Community Classes

### MHs39 Southern Mesic Maple-Basswood Forest

MHs39 and MHs38 are very similar, and the ranges of the two classes overlap strongly. The presence of species adapted to dense shade—especially spring ephemerals such as Dutchman's breeches (*Dicentra cucullaria*), cut-leaved toothwort (*Cardamine concatenata*), and white trout lily (*Erythronium albidum*)—and large patches of wood nettle (*Laportea canadensis*) help to differentiate MHs39 from MHs38.

MHe29 Indicator Spacios	(fre	q%)	MHs20 Indicator Spacios	(fred	1%)
winsso indicator species	MHs38	MHs39	winsse indicator species	MHs38	MHs39
Northern bedstraw (Galium boreale)	23	-	False rue anemone (Enemion biternatum)	2	25
Poison ivy (Toxicodendron rydbergii)	57	2	Dutchman's breeches (Dicentra cucullaria)	5	44
Paper birch (C)	20	2	Cut-leaved toothwort (Cardamine concatenata)	4	36
Canada mayflower (Maianthemum canadense)	37	4	White trout lily (Erythronium albidum)	4	30
Columbine (Aquilegia canadensis)	30	5	Blue phlox (Phlox divaricata)	5	36
Pointed-leaved tick trefoil (Desmodium glutinosum	) 47	7	Puttyroot (Aplectrum hyemale)	3	15
Wild sarsaparilla (Aralia nudicaulis)	54	15	Ostrich fern (Matteuccia struthiopteris)	3	15
Wild grape (Vitis riparia)	39	12	Stemless blue violets*	11	38

\* Stemless blue violets (Viola sororia and similar Viola spp.)

### MHs49 Southern Wet-Mesic Hardwood Forest

MHs49 can be somewhat similar to MHs38 but occurs on level wet-mesic sites on silty alluvium or glacial till and is more likely to have species adapted to high water tables or common on heavy, moist soils.

MHo29 Indicator Spacios	(fre	q%)	MHe40 Indicator Species	(free	q%)
winsso mulcator species	MHs38	MHs49	MIRS49 Indicator Species	MHs38	MHs49
Shining bedstraw (Galium concinnum)	31	-	False rue anemone (Enemion biternatum)	2	59
Wild sarsaparilla (Aralia nudicaulis)	54	3	Blue phlox (Phlox divaricata)	5	69
Pointed-leaved tick trefoil (Desmodium glutinosum)	) 47	3	White trout lily (Erythronium albidum)	4	44
Canada mayflower (Maianthemum canadense)	37	3	Dutchman's breeches (Dicentra cucullaria)	5	46
Poison ivy (Toxicodendron rydbergii)	57	5	Hackberry (C)	5	51
Red baneberry (Actaea rubra)	46	8	Hispid buttercup (Ranunculus hispidus)	5	41
Hog peanut (Amphicarpaea bracteata)	44	8	Virginia spring beauty (Claytonia virginica)	5	38
Rattlesnake fern (Botrychium virginianum)	50	10	Black ash (C,U)	14	64

### • MHc37 Central Mesic Hardwood Forest (Western)

The ranges of MHc37 and MHs38 overlap only in west-central Minnesota, where MHc37 is more likely to occur on stagnation moraines, and MHs38 is more likely on till plains.

<sup>1</sup>Forested communities that extend into the prairie regions of Minnesota tend to have shorter rotations of disturbance from fire (and often wind) on the western edge of their range compared with the eastern part. This probably results from drier climate in the west and being surrounded by prairie vegetation that burns frequently. Because estimated rotations of disturbance for forested communities are calculated from PLS bearing-tree records across the range of the community, and records in the prairie regions are often much sparser than those to the east, disturbance rotations may be much shorter for forest stands in the prairie regions than those presented for the class as a whole.



### MESIC HARDWOOD FOREST SYSTEM Southern Floristic Region



MHe29 Indicator Spacios	(free	q%)	MHo27 Indicator Spacios	(fred	q%)
winsso indicator species	MHs38	MHc37	which indicator species	MHs38	MHc37
Starry sedge (Carex rosea)	44	1	Leatherwood (Dirca palustris)	2	68
Hackberry (U)	42	1	Round-lobed hepatica (Anemone americana)	2	62
Wild grape (Vitis riparia)	44	2	Beaked hazelnut (Corylus cornuta)	5	49
Virginia waterleaf (Hydrophyllum virginianum)	77	4	Rose twistedstalk (Streptopus roseus)	5	43
Canada moonseed (Menispermum canadense)	26	2	Downy arrowwood (Viburnum rafinesquianum)	7	55
Cleavers (Galium aparine)	47	4	Paper birch (C,U)	9	65
Jack-in-the-pulpit (Arisaema triphyllum)	65	10	Sugar maple (C,U)	19	93
Starry false Solomon's seal (Smilacina stellata)	42	7	Quaking aspen (C,U)	9	47

### • MHc36 Central Mesic Hardwood Forest (Eastern)

The ranges of MHc36 and MHs38 overlap in west-central Minnesota, where MHc36 is more likely to occur on stagnation moraines, and MHs38 is more common on till plains.

MHo29 Indiantor Spania	(fre	q%)	MHa26 Indiantar Spanian	(free	q%)
winsso indicator species	MHs38	MHc36	whese indicator species	MHs38	MHc36
Shining bedstraw (Galium concinnum)	26	-	Red maple (C,U)	1	50
Canada moonseed (Menispermum canadense)	24	1	Rose twistedstalk (Streptopus roseus)	2	56
Missouri gooseberry (Ribes missouriense)	28	2	Round-lobed hepatica (Anemone americana)	5	61
Hackberry (U)	28	2	Large-leaved aster (Aster macrophyllus)	7	77
Giant Solomon's seal (Polygonatum biflorum)	26	2	Pale bellwort (Uvularia sessilifolia)	5	54
Cleavers (Galium aparine)	37	5	Beaked hazelnut (Corylus cornuta)	6	62
Sharp-lobed hepatica (Anemone acutiloba)	34	9	Large-flowered trillium (Trillium grandiflorum)	6	52
Wild grape (Vitis riparia)	36	10	Leatherwood (Dirca palustris)	6	38

### • MHs37 Southern Dry-Mesic Oak Forest

MHs37 and MHs38 can be very similar, and the ranges of the two classes overlap in east-central and southeastern Minnesota. MHs37 usually occurs on drier sites than MHs38 and is much less likely to have abundant sugar maple in the canopy.

MU-29 Indicator Encoico	(fre	q%)	MU-27 Indicator Spacios	(fred	q%)
winsso mulcator species	MHs38	MHs37	winssi mulcator species	MHs38	MHs37
Bladdernut (Staphylea trifolia)	16	-	Shagbark hickory (C,U)	1	33
Wild leek (Allium tricoccum)	27	2	Clearweed (Pilea spp.)	3	28
Long-stalked sedge (Carex pedunculata)	27	2	Spinulose shield fern or Glandular wood fern*	3	26
Blue beech (U)	23	2	Tall blackberries**	4	28
Canada moonseed (Menispermum canadense)	21	2	Black raspberry (Rubus occidentalis)	5	30
Nodding trillium (Trillium cernuum)	19	2	Bracken (Pteridium aquilinum)	9	40
Sharp-lobed hepatica (Anemone acutiloba)	38	7	Woodland sunflower (Helianthus strumosus)	6	26
Wild ginger (Asarum canadense)	43	14	White snakeroot (Eupatorium rugosum)	19	65

\* Spinulose shield fern or Glandular wood fern (Dryopteris carthusiana or D. intermedia) \*\* Tall blackberries (Rubus allegheniensis and similar Rubus spp.)

### MHc38 Central Mesic Cold-Slope Hardwood-Conifer Forest

The range of MHc38 overlaps with MHs38 in southeastern Minnesota, and the two communities can appear similar when MHs38 has white pine in the canopy (MHs38a). MHc38 is restricted to sites with cool microclimates maintained by subterranean ice and is more likely to have species most commonly found in northern Minnesota.

MUe20 Indiantes Species	(fre	q%)	MUs20 Indicator Cressies	(fre	q%)
winsse indicator species	MHs38	MHc38	MIC38 Indicator Species	MHs38	MHc38
Heart-leaved aster (Aster cordifolius)	61	-	Balsam fir (C,U)	-	50
Maryland black snakeroot (Sanicula marilandica)	61	-	Rose twistedstalk (Streptopus roseus)	-	50
Nannyberry (Viburnum lentago)	56	-	Slender cliff brake (Cryptogramma stelleri)	-	33
Bland sedge (Carex blanda)	56	-	Hairy Solomon's seal (Polygonatum pubescens)	-	33
Spreading Jacob's ladder (Polemonium reptans)	44	-	Yellow birch (C,U)	6	50
Rattlesnake fern (Botrychium virginianum)	39	-	Red-berried elder (Sambucus racemosa)	6	50
Wild geranium (Geranium maculatum)	94	17	Canada yew (Taxus canadensis)	6	50
Lopseed (Phryma leptostachya)	50	17	Highbush cranberry (Viburnum trilobum)	6	50
Wild geranium (Geranium maculatum) Lopseed (Phryma leptostachya)	94 50	17 17	Canada yew (Taxus canadensis) Highbush cranberry (Viburnum trilobum)	6 6	

# Native Plant Community Types in Class MHs38a White Pine - Oak - Sugar Maple Forest

Mesic hardwood-conifer forests, mostly on steep north-facing slopes on thin, windblown silty soil over bedrock. Canopy is dominated by northern red oak, often with sugar maple and occasionally with smaller amounts of basswood, paper birch, white oak, and other hardwood species. Most often a supercanopy of white pine is present. Subcanopy has abundant ironwood and sugar maple. MHs38a is distinguished from other types in this class by the presence of white pine in the canopy or understory; other species that can help to distinguish MHs38a include bush honeysuckle (*Diervilla lonicera*), elm-





### MHs38b Basswood - Bur Oak - (Green Ash) Forest

Mesic hardwood forests on hummocky topography or near lakes on till plains and stagnation moraines; slopes are generally not steep. Canopy most often is dominated by basswood, bur oak, or green ash, with northern red oak abundant in a few stands. Subcanopy and shrub layer have abundant ironwood with occasional basswood. In general, MHs38b can often be distinguished from the other types in this class by the presence of abundant green ash in the canopy and abundant Virginia waterleaf in the ground layer. It is further distinguished from MHs38c by lower frequency of northern red oak and almost complete lack of sugar maple in the canopy. Additional species that can help to distinguish MHs38b include snowberry or wolfberry (*Symphoricarpos albus* or *S. occidentalis*), starry false Solomon's seal (*Smilacina stellata*), and nodding trillium (*Trillium cernuum*). MHs38b has been documented in the MIM, CGP, and RRV. Description is based on summary of vegetation data from 43 plots.

### MHs38c Red Oak - Sugar Maple - Basswood - (Bitternut Hickory) Forest

Mesic hardwood forests on steep, mostly north-facing slopes on thin silt over bedrock and also on till plains with hummocky topography. Northern red oak and sugar maple are the most abundant canopy trees; basswood is also common. Ironwood and sugar maple are the most abundant subcanopy and shrub-layer species; bitternut hickory is common in both the subcanopy and shrub layers. When present, mayapple *(Podophyllum peltatum)* distinguishes MHs38c from MHs38a in the PPL; the absence of white pine also differentiates MHs38c from MHs38a. Farther north, MHs38c can be differentiated from MHs38b by the significantly higher abundance of northern red oak. Other species that can help to differentiate MHs38c from MHs38a and MHs38b include rue anemone *(Thalictrum thalictroides)* and hairy Solomon's seal *(Polygonatum pubescens)*. MHs38c has been documented mainly in the PPL and the southern half of the MIM. Description is based on summary of vegetation data from 67 plots.



Forestville State Park, Fillmore County, MN

# MHs38 Southern Mesic Oak-Basswood Forest – Species Frequency and Cover

Ξ.	G	6	~	$\sim$	_	6	(0)	_	~	<b>_</b>	7	Ŧ		_	~		-	m	_	-	_	m	c	_	m	~	_	_	<b>—</b>	~	N	Ъ	
Jannevilvania cadra (Carav nanevilvanica)	rasses & Sedges	Shining bedstraw (Galium concinnum)	Cleavers (Galium aparine)	Canada mayflower (Maianthemum canadense)	White avens (Geum canadense)	Sharp-lobed hepatica (Anemone acutiloba)	Sweet-scented bedstraw (Galium triflorum)	Wood anemone (Anemone quinquefolia)	Wild ginger (Asarum canadense)	Hog peanut (Amphicarpaea bracteata)	Maidenhair fern (Adiantum pedatum)	Red baneberry (Actaea rubra)	<sup>D</sup> ointed-leaved tick trefoil (Desmodium glutinosum)	Varyland black snakeroot (Sanicula marilandica)	Common false Solomon's seal (Smilacina racemosa)	Lady tern (Athyrium filix-temina)	Rattlesnake fern (Botrychium virginianum)	Blue cohosh (Caulophyllum thalictroides)	Wild sarsaparilla (Aralia nudicaulis)	Honewort (Cryptotaenia canadensis)	Wild geranium (Geranium maculatum)	Erect, Smooth, or Illinois carrion-flower*	Jack-in-the-pulpit (Arisaema triphyllum)	Virginia waterleaf (Hydrophyllum virginianum)	Early meadow-rue (Thalictrum dioicum)	Common enchanter's nightshade (Circaea lutetiana)	opseed (Phryma leptostachya)	arge-flowered bellwort (Uvularia grandiflora)	Bloodroot (Sanguinaria canadensis)	Clayton's sweet cicely (Osmorhiza claytonii)	Zigzag goldenrod (Solidago flexicaulis)	orbs, Ferns & Fern Allies	
77		31	34	37	37	38	41	41	43	44	44	46	47	<del>48</del> i	48 8	50	50	53	54	54	55	ប្រ	56	బ	ട്ട	64	<u>6</u> 5	73	77	81	84		freq%
:		•	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	:	•	•	•	•	•	•	:		cover
-														-										S			S						
Black charm 0	White pine 12	Red elm 16	Bitternut hickory 18	Paper birch 20	American elm 27	White oak 30	Bur oak 33	Green ash 36	Ironwood 42	Sugar maple 59	Northern red oak 60	Basswood 82	freç	rees	Alliencan hazen lut (Corynas ame	Downy arrowwood (Viburnum ra.	Nannyberry (Viburnum lentago)	Missouri gooseberry (Ribes miss	Pagoda dogwood (Cornus altern	Poison ivy (Toxicodendron rydb	Prickly ash (Zanthoxylum americ	Chokecherry (Prunus virginiana)	Prickly gooseberry (Ribes cynos	hrubs	Wild grape (Vitis riparia)	Virginia creeper (Parthenocissus	loody Vines	Bearded shorthusk (Brachyelytru	Nodding fescue (Festuca subvei	Long-stalked sedge (Carex pedu	Bottlebrush grass (Elymus hystri.	Bland sedge (Carex blanda)	
Black cherry 9	White pine 12 ••••	Red elm 16 •	Bitternut hickory 18 ••	Paper birch 20 •	American elm 27 ●●	White oak 30 •••	Bur oak 33 •••	Green ash 36 •••	Ironwood 42 •••	Sugar maple 59 ••••	Northern red oak 60 ••••	Basswood 82 •••	freq% cover	rees Canopy		Downy arrowwood (Viburnum rafinesquianum)	Nannyberry (Viburnum lentago)	Missouri gooseberry (Ribes missouriense)	Pagoda dogwood (Cornus alternifolia)	Poison ivy (Toxicodendron rydbergii)	Prickly ash (Zanthoxylum americanum)	Chokecherry (Prunus virginiana)	Prickly gooseberry (Ribes cynosbati)	hrubs	Wild grape (Vitis riparia)	Virginia creeper (Parthenocissus spp.)	loody Vines	Bearded shorthusk (Brachyelytrum erectum)	Nodding fescue (Festuca subverticillata)	Long-stalked sedge (Carex pedunculata)	Bottlebrush grass (Elymus hystrix)	Bland sedge (Carex blanda)	
Black cherry 9 • 9	White pine 12 •••• -	Red elm 16 • 19	Bitternut hickory 18 •• 26	Paper birch 20 • -	American elm 27 ●● 21	White oak 30 ••• -	Bur oak 33 ●●● -	Green ash 36 ●●● 16	Ironwood 42 ••• 84	Sugar maple 59 •••• 60	Northern red oak 60 •••• 11	Basswood 82 ••• 52	freq% cover freq%	rees Canopy Subca		Downy arrowwood (Viburnum rafinesquianum)	Nannyberry (Viburnum lentago)	Missouri gooseberry (Ribes missouriense)	Pagoda dogwood (Cornus alternifolia)	Poison ivy (Toxicodendron rydbergii)	Prickly ash (Zanthoxylum americanum)	Chokecherry (Prunus virginiana)	Prickly gooseberry (Ribes cynosbati)	hrubs	Wild grape (Vitis riparia)	Virginia creeper (Parthenocissus spp.)	loody Vines	Bearded shorthusk (Brachyelytrum erectum)	Nodding fescue (Festuca subverticillata)	Long-stalked sedge (Carex pedunculata)	Bottlebrush grass (Elymus hystrix)	Bland sedge (Carex blanda)	
Black cherry 9 • 9 •	White pine 12 ••••	Red elm 16 • 19 •	Bitternut hickory 18 •• 26 ••	Paper birch 20 •	American elm 27 ●● 21 ●●	White oak 30 •••	Bur oak 33 ●●●	Green ash 36 ●●● 16 ●	Ironwood 42 ••• 84 •••	Sugar maple 59 ●●●● 60 ●●●	Northern red oak 60 •••• 11 •	Basswood 82 ••• 52 ••	freq% cover freq% cover	rees Canopy Subcanopy	Annen Can Tiazen lut ( Coryius annen Cana)	Downy arrowwood (Viburnum rafinesquianum)	Nannyberry (Viburnum lentago)	Missouri gooseberry (Ribes missouriense)	Pagoda dogwood (Cornus alternifolia)	Poison ivy (Toxicodendron rydbergii)	Prickly ash (Zanthoxylum americanum)	Chokecherry (Prunus virginiana)	Prickly gooseberry (Ribes cynosbati)	hrubs	Wild grape (Vitis riparia)	Virginia creeper (Parthenocissus spp.)	loody Vines	Bearded shorthusk (Brachyelytrum erectum)	Nodding fescue (Festuca subverticillata)	Long-stalked sedge (Carex pedunculata)	Bottlebrush grass (Elymus hystrix)	Bland sedge (Carex blanda)	
Black cherry 9 • 9 • 34	White pine 12 ••••	Red elm 16 • 19 • 34	Bitternut hickory 18 ●● 26 ●● 46	Paper birch 20 •	American elm 27 ●● 21 ●● 32	White oak 30 ••• 9	Bur oak 33 ●●● 18	Green ash 36 ●●● 16 ● 38	Ironwood 42 ••• 84 ••• 70	Sugar maple 59 •••• 60 ••• 65	Northern red oak 60 ●●●● 11 ● 52	Basswood 82 ••• 52 •• 73	freq% cover freq% cover freq%	rees Canopy Subcanopy Shrub		Downy arrowwood (Viburnum rafinesquianum) 22	Nannyberry (Viburnum lentago) 23	Missouri gooseberry (Ribes missouriense) 30	Pagoda dogwood (Cornus alternifolia) 53	Poison ivy (Toxicodendron rydbergii) 57	Prickly ash (Zanthoxylum americanum) 57	Chokecherry (Prunus virginiana) 64	Prickly gooseberry (Ribes cynosbati) 71	hrubs	Wild grape (Vitis riparia) 39	Virginia creeper (Parthenocissus spp.) 80	loody Vines	Bearded shorthusk (Brachyelytrum erectum) 19	Nodding fescue (Festuca subverticillata) 20	Long-stalked sedge (Carex pedunculata) 27	Bottlebrush grass (Elymus hystrix) 28	Bland sedge (Carex blanda) 31	freq%

\*Erect, Smooth, or Illinois carrion-flower (Smilax ecirrata, S. herbacea, or S. illinoensis)



# MRn83

### Northern Mixed Cattail Marsh

Emergent marsh communities, typically dominated by cattails. Present on floating mats along shorelines in lakes, ponds, and river backwaters or rooted in mineral soil in shallow wetland basins.

### **Vegetation Structure & Composition**

Description is based on summary of field survey records and vascular plant data from 22 plots (relevés).

• Floating-leaved and submergent aquatic plant cover is sparse, with species such as duckweed (*Lemna* spp.) and greater duckweed (*Spirodela polyrhiza*) frequent, and common bladderwort (*Utricularia vulgaris*) and common coontail (*Ceratophyllum demersum*) occasionally present. Seasonally prolific, floating clones of the liverworts *Riccia fluitans* and *Ricciocarpos natans* may be present, becoming stranded during watertable drawdown.

• **Graminoid** cover is variable, with lake sedge (*Carex lacustris*) and bristly sedge (*C. comosa*) commonly present.

• Forb cover is strongly dominated by cattails



(*Typha* spp.), usually with > 50% cover. Other common forbs include emergent species such as broad-leaved arrowhead (*Sagittaria latifolia*), marsh skullcap (*Scutellaria galericulata*), small or three-cleft bedstraw (*Galium tinctorium* or *G. trifidum*), and bur marigold and beggarticks (*Bidens* spp.).

• Shrubs are absent or very sparse.

• Notes: Vegetation is often composed of dense stands of cattails interspersed with pools of open water. Associated species are highly variable. MRn83 and other shallow-water wetlands throughout much of the state (particularly the agricultural region) have been invaded by dense stands of the non-native species narrow-leaved cattail (*Typha angustifolia*) and hybrid cattail (*T. x glauca*). Invasion and dominance of marshes by non-native cattail species is likely related to alterations in wetland hydrology, commonly from drain tiling, ditching, and impoundments; high levels of nutrient-rich runoff from agricultural fields; and salt-containing runoff from roads. Marshes dominated by non-native cattail species are considered to be low-quality or disturbed examples of MRn83. Marshes dominated by the native species broad-leaved cattail (*T. latifolia*) are considered higher-quality examples of MRn83 and are increasingly rare in Minnesota.

### Landscape Setting & Soils

MRn83 occurs in shallow basins and depressions and along the shores of lakes, ponds, and river backwaters. Substrates range from muck or shallow, well-decomposed peat to floating peaty mats. Substrate surface is usually covered with plant litter, especially dead cattail stalks. MRn83 is often transitional between shallow aquatic communities and wet meadows.

### **Natural History**

MRn83 develops in areas where standing water is present most of the year, providing conditions favorable for hydrophytic plants. Occurrences of the community with plants rooted in muck or peat substrates may succeed to shallow aquatic communities if the water table rises for prolonged periods, or to wet meadows if the water table drops or if silt or sedimentary peat accumulation causes the substrate surface to become elevated above the water surface. Floating mats, which rise and fall with changes in water level, are presumably successionally stable but may be fragmented by strong





winds or beaver activity. Variation in species composition observed in the class is likely due to differences in water depth, the permanence of standing water, and variation in substrate. Fires during severe droughts can remove accumulated peat in fens or wet meadows, effectively lowering the growing surface and creating the wetter conditions that favor marsh over fen or wet meadow vegetation.

### Similar Native Plant Community Classes • MRn93 Northern Bulrush-Spikerush Marsh

MRn93 can be similar to MRn83 but occurs in deeper water and tends to be more affected by wave action. MRn93 is dominated by bulrushes (*Scirpus* spp.) and submergent aquatic species such as pondweeds (*Potamogeton* spp.) and water milfoil (*Myriophyllum* spp.), while MRn83 is dominated by cattails, with abundant sedges (*Carex* spp.) and forbs such as tufted loosestrife (*Lysimachia thyrsiflora*) and great water dock (*Rumex orbiculatus*).

MDn92 Indiactor Spacios	(fre	q%)	MDn02 Indiantar Spania	(free	<b>1%</b> )
wikings indicator species	MRn83	MRn93	wirings mulcator species	MRn83	MRn93
Marsh cinquefoil (Potentilla palustris)	13	-	False nettle (Boehmeria cylindrica)	-	18
Linear-leaved, Marsh, or Downy willow-herb*	21	3	Northern manna grass (Glyceria borealis)	-	15
Common bladderwort (Utricularia vulgaris)	42	9	Common water plantain (Alisma triviale)	4	26
Great water dock (Rumex orbiculatus)	42	12	Three-way sedge (Dulichium arundinaceum)	4	18
Marsh bellflower (Campanula aparinoides)	38	12	Rice cut grass (Leersia oryzoides)	21	71
Northern marsh fern (Thelypteris palustris)	17	6	River bulrush (Scirpus fluviatilis)	13	41
Lake sedge (Carex lacustris)	50	18	Nodding smartweed (Polygonum lapathifolium)	8	24
Tufted loosestrife (Lysimachia thyrsiflora)	50	21	Water smartweed (Polygonum amphibium)	29	68

\* Linear-leaved, Marsh, or Downy willow-herb (Epilobium leptophyllum, E. palustre, or E. strictum)

### • MRp83 Prairie Mixed Cattail Marsh

MRp83 is very similar to MRn83, but by convention the range of MRp83 is limited to the Prairie Parkland Province, and the range of MRn83 is limited to the Eastern Broadleaf Forest and Laurentian Mixed Forest provinces. There are too few detailed records available to identify species differences between the classes. Collection of additional data and further analysis may result in revision of the floristic and geographic relationships between the two classes.

### MRu94 Lake Superior Coastal Marsh

MRu94 is similar to MRn83 but is restricted to estuaries and embayments near the mouths of rivers flowing into Lake Superior, where seiches cause regular fluctuations in water level. MRu94 generally has higher species diversity, while MRn83 is more likely to be strongly dominated by cattails.

### Native Plant Community Types in Class

Although MRn83 has not been thoroughly sampled across its range in Minnesota, vegetation plot data and field observations indicate that the class can be divided into two community types based on dominant species.

### • MRn83a Cattail - Sedge Marsh (Northern)

Emergent marshes typically dominated by cattails but with a significant component of graminoids including sedges (*Carex* spp.), woolgrass (*Scirpus cyperinus*), and bluejoint (*Calamagrostis canadensis*). MRn83a is more likely than MRn83b to be dominated by the native species broad-leaved cattail and is uncommon.

### MRn83b Cattail Marsh (Northern)

Emergent marshes dominated by nearly pure stands of cattails. If sedges and grasses are present, they are minor components. MRn83b is the most common of the two community types in this class and often is dominated by the non-native species narrow-leaved and hybrid cattail. Marshes dominated by pure stands of the native species broad-leaved cattail were likely more common in the past but are now rare across much of the range of the community.



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Kandiyohi County, MN

	freq% c	er		freq%	cover
Grasses & Sedges		Unbranched bur reed (Sparganiu	im emersum)	6	•
Lake sedge (Carex lacustris)	45	Emergent Forbs			
Bristly sedge (Carex comosa)	41	Broad-leaved arrowhead (Sagitta	ıria latifolia)	64	٠
Red-stalked spikerush (Eleocharis palustris)	32	Marsh skullcap (Scutellaria galer	iculata)	64	•
Bluejoint (Calamagrostis canadensis)	27	<ul> <li>Three-cleft or small bedstraw (Ga</li> </ul>	alium trifidum or G. tinctorium)	59	•
Rice cut grass (Leersia oryzoides)	23	Bur marigold and Beggarticks (B)	idens spp.)	50	•
Tall manna grass (Glyceria grandis)	23	<ul> <li>Tufted loosestrife (Lysimachia th)</li> </ul>	yrsiflora)	45	•
Soft stem bulrush (Scirpus validus)	18	<ul> <li>Bulb-bearing water hemlock (Cic.</li> </ul>	uta bulbifera)	41	•
Fen wiregrass sedge (Carex lasiocarpa)	14	<ul> <li>Great water dock (Rumex orbicu)</li> </ul>	latus)	41	•
Wild rice (Zizania palustris)	14	Marsh beliflower (Campanula ap	arinoides)	41	•
Common reed grass (Phragmites australis)	14	<ul> <li>Clearweed (Pilea spp.)</li> </ul>		36	•
Tussock sedge (Carex stricta)	14	Northern bugleweed (Lycopus ur	hiflorus)	32	•
Cyperus sedge (Carex pseudocyperus)	14	Broad-leaved cattail (Typha latifo)	lia)	32	:
River bulrush (Scirpus fluviatilis)	14	<ul> <li>Touch-me-not (Impatiens spp.)</li> </ul>		32	•
Beaked sedge (Carex utriculata)	14	<ul> <li>Giant bur reed (Sparganium eury</li> </ul>	(carpum)	27	:
Ovoid spikerush (Eleocharis ovata)	6	Water parsnip (Sium suave)		27	•
Lesser-panicled sedge (Carex diandra)	6	<ul> <li>Linear-leaved, Marsh, or Downy v</li> </ul>	villow-herb*	23	•
Aquatic sedge (Carex aquatilis)	6	Spotted water hemlock (Cicuta m	iaculata)	23	•
Fragrant cyperus (Cyperus odoratus)	6	<ul> <li>Dotted smartweed (Polygonum p</li> </ul>	unctatum)	18	•
Porcupine sedge (Carex hystericina)	6	<ul> <li>Sweet flag (Acorus calamus)</li> </ul>		18	•
Woolgrass (Scirpus cyperinus)	6	<ul> <li>Swamp milkweed (Asclepias income incom</li></ul>	arnata)	18	•
Floating-Leaved & Submergent Forbs		Northern marsh fern (Thelypteris	palustris)	18	•
Star-duckweed (Lemna trisculata)	64	Cut-leaved bugleweed (Lycopus	americanus)	18	•
Lesser-duckweed (Lemna minor)	59	<ul> <li>Marsh cinquefoil (Potentilla palus</li> </ul>	ttris)	14	•
Greater duckweed (Spirodela polyrhiza)	55	<ul> <li>Spotted Joe pye weed (Eupatoriu)</li> </ul>	ım maculatum)	14	•
Common bladderwort (Utricularia vulgaris)	45	<ul> <li>Marsh horsetail (Equisetum palus</li> </ul>	stre)	თ	•
Common coontail (Ceratophyllum demersum)	36	<ul> <li>Common mint (Mentha arvensis)</li> </ul>		<b>б</b>	•
Water smartweed (Polygonum amphibium)	32	Stinging nettle (Urtica dioica)		<b>б</b>	•
Flat-stemmed pondweed (Potamogeton zosteriformis)	14	Nodding smartweed (Polygonum)	lapathifolium)	6	•
Common white water-lily (Nymphaea odorata)	14	<ul> <li>Lady's thumb (Polygonum persic</li> </ul>	aria)	6	•
Straight-leaved pondweed (Potamogeton strictifolius)	6	<ul> <li>Common water plantain (Alisma ti</li> </ul>	riviale)	Ŋ	٠
Intermediate bladderwort (Utricularia intermedia)	6	Shrubs			
Yellow pond lily (Nuphar variegata)	6	<ul> <li>Red-osier dogwood (Cornus serie)</li> </ul>	cea)	6	:
History International March or Downs willow both /Englophium Jontonhullium E	Catoriloo -	· F atriatum			

MRn83 Northern Mixed Cattail Marsh – Species Frequency & Cover

"Linear-leaved, Marsh, or Downy willow-herb (Epilobium leptophyllum, E. palustre, or E. strictum)



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### Northern Bulrush-Spikerush Marsh

Emergent marsh communities, typically dominated by bulrushes or spikerushes. Present mainly along lakeshores and stream borders.

### Vegetation Structure & Composition

Description is based on summary of field survey records and vascular plant data from 34 plots (relevés).

• Floating-leaved and submergent aquatic plant cover is variable, frequently with water smartweed (*Polygonum amphibium* var. *stipulaceum*) and duckweed (*Lemna* spp.) and infrequently with greater duckweed (*Spirodela polyrhiza*) and pondweed (*Potamogeton* spp).

• Graminoid cover is variable, often consisting of dense, clonal, single-species patches interspersed with areas of open water. Community most often is dominated by bulrushes, including soft stem bulrush (*Scirpus validus*) and river bulrush (*S. fluviatilis*), or by redstalked spikerush (*Eleocharis palustris*), with lesser amounts of rice cut grass (*Leersia oryzoides*).



• Forb cover is variable. Typical species include broad-leaved arrowhead (Sagittaria latifolia) and bur reeds (Sparganium spp.).

• Shrubs are absent.

### Landscape Setting & Soils

MRn93 occurs in shallow water (typically 20–40in [50–100cm] deep) along wavewashed and protected lakeshores and along stream borders. Substrates are usually mineral soil, sometimes held together by mats of plant roots. MRn93 appears to occur on permanently flooded sites but may be intermittently exposed during periods of low water.

### **Natural History**

MRn93 develops in settings where standing water is present most of the year, providing conditions favorable to hydrophytic plants. The community is most common along shorelines where exposure to waves hinders accumulation of peat and formation of floating mats. Variation in vegetation composition within the class is likely due to variation in water level, substrate, and exposure to wave action.

### Similar Native Plant Community Classes

### MRn83 Northern Mixed Cattail Marsh

MRn83 is similar to MRn93 but occurs in shallow water on softer substrates more protected from wave action. MRn83 is dominated by cattails (*Typha* spp.), with abundant sedges (*Carex* spp.) and forbs such as marsh cinquefoil (*Potentilla palustris*), northern bugleweed (*Lycopus uniflorus*), and tufted loosestrife (*Lysimachia thyrsiflora*). MRn93 is dominated by bulrushes (*Scirpus* spp.) and submergent aquatic species such as pondweeds and water milfoil (*Myriophyllum* spp.).



MARSH SYSTEM Northern Floristic Region

MRn93 Indicator Species	(fre <b>MRn93</b>	q%) MRn83	MRn83 Indicator Species	(frec MRn93	1%) <b>MRn83</b>
False nettle (Boehmeria cylindrica)	18	-	Marsh cinquefoil (Potentilla palustris)	-	13
Northern manna grass (Glyceria borealis)	15	-	Cyperus sedge (Carex pseudocyperus)	-	13
Common water plantain (Alisma triviale)	26	4	Linear-leaved, Marsh, or Downy willow-herb*	3	21
Three-way sedge (Dulichium arundinaceum)	18	4	Common bladderwort (Utricularia vulgaris)	9	42
Rice cut grass (Leersia oryzoides)	71	21	Great water dock (Rumex orbiculatus)	12	42
River bulrush (Scirpus fluviatilis)	41	13	Marsh bellflower (Campanula aparinoides)	12	38
Nodding smartweed (Polygonum lapathifolium)	24	8	Lake sedge (Carex lacustris)	18	50
Water smartweed (Polygonum amphibium)	68	29	Tufted loosestrife (Lysimachia thyrsiflora)	21	50

\* Linear-leaved, Marsh, or Downy willow-herb (Epilobium leptophyllum, E. palustre, or E. strictum)

### MRp93 Prairie Bulrush - Arrowhead Marsh

MRp93 is similar to MRn93 but by convention the range of MRp93 is limited to the Prairie Parkland Province, and the range of MRn93 is limited to the Eastern Broadleaf Forest and Laurentian Mixed Forest provinces. There are too few detailed records available to identify species differences between the two classes. Collection of additonal data and further analysis may result in revision of the floristic and geographic relationships between the two classes.

### • MRu94 Lake Superior Coastal Marsh

MRu94 is similar to MRn93 but is restricted to estuaries and embayments near the mouths of rivers flowing into Lake Superior, where seiches cause regular fluctuations in water level. MRu94 generally has higher species diversity than MRn93.

### Native Plant Community Types in Class

Very little data are available for MRn93, but field observations indicate that the class can be divided into two community types based on dominant species.

### • MRn93a Bulrush Marsh (Northern)

Emergent marshes typically dominated by bulrushes (Scirpus spp.).

• MRn93b Spikerush - Bur Reed Marsh (Northern)

Emergent marshes dominated by spikerushes (*Eleocharis* spp.) or bur reeds (*Sparganium* spp.).



Itasca County, MN

MRn93
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Narsh –
- Species
Frequenc
y & Cover

cover     freq?s     freq?s     cov       Final Process     Broad-leaved arrowhead (Sagittaria latifolia)     68       Bur margoid and Beggarticks (Bidens spp.)     69     69       Clearweed (Pilea spp.)     70     69       Three-cleft or small bedstraw (Calium trifidum or G. tinctonium)     26       Nodding smartweed (Polygonum lapathilolium)     26       Nodding smartweed (Polygonum lapathilolium)     26       Nodriem bugleweed (Lycopus unitionus)     21       Cut-leaved bugleweed (Lycopus americanus)     21       Dotted smartweed (Polygonum punctatum)     15       Faise nettle (Boehmeria cylindrica)     15       Goiden dock (Rumex orbiculatus)     15       Goiden dock (Rumex maritimus)     15       Mad dog skullcap (Scutellaria laterifora)     15       Swamp milkweed (Asclepias incarnata)     15       Burnsh (Scirpus acutus or S. heterochaetus)     15       Labrador bedstraw (Galium labradoricum)     15       Burnsh bellflower (Campanuia aparinoides)     12       Burnsh bellflower (Campanuia spinoides)     12       Burnsh bellflower (Campanuia spinoides)     9<	 Unbranched bur reed (Sparganium emersum) 6	Watershield (Brasenia schreberi) 6	Spiny coontail (Ceratophyllum echinatum) 9	Straight-leaved pondweed (Potamogeton strictifolius) 9	Common bladderwort (Utricularia vulgaris) 9	Floating pondweed (Potamogeton natans) 9	Flexuous naiad (Najas flexilis) 12	Star-duckweed (Lemna trisculata) 12	Flat-stemmed pondweed (Potamogeton zosteriformis) 12	Northern water milfoil (Myriophyllum sibiricum) 12	Common coontail (Ceratophyllum demersum) 12	Common white water-lily (Nymphaea odorata) 15	Greater duckweed (Spirodela polyrhiza) 18	Lesser-duckweed (Lemna minor) 56	Water smartweed (Polygonum amphibium) 65	Floating-Leaved & Submergent Forbs	Beaked sedge (Carex utriculata) 12	Woolgrass (Scirpus cyperinus) 12	Fen wiregrass sedge (Carex lasiocarpa) 12	Northern manna grass (Glyceria borealis) 15	Bluejoint (Calamagrostis canadensis) 18	Bristly sedge (Carex comosa) 18	Three-way sedge (Dulichium arundinaceum) 18	Common reed grass (Phragmites australis) 18	Lake sedge (Carex lacustris) 24	Tall manna grass (Glyceria grandis) 26	Red-stalked spikerush (Eleocharis palustris) 32	River bulrush (Scirpus fluviatilis) 38	Soft stem bulrush (Scirpus validus) 38	Rice cut grass (Leersia oryzoides) 65	Grasses & Sedges	freq%
Emergent Forbs       freq% cov         Broad-leaved arrowhead (Sagittaria latifolia)       freq% cov         Giant bur reed (Sparganium eurycarpum)       59         Bur marigold and Beggarticks (Bidens spp.)       68         Giant bur reed (Sparganium eurycarpum)       59         Bur marigold and Beggarticks (Bidens spp.)       67         Clearweed (Pilea spp.)       47         Tufted loosestrife (Lysimachia thyrsiliora)       26         Common water plantain (Alisma triviale)       26         Common mut (Mentha arvensis)       26         Curl-leaved bugleweed (Lycopus uniflorus)       21         Sweet flag (Accrus calamus)       21         Curl-leaved bugleweed (Lycopus americanus)       21         Dotted smartweed (Polygonum punctatum)       15         False nettle (Boehmeria cylindrica)       15         Giden dock (Rumex naritimus)       15         Goden dock (Rumex maritimus)       15         Goden dock (Rumex maritimus)       15         Burdor bedstraw (Galium labradoricum)       15         Swamp milkweed (Asclepias incarnata)       15         Burlush (Scirpus acutus or S. heterochaetus)       12         Golden dock (Rumex maritimus)       12         Guehaved teastraw (Galium labradoricum)       12 <th>:</th> <th>:</th> <th>•</th> <th>•</th> <th>•</th> <th>•</th> <th>•</th> <th>:</th> <th>•</th> <th>•</th> <th>•</th> <th>:</th> <th>•</th> <th>:</th> <th>:</th> <th></th> <th>i</th> <th>•</th> <th>•</th> <th>•</th> <th>:</th> <th>•</th> <th>:</th> <th>:</th> <th>:</th> <th>i</th> <th>:</th> <th>:</th> <th>:</th> <th>:</th> <th></th> <th>cover</th>	:	:	•	•	•	•	•	:	•	•	•	:	•	:	:		i	•	•	•	:	•	:	:	:	i	:	:	:	:		cover
freq% cov 68 29 29 26 26 26 26 26 26 26 26 26 26 26 26 26	 Pennsvlvania smartweed (Polvgonum pensvlvanicum)	Marsh bellflower (Campanula aparinoides)	Northern blue flag (Iris versicolor)	Touch-me-not (Impatiens spp.)	Labrador bedstraw (Galium labradoricum)	Icelandic yellow cress (Rorippa palustris)	Bulrush (Scirpus acutus or S. heterochaetus)	Swamp milkweed (Asclepias incarnata)	Mad dog skullcap (Scutellaria lateriflora)	Golden dock (Rumex maritimus)	Great water dock (Rumex orbiculatus)	False nettle (Boehmeria cylindrica)	Arrow-leaved tearthumb (Polygonum sagittatum)	Broad-leaved cattail (Typha latifolia)	Dotted smartweed (Polygonum punctatum)	Cut-leaved bugleweed (Lycopus americanus)	Common mint (Mentha arvensis)	Sweet flag (Acorus calamus)	Northern bugleweed (Lycopus uniflorus)	Nodding smartweed (Polygonum lapathifolium)	Common water plantain (Alisma triviale)	Tufted loosestrife (Lysimachia thyrsiflora)	Marsh skullcap (Scutellaria galericulata)	Three-cleft or small bedstraw (Galium trifidum or G. tinctorium)	Clearweed (Pilea spp.)	Water parsnip (Sium suave)	Bulb-bearing water hemlock (Cicuta bulbifera)	Giant bur reed (Sparganium eurycarpum)	Bur marigold and Beggarticks (Bidens spp.)	Broad-leaved arrowhead (Sagittaria latifolia)	Emergent Forbs	
	9	9	9	12	12	12	12	12	12	15	15	15	15	15	18	18	21	21	24	24	26	26	26	26	26	29	35	47	59	68		freq%



# RVx32

### Sand/Gravel/Cobble River Shore

Sparsely to densely vegetated plant communities on sand, gravel, or small cobbles on river shores. Characterized by annual herbaceous species, firmly rooted perennial species tolerant of inundation, and species dispersed by tubers and other floating propagules. Scoured annually during spring breakup and flooding by ice and currents, and following heavy rains.

### Vegetation Structure & Composition

Description is based on field observations and review of field notes for river shore communities.

• **Vegetation** cover may be relatively stable or may be variable and ephemeral, changing seasonally with change in water level. Community is distinctly zonal, usually with an upper beach zone and one or more lower beach zones.

• **Upper zone** is inundated during highest water levels, typically following spring runoff and repeated heavy summer rains; otherwise the upper zone is exposed and often droughty, especially in sunny settings. Vegetation is composed of woody species and annual and perennial herbaceous species. Cover and composition are highly variable.

• **PPL & MIM**—Sandbar willow (*Salix exigua*) often forms thickets. False indigo (*Amorpha fruticosa*) and seedlings of willow trees, cottonwood, and silver maple are often present. Common herbaceous species include bunched ironweed (*Vernonia fasciculata*), blue vervain (*Verbena hastata*), swamp milkweed (*Asclepias incarnata*), obedient plant (*Physostegia virginiana*), clammy weed (*Polanisia dodecandra*), horseweed (*Conyza canadensis*), and woundwort (*Stachys palustris*). Emory's sedge (*Carex emoryi*) may form dense patches in shaded settings. The highly invasive species reed canary grass (*Phalaris arundinacea*) is often abundant in this zone.

• **WSU & MDL**—Sandbar willow often forms dense thickets, especially on sand substrates. Other characteristic species include bulrushes (*Scirpus* spp.), blue monkey flower (*Mimulus ringens*), woolgrass (*Scirpus cyperinus*), fringe sedge (*Carex crinita*), bulb-bearing water hemlock (*Cicuta bulbifera*), swamp milkweed (*Asclepias incarnata*), water parsnip (*Sium suave*), retrorse sedge (*Carex retrorsa*), northern blue flag (*Iris versicolor*), cyperus sedge (*Carex pseudocyperus*), and bluejoint (*Calamagrostis canadensis*).

• **NSU**—On relatively stable beaches (usually on gravel or cobble substrates), the upper zone may have black ash, mountain maple (*Acer spicatum*), red maple, speckled alder (*Alnus incana*), tall meadow-rue (*Thalictrum dasycarpum*), hawthorns (*Crataegus spp.*), high-bush cranberry (*Viburnum trilobum*), flat-topped aster (*Aster umbellatus*), jack-in-the-pulpit (*Arisaema triphyllum*), false Solomon's seal (*Smilacina racemosa*), drooping woodreed (*Cinna latifolia*), virgin's bower (*Clematis virginiana*), and northern blue flag (*Iris versicolor*). In some instances, herbaceous plant cover is dominated by just a few species. On less stable substrates (such as sandy beaches), vegetation in the upper zone is typically sparse but includes many of the perennial species mentioned above, along with annual species.

• Lower zone is generally exposed during normal to low water levels, typically from midsummer to fall. Receding waters may deposit a thin layer of silt or clay in this zone, but it is removed when water levels rise again. Vegetation is highly variable in cover and composition but often is characterized by annual herbaceous species, especially on sand substrates. On gravel or cobble substrates, vascular plants are mostly restricted to patches of finer material that collects in interstitial spaces between cobbles.

• **PPL & MIM**—Creeping lovegrass (*Eragrostis hypnoides*) and awned umbrella sedge (*Cyperus squarrosus*) are often abundant. Other typical species include tufted lovegrass (*Eragrostis pectinacea*), Frank's lovegrass (*E. frankii*), barnyard grasses (*Echinochloa* spp.), witch grass (*Panicum capillare*), Philadelphia panic grass (*P. philadelphicum*), brook nut sedge (*Cyperus bipartitus*), fragrant cyperus (*Cyperus odoratus*), spikerushes (*Eleocharis erythropoda*, *E. intermedia*, and *E. ovata*), knotty rush (*Juncus nodosus*), hemicarpha (*Hemicarpha micrantha*), water stargrass (*Zosterella dubia*), blue monkey flower (*Mimulus ringens*), ditch stonecrop (*Penthorum sedoides*), golden dock (*Rumex maritimus*), yellow-seeded false



pimpernel (Lindernia dubia), common plantain (Plantago major), Rugel's plantain (*P. rugelii*), large-bracted vervain (Verbena bracteata), low cudweed (Gnaphalium uliginosum), speedwells (Veronica catenata and V. americana), carpetweed (Mollugo verticillata), and beggarticks (Bidens spp.). Emergent aquatic plants and floating-leaved or submerged aquatic plants tolerant of stranding are sometimes present, especially during low water levels. These include river bulrush (Scirpus fluviatile), sessile-fruited arrowhead (Sagittaria rigida), and arum-leaved arrowhead (S. cuneata).

• **WSU & MDL**—Characteristic species include creeping lovegrass, awned umbrella sedge, water horsetail (*Equisetum fluviatile*), broad-leaved arrowhead (*Sagittaria latifolia*), sessile-fruited arrowhead, bald spikerush (*Eleocharis erythropoda*), red-stalked spikerush (*E. palustris*), soft stem bulrush (*Scirpus validus*), broad-leaved cattail (*Typha latifolia*), tussock sedge (*Carex stricta*), beaked sedge (*C. utriculata*), lake sedge (*C. lacustris*), giant bur reed (*Sparganium eurycarpum*), wild rice (*Zizania palustris*), Bebb's sedge (*C. bebbii*), marsh cinquefoil (*Potentilla palustris*), and low cudweed.

• **NSU**—On gravel and cobble substrates, the lower zone may have black ash, mountain maple, speckled alder, tall meadow-rue, hawthorns, high-bush cranberry, Bebb's willow (*Salix bebbiana*), nodding sedge (*Carex gynandra*), aquatic sedge (*Carex aquatilis*), beaked sedge (*Carex utriculata*), grass-leaved goldenrod (*Euthamia graminifolia*), giant goldenrod (*Solidago gigantea*), sweet Joe pye weed (*Eupatorium purpureum*), spotted Joe pye weed (*Eupatorium maculatum*), blue monkey flower, purple fringed orchid (*Platanthera psycodes*), manna grass (*Glyceria spp.*), narrow-leaved bur reed (*Sparganium angustifolium*), marsh bellflower (*Campanula aparinoides*), common mint (*Mentha arvensis*), common marsh marigold (*Caltha palustris*), bladder sedge (*Carex intumescens*), and lady fern (*Athyrium filix-femina*).

### Landscape Setting & Soils

RVx32 occurs on river shores across Minnesota in the zone between normal low- and high-water levels. Sites are typically inundated during spring flooding. Substrate consists of sand, gravel, or cobbles < 12in (30cm) in diameter that are deposited or eroded by river currents. Soils are highly variable in depth and texture because of frequent erosion and deposition of sediment or substrate and may be limited to interstices between larger particles such as cobbles. Conditions suitable for formation of stable beach communities are most likely to occur along streams in glacial till or outwash deposits or in landscapes where sandstone bedrock is exposed. Along rivers with distinct floodplains, RVx32 is often adjacent to floodplain forest or other wetland communities.

### **Natural History**

The often ephemeral nature, characteristic pattern of zonation, and variable composition of RVx32 are caused by alternating episodes of deposition, erosion, and exposure of sediments as river levels rise and fall during the growing season. On finer, sandy substrates, the upper and lower beach zones are often severely eroded by currents. wave action, and ice flows during periods of high water. On coarser gravelly or cobbly substrates, more stable communities may form in the upper zone, especially on instream islands and the upper portions of deep beach deposits on the insides of stream or river bends, where the intensity of erosion and scouring is diminished because of lower stream energy. In addition to moving large quantities of sediment, floodwaters typically transport logs and other large debris that scour the shoreline and can form jams that impede stream flow and cause flooding of the upper beach zone. Scouring during high water removes upland or forest vegetation along the shoreline, thereby delineating the upper edge of the river shore community. Lower beach zones are typically exposed later in the growing season, with cover and composition of vegetation strongly influenced by substrate, gradient, exposure to light, and other local conditions. Common species include perennial forbs and graminoids tolerant of erosion and inundation, annual herbaceous species that germinate on exposed sediments, emergent aquatic plants, and floating-leaved or submerged aquatic plants tolerant of stranding.



### Similar Native Plant Community Classes

### • RVx43 Rocky River Shore

When present on boulder substrates, RVx43 can be similar to RVx32, although RVx43 generally occurs on boulders > 12in (30cm) in diameter, while RVx32 occurs on cobbles < 12in (30cm) in diameter.

### • RVx54 Clay/Mud River Shore

RVx54 occurs in similar settings and along most of the same streams as RVx32 and shares many species but is present on clay or silt substrates. The two classes may be difficult to differentiate when silt is deposited over sand, especially on the upstream and downstream margins of RVx54, where the two communities often intergrade. As a general rule, when silt is greater than 1in (3cm) thick over sand, the community is classified as RVx54.

### • LKi32 Inland Lake Sand/Gravel/Cobble Shore

LKi32 shares a number of species with RVx32; distinguishing the two classes is most difficult along riverine lakes where shorelines are influenced both by seasonal flooding and by wave action.

### Native Plant Community Types in Class

Plant species composition has not been systematically sampled across the range of RVx32. Delineation of the community is based primarily on characteristics of the physical environment.

### • RVx32a Willow Sandbar Shrubland (River)

Shrub-dominated communities on higher zones of river sandbars. Sandbar willow is the dominant species. False indigo and seedlings of willow trees, cottonwood, and silver maple are often present. Typical herbaceous species include bunched ironweed, blue vervain, swamp milkweed, obedient plant, clammy weed, and horseweed. RVx32a is present on sandbars along rivers and larger streams across much of Minnesota.

### • RVx32b Sand Beach/Sandbar (River)

Sparsely vegetated herbaceous plant communities on exposed sandy river sediments, beaches, and sandbars. RVx32b occurs along lower beach zones and is exposed generally from midsummer through fall. Common herbaceous species include creeping lovegrass, tufted lovegrass, barnyard grasses, awned umbrella sedge, brook nut, spikerushes, knotty rush, small-flowered hemicarpha, ditch stonecrop, golden dock, yellow-seeded false pimpernel, common plantain, large-bracted vervain, and American willow herb, along with emergent, floating-leaved, or submergent aquatic plants tolerant of stranding. RVx32b is divided into two subtypes based on stream permanence.

### • RVx32b1 Intermittent Streambed Subtype

Present on exposed sand in streams that become almost completely dry during normal low-water periods. RVx32b1 occurs in seasonal drainage ways across much of Minnesota.

### • RVx32b2 Permanent Stream Subtype

Present on sandy shores and sandbars formed by sand deposited by receding floodwaters and frequently reworked by currents. RVx32b2 occurs along river shores, islands, and point bars in permanent streams and rivers across much of Minnesota.

### • RVx32c Gravel/Cobble Beach (River)

Sparsely to densely vegetated plant communities on exposed gravel and cobble river sediments and beaches. RVx32c supports many of the species found in RVx32b and is also divided into two subtypes based on stream permanence.

### • RVx32c1 Intermittent Streambed Subtype

Present on exposed gravel or cobble sediments in streams that become almost completely dry during normal low-water periods. RVx32c1 occurs in seasonal drainage ways across much of Minnesota.

### • RVx32c2 Permanent Stream Subtype

Present on gravel or small cobbles on river shores. Nodding sedge (*Carex gynandra*) and black hawthorn (*Crataegus douglasii*) are characteristic species in RVx32c2 in parts of the NSU. RVx32c2 occurs along river shores and islands in permanent streams and rivers across much of Minnesota.





Washington County, MN

# UPs23

### Southern Mesic Prairie

Grass-dominated but forb-rich herbaceous communities on somewhat poorly drained to well-drained loam soils mainly formed in unsorted glacial till, sometimes in a thin loess layer over till, and locally in lacustrine sediments and outwash deposits. Communities in this class occur primarily on level to gently rolling sites. Drought stress is irregular in occurrence and usually not severe.

### **Vegetation Structure & Composition**

Description is based on summary of vegetation data from 102 plots (relevés).

• Graminoid cover is usually continuous (75–100%). Tallgrasses dominate, but several midheight grasses are also important. Species composition is fairly uniform, although relative abundances shift across the moisture gradient within the community. Big bluestem (Andropogon gerardii) and Indian 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 arass (Stipa 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. Narrow-leaved purple coneflower (Echinacea pallida) is common in the drier end of the gradient in the CGP but absent from the Eastern Broadleaf Forest Province.

• 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.

• **Trees** are absent except where fire suppression has allowed invasion by woody species.

• **Notes**: Kentucky bluegrass (*Poa pratensis*), an introduced species, is invariably present; it increases in the prolonged absence of fire but becomes dominant only with heavy grazing pressure. Smooth brome (*Bromus inermis*), another exotic, is a very troublesome invasive species favored by disturbance, including natural disturbance by pocket gophers.





The region of Minnesota in which UPs23 occurs is predominantly a low-relief landscape interrupted by local areas of greater relief associated with stagnation moraines and large erosional features created by glacial meltwaters. The deeply dissected PPL in the southeast corner of the state, where UPs23 is rare, is exceptional. Historically in the PPL, UPs23 was confined to the tops of broader interfluves. UPs23 typically occupies ground moraines and end moraines and smaller inclusions of outwash and lacustrine sediments. In southwestern and southeastern Minnesota, outside the boundaries of the Wisconsin glacial deposits, UPs23 occurs on older, loess-mantled ground moraines. Soils are somewhat poorly drained to well drained, mostly moderately permeable to permeable, fine- and medium-textured loams and loamy sands. Soils are mollisols, characterized by thick, dark, organic-enriched upper horizons with high base saturation and dominantly bivalent cations.

### **Natural History**

UPs23 is present on level to gently sloping sites where the water table is below the rooting zone except for brief periods during the growing season. Soil moisture availability remains high on average because of soil texture and composition. Recurrent fire is essential for the existence of UPs23, as environmental conditions are otherwise suitable for the growth of trees; where propagules are available, succession to forest occurs rapidly in the absence of fire. Fires also recycle nutrients bound up in litter and promote flowering and seed production. These events temporarily expose the soil surface and so probably play an important role in plant regeneration. Before Euro-American settlement, grazing and trampling by large ungulates were regular occurrences in UPs23. The contribution of this disturbance to the composition and structure of the vegetation is not well understood, although it is known that confined grazing by domestic livestock can guickly destroy mesic prairies, promoting the replacement of most native species by introduced ones. Episodic grazing probably enables the persistence of some native species that cannot otherwise reproduce in the dense canopy of tall grasses and forbs characteristic of UPs23; these would include shorter species and especially annual or biennial species. Spatial patchiness in grazing intensity is also thought to have influenced fire behavior, providing a shifting patchwork of refugia for fire-sensitive animal species. The fertile soils and gentle relief of UPs23 are ideal for row-crop agriculture, and almost all of the land that supported this class has been converted to cropland.

### Similar Native Plant Community Classes • UPn23 Northern Mesic Prairie

UPn23 differs from UPs23 mainly in the rarity or absence of several species typically present in UPs23, although none is present throughout the range of UPs23. Shrubs become increasingly important northward in UPn23. Tufted hairgrass (*Deschampsia cespitosa*), absent from UPs23, is present in UPn23, although limited to wet-mesic occurrences. The boundary between these two classes is set more or less by convention; further study may determine that it should be repositioned or abandoned. Because of differences between the predominant glacial landforms in the ranges of the two classes, wet-mesic prairies are more common in UPn23 and dry-mesic prairies more common in UPs23. This imbalance seems to account for most of the differences in species frequency and cover between these two classes.

LIDe22 Indicator Spacios	(fre	q%)	11Dn22 Indicator Spacios	(free	q%)
UPS25 Indicator Species	UPs23	UPn23	OPTIZS Indicator Species	UPs23	UPn23
Gray-headed coneflower (Ratibida pinnata)	36	-	Tufted hair grass (Deschampsia cespitosa)	-	35
Bird's foot coreopsis (Coreopsis palmata)	30	-	Harebell (Campanula rotundifolia)	2	48
Skyblue aster (Aster oolentangiensis)	18	-	Bebb's willow (Salix bebbiana)	2	24
Clammy ground cherry (Physalis heterophylla)	14	-	Glaucous false dandelion (Agoseris glauca)	2	24
Bicknell's sedge (Carex bicknellii)	11	-	-	-	-
Round-headed bush clover (Lespedeza capitata)	10	-	-	-	-
Canada tick trefoil (Desmodium canadense)	17	1	-	-	-
Aromatic aster (Aster oblongifolius)	10	2	-	-	-





### UPs24 Southern Mesic Savanna

Scarcity of data for UPs24 makes comparison with UPs23 speculative. The herbaceous component of the two classes is probably similar, although forbs possibly are more important relative to graminoids in UPs24 than in UPs23. UPs24 is distinguished by the presence of at least sparse (> 10%) tree cover, dominated by bur oak.

### UPs13 Southern Dry Prairie

The greater importance of midheight grasses relative to tallgrass species in UPs13 results in generally lower canopy height in UPs13 than in UPs23. UPs13 typically has sparser vegetation cover, with some bare soil exposed, often with terricolous lichens, while the soil surface is completely hidden in UPs23. There is little difference in species composition between drier examples of UPs23 and occurrences of UPs13 on loamier soils. Topography, soil characteristics, and relative abundances of species characteristic of dry versus mesic habitats provide the basis for determination.

LIDe22 Indicator Species	(fre	q%)	UDe12 Indicator Species	(free	q%)
UPS23 Indicator Species	UPs23	UPs13	UPSIS Indicator Species	UPs23	UPs13
Prairie cordgrass (Spartina pectinata)	30	-	Hairy grama (Bouteloua hirsuta)	-	30
American vetch (Vicia americana)	23	1	Dotted blazing star (Liatris punctata)	1	34
Ox-eye (Heliopsis helianthoides)	31	2	Sage wormwood (Artemisia frigida)	1	23
Tall meadow-rue (Thalictrum dasycarpum)	44	5	Flowering spurge (Euphorbia corollata)	1	22
Maximilian's sunflower (Helianthus maximiliani)	31	4	Harebell (Campanula rotundifolia)	2	25
Switchgrass (Panicum virgatum)	44	8	Western ragweed (Ambrosia psilostachya)	4	26
Silverleaf scurfpea (Pediomelum argophyllum)	43	12	Plains muhly (Muhlenbergia cuspidata)	11	56
Leiberg's panic grass (Panicum leibergii)	43	16	Hoary vervain (Verbena stricta)	5	23

### • WPs54 Southern Wet Prairie

WPs54 grades into UPs23 at the moist end of the moisture gradient in UPs23, without a distinct floristic boundary between the two classes. WPs54 is always present on level or slightly concave sites except in the unusual situation where groundwater seepage creates moist habitat. Prairie cordgrass is typically much more important in WPs54 than in UPs23, as are sedges (Carex spp.). Big bluestem is typically present, although its contribution to total cover is usually less than in UPs23, and it may be absent. Leadplant is present in most instances of UPs23 and rarely present in WPs54.

LIDo22 Indiantor Spanion	(fre	q%)	WDoE4 Indiantor Spanian	(fre	q%)
OPSZS mulcator species	UPs23	WPs54	WPS54 mulcator species	UPs23	WPs54
Stiff sunflower (Helianthus pauciflorus)	50	-	Bluejoint (Calamagrostis canadensis)	1	25
White sage (Artemisia ludoviciana)	43	-	Spotted water hemlock (Cicuta maculata)	2	35
Porcupine grass (Stipa spartea)	58	2	Autumn sneezeweed (Helenium autumnale)	3	37
Leiberg's panic grass (Panicum leibergii)	43	2	Prairie loosestrife (Lysimachia quadriflora)	4	33
Leadplant (Amorpha canescens)	74	6	Riddell's goldenrod (Solidago riddellii)	6	41
Missouri goldenrod (Solidago missouriensis)	47	4	Golden or False golden ragwort*	9	43
Rough blazing star (Liatris aspera)	59	6	Stemless blue violets**	9	41
White prairie clover (Dalea candida)	55	8	Woolly sedge (Carex pellita)	9	41
*Goldon or Falso goldon ragwort (Sonocio aurous	or S peou	daurous	**Stomloss blue violets (Viela neebropbylla and si	milar Viola	(con)

ragwort (Senecio aureus or S.pseudaureus) \*\*Stemless blue violets (Viola nephrophylla and similar

### Native Plant Community Types in Class

### • UPs23a Mesic Prairie (Southern)

UPs23a is the only community type recognized in this class. Additional data and further analysis may warrant subdivision based on soils (sands versus loams) and differences in moisture regime (dry-mesic versus wet-mesic).





Schaefer Prairie, McLeod County, MN





freq%	cover		freq% cov
Forbs, Ferns & Fern Allies		White camas (Zigadenus elegans)	27
Heart-leaved alexanders (Zizia aptera) 78	•	Common strawberry (Fragaria virginiana)	26
Heath aster (Aster ericoides) 77	:	Bastard toadflax (Comandra umbellata)	25
Stiff goldenrod (Solidago rigida) 74	•	Virginia mountain mint (Pycnanthemum virginianum)	25
Canada goldenrod (Solidago canadensis) 69	:	Pale-spiked lobelia (Lobelia spicata)	25
Purple prairie clover (Dalea purpurea) 68	•	American vetch (Vicia americana)	23
Yarrow (Achillea millefolium) 65	•	Ground plum (Astragalus crassicarpus)	23
Rough blazing star (Liatris aspera) 59	•	Canada anemone (Anemone canadensis)	52
Prairie phlox (Phlox pilosa) 55	•	Clasping dogbane (Apocynum sibiricum)	52
White prairie clover (Dalea candida) 55	•	Virginia ground cherry (Physalis virginiana)	52
Hoary puccoon (Lithospermum canescens) 53	•	Toothed evening primrose (Calylophus serrulatus)	21
Stiff sunflower (Helianthus pauciflorus) 50	•	Wood betony (Pedicularis canadensis)	20
Prairie wild onion (Allium stellatum) 49	•	Northern plains blazing star (Liatris ligulistylis)	20
Missouri goldenrod (Solidago missouriensis) 47	:	Wild bergamot (Monarda fistulosa)	19
Long-headed thimbleweed (Anemone cylindrica) 46	•	Skyblue aster (Aster oolentangiensis)	18
Bearded birdfoot violet (Viola palmata) 45	•	Canada tick trefoil (Desmodium canadense)	17
Flodman's thistle (Cirsium flodmanii) 45	•	Smooth rattlesnakeroot (Prenanthes racemosa)	15
Tall meadow-rue (Thalictrum dasycarpum) 44	•	Wood lily (Lilium philadelphicum)	13
Daisy fleabane (Erigeron strigosus) 44	•	Rattlesnake master (Eryngium yuccifolium)	12
Silverleaf scurtpea (Pediomelum argophyllum) 43	•	Grasses & Sedges	
White sage (Artemisia ludoviciana) 43	•	Big bluestem (Andropogon gerardii)	94
Northern bedstraw (Galium boreale) 39	:	Indian grass (Sorghastrum nutans)	80
Smooth blue aster (Aster laevis) 37	•	Little bluestem (Schizachyrium scoparium)	67
Gray-headed coneflower (Ratibida pinnata) 36	:	Prairie dropseed (Sporobolus heterolepis)	•
Silky aster (Aster sericeus) 34	•	Porcupine grass (Stipa spartea)	£8
Maximilian's sunflower (Helianthus maximiliani) 31	:	Side-oats grama (Bouteloua curtipendula)	46
Gray goldenrod (Solidago nemoralis) 31	:	Switchgrass (Panicum virgatum)	44
Ox-eye (Heliopsis helianthoides) 31	•	Leiberg's panic grass (Panicum leibergii)	43
Tall cinquefoil (Potentilla arguta) 31	•	Slender wheatgrass (Elymus trachycaulus)	32
Common milkweed (Asclepias syriaca) 31	•	Prairie cordgrass (Spartina pectinata)	e R
Bird's foot coreopsis (Coreopsis palmata) 30	:	Semi-Shrubs	
Narrow-leaved purple coneflower (Echinacea pallida) 30	•	Leadplant (Amorpha canescens)	74
Prairie turnip (Pediomelum esculentum) 30	•	Prairie rose (Rosa arkansana)	70
Alumroot (Heuchera richardsonii) 28	•	Shrubs	
Great blazing star (Liatris pycnostachya) 27	•	Wolfberry (Symphoricarpos occidentalis)	17

UPs23 Southern Mesic Prairie — Species Frequency & Cover

# UPs24

### Southern Mesic Savanna

Sparsely treed communities with tallgrass-dominated ground layers on somewhat poorly drained to well-drained loam soils mainly formed in unsorted glacial till, sometimes in a thin loess layer over till, and locally in lacustrine sediments and outwash deposits. Present primarily on level to gently rolling sites. Drought stress is irregular in occurrence and usually not severe.

### Vegetation Structure & Composition

There is only one vegetation plot for this class; description is based mainly on inference from Southern Mesic Prairie (UPs23) and Southern Dry Savanna (UPs14).

• Graminoid cover is interrupted to continuous (50–100%). Tallgrasses dominate, but several midheight grasses are also important. Big bluestem (Andropogon gerardii) and Indian grass (Sorghastrum nutans) are the dominant tallgrasses, with prairie dropseed (Sporobolus heterolepis) either a codominant or subdominant component. On the drier end of the moisture gradient, little bluestem (Schizachyrium scoparium), porcupine grass (Stipa spartea), and side-oats grama (Bouteloua curtipendula) are important.

• Forb cover is sparse to patchy (5–50%). The most common species are 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 max-imiliani*), tall meadow-rue (*Thalictrum dasycarpum*), prairie phlox (*Phlox pilosa*), and gray-headed coneflower (*Ratibida pinnata*) are common in moister examples; rough blazing star (*Liatris aspera*), Missouri and gray goldenrods (*Solidago missouriensis* and *S. nemoralis*), and bird's foot coreopsis (*Coreopsis palmata*) are common in drier ones.

• **Woody vines** are a minor component. Virginia creeper (*Parthenocissus* spp.) is frequently present, and wild grape (*Vitis riparia*) is occasionally present.

• Shrub layer is patchy to interrupted (50–75% cover) and composed of low (< 20in [50cm]) semi-shrubs, taller (up to 6ft [2m]) shrubs, and oak seedlings and saplings (< 6ft). The low semi-shrubs leadplant (*Amorpha canescens*), prairie rose (*Rosa arkan-sana*), and poison ivy (*Toxicodendron rydbergii*) are generally common. Common taller shrubs are chokecherry (*Prunus virginiana*), American hazelnut (*Corylus americana*), smooth sumac (*Rhus glabra*), gray dogwood (*Cornus racemosa*), wolfberry (*Symphoricarpos occidentalis*), low juneberry (*Amelanchier humilis*), and wild plum (*Prunus americana*).

• **Trees** are scattered or in scattered clumps, with total cover < 70% and typically 25– 50%. Bur oak is most common, but northern pin oak is also usually present.

• Notes: The exotic grasses Kentucky bluegrass (*Poa pratensis*) and smooth brome (*Bromus inermis*) are often problematic in UPs24. Pennsylvania sedge (*Carex pensylvanica var. pensylvanica*), a native graminoid that is naturally a minor component of UPs24, increases in abundance with prolonged heavy grazing. With fire suppression, trees other than the oaks become established, especially green ash, quaking aspen, and basswood.





### Landscape Setting & Soils

Historically, UPs24 occurred most commonly in low relief prairie landscapes on ground moraines and end moraines, and less commonly on lacustrine deposits and finer-textured outwash. In the Rochester Plateau Subsection of the PPL, UPs24 occurred on loess-mantled pre-Wisconsin till. Soils are somewhat poorly drained to well drained, mostly moderately permeable to permeable, fine- and medium-textured loams and loamy sands. These are mollisols, characterized by thick, dark, organic-enriched upper horizons with high base saturation and dominantly bivalent cations.

### **Natural History**

Savannas form where fire recurs frequently enough to prevent trees and shrubs from dominating, but where frequency and severity are low enough to allow fire-tolerant trees to become established and sometimes reach maturity. Historically, savannas occurred in physical proximity to prairies, but where features such as streams, lakes, and steep topography impeded the spread of fires, providing local amelioration of the prairie fire regime. All savannas are highly sensitive to fire suppression, quickly succeeding to woodland and eventually to forest, and the higher productivity of sites where UPs24 occurs makes it even more susceptible to succession than UPs14. UPs24 occupies sites where soil moisture availability remains high on average because of soil texture and composition, although the water table is below the rooting zone during the growing season except for brief periods. Before Euro-American settlement, grazing, browsing, and trampling by large ungulates were probably regular occurrences in UPs24. The contribution of this disturbance to the composition and structure of the vegetation is poorly understood, although confined grazing by domestic livestock can quickly destroy mesic savannas, promoting replacement of most of the native species by introduced ones. The fertile soils and gentle relief of UPs24 are ideal for row-crop agriculture, and almost all of the land that supported UPs24 has been converted to cropland; areas not converted have either been so heavily pastured that almost none of the native herbaceous flora survives, or they have become woodland or forest with fire suppression.

# Similar Native Plant Community Classes UPn24 Northern Mesic Savanna

The scarcity of plot data for UPn24 and UPs24 make comparison of these classes speculative. Differences in the herbaceous flora probably mirror differences between UPs23 and UPn23. The two differ in tree composition, with northern pin oak frequent in UPs24 but rare in UPn24, and white oak occasional in UPs24 but not present in UPn24. Quaking aspen is probably more frequent in UPn24 than in UPs24. The boundary between these two classes, like that between UPs23 and UPn23, is set more or less by convention and could be repositioned or abandoned on further study.

### • UPs23 Southern Mesic Prairie

UPs23 has similar herbaceous composition to UPs24—although forbs may be more important relative to graminoids in UPs24 than in UPs23—but generally lacks trees, while UPs24 has at least sparse (> 10%) tree cover, dominated by bur oak. Because of partial shading in UPs24, cool-season graminoids such as junegrass (*Koeleria pyramidata*), porcupine grass, green needle grass (*Stipa viridula*), and Pennsylvania sedge may be more important relative to warm-season grasses than in UPs23.

### • UPs14 Southern Dry Savanna

Differences in the herbaceous flora between UPs14 and UPs24 are probably similar to the differences between UPs13 and UPs23. Shrub cover is probably greater in UPs24 than in UPs14—UPs24 might have more the appearance of a shrub thicket than that of a tree-studded prairie. Differences in substrate characteristics (predominantly sandy or gravelly outwash and lacustrine deposits versus predominantly loamy till) are sufficient in most cases to distinguish the two classes; classification uncertainty is likely only when UPs14 is on loamy slopes (UPs14c).



### Native Plant Community Types in Class

• UPs24a Mesic Oak Savanna (Southern) UPs24a is the only community type recognized in this class. Additional data and further analysis may warrant subdivision based on soils (sands versus loams).



Fillmore County, MN



### Southern Wet Ash Swamp

Wet hardwood forests on mucky or peaty soils in areas of groundwater seepage, most often on level stream or river terraces at bases of steep slopes. Community is uncommon and often present as small inclusions within larger forest areas.

### Vegetation Structure & Composition

Description is based on summary of vegetation data from 32 plots (relevés)

• Ground layer is characterized by raised peaty hummocks, with open pools and rivulets in seepage areas. Wetland species such as common marsh marigold (*Caltha palustris*), touch-me-nots (*Impatiens* spp.), and fowl manna grass (*Glyceria striata*) are common in wet areas, with Virginia creeper (*Parthenocissus* spp.), jack-in-the-pulpit (*Arisaema triphyllum*), wood nettle (*Laportea canadensis*), wild geranium (*Geranium maculatum*), common enchanter's nightshade (*Circaea lutetiana*), tall coneflower (*Rudbeckia laciniata*), and other mesic or wetmesic forest species present on hummocks. Skunk cabbage (*Symplocarpus foetidus*),



false mermaid (*Floerkea proserpinacoides*), brome-like sedge (*Carex bromoides*), and smooth-sheathed sedge (*C. laevivaginata*) are sometimes abundant in seepage zones and in Minnesota are essentially restricted to this community.

• Shrub layer is sparse (5-25% cover). Black ash seedlings or saplings are almost always present, often with wild black currant (*Ribes americanum*), chokecherry (*Prunus virginiana*), and nannyberry (*Viburnum lentago*).

• **Subcanopy**, when present, is patchy to interrupted (25-75% cover) and generally not well differentiated from canopy.

• **Canopy** is patchy to interrupted, with trees often absent from localized areas of groundwater discharge and in some instances limited to margins of the community around open peaty upwelling zones. Tree canopy is strongly dominated by black ash, often with other hardwood species, especially basswood, sugar maple, and American elm. Yellow birch and bur oak are also sometimes present.

### Landscape Setting & Soils

WFs57 occurs on strongly rolling to steeply dissected terrain where there is sufficient relief for groundwater to upwell or discharge laterally in springs or broad zones. Most often these seepage areas are present on level alluvial terraces below steep slopes with exposed bedrock aquifers; less often, they develop in regions of deep glacial drift where groundwater flows through highly permeable aquifers and emerges at the ground surface. In all settings, springheads and rivulets with continuously flowing cold groundwater are evident. Parent material is silty colluvium or alluvium capped by mucky peat. The organic cap is often thin and discontinuous in the southeastern blufflands and thicker to the north, where peat depths can exceed 40in (100cm). The underlying mineral soil is gray, indicating permanent saturation. Soils are poorly to very poorly drained. Soil-moisture regime is very moist to moderately wet. (WSU, MDL, MIM, PPL)

### **Natural History**

In the past, catastrophic disturbances were rare in WFs57. The rotation of catastrophic windthrow is estimated to be about 630 years; there were no references to fire in the relevant Public Land Survey records. Events that result in partial loss of trees, especially





selective windthrow, were somewhat more common, with an estimated rotation of about 140 years. The historic records suggest there were only slight changes in tree dominance among age classes in the community, with succession consisting of minor changes in tree abundance around a constant base of black ash, which dominated all age classes. American elm and basswood were minor components in the 50-to-90-year age class, while small amounts of tamarack and white spruce were sometimes present in forests older than about 110 years in the northern part of the community's range. (Tamarack and white spruce are absent from most modern examples of the community.)

### Similar Native Plant Community Classes • FFn57 Northern Terrace Forest

Both communities commonly occur on stream terraces, where they can grade into one another. FFn57 often has abundant silver maple in the canopy with black ash and occurs in areas lacking evidence of groundwater seepage. WFs57 is strongly dominated by black ash and lacks silver maple in the canopy. On stream terraces, WFs57 is always associated with areas of groundwater seepage, as evidenced by the presence of rivulets and saturated peaty hummocks.

WESEZ Indiantar Spanian	(fre	q%)	EEnEZ Indiactor Species	(free	q%)
wrs57 mulcalor species	WFs57	FFn57	FFIIS7 Indicator Species	WFs57	FFn57
Fowl manna grass (Glyceria striata)	68	-	Prickly or Smooth wild rose*	-	27
Cleavers (Galium aparine)	45	-	Projecting sedge (Carex projecta)	-	27
Bulblet fern (Cystopteris bulbifera)	35		Canada anemone (Anemone canadensis)	-	25
Skunk cabbage (Symplocarpus foetidus)	35	-	Spinulose shield fern or Glandular wood fern**	-	25
Two-leaved miterwort (Mitella diphylla)	48	2	Silver maple (C,U)	3	50
Sugar maple (C,U)	61	4	Tall meadow-rue (Thalictrum dasycarpum)	13	67
Common marsh marigold (Caltha palustris)	68	6	Erect, Smooth, or Illinois carrion-flower***	16	75
Awl-fruited sedge (Carex stipata)	52	6	Nodding trillium (Trillium cernuum)	6	29
*Prickly or Smooth wild rose (Rosa acicularis or F	hlanda)	**Sninul	ose shield fern or Glandular wood fern (Dryonteris (	arthusian	a or D

intermedia) \*\*\*Erect, Smooth, or Illinois carrion-flower (Smilax ecirrata, S.herbacea, or S. illinoensis)

### WFn55 Northern Wet Ash Swamp

WFn55, like WFs57, is most often dominated by black ash. WFn55 generally occurs to the north of WFs57, but the ranges of the two communities overlap in a broad zone along the boundary between the EBF and LMF provinces. WFn55 is most common in shallow basins and other sites where water ponds or pools; it is less commonly associated with groundwater discharge areas. WFs57 is always associated with groundwater discharge areas.

WEGET Indicator Spacios	(fre	eq%)	WEREE Indiantar Spanian	(free	q%)
Wrs57 Indicator Species	WFs57	WFn55	wrn55 indicator species	WFs57	WFn55
Crooked aster (Aster prenanthoides)	29	-	Spinulose shield fern or Glandular wood fern*	-	67
Wild geranium (Geranium maculatum)	65	1	Balsam fir (U)	3	54
Bulblet fern (Cystopteris bulbifera)	35	2	Common oak fern (Gymnocarpium dryopteris)	3	44
Cleavers (Galium aparine)	45	3	Bluebead lily (Clintonia borealis)	3	40
Virginia waterleaf (Hydrophyllum virginianum)	39	3	Mountain maple (Acer spicatum)	10	68
Clearweed (Pilea spp.)	29	3	Starflower (Trientalis borealis)	6	42
Skunk cabbage (Symplocarpus foetidus)	35	6	Naked miterwort (Mitella nuda)	10	56
Tall coneflower (Rudbeckia laciniata)	61	11	Woodland horsetail (Equisetum sylvaticum)	10	52
*Chinulage chield fam as Clandulas wood fam (Dru	antaria ar		a ar D intermedia)		

Spinulose shield fern or Glandular wood fern (Dryopteris carthusiana or D. intermedia)

### FFs59 Southern Terrace Forest

FFs59 sometimes has abundant black ash in the canopy and can grade into WFs57 on stream terraces. FFs59 is more likely to have other tree species mixed with black ash in the canopy, including riparian species such as cottonwood and silver maple, and occurs on sites lacking evidence of groundwater seepage. WFs57 is always associated with groundwater seepage areas.

WEaEZ Indiantar Spanian	(fre	q%)	EEsEQ Indicator Spacios	(fred	<b>q%</b> )
wrs57 mulcalor species	WFs57	FFs59	FFS59 Indicator Species	WFs57	FFs59
Fowl manna grass (Glyceria striata)	68	-	Cottonwood (C)	-	31
Awl-fruited sedge (Carex stipata)	52	-	Silver maple (C,U)	3	49
Sensitive fern (Onoclea sensibilis)	48	-	Greenbrier (Smilax tamnoides)	3	34
Michigan lily (Lilium michiganense)	39	-	Ontario aster (Aster ontarionis)	3	29
Skunk cabbage (Symplocarpus foetidus)	35	-	Aniseroot (Osmorhiza longistylis)	6	46
Common marsh marigold (Caltha palustris)	68	3	Box elder (C)	10	66
Lady fern (Athyrium filix-femina)	58	6	Hackberry (C,U)	10	60
Two-leaved miterwort (Mitella diphylla)	48	9	Woodmint (Blephilia hirsuta)	3	20



### WMs83 Southern Seepage Meadow/Carr

WMs83, like WFs57, develops in groundwater seepage areas, and the two classes share many common wetland species, including common marsh marigold, fowl manna grass, and interior sedge (*Carex interior*). WMs83, however, is typically an open wetland community with few trees and is dominated by large, often tussock-forming sedges such as lake sedge (*Carex lacustris*), tussock sedge (*C. stricta*), and aquatic sedge (*C. aquatilis*), with the latter two species absent from WFs57. WMs83 and WFs57 are most difficult to differentiate in seepage areas characterized by sparse or patchy cover of black ash trees or where trees are restricted to the margins of large upwelling zones.

### • WFs55 Southern Wet Aspen Forest

The range of WFs55 overlaps with WFs57 in southern and western Minnesota. WFs55 is dominated by quaking aspen with only scattered black ash, while WFs57 is almost always dominated by black ash and has little if any quaking aspen. WFs55 is not as wet as WFs57 and is more likely to have species characteristic of dry-mesic to mesic woodlands and wet meadows such as gray dogwood (*Cornus racemosa*), false melic grass (*Schizachne purpurascens*), and Hayden's sedge (*Carex haydenii*). WFs57 is more likely to have shallow open pools and wetland plants such as marsh marigold, fowl manna grass, and brome-like sedge (*Carex bromoides*) in the ground layer.

### Native Plant Community Types in Class

### • WFs57a Black Ash - (Red Maple) Seepage Swamp

Canopy is dominated by black ash, often with basswood, especially in western Minnesota. Green ash, yellow birch, or paper birch are abundant in some stands. Species that can help to differentiate WFs57a from WFs57b include red maple and speckled alder (*Alnus incana*) in the understory, and sensitive fern (*Onoclea sensibilis*), Canada mayflower (*Maianthemum canadense*), dwarf raspberry (*Rubus pubescens*), pale bellwort (*Uvularia sessilifolia*), mad dog skullcap (*Scutellaria lateriflora*), starry false Solomon's seal (*Smilacina stellata*), northern bugleweed (*Lycopus uniflorus*), northern blue flag (*Iris versicolor*), white rattlesnakeroot (*Prenanthes alba*), lake sedge (*Carex lacustris*), and brome-like sedge (*Carex bromoides*) in the ground layer. In Minnesota, the rare species bog bluegrass (*Poa paludigena*) and American water pennywort (*Hydrocotyle americana*) are largely restricted to this community type. WFs57a occurs in seepage areas on alluvial terraces below steep slopes and on level sites and gradual slopes on rolling glacial moraines. WFs57a has been documented in the WSU, MDL, and MIM and likely also occurs in the CGP. Description is based on summary of vegetation data from 19 plots.

• WFs57b Black Ash - Sugar Maple - Basswood - (Blue Beech) Seepage Swamp Canopy is dominated by black ash, often with sugar maple and basswood, and sometimes with American elm or yellow birch as codominants. Species that help to differentiate WFs57b from WFs57a include blue beech, pagoda dogwood (Cornus alternifolia), bulblet fern (Cystopteris bulbifera), crooked aster (Aster prenanthoides), hispid buttercup (Ranunculus hispidus), common false Solomon's seal (Smilacina racemosa), cut-leaved toothwort (Cardamine concatenata), agrimonies (Agrimonia spp.), false mermaid, false rue anemone (Enemion biternatum), hairy-leaved sedge (Carex hirtifolia), Virginia waterleaf (Hydrophyllum virginianum), appendaged waterleaf (H. appendiculatum), bottlebrush grass (Elymus hystrix), and smooth-sheathed sedge (Carex laevivaginata); in Minnesota, crooked aster, false mermaid, and smoothsheathed sedge are largely restricted to this community type. WFn57b usually occurs on alluvial soils at the bases of steep bluffs, less commonly toward the middle of valley floors between bluffs, and rarely on bluff slopes. WFs57b is uncommon and is limited to the Blufflands Subsection of the PPL. Description is based on summary of vegetation data from 13 plots.







Wabasha County, MN

# WFs57 Southern Wet Ash Swamp – Species Frequency & Cover

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Forbs, Ferns & Fern Allies Touch-me-not (Impatiens spp.) Jack-in-the-pulpit (Arisaema triphyllum)	freq% 97 90	cover	Small-leaved water cress (F Grasses & Sedges Fowl manna grass (Glyceria	orippa nasturtium striata)	-aquaticum)	freq% 10 69	cover
Common marsh marigold (Caltha palustris) Wild geranium (Geranium maculatum)	65 68	.:	Starry sedge (Carex rosea of Bland sedge (Carex blanda)	r C. radiata)		32 32	. :
Common enchanter's nightshade (Circaea lutetiana) Tall coneflower (Rudbeckia laciniata)	<u>6</u> 6	• •	Graceful sedge (Carex grac Lake sedge (Carex lacustris	illima) )		29 29	:.
Lady fern (Athyrium filix-femina)	л 57 Л 60	. :	Brome-like sedge (Carex br	omoides)	-	1.23	. :
White avens (Geum canadense) Sensitive fern (Onoclea sensibilis)	48 55	• •	Smooth-sheathed sedge (C Interior sedge (Carex interio	arex laevivaginata r)		16 13	:.
Clayton's sweet cicely (Osmorhiza claytonii)	48	•	Climbing Plants				
Two-leaved miterwort ( <i>Mitella diphylla</i> )	ŧ₿		Virginia creeper (Parthenoc.	ssus spp.)		94	
Wild ginger (Asarum canadense) Sweet-scented bedstraw (Galium triflorum)	45 f	. :	Shrups Wild black currant (Ribes ar	nericanum)		52	•
Cleavers (Galium aparine)	45	•	Chokecherry (Prunus virgin	ana)		45	•
Hog peanut (Amphicarpaea bracteata)	; <del>4</del> 5	•	Nannyberry (Viburnum lenta	go)		45	:
Honewort (Cryptotaenia canadensis)	3 <del>6</del>	•	Pagoda dogwood (Cornus a	lternifolia)		ი წ	•
Canada mayflower (Maianthemum canadense)	42 f	•	Prickly gooseberry (Ribes c	yubergii) vnosbati)		29 29	•
Ostrich fern (Matteuccia struthiopteris)	39	•	Speckled alder (Alnus incar	a)		26	:
Zigzag goldenrod (Solidago flexicaulis) Stinging nettle (Urtica dioica)	39 39 99	• •	Missouri gooseberry (Ribes	missouriense)		23	:
Michigan Illy (Lillum michiganense)	30		Trees	Canopy	Subcanopy	Shrub	Layer
Virginia waterleaf (Hydrophyllum virginianum)	39	•	Black ash	•••• 76	••• 06 10100 0101	06 20	•
Dwarf raspberry (Rubus pubescens)	39	•	Basswood	•	52	42	•
Hooked crowfoot (Ranunculus recurvatus)	35	•	Sugar maple	39	39	42	•
Skunk cabbage (Sympiocarpus Toetious) Bulblet fern (Cystopteris bulbifera)	35 33		American eim Bur oak		- 43 - •	48 26	• •
Field horsetail (Equisetum arvense)	32	•	Yellow birch	19 •••	19 •••	16	•
Clearweed (Pilea spp.)	29	:	Paper birch	16 •••			
Crooked aster (Aster prenanthoides)	29	:	Green ash	16 •••	13 ••	13	•
Tall scouring rush (Equisetum hyemale)	23	:	Blue beech	13 •	23	23	•
False mermaid (Floerkea proserpinacoides)	19	•••	Northern red oak	•		32	•



•••• Northern red oak

### APPENDIX B. HISTORIC LAND USE IMAGES



Figure 1. Historical Aerial Imagery from 1938. Source- Minnesota Historical Aerial Photographs Online University of Minnesota.



Figure 2. Historical Aerial Imagery from 1957. Source- Minnesota Historical Aerial Photographs Online University of Minnesota.

Lake Byllesby Natural Resource Management Plan



Figure 3. Historical Aerial Imagery from 1964. Source- Minnesota Historical Aerial Photographs Online University of Minnesota.

### APPENDIX C. BYLLESBY RESERVOIR SEDIMENTATION PROGRESSION



Figure 4. Historical Aerial Imagery from 1938. Source- Minnesota Historical Aerial Photographs Online University of Minnesota. Also note that Hwy 56 has not yet been constructed, and thus Chub Creek has not yet been redirected.



Figure 5. Historical Aerial Imagery from 1951. Source- Minnesota Historical Aerial Photographs Online University of Minnesota.



Figure 6. Historical Aerial Imagery from 1964. Source- Minnesota Historical Aerial Photographs Online University of Minnesota.



Figure 7. Historical Aerial Imagery from 1970. Source- Minnesota Historical Aerial Photographs Online University of Minnesota.



Figure 8. Historical Aerial Imagery from 1991. Source- Google Earth Historical Aerial Imagery


Figure 9. Historical Aerial Imagery from 2003. Source- Google Earth Historical Aerial Imagery



Figure 10. Historical Aerial Imagery from 2010. Source- Google Earth Historical Aerial Imagery



Figure 11. Historical Aerial Imagery from 2015. Source- Google Earth Historical Aerial Imagery

## APPENDIX D. SGCN AND RARE SPECIES IN DAKOTA COUNTY

#### Mammals

	Таха	Sciențific name	Common name	State status	Federal status	Criteria (stressors and life-history traits)
1	Mammals	Alces americanus	moose	SPC		habitat loss; disease; need special resources (narrow thermal preferences)
2	Mammals	Cervus canadensis	elk	SPC		state listed; no additional criteria identified
3	Mammals	Cryptotis parva	North American least shrew	SPC		need special resources (narrow thermal preferences); highly localized/restricted distribution
4	Mammals	Eptesicus fuscus	big brown bat	SPC		disease; need special resources (narrow thermal preferences); limited ability to recover (low reproductive rate); aggregate their populations
5	Mammals	Lasionycteris noctivagans	silver-haired bat	NL		habitat fragmentation; limited ability to recover (low reproductive rate)
6	Mammals	Lasiurus borealis	red bat	NL		habitat fragmentation; limited ability to recover (low reproductive rate)
7	Mammals	Lasiurus cinereus	hoary bat	NL		habitat fragmentation; limited ability to recover (low reproductive rate)
8	Mammals	Lepus townsendii	white-tailed jack- rabbit	NL		statistically valid decline documented; extensive surveys indicate a decline of unknown cause
9	Mammals	Lynx canadensis	Canada lynx	SPC	т	habitat degradation; need special resources (narrow thermal preferences); depend on ecological process no longer within NRV
10	Mammals	Microtus ochrogaster	prairie vole	SPC		habitat loss; habitat degradation; invasive species; highly localized/restricted distribution
11	Mammals	Microtus pinetorum	woodland vole	SPC		highly localized/restricted distribution
12	Mammals	Mustela nivalis	least weasel	SPC		highly localized/restricted distribution
13	Mammals	Myotis lucifugus	little brown myotis	SPC		disease; need special resources (narrow thermal preferences); limited ability to recover (low reproductive rate); aggregate their populations
14	Mammais	Myotis septentrionalis	northern long-eared bat	SPC	Т	disease; need special resources (narrow thermal preferences); limited ability to recover (low reproductive rate); aggregate their populations
15	Mammals	Onychomys Ieucogaster	northern grasshopper mouse	SPC		state listed – no additional criteria identified
16	Mammals	Perimyotis subflavus	tri-colored bat	SPC		disease; need special resources (narrow thermal preferences); limited ability to recover (low reproductive rate); aggregate their populations
17	Mammals	Perognathus flavescens	plains pocket mouse	SPC		highly localized/restricted distribution
18	Mammals	Phenacomys ungava	eastern heather vole	SPC		highly localized/restricted distribution
19	Mammals	Poliocitellus franklinii	Franklin's ground squirrel	NL		populations in Minnesota stable, but have declined or are declining in a substantial part of range
20	Mammals	Puma concolor	mountain lion	SPC		state listed; no additional criteria identified
21	Mammals	Reithrodontomys megalotis	western harvest mouse	SPC		state listed; no additional criteria identified
22	Mammals	Sorex fumeus	smoky shrew	SPC		state listed; no additional criteria identified
23	Mammals	Spilogale putorius	eastern spotted skunk	THR		statistically valid decline documented; extensive surveys indicate a decline of unknown cause
24	Mammals	Synaptomys borealis	northern bog lemming	SPC		highly localized/restricted distribution
25	Mammals	Taxidea taxus	American badger	NL		habitat loss; habitat fragmentation
26	Mammals	Thomomys talpoides	northern pocket gopher	THR	) = 0	habitat loss; deliberate killing; highly localized/ restricted distribution
27	Mammals	Urocitellus richardsonii	Richardson's ground squirrel	SPC		habitat loss

	Таха	Scientific name	Common name	State status	Federal status	Criteria (stressors and life-history traits)
1	Birds	Accipiter gentilis	northern goshawk	SPC		habitat fragmentation; requires large home ranges/multiple habitats; depend on large habitat
2	Birds	Aechmophorus	western grebe	NL		rare, vulnerable/declining habitat; aggregate their populations
3	Birds	Aegolius funereus	boreal owl	SPC		rare, vulnerable/declining habitat; requires large home ranges/multiple habitats; highly localized/ restricted distribution; extensive surveys indicate a decline of unknown cause
4	Birds	Ammodramus bairdii	Baird's sparrow	END	1.05	rare, vulnerable/declining habitat
5	Birds	Ammodramus henslowii	Henslow's sparrow	END		rare, vulnerable/declining habitat; habitat loss
6	Birds	Ammodramus Jeconteii	Le Conte's sparrow	NL		rare, vulnerable/declining habitat; habitat loss
7	Birds	Ammodramus nelsoni	Nelson's sparrow	SPC		rare, vulnerable/declining habitat
8	Birds	Ammodramus savan- narum	grasshopper sparrow	NL		statistically valid decline documented; rare, vulnerable/declining habitat; habitat loss; depend on large habitat
9	Birds	Anas acuta	northern pintail	NL		statistically valid decline documented
10	Birds	Anas rubripes	American black duck	NL		highly localized/restricted distribution
11	Birds	Anthus spragueii	Sprague's pipit	END	С	rare, vulnerable/declining habitat; extensive surveys indicate a decline of unknown cause
12	Birds	Antrostomus vociferus	eastern whip-poor- will	NL		rare, vulnerable/declining habitat; habitat degra- dation; depend on ecological process no longer within NRV; extensive surveys indicate a decline of unknown cause
13	Birds	Asio flammeus	short-eared owl	SPC		rare, vulnerable/declining habitat; habitat loss
14	Birds	Athene cunicularia	burrowing owl	END		rare, vulnerable/declining habitat; need special resources (narrow thermal preferences)
15	Birds	Aythya affinis	lesser scaup	NL		statistically valid decline documented
16	Birds	Bartramia longicauda	upland sandpiper	NL		statistically valid decline documented; rare, vulnerable/declining habitat
17	Birds	Botaurus lentiginosus	American bittern	NL		statistically valid decline documented
18	Birds	Buteo lineatus	red-shouldered hawk	SPC		habitat degradation; habitat fragmentation; requires large home ranges/multiple habitats
19	Birds	Buteo swainsoni	Swainson's hawk	NL		rare, vulnerable/declining habitat
20	Birds	Calcarius ornatus	chestnut-collared longspur	END		rare, vulnerable/declining habitat; highly localized/restricted distribution
21	Birds	Calidris canutus rufa	rufa red knot		т	federally listed, no additional criteria identified
22	Birds	Calidris pusilla	semipalmated sandpiper	NL		migrating populations congregating in Minnesota represent a significant portion of the North American population
23	Birds	Catharus fuscescens	veery	NL		statistically valid decline documented; Minnesota population represents significant portion of their North American breeding or wintering population
24	Birds	Chaetura pelagica	chimney swift	NL		statistically valid decline documented
25	Birds	Charadrius melodus	piping plover	END	E/T	rare, vulnerable/declining habitat; habitat loss; highly localized/restricted distribution
26	Birds	Chlidonias niger	black tern	NL		statistically valid decline documented; rare, vulnerable/declining habitat
27	Birds	Chondestes grammacus	lark sparrow	SPC		rare, vulnerable/declining habitat; habitat degradation
28	Birds	Chordeiles minor	common nighthawk	NL		extensive surveys indicate a decline of unknown

29	Birds	Circus cyaneus	northern harrier	NL	rare, vulnerable/declining habitat; habitat loss; depend on large habitat
30	Birds	Cistothorus platensis	sedge wren	NL	Minnesota population represents significant portion of their North American breeding or wintering population
31	Birds	Coccothraustes ves- pertinus	evening grosbeak	NL	extensive surveys indicate a decline of unknown cause
32	Birds	Coccyzus americanus	yellow-billed cuckoo	NL	statistically valid decline documented
33	Birds	Coccyzus erythrop- thalmus	black-billed cuckoo	NL	statistically valid decline documented; depend on ecological process no longer within NRV
34	Birds	Contopus cooperi	olive-sided flycatcher	NL	statistically valid decline documented
35	Birds	Coturnicops noveboracensis	yellow rail	SPC	rare, vulnerable/declining habitat; habitat loss
36	Birds	Cygnus buccinator	trumpeter swan	SPC	Minnesota population represents significant portion of their North American breeding or wintering population
37	Birds	Dolichonyx oryzivorus	bobolink	NL	statistically valid decline documented; rare, vulnerable/declining habitat; habitat loss; Min- nesota population represents significant portion of their North American breeding or wintering population
38	Birds	Empidonax virescens	Acadian flycatcher	SPC	rare, vulnerable/declining habitat; habitat degradation
39	Birds	Falcipennis canadensis	spruce grouse	NL	habitat loss; habitat fragmentation
40	Birds	Falco peregrinus	peregrine falcon	SPC	statistically valid decline documented; limited ability to recover (low reproductive rate)
41	Birds	Falco sparverius	American kestrel	NL	statistically valid decline documented
42	Birds	Gallinula galeata	common gallinule	SPC	habitat loss
43	Birds	Gavia immer	common loon	NL	contaminants
44	Birds	Haemorhous purpureus	purple finch	NL	statistically valid decline documented
45	Birds	Hylocichla mustelina	wood thrush	NL	habitat loss; habitat degradation
46	Birds	Ixobrychus exilis	least bittern	NL	rare, vulnerable/declining habitat; habitat loss; habitat degradation
47	Birds	Lanius ludovicianus	loggerhead shrike	END	rare, vulnerable/declining habitat; extensive surveys indicate a decline of unknown cause
48	Birds	Leucophaeus pipixcan	Franklin's gull	SPC	habitat loss; aggregate their populations
49	Birds	Limnodromus griseus	short-billed dow- itcher	NL	migrating populations congregating in Minnesota represent a significant portion of the North American population
50	Birds	Limosa fedoa	marbled godwit	SPC	rare, vulnerable/declining habitat; depend on large habitat; depend on ecological process no longer within NRV
51	Birds	Limosa haemastica	Hudsonian godwit	NL	migrating populations congregating in Minnesota represent a significant portion of the North American population
52	Birds	Megaceryle alcyon	belted kingfisher	NL	statistically valid decline documented
53	Birds	Melanerpes erythrocephalus	red-headed woodpecker	NL	statistically valid decline documented
54	Birds	Mergus merganser	common merganser	NL	migrating populations congregating in Minnesota represent a significant portion of the North American population
55	Birds	Nycticorax nycticorax	black-crowned night-heron	NL	rare, vulnerable/declining habitat; aggregate their populations
56	Birds	Oporornis agilis	Connecticut warbler	NL	statistically valid decline documented; habitat loss; habitat fragmentation
57	Birds	Parkesia motacilla	Louisiana water- thrush	SPC	rare, vulnerable/declining habitat; habitat deg- radation; requires large home ranges/multiple habitats

5					Minnesota population represents significant
58	Birds	Pelecanus erythrorhynchos	American white pelican	SPC	portion of their North American breeding or wintering population; aggregate their populations
59	Birds	Phalaropus tricolor	Wilson's phalarope	THR	rare, vulnerable/declining habitat; habitat loss
60	Birds	Picoides arcticus	black-backed wood- pecker	NL	habitat loss; habitat fragmentation; depend on ecological process no longer within NRV
61	Birds	Pipilo erythrophthalmus	eastern towhee	NL	statistically valid decline documented; depend on ecological process no longer within NRV
62	Birds	Podiceps auritus	horned grebe	END	rare, vulnerable/declining habitat; habitat loss
63	Birds	Podiceps grisegena	red-necked grebe	NL	rare, vulnerable/declining habitat
64	Birds	Podiceps nigricollis	eared grebe	NL	rare, vulnerable/declining habitat; aggregate their populations
65	Birds	Poecile hudsonicus	boreal chickadee	NL	habitat loss; habitat degradation; habitat frag- mentation
66	Birds	Progne subis	purple martin	SPC	statistically valid decline documented; contami- nants; aggregate their populations
67	Birds	Protonotaria citrea	prothonotary warbler	NL	habitat loss; habitat degradation; invasive species
68	Birds	Rallus elegans.	king rail	END	rare, vulnerable/declining habitat; habitat loss
69	Birds	Rallus limicola	Virginia rail	NL	rare, vulnerable/declining habitat
70	Birds	Scolopax minor	American woodcock	NL	statistically valid decline documented
71	Birds	Setophaga	black-throated blue warbler	NL	rare, vulnerable/declining habitat; habitat
72	Birds	Setophaga castanea	bay-breasted warbler	NL	habitat loss; need special resources (narrow
73	Birds	Setophaga cerulea	cerulean warbler	SPC	rare, vulnerable/declining habitat; habitat
74	Birds	Setophaga citrina	hooded warbler	SPC	habitat loss; highly localized/restricted
75	Birds	Setophaga tigrina	Cape May Warbler	NL	habitat loss; need special resources (narrow thermal preferences)
76	Birds	Spiza americana	dickcissel	NL	statistically valid decline documented
77	Birds	Spizella pusilla	field sparrow	NL	statistically valid decline documented; rare,
78	Birds	Stelgidopteryx	northern rough-	NL	statistically valid decline documented
79	Birds	Sterna forsteri	Forster's tern	SPC	rare, vulnerable/declining habitat; habitat loss;
80	Birds	Sterna hirundo	common tern	THR	aggregate their populations
81	Birds	Sturnella magna	eastern meadowlark	NL	rare, vulnerable/declining habitat; habitat loss
82	Birds	Sturnella neglecta	western meadowlark	NL	statistically valid decline documented; rare,
83	Birds	Toxostoma rufum	brown thrasher	NL	statistically valid decline documented
84	Birds.	Tringa melanoleuca	greater yellowlegs	NL	migrating populations congregating in Minnesota represent a significant portion of the North American population
85	Birds	Troglodytes hiemalis	winter wren	NL	habitat loss
86	Birds	Tympanuchus cupido	greater prairie- chicken	SPC	rare, vulnerable/declining habitat
87	Birds	Tympanuchus	sharp-tailed grouse	NL	rare, vulnerable/declining habitat; aggregate
88	Birds	Tyrannus verticalis	western kingbird	NL	statistically valid decline documented; rare, vulnerable/declining habitat; depend on large habitat
89	Birds	Vermivora chrysoptera	golden-winged warbler	NL	Minnesota population represents significant portion of their North American breeding or wintering population; populations in Minnesota stable but have declined or are declining in a substantial part of range

90	Birds	Vireo bellii	Bell's vireo	SPC	rare, vulnerable/declining habitat; extensive surveys indicate a decline of unknown cause
91	Birds	Vireo philadelphicus	Philadelphia vireo	NL	rare, vulnerable/declining habitat; extensive surveys indicate a decline of unknown cause
92	Birds	Xanthocephalus xanthocephalus	yellow-headed blackbird	NL	statistically valid decline documented; rare, vulnerable/declining habitat

# Amphibians

	Таха	Scientific name	Common name	State status	Federal status	Criteria (stressors and life-history traits)
1	Amphibians	Acris blanchardi	Blanchard's cricket frog	END		habitat loss; habitat degradation; need special resources (narrow thermal preferences); highly localized/restricted distribution
2	Amphibians	Ambystoma maculatum	spotted salamander	SPC		rare, vulnerable/declining habitat; habitat loss; habitat degradation; habitat fragmentation; requires large home ranges/multiple habitats; highly localized/restricted distribution; aggregate their populations
3	Amphibians	Anaxyrus cognatus	Great Plains toad	SPC		rare, vulnerable/declining habitat; habitat loss; habitat degradation; habitat fragmentation; requires large home ranges/multiple habitats; aggregate their populations
4	Amphibians	Hemidactylium scutatum	four-toed salamander	SPC		rare, vulnerable/declining habitat; habitat loss; habitat degradation; habitat fragmentation; requires large home ranges/multiple habitats; limited ability to recover (low dispersal ability); highly localized/restricted distribution
5	Amphibians	Lithobates palustris	pickerel frog	NL		rare, vulnerable/declining habitat; habitat loss; habitat degradation; requires large home rang- es/multiple habitats; highly localized/restricted distribution; aggregate their populations
6	Amphibians	Necturus maculosus	mudpuppy	SPC		habitat degradation; habitat fragmentation; over-exploitation; disease
7	Amphibians	Notophthalmus viridescens	eastern newt	NL		rare, vulnerable/declining habitat; habitat degradation; habitat fragmentation; requires large home ranges/multiple habitats
8	Amphibians	Plethodon cinereus	eastern red-backed salamander	NL		habitat degradation; habitat fragmentation

# Reptiles

1	Reptiles	Apalone mutica	smooth softshell	SPC	rare, vulnerable/declining habitat; habitat loss; habitat degradation; predation beyond normal levels; highly localized/restricted distribution; aggregate their populations
2	Reptiles	Aspidoscelis sexlineata	six-lined racerunner	NL	rare, vulnerable/declining habitat; habitat degradation; highly localized/restricted distribution
3	Reptiles	Coluber constrictor	North American racer	SPC	rare, vulnerable/declining habitat; habitat loss; highly localized/restricted distribution; aggregate their populations
4	Reptiles	Crotalus horridus	timber rattlesnake	THR	rare, vulnerable/declining habitat; habitat loss; habitat degradation; habitat fragmentation; overexploitation; disease; deliberate killing; limited ability to recover (low reproductive rate); highly localized/restricted distribution; aggregate their populations
5	Reptiles	Diadophis punctatus edwardsii (northern subspecies)	northern ring-necked snake	NL	highly localized/restricted distribution
6	Reptiles	Emydoidea blandingii	Blanding's turtle	THR	rare, vulnerable/declining habitat; habitat loss; habitat degradation; habitat fragmentation; requires large home ranges/multiple habitats; depend on large habitat; limited ability to recov- er (low reproductive rate)
7	Reptiles	Glyptemys insculpta	wood turtle	THR	statistically valid decline documented; rare, vul- nerable/declining habitat; habitat loss; habitat degradation; habitat fragmentation; requires large home ranges/multiple habitats; depend on large habitat; limited ability to recover (low reproductive rate); aggregate their populations

8	Reptiles	Heterodon nasicus	plains hog-nosed snake	SPC		rare, vulnerable/declining habitat; habitat loss; habitat degradation; habitat fragmentation; overexploitation
9	Reptiles	Heterodon platirhinos	eastern hog-nosed snake	NL		rare, vulnerable/declining habitat; habitat loss; habitat degradation; habitat fragmentation
10	Reptiles	Opheodrys vernalis	smooth greensnake	NL		habitat loss; habitat degradation; habitat fragmentation; contaminants
11	Reptiles	Pantherophis obsoletus	western ratsnake	THR		habitat degradation; disease; highly localized/ restricted distribution; aggregate their populations
12	Reptiles	Pituophis catenifer	gophersnake	SPC		rare, vulnerable/declining habitat; habitat loss; habitat degradation; habitat fragmentation; overexploitation; deliberate killing; requires large home ranges/multiple habitats; depend on large habitat
13	Reptiles	Plestiodon fasciatus	common five-lined skink	SPC		rare, vulnerable/declining habitat; habitat degradation; highly localized/restricted distribution
14	Reptiles	Sistrurus catenatus	massasauga	END	С	rare, vulnerable/declining habitat; habitat loss; habitat degradation; habitat fragmentation; disease; deliberate killing; need special resources (narrow thermal preferences); depend on ecological process no longer within NRV; limited ability to recover (low reproductive rate); highly localized/restricted distribution; extensive surveys indicate a decline of unknown cause
15	Reptiles	Tropidoclonion lineatum	lined snake	SPC	11	habitat loss; habitat fragmentation; highly localized/restricted distribution

Fish

	Таха	Scientific name	Common name	State status	Federal status	Criteria (stressors and life-history traits)
1	Fish	Acipenser fulvescens	lake sturgeon	SPC		habitat fragmentation; requires large home ranges/multiple habitats; depend on large habitats; depend on ecological process no longer within NRV
2	Fish	Alosa chrysochloris	skipjack herring	END		habitat fragmentation; depend on ecological process no longer within NRV; highly localized/ restricted distribution
3	Fish	Ammocrypta clara	western sand darter	NL	1	habitat degradation; depend on ecological process no longer within NRV
4	Fish	Anguilla rostrata	American eel	SPC		habitat fragmentation; depend on ecological process no longer within NRV
5	Fish	Aphredoderus sayanus	pirate perch	SPC		habitat degradation; highly localized/restricted distribution
6	Fish	Catostomus	longnose sucker	NL		extensive surveys indicate a decline of unknown cause
7	Fish	Clinostomus elongatus	redside dace	SPC		habitat degradation; invasive species; need special resources (narrow thermal preferences)
8	Fish	Coregonus kiyi	kiyi	SPC		overexploitation; depend on ecological process no longer within NRV
9	Fish	Coregonus nipigon	Nipigon cisco	SPC		rare, vulnerable/declining habitat; need special resources (narrow thermal preferences); highly localized/restricted distribution
10	Fish	Coregonus zenithicus	shortjaw cisco	SPC	11.	overexploitation
11	Fish	Cottus ricei	spoonhead sculpin	NL	1.15	highly localized/restricted distribution
12	Fish	Couesius plumbeus	lake chub	SPC	-	highly localized/restricted distribution
13	Fish	Crystallaria asprella	crystal darter	END		habitat degradation; depend on ecological process no longer within NRV
14	Fish	Cycleptus elongatus	blue sucker	SPC		habitat degradation; habitat fragmentation; depend on ecological process no longer within NRV
15	Fish	Erimystax x-punctata	gravel chub	THR		habitat degradation; depend on ecological process no longer within NRV; highly localized/ restricted distribution

16	Fish	Etheostoma chlorosoma	bluntnose darter	SPC		highly localized/restricted distribution
17	Fish	Etheostoma microperca	least darter	SPC		state listed; no additional criteria identified
18	Fish	Fundulus sciadicus	plains topminnow	THR		rare, vulnerable/declining habitat; habitat degradation; highly localized/restricted distribution
19	Fish	Hybognathus nuchalis	Mississippi silvery minnow	SPC		habitat fragmentation; depend on ecological process no longer within NRV; highly localized/ restricted distribution
20	Fish	Hybopsis amnis	pallid shiner	END		extensive surveys indicate a decline of unknown cause
21	Fish	Ichthyomyzon fossor	northern brook lamprey	SPC		state listed; no additional criteria identified
22	Fish	lchthyomyzon gagei	southern brook lamprey	SPC		state listed; no additional criteria identified
23	Fish	Ictiobus niger	black buffalo	THR		habitat degradation; habitat fragmentation; depend on ecological process no longer within NRV
24	Fish	Lepomis gulosus	warmouth	SPC		habitat degradation; highly localized/restricted distribution
25	Fish	Lepomis peltastes	northern longear sunfish	SPC		habitat loss; habitat degradation
26	Fish	Lythrurus umbratilis	redfin shiner	SPC		extensive surveys indicate a decline of unknown cause
27	Fish	Morane	yellow bass	SPC		state listed; no additional criteria identified
28	Fish	Moxostoma duquesnei	black redhorse	SPC		habitat degradation; highly localized/restricted
29	Fish	Myoxocephalus thompsoni	deepwater sculpin	NL		highly localized/restricted distribution
30	Fish	Nocomis biguttatus	hornyhead chub	NL		habitat degradation; over-exploitation; extensive surveys indicate a decline of unknown cause
31	Fish	Notropis anogenus	pugnose shiner	THR		habitat loss; habitat degradation
32	Fish	Notropis nubilus	Ozark minnow	SPC		highly localized/restricted distribution
33	Fish	Notropis texanus	weed shiner	NL		highly localized/restricted distribution
34	Fish	Notropis topeka	Topeka shiner	SPC	E	Minnesota population represents significant portion of their North American breeding or wintering population
35	Fish	Noturus exilis	slender madtom	END		highly localized/restricted distribution
36	Fish	Opsopoeodus emiliae	pugnose minnow	NL		habitat degradation; habitat fragmentation; populations in Minnesota stable but have declined or are declining in a substantial part of range
37	Fish	Percina evides	gilt darter	SPC		habitat degradation; highly localized/restricted distribution
38	Fish	Phenacobius mirabilis	suckermouth	SPC		extensive surveys indicate a decline of unknown cause
39	Fish	Platygobio gracilis	flathead chub	SPC		state listed; no additional criteria identified
40	Fish	Polyodon spathula	paddlefish	THR		invasive species; depend on ecological process no longer within NRV
41	Fish	Prosopium coulterii	pygmy whitefish	SPC		highly localized/restricted distribution
42	Fish	Salvelinus fontinalis	coaster brook trout	NL		statistically valid decline documented
43	Fish	Salvelinus fontinalis	brook trout SE Minnesota heritage strain	NL		highly localized/restricted distribution; Minnesota population represents significant portion of their North American breeding or wintering population

#### Mussels

	Таха	Scientific name	Common name	State status	Federal status	Criteria (stressors and life-history traits)
1	Mussels	Actinonaias ligamentina	mucket	THR		statistically valid decline documented; habitat loss; habitat degradation; habitat fragmentation; invasive species; contaminants
2	Mussels	Alasmidonta marginata	elktoe	THR		statistically valid decline documented; habitat loss; habitat degradation; habitat fragmentation; invasive species; contaminants; need special resources (host species); highly localized/ restricted distribution
3	Mussels	Anodonta suborbiculata	flat floater	SPC		contaminants; highly localized/restricted distri- bution
4	Mussels	Arcidens confragosus	rock pocketbook	END		statistically valid decline documented; habitat loss; habitat degradation; habitat fragmentation; invasive species; contaminants
5	Mussels	Cumberlandia mono- donta	spectaclecase	END	E	statistically valid decline documented; habitat loss; habitat degradation; habitat fragmentation; invasive species; contaminants; limited ability to recover (low dispersal ability); highly localized/restricted distribution; aggregate their populations; Minnesota population represents significant portion of their North American breeding or wintering population
6	Mussels	Cyclonaias tuberculata	purple wartyback	END		statistically valid decline documented; habitat loss; habitat degradation; habitat fragmentation; invasive species; contaminants; need special resources (host species)
7	Mussels	Ellipsaria lineolata	butterfly	THR		statistically valid decline documented; habitat loss; habitat degradation; habitat fragmentation; invasive species; contaminants; need special resources (host species)
8	Mussels	Elliptio complanata	eastern elliptio	SPC		invasive species; highly localized/restricted distribution
9	Mussels	Elliptio crassidens	elephant-ear	END		statistically valid decline documented; habitat loss; habitat degradation; habitat fragmentation; invasive species; contaminants; need special resources (host species)
10	Mussels	Elliptio dilatata	spike	THR		statistically valid decline documented; habitat loss; habitat degradation; habitat fragmentation; invasive species; contaminants
11	Mussels	Epioblasma triquetra	snuffbox	END	E	statistically valid decline documented; habitat loss; habitat degradation; habitat fragmentation; invasive species; contaminants; need special resources (host species); Minnesota population represents significant portion of their North American breeding or wintering population
12	Mussels	Fusconaia ebena	ebonyshell	END		statistically valid decline documented; habitat loss; habitat degradation; habitat fragmentation; invasive species; contaminants; need special resources (host species)
13	Mussels	Lampsilis higginsii	Higgins eye	END	E	statistically valid decline documented; habitat loss; habitat degradation; habitat fragmentation; invasive species; contaminants
14	Mussels	Lampsilis teres	yellow sandshell	END		statistically valid decline documented; invasive species; contaminants; need special resources (host species); extensive surveys indicate a decline of unknown cause
15	Mussels	Lasmigona compressa	creek heelsplitter	SPC		habitat degradation; contaminants
16	Mussels	Lasmigona costata	fluted-shell	THR		statistically valid decline documented; habitat loss; habitat degradation; habitat fragmentation; invasive species; contaminants
17	Mussels	Ligumia recta	black sandshell	SPC		statistically valid decline documented; habitat loss; habitat degradation; habitat fragmentation; invasive species; contaminants
18	Mussels	Ligumia subrostrata	pondmussel	THR		statistically valid decline documented; habitat loss; habitat degradation; habitat fragmenta- tion; contaminants; highly localized/restricted distribution

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19	Mussels	Megalonaias nervosa	washboard	END		statistically valid decline documented; habitat loss; habitat degradation; habitat fragmentation; over-exploitation; invasive species; contaminants
20	Mussels	Obovaria olivaria	hickorynut	NL		statistically valid decline documented; habitat loss; habitat degradation; habitat fragmen- tation; invasive species; contaminants; need special resources (host species)
21	Mussels	Plethobasus cyphyus	sheepnose	END	E	statistically valid decline documented; habitat loss; habitat degradation; habitat fragmentation; invasive species; contaminants
22	Mussels	Pleurobema sintoxia	round pigtoe	SPC		statistically valid decline documented; habitat loss; habitat degradation; habitat fragmentation; invasive species; contaminants
23	Mussels	Potamilus capax	fat pocketbook	NL		statistically valid decline documented; habitat fragmentation; need special resources (host species); extensive surveys indicate a decline of unknown cause. currently extirpated in Minnesota, there is a strong likelihood that this species will be reintroduced within the next 10 years
24	Mussels	Quadrula fragosa	winged mapleleaf	END	E	Statistically valid decline documented; Habitat loss; Habitat degradation; Habitat fragmen- tation; Invasive species; Contaminants; Need special resources (host species); MN population represents significant portion of their N. Am. breeding or wintering pop.
25	Mussels	Quadrula metanevra	monkeyface	THR		statistically valid decline documented; habitat loss; habitat degradation; habitat fragmentation; invasive species; contaminants
26	Mussels	Quadrula nodulata	wartyback	THR		statistically valid decline documented; habitat loss; habitat degradation; habitat fragmentation; invasive species; contaminants; Minnesota population represents significant portion of their North American breeding or wintering population
27	Mussels	Simpsonaias ambigua	salamander mussel	END		statistically valid decline documented; habitat loss; habitat degradation; habitat fragmentation; invasive species; contaminants; need special resources (host species); limited ability to recover (low dispersal ability); highly localized/ restricted distribution; highly localized/restricted distribution; aggregate their populations
28	Mussels	Tritogonia verrucosa	pistolgrip	END		statistically valid decline documented; habitat loss; habitat degradation; habitat fragmentation; invasive species; contaminants; need special resources (host species)
29	Mussels	Truncilla donaciformis	fawnsfoot	THR		statistically valid decline documented; habitat loss; habitat degradation; habitat fragmentation; invasive species; contaminants; need special resources (host species); extensive surveys indicate a decline of unknown cause
30	Mussels	Venustaconcha ellipsiformis	ellipse	THR		statistically valid decline documented; habitat loss; habitat degradation; habitat fragmentation; invasive species; contaminants; limited ability to recover (low dispersal ability)

## Snails

	Таха	Scientific name	Common name	State status	Federal status	Criteria (stressors and life-history traits)
1	Snails	Gastrocopta rogersensis	Rogers' snaggletooth snail	SPC		statistically valid decline documented; highly localized/restricted distribution
2	Snails	Planogyra asteriscus	eastern flat-whorl snail	SPC		rare, vulnerable/declining habitat; highly localized/restricted distribution
3	Snails	Striatura ferrea	black striate snail	SPC		highly localized/restricted distribution
4	Snails	Vertigo meramecensis	bluff vertigo	THR		rare, vulnerable/declining habitat; highly localized/restricted distribution
5	Snails	Zonitoides limatulus	dull gloss	SPC		highly localized/restricted distribution

# **Jumping Spiders**

	Таха	Scientific name	Common name	State status	Federal status	Criteria (stressors and life-history traits)
1	Jumping spiders	Habronattus calcara- tus maddisoni	A species of jumping spider	SPC		state listed; no additional criteria identified
2	Jumping spiders	Habronattus texanus	A species of jumping spider	SPC		rare, vulnerable/declining habitat; highly localized/restricted distribution
3	Jumping spiders	Habronattus viridipes	A species of jumping spider	SPC		rare, vulnerable/declining habitat; highly localized/restricted distribution
4	Jumping spiders	Marpissa formosa	A species of jumping spider	SPC		highly localized/restricted distribution
5	Jumping spiders	Paradamoetas fontana	A species of jumping spider	SPC		habitat loss; highly localized/restricted distribution
6	Jumping spiders	Pelegrina arizonensis	A species of jumping spider	SPC		rare, vulnerable/declining habitat; need special resources (host species); depend on ecological process no longer within NRV; highly localized/ restricted distribution
7	Jumping spiders	Phidippus apacheanus	A species of jumping spider	SPC		rare, vulnerable/declining habitat; habitat loss; habitat degradation; highly localized/restricted distribution
8	Jumping spiders	Phidippus pius	A species of jumping spider	SPC		rare, vulnerable/declining habitat; habitat loss; habitat degradation; highly localized/restricted distribution
9	Jumping spiders	Sassacus papenhoei	A species of jumping spider	SPC	1	rare, vulnerable/declining habitat; highly localized/restricted distribution
10	Jumping spiders	Tutelina formicaria	A species of jumping spider	THR		rare, vulnerable/declining habitat; need special resources (host species); highly localized/ restricted distribution

#### Leafhoppers

	Таха	Scientific name	Common name	State status	Federal status	Criteria (stressors and life-history traits)
1	Leafhoppers	Aflexia rubranura	red-tailed leafhopper	SPC		rare, vulnerable/declining habitat; need special resources (host species)
2	Leafhoppers	Attenuipyga vanduzeei	hill prairie shovelhead leafhopper	SPC		rare, vulnerable/declining habitat; highly localized/restricted distribution
3	Leafhoppers	Macrosteles clavatus	caped leafhopper	SPC	112	rare, vulnerable/declining habitat; highly localized/restricted distribution

#### **Dragonflies & Damselflies**

	Таха	Scientific name	Common name	State status	Federal status	Criteria (stressors and life-history traits)
1	Dragonflies & damselflies	Aeshna sitchensis	zigzag darner	SPC	1	rare, vulnerable/declining habitat; need special resources (narrow thermal preferences)
2	Dragonflies & damselflies	Aeshna subarctica	subarctic darner	SPC		rare, vulnerable/declining habitat; need special resources (narrow thermal preferences)
3	Dragonflies & damselflies	Amphiagrion abbreviatum	western red damsel	NL		rare, vulnerable/declining habitat; habitat loss; habitat degradation; need special resources (narrow thermal preferences)
4	Dragonflies & damselflies	Argia plana	springwater dancer	NL		highly localized/restricted distribution
5	Dragonflies & damselflies	Boyeria grafiana	ocellated darner	SPC		highly localized/restricted distribution
6	Dragonflies & damselflies	Coenagrion angulatum	prairie bluet	NL		rare, vulnerable/declining habitat; habitat loss
7	Dragonflies & damselflies	Coenagrion interrogatum	subartic bluet	NL		habitat loss; habitat degradation
8	Dragonflies & damselflies	Cordulegaster obliqua	arrowhead spiketail	NL		habitat degradation
9	Dragonflies & damselflies	Gomphus adelphus	mustached clubtail	NL		habitat degradation; need special resources (narrow thermal preferences)
10	Dragonflies & damselflies	Gomphus lineatifrons	splendid clubtail	NL		habitat degradation; need special resources (narrow thermal preferences)

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11	Dragonflies & damselflies	Gomphus quadricolor	rapids clubtail	NL	habitat degradation; need special resources (narrow thermal preferences)
12	Dragonflies & damselflies	Gomphus ventricosus	skillet clubtail	NL	habitat degradation; need special resources (narrow thermal preferences)
13	Dragonflies & damselflies	Gomphus viridifrons	green-faced clubtail	NL	habitat degradation; need special resources (narrow thermal preferences)
14	Dragonflies & damselflies	Ischnura posita	fragile forktail	NL	statistically valid decline documented
15	Dragonflies & damselflies	Leucorrhinia glacialis	crimson-ringed whiteface	NL	rare, vulnerable/declining habitat
16	Dragonflies & damselflies	Nannothemis bella	elfin skimmer	NL	rare, vulnerable/declining habitat
17	Dragonflies & damselflies	Neurocordulia molesta	smoky shadow- dragon	NL	habitat degradation
18	Dragonflies & damselflies	Ophiogomphus anomalus	extra-striped snaketail	SPC	habitat degradation; need special resources (narrow thermal preferences)
19	Dragonflies & damselflies	Ophiogomphus carolus	riffle snaketail	NL	habitat degradation; need special resources (narrow thermal preferences)
20	Dragonflies & damselflies	Ophiogomphus colubrinus	boreal snaketail	NL	habitat degradation; need special resources (narrow thermal preferences)
21	Dragonflies & damselflies	Ophiogomphus howei	pygmy snaketail	SPC	habitat degradation; need special resources (narrow thermal preferences)
22	Dragonflies & damselflies	Ophiogomphus smithi	Sioux snaketail	NL	habitat degradation; need special resources (narrow thermal preferences)
23	Dragonflies & damselflies	Ophiogomphus susbehcha	St. Croix snaketail	THR	habitat degradation; need special resources (narrow thermal preferences)
24	Dragonflies & damselflies	Rhionaeschna multicolor	blue-eyed darner	NL	habitat loss
25	Dragonflies & damselflies	Rhionaeschna mutata	spatterdock darner	NL	rare, vulnerable/declining habitat; habitat loss; need special resources (narrow thermal preferences); highly localized/restricted distribution
26	Dragonflies & damselflies	Somatochlora brevicincta	Quebec emerald	SPC	rare, vulnerable/declining habitat; need special resources (narrow thermal preferences)
27	Dragonflies & damselflies	Somatochlora cingulata	lake emerald	NL	rare, vulnerable/declining habitat; need special resources (narrow thermal preferences)
28	Dragonflies & damselflies	Somatochlora elongata	ski-tipped emerald	NL	rare, vulnerable/declining habitat; need special resources (narrow thermal preferences)
29	Dragonflies & damselflies	Somatochlora ensigera	plains emerald	NL	habitat loss; habitat degradation
30	Dragonflies & damselflies	Somatochlora forcipata	forcipate emerald	SPC	rare, vulnerable/declining habitat; need special resources (narrow thermal preferences)
31	Dragonflies & damselflies	Somatochlora franklini	delicate emerald	NL	rare, vulnerable/declining habitat; need special resources (narrow thermal preferences)
32	Dragonflies & damselflies	Somatochlora kennedyi	Kennedy's emerald	NL	rare, vulnerable/declining habitat; need special resources (narrow thermal preferences)
33	Dragonflies & damselflies	Somatochlora minor	ocellated emerald	NL	rare, vulnerable/declining habitat; need special resources (narrow thermal preferences)
34	Dragonflies & damselflies	Somatochlora walshii	brush-tipped em- erald	NL	rare, vulnerable/declining habitat; need special resources (narrow thermal preferences)
35	Dragonflies & damselflies	Stylogomphus albistylus	eastern least clubtail	NL	habitat degradation
36	Dragonflies & damselflies	Stylurus amnicola	riverine clubtail	NL	habitat degradation
37	Dragonflies & damselflies	Stylurus plagiatus	russet-tipped clubtail	NL	habitat degradation
38	Dragonflies & damselflies	Stylurus scudderi	zebra clubtail	NL	habitat degradation
39	Dragonflies & damselflies	Sympetrum madidum	red-veined meadow- hawk	NL	highly localized/restricted distribution
40	Dragonflies & damselflies	Williamsonia fletcheri	ebony boghunter	NL	rare, vulnerable/declining habitat; need special resources (narrow thermal preferences)

#### **Butterflies & Moths**

	Таха	Scientific name	Common name	State status	Federal status	Criteria (stressors and life-history traits)
1	Butterflies & moths	Aspitates aberrata	A species of geometrid moth	NL		rare, vulnerable/declining habitat

2	Butterflies & moths	Atrytone arogos iowa	Arogos skipper	SPC		rare, vulnerable/declining habitat; habitat loss; habitat degradation; habitat fragmentation
3	Butterflies & moths	Atrytonopsis hianna	dusted skipper	NL		rare, vulnerable/declining habitat; habitat loss; habitat degradation; habitat fragmentation; need special resources (host species); depend on ecological process no longer within NRV; highly localized/restricted distribution
4	Butterflies & moths	Boloria chariclea	arctic fritillary	NL		habitat loss; habitat degradation; need special resources (host species)
5	Butterflies & moths	Carmenta anthracipennis	blazing star clear- wing moth	NL		rare, vulnerable/declining habitat; habitat loss; habitat degradation; habitat fragmentation; need special resources (host species)
6	Butterflies & moths	Catocala abbreviatella	abbreviated underwing	SPC		rare, vulnerable/declining habitat; habitat fragmentation; need special resources (host species)
7	Butterflies & moths	Catocala whitneyi	Whitney's underwing	SPC		rare, vulnerable/declining habitat; need special resources (host species)
8	Butterflies & moths	Danaus plexippus	monarch	NL		statistically valid decline documented; rare, vul- nerable/declining habitat; habitat loss; habitat degradation; habitat fragmentation; need special resources (host species); Minnesota population represents significant portion of their North American breeding or wintering population
9	Butterflies & moths	Erebia mancinus	Disa alpine	SPC		habitat loss; habitat degradation; need special resources (narrow thermal preferences); highly localized/restricted distribution
10	Butterflies & moths	Erynnis martialis	mottled dusky wing	NL		rare, vulnerable/declining habitat; habitat loss; habitat degradation; habitat fragmentation; need special resources (host species); depend on ecological process no longer within NRV
11	Butterflies & moths	Erynnis persius persius	Persius duskywing	END		rare, vulnerable/declining habitat; habitat loss; habitat degradation; habitat fragmentation; need special resources (host species); depend on ecological process no longer within NRV
12	Butterflies & moths	Euchloe ausonides	large marble	NL		depend on large habitat; need special resources (host species, narrow thermal preferences); depend on ecological process no longer within NRV; highly localized/restricted distribution
13	Butterflies & moths	Euphyes binacula illinois	two-spotted skipper	NL		rare, vulnerable/declining habitat; habitat loss; habitat degradation; need special resources (host species); depend on ecological process no longer within NRV
14	Butterflies & moths	Hesperia assiniboia	Assiniboia skipper	END		rare, vulnerable/declining habitat; habitat loss; habitat degradation; habitat fragmentation; need special resources (host species); depend on ecological process no longer within NRV
15	Butterflies & moths	Hesperia dacotae	Dakota skipper	END	т	rare, vulnerable/declining habitat; habitat loss; habitat degradation; habitat fragmentation; depend on ecological process no longer within NRV; extensive surveys indicate a decline of unknown cause; Minnesota population represents significant portion of their North American breeding or wintering population
16	Butterflies & moths	Hesperia leonardus	Leonard's skipper	SPC	1	rare, vulnerable/declining habitat; habitat loss; habitat degradation; habitat fragmentation
17	Butterflies & moths	Hesperia ottoe	Ottoe skipper	END		rare, vulnerable/declining habitat; habitat loss; habitat degradation; habitat fragmentation; depend on ecological process no longer within NRV; highly localized/restricted distribution
18	Butterflies & moths	Hesperia uncas	Uncas skipper	END		rare, vulnerable/declining habitat; habitat loss; habitat degradation; habitat fragmentation; need special resources (host species); depend on ecological process no longer within NRV
19	Butterflies & moths	Lasionycta secedens	a species of owlet moth	NL		need special resources (narrow thermal preferences); highly localized/restricted distribution
20	Butterflies & moths	Lasionycta taigata	a species of owlet moth	NL		need special resources (narrow thermal preferences); highly localized/restricted distribution

21	Butterflies & moths	Plebejus idas nabokovi	Nabokov's blue	SPC		rare, vulnerable/declining habitat; habitat degradation; need special resources (host species); depend on ecological process no longer within NRV; highly localized/restricted distribution
22	Butterflies & moths	Plebejus melissa samuelis	Karner blue	END	E	rare, vulnerable/declining habitat; habitat loss; habitat degradation; habitat fragmentation; need special resources (host species); depend on ecological process no longer within NRV
23	Butterflies & moths	Oarisma garita	Garita skipper	THR		rare, vulnerable/declining habitat; habitat degradation; depend on ecological process no longer within NRV; highly localized/restricted distribution
24	Butterflies & moths	Oarisma poweshiek	Poweshiek skipper	END	E	statistically valid decline documented; rare, vul- nerable/declining habitat; habitat loss; habitat degradation; habitat fragmentation; depend on ecological process no longer within NRV; exten- sive surveys indicate a decline of unknown cause
25	Butterflies & moths	Oeneis uhleri varuna	Uhler's arctic	END		rare, vulnerable/declining habitat; habitat loss; habitat degradation; habitat fragmentation, highly localized/restricted distribution
26	Butterflies & moths	Polygonia gracilis	hoary comma	NL		highly localized/restricted distribution
27	Butterflies & moths	Proserpina juanita	Juanita sphinx moth	NL		rare, vulnerable/declining habitat; habitat loss; habitat degradation; depend on large habitat; habitat fragmentation; need special resources (host species); depend on ecological process no longer within NRV
28	Butterflies & moths	Pyrgus centaureae freija	grizzled skipper	SPC		state listed; no additional criteria identified
29	Butterflies & moths	Schinia indiana	phlox moth	SPC		rare, vulnerable/declining habitat; habitat loss; habitat degradation; habitat fragmentation; need special resources (host species)
30	Butterflies & moths	Schinia lucens	Leadplant Flower Moth	SPC		rare, vulnerable/declining habitat; habitat loss; habitat degradation; habitat fragmentation; need special resources (host species)
31	Butterflies & moths	Schinia sanguinea	blazing star flower moth	NL		rare, vulnerable/declining habitat; habitat loss; habitat degradation; habitat fragmentation; need special resources (host species)
32	Butterflies & moths	Speyeria idalia	regal fritillary	SPC		rare, vulnerable/declining habitat; habitat loss; habitat degradation; habitat fragmentation; depend on large habitat; need special resources (host species); depend on ecological process no longer within NRV
33	Butterflies & moths	Xestia mixta	a species of owlet moth	NL		need special resources (host species); depend on ecological process no longer within NRV

#### Caddisflies

	Таха	Scientific name	Common name	State status	Federal status	Criteria (stressors and life-history traits)
1	Caddisflies	Agapetus tomus	A species of caddisfly	SPC		habitat degradation; need special resources (narrow thermal preferences); highly localized/ restricted distribution
2	Caddisflies	Anabolia ozburni	A species of northern caddisfly	SPC		habitat loss; habitat degradation; extensive sur- veys indicate a decline of unknown cause
3	Caddisflies	Chilostigma itascae	headwaters Chilostigman caddisfly	THR		highly localized/restricted distribution; Minnesota population represents significant portion of their North American breeding or wintering population
4	Caddisflies	Goera stylata	A species of caddisfly	THR		need special resources (narrow thermal preferences); highly localized/restricted distribution
5	Caddisflies	Hydroptila metoeca	A species of purse casemaker caddisfly	SPC		state listed; no additional criteria identified
6	Caddisflies	Hydroptila quinola	A species of purse casemaker caddisfly	SPC		habitat degradation; highly localized/restricted distribution
7	Caddisflies	Hydroptila rono	A species of purse casemaker caddisfly	THR	í	habitat degradation; highly localized/restricted distribution
8	Caddisflies	Hydroptila tortosa	A species of purse casemaker caddisfly	SPC	1	state listed; no additional criteria identified

9	Caddisflies	Hydroptila waskesia	A species of purse casemaker caddisfly	END	habitat degradation; highly localized/restricted distribution
10	Caddisflies	Ironoquia punctatis- sima	A species of northern caddisfly	THR	rare, vulnerable/declining habitat; highly local- ized/restricted distribution
11	Caddisflies	Lepidostoma libum	A species of caddisfly	THR	habitat degradation; highly localized/restricted distribution
12	Caddisflies	Limnephilus janus	A species of northern caddisfly	END	habitat degradation; highly localized/restricted distribution
13	Caddisflies	Limnephilus rossi	A species of northern caddisfly	THR	habitat degradation; highly localized/restricted distribution
14	Caddisflies	Limnephilus secludens	A species of northern caddisfly	END	habitat degradation
15	Caddisflies	Ochrotrichia spinosa	A species of purse casemaker caddisfly	END	highly localized/restricted distribution; extensive surveys indicate a decline of unknown cause
16	Caddisflies	Oecetis ditissa	A species of long- horned caddisfly	THR	habitat degradation; highly localized/restricted distribution
17	Caddisflies	Oxyethira ecornuta	A species of purse casemaker caddisfly	THR	highly localized/restricted distribution
18	Caddisflies	Oxyethira itascae	A species of purse casemaker caddisfly	SPC	highly localized/restricted distribution; Minnesota population represents significant portion of their North American breeding or wintering population
19	Caddisflies	Parapsyche apicalis	A species of netspin- ning caddisfly	THR	habitat degradation; highly localized/restricted distribution
20	Caddisflies	Polycentropus glacialis	A species of tube casemaker caddisfly	THR	highly localized/restricted distribution
21	Caddisflies	Polycentropus milaca	A species of tube casemaker caddisfly	END	highly localized/restricted distribution; Minnesota population represents significant portion of their North American breeding or wintering population
22	Caddisflies	Protoptila erotica	A species of saddle casemaker caddisfly	SPC	highly localized/restricted distribution
23	Caddisflies	Triaenodes flavescens	A species of long- horned caddisfly	SPC	highly localized/restricted distribution
24	Caddisflies	Ylodes frontalis	A species of long- horned caddisfly	THR	highly localized/restricted distribution

## **Tiger Beetles**

	Таха	Scientific name	Common name	State status	Federal status	Criteria (stressors and life-history traits)
1	Tiger Beetles	Cicindela cursitans	ant-like tiger beetle	NL		highly localized/restricted distribution
2	Tiger Beetles	Cicindela denikei	Laurentian tiger beetle	SPC		highly localized/restricted distribution
3	Tiger Beetles	Cicindela fulgida fulgida	crimson saltflat tiger beetle, fulgida ssp.	END		rare, vulnerable/declining habitat; need special resources; highly localized/restricted distribution; depend on ecological process no longer within NRV
4	Tiger Beetles	Cicindela fulgida westbournei	crimson saltflat tiger beetle, westb. ssp.	THR		rare, vulnerable/declining habitat; need special resources; highly localized/restricted distribution
5	Tiger Beetles	Cicindela hirticollis hirticollis ssp.	hairy-necked tiger beetle	NL		habitat degradation
6	Tiger Beetles	Cicindela hirticollis rhodensis ssp.	hairy-necked tiger beetle	END	1-1-1	habitat degradation; highly localized/restricted distribution
7	Tiger Beetles	Cicindela lepida	ghost tiger beetle	THR		rare, vulnerable/declining habitat; highly localized/restricted distribution
8	Tiger Beetles	Cicindela limbata nympha	sandy tiger beetle	END		rare, vulnerable/declining habitat; highly localized/restricted distribution
9	Tiger Beetles	Cicindela macra macra	sandy stream tiger beetle	SPC		highly localized/restricted distribution
10	Tiger Beetles	Cicindela patruela patruela	northern barrens tiger beetle	SPC		rare, vulnerable/declining habitat; habitat loss
11	Tiger Beetles	Cicindela splendida cyanocephalata	splendid tiger beetle	SPC		need special resources; highly localized/ restricted distribution

#### Bees

	Таха	Scientific name	Common name	State status	Federal status	Criteria (stressors and life-history traits)
1	Bees	Bombus affinis	rusty patched bumble bee	NL		extensive surveys indicate a decline of unknown cause
2	Bees	Bombus bohemicus	Ashton cuckoo bumble bee	NL		need special resources (host species)
3	Bees	Bombus terricola	yellowbanded bumble bee	NL		extensive surveys indicate a decline of unknown cause
4	Bees	Bombus fervidus	golden northern bumble bee or yellow bumble bee	NL		extensive surveys indicate a decline of unknown cause
5	Bees	Bombus pensylvanicus	American bumble bee	NL		extensive surveys indicate a decline of unknown cause

Common Name	Common Name Latin name Group		Federal Status	State Status
Mudpuppy	Necturus maculosus	amphibian	none	special concern
Acadian Flycatcher	Empidonax virescens	bird none		special concern
Bald Eagle	Haliaeetus leucocephalus	bird none		delisted
Bell's Vireo	Vireo bellii	bird	none	special concern
Cerulean Warbler	Setophaga cerulea	bird	none	special concern
Hooded Warbler	Setophaga citrina	bird	none	special concern
Lark Sparrow	Chondestes grammacus	bird	none	special concern
Loggerhead Shrike	Lanius ludovicianus	bird	none	endangered
Peregrine Falcon	Falco peregrinus	bird	none	special concern
Purple Martin	Progne subis	bird	none	special concern
Red-shouldered Hawk	Buteo lineatus	bird	none	special concern
Trumpeter Swan	Cygnus buccinator	bird	none	special concern
American Eel	Anguilla rostrata	fish	none	special concern
Black Buffalo	Ictiobus niger	fish	none	threatened
Blue Sucker	Cycleptus elongatus	fish	none	special concern
Lake Sturgeon	Acipenser fulvescens	fish	none	special concern
Mississippi Silvery Minnow	Hybognathus nuchalis	fish	none	special concern
Ozark Minnow	Notropis nubilus	fish	none	special concern
Paddlefish	Polyodon spathula	fish	none	threatened
Pallid Shiner	Hybopsis amnis	fish	none	endangered
Pirate Perch	Aphredoderus sayanus	fish	none	special concern
Pugnose Shiner	Notropis anogenus	fish	none	threatened
Redside Dace	Clinostomus elongatus	fish	none	special concern
Skipjack Herring	Alosa chrysochloris	fish	none	endangered
Sandy Laccaria	Laccaria trullisata	fungus	none	special concern
Iowa Skipper	Atrytone arogos iowa	insect	none	special concern
Leonard's Skipper	Hesperia leonardus	insect	none	special concern
Regal Fritillary	Speyeria idalia	insect	none	special concern
Sandy Stream Tiger Beetle	Cicindela macra macra	insect	none	special concern
Eastern Spotted Skunk	Spilogale putorius	mammal	none	threatened
Northern Long-eared Bat	Myotis septentrionalis	mammal	threatened	special concern
Plains Pocket Mouse	Perognathus flavescens	mammal	none	special concern
Western Harvest Mouse	Reithrodontomys megalotis	mammal	none	special concern
Black Sandshell	Ligumia recta	mussel	none	special concern
Butterfly Ellipsaria lineolata		mussel	none	threatened
Creek Heelsplitter	Creek Heelsplitter Lasmigona compressa		none	special concern
Ebonyshell	Ebonyshell Fusconaia ebena		mussel none	
Elephant-ear Elliptio crassidens		mussel	none	endangered
Elktoe Alasmidonta marginata		mussel	none	threatened
Ellipse Venustaconcha ellipsiformis		mussel none		threatened
Fawnsfoot	Truncilla donaciformis	mussel none		threatened
Fluted-shell	Lasmigona costata	mussel	none	threatened
Hickorynut	Obovaria olivaria	mussel	none	delisted

Common Name	Latin name	Group	Federal Status	State Status
Higgins Eye	Lampsilis higginsii	mussel	endangered	endangered
Monkeyface	Quadrula metanevra	mussel	none	threatened
Mucket	Actinonaias ligamentina	mussel	none	threatened
Pistolgrip	Tritogonia verrucosa	mussel	none	endangered
Purple Wartyback	Cyclonaias tuberculata	mussel	none	endangered
Rock Pocketbook	Arcidens confragosus	mussel	none	endangered
Round Pigtoe	Pleurobema sintoxia	mussel	none	special concern
Salamander Mussel	Simpsonaias ambigua	mussel	none	endangered
Sheepnose	Plethobasus cyphyus	mussel	endangered	endangered
Snuffbox	Epioblasma triquetra	mussel	endangered	endangered
Spectaclecase	Cumberlandia monodonta	mussel	endangered	endangered
Spike	Elliptio dilatata	mussel	none	threatened
Wartyback	Quadrula nodulata	mussel	none	threatened
Washboard	Megalonaias nervosa	mussel	none	endangered
Winged Mapleleaf	Quadrula fragosa	mussel	endangered	endangered
Yellow Sandshell	Lampsilis teres	mussel	none	endangered
Blanding's Turtle	Emydoidea blandingii	reptile	none	threatened
Gophersnake	Pituophis catenifer	reptile	none	special concern
North American Racer	Coluber constrictor	reptile	none	special concern
Timber Rattlesnake	Crotalus horridus	reptile	none	threatened
Wood Turtle	Glyptemys insculpta	reptile	none	threatened
American Ginseng	Panax quinquefolius	vascular plant	none	special concern
Beach Heather	Hudsonia tomentosa	vascular plant	none	threatened
Big Tick Trefoil	Desmodium cuspidatum var. Iongifolium	vascular plant	none	threatened
Canada Frostweed	Crocanthemum canadense	vascular plant	none	special concern
Clasping Milkweed	Asclepias amplexicaulis	vascular plant	none	threatened
Clustered Broomrape	Orobanche fasciculata	vascular plant	none	threatened
Creeping Juniper	Juniperus horizontalis	vascular plant	none	special concern
Eared False Foxglove	Agalinis auriculata	vascular plant	none	endangered
Ebony Spleenwort	Asplenium platyneuron	vascular plant	none	special concern
Edible Valerian	Valeriana edulis var. ciliata	vascular plant	none	threatened
Gray's Sedge	Carex grayi	vascular plant	none	special concern
Green Dragon	Green Dragon Arisaema dracontium		none	special concern
Hair-like Beak Rush	Rhynchospora capillacea	vascular plant	none	threatened
Hill's Thistle	Cirsium pumilum var. hillii	vascular plant	none	special concern
Hooded Arrowhead	Sagittaria calycina var. calycina	vascular plant	none	threatened
James' Polanisia	Polanisia jamesii	vascular plant	vascular plant none endan	
Jointed Sedge	Carex conjuncta	vascular plant	none	threatened
Kentucky Coffee Tree	Gymnocladus dioica	vascular plant	none	special concern
Kinnickinnick Dewberry	Rubus multifer	vascular plant	none	special concern

Common Name	Latin name Grou		Federal Status	State Status	
Kitten-tails	Besseya bullii	vascular plant	none	threatened	
Narrow-leaved Pinweed	Lechea tenuifolia var. tenuifolia	vascular plant none endange		endangered	
Old Field Toadflax	Nuttallanthus canadensis	vascular plant	none	special concern	
One-flowered Broomrape	Orobanche uniflora	vascular plant	none	threatened	
Ovate-leaved Skullcap	Scutellaria ovata var. versicolor	vascular plant	none	threatened	
Plains Wild Indigo	Baptisia bracteata var. glabrescens	vascular plant	none	special concern	
Prairie Bush Clover	Lespedeza leptostachya	vascular plant	threatened	threatened	
Rattlebox	Crotalaria sagittalis	vascular plant	none	special concern	
Rattlesnake Master	Eryngium yuccifolium	vascular plant	none	special concern	
Rhombic Evening Primrose	Oenothera rhombipetala	vascular plant	none	special concern	
Rock Sandwort	Minuartia dawsonensis	vascular plant	none	threatened	
Seaside Three-awn	Aristida tuberculosa	vascular plant	none	threatened	
Sessile-flowered Yellow Cress	Rorippa sessiliflora	vascular plant	none	special concern	
Small White Lady's-slipper	Cypripedium candidum	vascular plant	none	special concern	
Small-leaved Pussytoes	Antennaria parvifolia	vascular plant	none	special concern	
Snow Trillium	Trillium nivale	vascular plant	none	special concern	
Snowy Campion	Silene nivea	vascular plant	none	threatened	
Sterile Sedge	Carex sterilis	vascular plant	none	threatened	
Stream Parsnip	Berula erecta	vascular plant	none	threatened	
Sullivant's Milkweed	Asclepias sullivantii	vascular plant	none	threatened	
Tall Nutrush	Scleria triglomerata	vascular plant	none	endangered	
Tubercled Rein Orchid	Platanthera flava var. herbiola	vascular plant	none	threatened	
Tuberous Indian-plantain	Arnoglossum plantagineum	vascular plant	ascular plant none threaten		
Twig Rush	Cladium mariscoides	vascular plant	none	special concern	
Water-willow	Decodon verticillatus var. laevigatus	vascular plant none		special concern	
Waterhyssop	Bacopa rotundifolia	vascular plant	none	threatened	
Western Prairie Fringed Orchid	Platanthera praeclara	vascular plant	threatened	endangered	
Whorled Nutrush	Scleria verticillata	vascular plant	none	threatened	
Wild Sweetwilliam	Phlox maculata	vascular plant	none	special concern	
Yellow Pimpernel	Taenidia integerrima	vascular plant	none	special concern	

# **DENSE BUFFER**



6-12′

The dense buffer provides an opaque visual barrier and wide physical barrier between park programs or native prairie restoration areas and adjacent land uses such as residential neighborhoods and roads or highways. A variety of planting types are used in succession to provide a smooth height transition between a short prairie area and tall evergreen buffer trees that are either existing prior to park development or planted for this purpose.

4-6′

1-3′

20-60'

ROAD/HIGHWAY **OR RESIDENTIAL** AREA



# FOCAL DRAW | LANDSCAPE ATTRACTION



The focal draw landscape attraction uses landform as well as vegetation (or other landscape features) to create focal points in the landscape that attract interest and draw visitors out of maintained camp areas and into the naturalized space of a prairie restoration. One way this can be done is to transplant a large, unique specimen tree on top of a short berm a few dozen yards away from a trail or campsite. The tree will provide visual interest from afar and will draw visitors to it, across the prairie, for further exploration. Other elements that could be used as a focal draw include a raptor platform, rock cairn, art installation, large boulder, or even a downed tree.







# FORMAL BUFFER | LANDFORM



The formal buffer provides a spatial barrier between active park programs using naturalized prairie restoration areas interspersed with trees. This buffer area is bordered by mowed turf grass, which reduces the number of insects in human-occupied areas and reduces the incidence of prairie plants creeping into maintained park areas. It also provides a psychological separation of park programs for campers and hikers. A physical edging material delineates the break between mowed and naturalized areas which helps ensure maintenance of a consistent edge.



# PERMEABLE BUFFER



The permeable buffer provides specific opportunities for park visitors to penetrate the prairie setting, without stepping off mowed/maintained areas that are easily accessible. Special points of interest (such as rock outcroppings or downed tree trunks) should be placed within this landscape to draw visitors out of planned programmatic areas and into this interstitial park space.



## **APPENDIX F. NATIVE SEED SOURCING**



Native seed source origin should be from within circle shown below.

Lake Byllesby Natural Resource Management Plan

APPENDIX G. POTENTIAL MANAGEMENT ACTIVITY EVALUATION FORMS

## **Management Activity Evaluation Form**

#### **Background**

Location:

**Fiscal Year Funds**:

Start Date:

Predominant Habitat type:

Additional Habitat types:

**Project Status:** 

#### **Goals and Planning**

- 1. What are the specific Goals and Objectives?
- 2. What plans / record of project decisions / prescription worksheets are available? Provide location data?
- 3. List specific measurements of success.
- 4. Provide list of best management practices, standards, guidelines identified in plan set? Are these based on best current science?

#### **Project Implementation**

- 5. Were alterations made to the original plan during construction?
- 6. In what ways did alterations to the plan or implementation change the proposed project outcome? Did this change derive from a desire to change outcomes?

#### Site Assessment

Field Review Date: Site Assessor(s) Conducting Review:

- 7. Surrounding Landscape Characteristics:
- 8. Site Characteristics:

9a. Soils:

- 9b. Topography:
- 9c. Hydrology:
- 9d. Plant Communities, Dominant Species & Invasives % Cover:
- 9d. Meander Search Species List (as appropriate for site)

- 9. List indicators of project outcomes at this stage of project:
- **10.** Does the project plan / implementation of the project plan reasonable allow for achieving proposed project outcome?
- 11. Are corrections or modifications needed to meet proposed outcomes?

- 12. Do proposed or planned future steps, including long term management appear practical and reasonable? What are the potential challenges, limitations?
- **13.** Do any of the project activities, planned or implemented, likely detract from existing or potential habitat? Explain.
- 14. Are follow-up assessments needed? Explain.
- 15. Additional comments on the restoration project.

#### **Project Evaluation**

- **16.** The project will:
- a. Likely not meet proposed outcomes  $\ \ \Box$
- b. Minimally meet proposed outcomes  $\Box$
- c. Meet proposed outcomes
- d. Likely exceed proposed outcomes
- e. Greatly exceed proposed outcomes  $\Box$
- 17. Provide explanation of reason(s) for determination.

Confidence of outcome determination

- a. Low 🛛
- b. Medium
- c. High 🗌



THE XERCES SOCIETY FOR INVERTEBRATE CONSERVATION

# Native Bee Conservation

# **Pollinator Habitat** Assessment Form and Guide NATURAL AREAS AND RANGELANDS



December 2014

The Xerces Society for Invertebrate Conservation

www.xerces.org

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#### **Cover Photographs**

Cover main: California rangeland planted with wildflowers to promote pollinators (photograph by Claudia Street, Glenn County RCD); left: *Megachile* leafcutter bee on native swamp thistle, *Cirsium muticum* (photograph by Sarah Foltz Jordan, The Xerces Society); right: eastern woodland with pollinator-friendly understory (photograph by Jennifer Hopwood, The Xerces Society).

#### Photographs

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Regional offices in California, Minnesota, Nebraska, New Jersey, North Carolina, and Texas.

The Xerces Society for Invertebrate Conservation is a nonprofit organization that protects wildlife through the conservation of invertebrates and their habitat. Established in 1971, the Society is at the forefront of invertebrate protection, harnessing the knowledge of scientists and enthusiasm of citizens to implement conservation programs worldwide. The Society uses advocacy, education, and applied research to promote invertebrate conservation.

The Xerces Society is an equal opportunity employer and provider.

# Native Bee Conservation Habitat Assessment Form and Guide

# Purpose

This tool is meant to help educate conservation planners and landowners, prioritize conservation actions, and quantify habitat or land management improvements on a single site. The goal of this tool is not to compare one site with another. Rather, it is intended to help incorporate pollinator conservation into a landscape management plan and then document improvements in pollinator habitat resulting from specific actions and management practices. As with any tool of this nature, the evaluation and scoring practice is a subjective process, and the usefulness of the tool is dependent upon the consistency of the evaluator. While the goal is to implement changes that will result in an increased final score, there may not always be a viable treatment for individual variables. The scoring goals outlined in the instructions are general guidelines, but the capacity to reach or exceed these goals varies widely in different landscapes and may be refined by state NRCS offices and other conservation agencies for a more regionally specific pollinator habitat assessment guide.

## Instructions

- This pollinator habitat assessment guide is designed for natural areas and rangelands, on public and private lands. If you are working in a farm landscape, please use our *Pollinator Habitat Assessment Form and Guide: Farms and Agricultural Landscapes* (available at: http://www.xerces.org/wp-content/uploads/2009/11/ PollinatorHabitatAssessment.pdf).
- The accompanying photos and notes will help you identify and assess some specific habitat features.
- An assessment should be done twice, once during the conservation planning process (before project implementation) and once after the plan has been implemented.
- Each item in the assessment should be given a score of 0 if not present or the appropriate value from the "Score" column.

- Prior to conducting an assessment, print out aerial photos to help with site and landscape questions.
- Add up the scores to calculate a subtotal for each subsection (e.g., 4a. Sites for ground-nesting bees).
- Next, add up subsection subtotals to get a total for each section. Transfer these figures into the summary table on page 3 to generate the overall score for each assessment.
- The post-implementation goal is hard to define for the country as a whole. Ideally, landowners/ managers should strive to achieve an overall score of at least 100, and an improvement of at least 40 points. If this is not possible for your region or land management plan, talk to your area biologist, regional ecologist, or planner for guidance.



California pollinator meadow featuring a mix of native wildflowers. Dominant flowers in bloom include California phacelia, California poppies, and golden lupine

# **Site Summary**

Owner/ Operator:		Planner:	Planner:		
Address:			County:		
	tes Assessment before implementation (existing habitat): Assessment after implementation:				
Dates					
Dates       Assessment after implementation:         Define and describe the project area (attach annotated maps; include Ecological Classification System information, if known):					

# **Total Score for Habitat Assessment**

The figures entered into this summary table will be calculated during completion of the assessment.

	BEFORE	AFTER
Section 1: Landscape Features (max score 20)		
Section 2: Site Features (max score 35)		
Section 3: Foraging Habitat (max score 40)		
Section 4: Native Bee Nesting Habitat (max score 35)		
Section 5: Management Practices (max score 70)		
OVERALL SCORE		

#### Section 1: Landscape Features

Characteristics of the broader landscape have a significant influence on wild bee populations and pollination services on adjacent sites. Natural areas in the landscape can also increase the likelihood that new habitat will be colonized by bees. Native plants, especially, are critical for supporting overall pollinator and wildlife diversity.

1a. Percent of natural or semi-natural vegetation within ½ mile of project area (whether on- or off-site). This land use cover includes prairie, shrub lands, woodlands, grasslands, riparian habitat, wetlands, and non-invasive weedy areas. It does NOT include lawn grass, cropland, or overgrazed pasture.

Max score of 10.

SELECT ONLY ONE	Score	Before	After	Treatment to increase score (no treatment if off-site)
>30%	10			
20%-30%	7			
5%–20%	3			
<5%	0			
Sub	total (1a)			(1a)

The photos below illustrate the different percent covers.









Go to top of page 6
### Section 1: Landscape Features continued

1b. Dominant vegetation in non-cropped area within ½ mile of project area (whether on- or off-site). *Max score of 10.* 

SELECT ONLY ONE	Score	Before	After	Treatment to increase score (no treatment if off-site)
Native plants	10			
Mix of native and naturalized (non-invasive) plants	7			
Naturalized flowering species (e.g., alfalfa)	5			
Mix of native, naturalized, and weedy/ invasive species	3			
Invasive flowering weeds and/ or sod-forming grasses	0			
Si	ubtotal (1b)			(1b)
Landscape Features Total				(1a + 1b)

### **Section 2: Site Features**

On-site natural areas and other features have a significant influence on pollinator abundance and diversity.

2a. Percentage of target site that is in natural or semi-natural habitat (see 1a for examples). Max score of 10.					
SELECT ONLY ONE	Score	Before	After	Treatment to increase score	
>75%	10				
50%-75%	7				
25%-49%	5				
10%-24%	3				
<10%	0				
	Subtotal (2a)			(2a)	

Section 2: Site Features

2b. Additional site features that are present. Max score of 10.				
SCORE ALL OPTIONS THAT APPLY	Score	Before	After	Treatment to increase score
Permanent meadows with diverse native wildflowers allowed to bloom	10			
Pasture with >30% non-invasive, bee-friendly forage legumes (e.g., red clover, alfalfa, etc.) allowed to bloom	5			
Source of clean surface water protected from pesticides	5			
Buffers: 1 point for every 20% of area within 25' of water features (e.g., stream, irrigation ditch, pond) that is vegetated, ideally including bee-friendly plants	0–5			
Subi	total (2b)			(2b)
Site Features	Total			(2a + 2b)

# **Section 3: Foraging Habitat**

High flower abundance and season long bloom positively influence bee abundance and diversity.

3a. Percentage of vegetative cover that is forbs, for invasive or noxious species (e.g., knapweed, purple Max score of 10.	lowering <i>loosestri</i>	shrubs, fe, Canad	or polli da thistl	nator-friendly trees on site. <i>This does not include</i> e, yellow star thistle, etc.).
SELECT ONLY ONE	Score	Before	After	Treatment to increase score
>50% cover	10			
30%–50% cover	7			
20%-30% cover	5			
10%–20% cover	3			
<10% cover	1			
Sub	ototal (3a)			(3a)

The photos below illustrate some categories. See regional technical notes (listed on page 12) for lists of preferred pollinator plants and other information.









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### Section 3: Foraging Habitat continued

3b. Number of species of forbs, flowering shrubs, or pollinator-friendly trees on site that bloom in **spring** and support bees. In rangelands, this includes some forage legumes and cover crops, but does not include invasive or noxious species (see references section for examples).

### Max score of 10.

SELECT ONLY ONE	Score	Before	After	Treatment to increase score	
5+ species (for rangelands) 10+ species (for natural areas)	10				
3–4 species (for rangelands) 5–9 species (for natural areas)	5				
1–2 species (for rangelands) 1–4 species (for natural areas)	3				
0 species	0				
	Subtotal (3b)			(3b)	

3c. Number of species of forbs, flowering shrubs, or pollinator-friendly trees on site that bloom in **<u>summer</u>** and support bees. In rangelands, this includes some forage legumes and cover crops, but does not include invasive or noxious species (see references section for examples).

Max score of 10.	and the second	La contra		
SELECT ONLY ONE	Score	Before	After	Treatment to increase score
5+ species (for rangelands) 10+ species (for natural areas)	10			
3–4 species (for rangelands) 5–9 species (for natural areas)	7			
1–2 species (for rangelands) 1–4 species (for natural areas)	3			
0 species	0			
	Subtotal (3c)			(3c)

3d. Number of species of forbs, flowering shrubs, or pollinator-friendly trees on site that bloom in **fall** and support bees. *In rangelands, this includes some forage legumes and cover crops, but does not include invasive or noxious species (see references section for examples).* 

Max score of 10.				
SELECT ONLY ONE	Score	Before	After	Treatment to increase score
5+ species (for rangelands) 8+ species (for natural areas)	10			
3–4 species (for rangelands) 4–7 species (for natural areas)	7			
1–2 species (for rangelands) 1–3 species (for natural areas)	5			
0 species	0			
	Subtotal (3d)			(3d)
Foraging	Habitat Total			(3a + 3b + 3c + 3d)

### Section 4: Native Bee Nesting Habitat

Native bees have a variety of nesting requirements. About 70% of native bee species in North America nest in the ground, 30% nest in cavities in wood or stems.

4a. Sites for ground-nesting bees. Ground nests are often marked by a small mound of excavated soil, but may also be nothing more than a small hole in the ground. Nests may be dug in bare soil, areas of patchy vegetation, or hidden among plants. They are usually in marginal areas such as ditch banks or track sides, and frequently can be found on slopes with well-drained soil and good sun exposure. Bumble bees frequently nest in abandoned rodent burrows or under clump-forming bunch grasses.

	the second second			
SCORE ALL OPTIONS THAT APPLY A = abundant, M = moderate, S = scarce	Score	Before	After	Treatment to increase score
Areas of site with undisturbed, well-drained bare ground, or with sparse vegetation $(A = >20\%, M = 20\%-5\%, S = <5\%)$	A = 5 M = 3 S = 1			
Areas with well-drained sandy to sandy/ loam soil $(A = >20\%, M = 20\%-5\%, S = <5\%)$	A = 5 M = 3 S = 1			
1 point for every 10% of area untilled on site	0–10			
Areas of undisturbed (for example, ungrazed) native bunch grasses (clump-forming) (A = >20%, M = 20%–5%, S = <5%)	A = 5 M = 3 S = 1			
Sub	total (4a)			(4a)

The photos below illustrate some ground nests and typical habitat.







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# Section 4: Native Bee Nesting Habitat continued

4b. Sites for wood- and cavity-nesting bees. The majority of wood- or cavity-nesting bees nest in pre-existing tunnels or cavities in snags, brush, or the centers of pithy-stemmed shrubs, and large-statured prairie plants. Max score of 10.

SCORE ALL OPTIONS THAT APPLY S = scarce, M = moderate, A = abundant	Score	Before	After	Treatment to increase score
Site has dead wood, snags, brush piles, shrubs with hollow or pithy stalks (e.g., elderberry, cane fruit, sumac) and/ or large, sturdy prairie plants with hollow or pithy centers (e.g., <i>Silphium, Solidago, Amorpha</i> ). Note: all of these features may not be appropriate for each habitat type.	S = 1 M = 5 A = 10			
Sub	total (4b)			(4b)

The photos below illustrate some wood- and cavity-nest sites.



### **Section 5: Management Practices**

Management practices in and around habitat areas have a significant influence on bee populations.

5a. Pesticide use, including pollinator-toxic insecticides. Max score of 40.					
SCORE ALL OPTIONS THAT APPLY	Score	Before	After	Treatment to increase score	
Buffer of at least 30' between any insecticide application and habitat areas, either on- or off-site	5				
Invasive weed control, if any, carried out with targeted herbicide applications, rather than broadcast	5				
No use of insecticides on site	30				
If insecticides are used (e.g., for mosquito control, grasshoppers, gypsy moth control), IPM program is in place	10				
If insecticides are used (e.g., for mosquito control, grasshoppers, gypsy moth control), IPM program is in place that specifically addresses pollinator protection	5				
If insecticides are used, spray drift is carefully controlled	5				
If insecticides are used, spray equipment calibrated annually, as per state regulations	5				
Sum all scores above for sub-	total (5a)			(5a)	

### 5b. Land management techniques used on the site or in project area. These questions pertain to ongoing site management as opposed to site preparation. Note 'n/a' if option is not applicable to the site.

M	ax	SC	ore	of	30	l

that specifically addresses pollinator protection				
If insecticides are used, spray drift is carefully controlled	5			
l <u>f insecticides are used</u> , spray equipment calibrated annually, as per state regulations	5			T
Sum all scores above for subt	otal (5a)			(5a)
5b. Land management techniques used on the sit as opposed to site preparation. Note 'n/a' if option is Max score of 30.	e or in p s not ap	project a plicable t	rea. The to the sit	se questions pertain to ongoing site managemer te.
SCORE ALL OPTIONS THAT APPLY	Score	Before	After	Treatment to increase score
f mowing or haying occurs, then entire disturbed area is limited to ½ of habitat per year. Haying or mowing is done patchily, at reduced speeds (<8 mph), with high mower height (12–16"), and in late summer (after peak bloom).	0–10			
If site is grazed, then conservation grazing plan is in place and includes prescribed grazing practices that encourage wildflower diversity/ abundance, such as low intensity grazing, or short duration grazing with long recovery periods.	0–10			
f burning occurs, then entire disturbed area is limited to s of habitat per year, and a patchy burn approach is used leaving numerous skips and unburned patches. A 3–10 year burn rotation period is used, and the time of year when burning occurs is varied. Rare invertebrate species and their specific needs are considered.	0–10			
Cub	otal (5b)			(5b)
5000	0101 (50)		1	(0.0)



# Habitat Assessment Reference Materials

# Crops and cover crops that provide pollen and/ or nectar for bees:

Alfalfa, almonds, alsike clover, apples, avocados, apricots, blueberries, buckwheat, canola, cherries, citrus, crimson clover, corn, cotton, cranberries, cucumber, dutch white clover, eggplant, fava beans, macadamia nuts, milkvetch, melons, mustard, peaches, pears, pears, pears, phacelia, plums, pumpkins, raspberries, red clover, sainfoin, soybean, squash, strawberries, sunflower, tomatoes, vegetable seed, purple vetch, and watermelon. (Note: this list is not exhaustive.)

# General Pollinator Conservation

#### Pollinator Conservation Resource Center

The Pollinator Conservation Resource Center includes regional information on plants for pollinator habitat enhancement, habitat conservation guides, nest management instructions, bee identification and monitoring resources, and directories of native pollinator plant nurseries.

www.xerces.org/pollinator-resource-center/

#### Attracting Native Pollinators

A complete guide to the fascinating lives of these vital creatures. The book includes detailed profiles of over 30 commonly encountered bee genera and more than 50 pages of fully-illustrated plant lists that enable you to choose the best plants for your region.

www.xerces.org/announcing-the-publication-of-attracting-nativepollinators/

#### Streamlined Bee Monitoring Protocol

Developed the University of California-Davis, Rutgers University, Michigan State University, and The Xerces Society, this guide provides instructions for assessing pollinator habitat quality and diversity by monitoring native bees. It was developed for conservationists, farmers, land managers, and restoration professionals to document how native bee communities change over time in pollinator habitats. www.xerces.org/streamlined-bee-monitoring-protocol/

#### Pollinator Habitat Installation Guides

These regional guidelines provide in-depth practical guidance on how to install and maintain foraging and nesting habitat for pollinators in wildflower meadow plantings or linear rows of native flowering shrubs. Region-specific seed mixes and plant recommendations are included in the appendices of each guide.

www.xerces.org/pollinator-conservation/agriculture/pollinatorhabitat-installation-guides/

#### Pollinators in Natural Areas: A Management Primer

A fact sheet discussing the importance of pollinators in natural areas, as well as their habitat needs. An extensive list of references is also provided.

www.xerces.org/wp-content/uploads/2008/11/pollinators in natural areas xerces society.pdf

### Inside Agroforestry-Windbreaks

An article about using windbreaks to provide pollinator habitat or to capture pesticide drift.

http://nac.unl.edu/documents/insideagroforestry/vol20issue1.pdf

#### Introduced, Invasive, and Noxious Plants

Federal and state noxious weed lists, invasive plant lists, and introduced plant lists, with links to more information. https://plants.usda.gov/java/noxiousDriver

### **Bumble Bee Conservation**

Conserving Bumble Bees: Guidelines for Creating and Managing Habitat for America's Declining Pollinators

A publication to help landowners and managers create, protect, and restore habitat for bumble bee populations.

www.xerces.org/wp-content/uploads/2012/06/conserving\_bb.pdf

#### Bumble Bee Watch

A collaborative citizen science effort to track and conserve North America's bumble bees. www.bumblebeewatch.org

# Native Bee Nest Sites Guidelines

Tunnel Nest Construction and Management Guidelines on the construction and maintenance of nests for tunnelnesting native bees.

www.xerces.org/wp-content/uploads/2009/11/tunnel-nestmanagement-xerces-society.pdf

Enhancing Nest Sites for Native Bee Crop Pollinators

This article describes how to provide nesting habitat for native bees. www.xerces.org/wp-content/uploads/2011/02/agroforestrynotes34bee nests1.pdf

### **Coming Soon from the Xerces Society**

- Prescribed Grazing to Increase Pollinator Habitat in the Central United States
- Natural Nesting Materials for Native Bees



This mesic prairie provides both forage and nesting habitat with a mix of native wildflowers and bunch grasses.

Last updated: December 30, 2014

Pollinator Habitat Assessment Form and Guide: Natural Areas and Rangelands



August 2010 Checklist of Minnesota Birds	Compiled list from all available data sources (BOLD RED are
Red: PIF Continental Importance	
Green: Stewardship Species	Nesting Species as documented
Blue: BCR Important Species	by one of the sources)
Purple: PIF Priority in one or more regions	
REGULAR	
Ducks, Geese, Swans	
Greater White-fronted Goose	1
Snow Goose	
Ross's Goose	
Cackling Goose (tallgrass prairie)	
Canada Goose	1
Mute Swan	
Trumpeter Swan	
Tundra Swan	
Wood Duck	1
Gadwall	
American Wigeon	
American Black Duck	1
Mallard	1
Blue-winged Teal	1
Cinnamon Teal	
Northern Shoveler	
Northern Pintail	1
Green-winged Teal	
Canvasback	1
Redhead	1
Ring-necked Duck	1
Greater Scaup	
Lesser Scaup	1
Harlequin Duck	
Surf Scoter	
White-winged Scoter	
Black Scoter	
Long-tailed Duck	
Bufflehead	
Common Goldeneye	



Lake Byllesby IBA

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Purple: PIF Priority in one or more regions	
Hooded Merganser	1
Common Merganser	
Red-breasted Merganser	
Ruddy Duck	
Partridge, Grouse, Turkey	
Gray Partridge	1
Ring-necked Pheasant	1
Ruffed Grouse	
Spruce Grouse	
Sharp-tailed Grouse	
Greater Prairie-Chicken	
Wild Turkey	1
Loons	
Red-throated Loon	
Pacific Loon	
Common Loon	
Grebes	
Pied-billed Grebe	1
Horned Grebe	1
Red-necked Gebe	1
Eared Grebe	1
Western Grebe	1
Clark's Grebe	1
Cormorants	
Double-crested Cormorant	1
Pelicans	
American White Pelican	1
Herons and Bitterns	
American Bittern	
Least Bittern	
Great Blue Heron	1
Great Egret	
Snowy Egret	



# Important Bird Area - Bird List Lake B

Lake Byllesby IBA

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Red: PIF Continental Importance	data sources (BOLD RED are Nesting Species as documented
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Blue: BCR Important Species	by one of the sources
Purple: PIF Priority in one or more regions	
Little Blue Heron	
Cattle Egret	
Green Heron	1
Black-crowned Night-Heron	
Yellow-crowned Night-Heron	
Ibises	
White-faced Ibis	
New World Vultures	
Turkey Vulture	1
Hawks and Eagles	
Osprey	
Bald Eagle	1
Northern Harrier	
Sharp-shinned Hawk	
Cooper's Hawk	1
Northern Goshawk	
Red-shouldered Hawk	
Broad-winged Hawk	
Swainson's Hawk	
Red-tailed Hawk	1
Rough-legged Hawk	
Golden Eagle	
Falcons	
American Kestrel	1
Merlin	
Peregrine Falcon	1
Prairie Falcon	
Rails, Gallinules, Coots	
Yellow Rail	
Virginia Rail	
Sora	
Common Moorhen	
American Coot	

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Cranes	
Sandhill Crane	
Plovers	
Black-bellied Plover	1
American Golden-Plover	
Semipalmated Plover	1
Piping Plover: Great Lakes	1
Piping Plover: Great Plains	
Killdeer	1
Avocet	
American Avocet	1
Sandpipers and Phalaropes	
Spotted Sandpiper	
Solitary Sandpiper	
Greater Yellowlegs	
Willet	1
Lesser Yellowlegs	
Upland Sandpiper	1
Whimbrel	1
Hudsonian Godwit (Hudson's Bay)	1
Marbled Godwit (Great Plains)	1
Ruddy Turnstone	1
Red Knot (Calidis canutus roselaari)	1
Sanderling	1
Semipalmated Sandpiper	1
Least Sandpiper	1
White-rumped Sandpiper	1
Baird's Sandpiper	1
Pectoral Sandpiper	1
Dunlin (Calidris alpina hudsonia)	1
Stilt Sandpiper	1
Buff-breasted Sandpiper	
Short-billed Dowitcher (L. g. hendersoni)	



# Important Bird Area - Bird List La

Lake Byllesby IBA

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Purple: PIF Priority in one or more regions	
Long-billed Dowitcher	
Wilson's Snipe	1
American Woodcock	
Wilson's Phalarope	1
Red-necked Phalarope	1
Jaegers, Gulls, Terns	
Bonaparte's Gull	
Little Gull	
Franklin's Gull	1
Ring-billed Gull	
Herring Gull	
Thayer's Gull	
Iceland Gull	
Lesser Black-backed Gull	
Glaucous Gull	
Great Black-backed Gull	
Caspian Tern	1
Black Tern	1
Common Tern	1
Forster's Tern	1
Parasitic Jaeger	
Pigeons & Doves	
Rock Pigeon	1
Eurasian Collared-Dove	
Mourning Dove	1
Cuckoos	
Yellow-billed Cuckoo	
Black-billed Cuckoo	
Owls	
Eastern Screech Owl	
Great Horned Owl	1
Snowy Owl	
Northern Hawk Owl	



# Important Bird Area - Bird List Lake

Lake Byllesby IBA

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Barred Owl	
Great Gray Owl	
Long-eared Owl	
Short-eared Owl	
Boreal Owl	
Northern Saw-whet Owl	
Nighthawks & Nightjars	
Common Nighthawk	
Eastern Whip-poor-will	
Chimney Swift	
Hummingbirds	
Ruby-throated Hummingbird	
Kingfishers	
Belted Kingfisher	1
Woodpeckers	
Red-headed Woodpecker	
Red-bellied Woodpecker	1
Yellow-bellied Sapsucker	
Downy Woodpecker	
Hairy Woodpecker	
American Three-toed Woodpecker	
Black-backed Woodpecker	
Northern Flicker	1
Pileated Woodpecker	
Tyrant Flycatchers	
Olive-sided Flycatcher	
Eastern Wood-Pewee	
Yellow-bellied Flycatcher	
Acadian Flycatcher	
Alder Flycatcher	
Willow Flycatcher	
Least Flycatcher	
Eastern Phoebe	1

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Great Crested Flycatcher	
Western Kingbird	
Eastern Kingbird	1
Shrikes	
Loggerhead Shrike	
Northern Shrike	
Vireos	
White-eyed Vireo	
Bell's Vireo	
Yellow-throated Vireo	1
Blue-headed Vireo	
Warbling Vireo	1
Philadelphia Vireo	
Red-eyed Vireo	1
Jays & Crows	_
Gray Jay	
Blue Jay	1
Black-billed Magpie	
American Crow	1
Common Raven	
Larks	
Horned Lark	1
Swallows	_
Purple Martin	1
Tree Swallow	1
Northern Rough-winged Swallow	1
Bank Swallow	
Cliff Swallow	1
Barn Swallow	1
Chickadees & Titmouse	
Black-capped Chickadee	1
Boreal Chickadee	
Tufted Titmouse	



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Nuthatches	
Red-breasted Nuthatch	
White-breasted Nuthatch	1
Creepers	
Brown Creeper	
Wrens	
Carolina Wren	
House Wren	1
Winter Wren	
Sedge Wren	
Marsh Wren	
Gnatcatchers	
Blue-gray Gnatcatcher	
Kinglets	-
Golden-crowned Kinglet	
Ruby-crowned Kinglet	
Thrushes	
Eastern Bluebird	1
Mountain Bluebird	
Townsend's Solitaire	
Veery	
Gray-cheeked Thrush	
Swainson's Thrush	
Hermit Thrush	
Wood Thrush	
American Robin	1
Varied Thrush	
Mockingbirds & Thrashers	
Gray Catbird	1
Northern Mockingbird	
Brown Thrasher	1
Starlings	
European Starling	1

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Pipits	
American Pipit	
Waxwings	
Bohemian Waxwing	
Cedar Waxwing	1
Longspurs and Snow Buntings	
Lapland Longspur	
Chestnut-collared Longspur	
Smith's Longspur	
Snow Bunting	
Wood-Warblers	
Blue-winged Warbler	
Golden-winged Warbler	
Tennessee Warbler	
Orange-crowned Warbler	
Nashville Warbler	
Northern Parula	
Yellow Warbler	1
Chestnut-sided Warbler	
Magnolia Warbler	
Cape May Warbler	
Black-throated Blue Warbler	
Yellow-rumped Warbler	
Black-throated Green Warbler	
Blackburnian Warbler	
Pine Warbler	
Palm Warbler	
Bay-breasted Warbler	
Blackpoll Warbler	
Cerulean Warbler	
Black-and-White Warbler	
American Redstart	1
Prothonotary Warbler	



# Important Bird Area - Bird List Lake B

Lake Byllesby IBA

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Ovenbird	
Northern Waterthrush	
Louisiana Waterthrush	
Kentucky Warbler	
Connecticut Warbler	
Mourning Warbler	
Common Yellowthroat	1
Hooded Warbler	
Wilson's Warbler	
Canada Warbler	
Yellow-breasted Chat	
Towhees and Sparrows	_
Spotted Towhee	
Eastern Towhee	
American Tree Sparrow	
Chipping Sparrow	1
Clay-colored Sparrow	1
Field Sparrow	1
Vesper Sparrow	1
Lark Sparrow	1
Savannah Sparrow	1
Grasshopper Sparrow	1
Henslow's Sparrow	
LeConte's Sparrow	
Nelson's Sparrow	
Fox Sparrow	
Song Sparrow	1
Lincoln's Sparrow	
Swamp Sparrow	
White-throated Sparrow	
Harris's Sparrow	
White-crowned Sparrow	
Dark-eyed Junco	



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Cardinals and Grosbeaks	
Summer Tanager	
Scarlet Tanager	1
Western Tanager	
Northern Cardinal	1
Rose-breasted Grosbeak	
Blue Grosbeak	
Indigo Bunting	1
Dickcissel	1
Blackbirds & Orioles	
Bobolink	1
Red-winged Blackbird	1
Eastern Meadowlark	1
Western Meadowlark	1
Yellow-headed Blackbird	
Rusty Blackbird	
Brewer's Blackbird	
Common Grackle	1
Great-tailed Grackle	
Brown-headed Cowbird	1
Orchard Oriole	1
Baltimore Oriole	1
Pine Grosbeak	
Finches	
Purple Finch	
House Finch	1
Red Crossbill	
White-winged Crossbill	
Common Redpoll	
Hoary Redpoll	
Pine Siskin	
American Goldfinch	1
Evening Grosbeak	



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Old World Sparrows	
House Sparrow	1
CASUAL	
Ruff	1
TOTAL	114