



Minneapolis
Park & Recreation Board

Natural Areas Plan – Phase 1



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EXECUTIVE SUMMARY

The Minneapolis Park and Recreation Board (MPRB) is responsible for managing more than 6,700 acres of park, trails, and open space. Most of that area consists of buildings, paved roads and parking lots, and maintained parkland, yet, more than 2,800 acres remain as natural areas. These natural areas include: upland and lowland forests, woodlands, shrublands, and grasslands; a variety of wetlands and stormwater management areas; and lakes. MPRB is committed to protecting and maintaining essential habitat for diverse plant and animal communities, as well as providing quality natural areas for park users. As part of ongoing system-wide maintenance and planning efforts, the MPRB initiated this Phase 1 Natural Areas Plan to address how park spaces are classified and ranked for purposes of natural resource management.

The following goals were identified for Phase 1 of the Natural Areas Plan.

1. Develop and define a plant community classification that encompasses and adequately describes the wide array of MPRB's vegetated natural areas.
2. Develop an ecological quality ranking system appropriate for guiding and prioritizing natural area management.
3. Conduct a preliminary inventory and assessment of representative natural areas, including photo documentation.
4. Deliver a GIS-based landscape inventory of MPRB's natural areas, integrated with existing
5. MPRB data.

MPRB retained Applied Ecological Services, Inc. (AES) and SRF Consulting Group, Inc. (SRF) to categorize, inventory, and map using a geographic information system (GIS) the various natural areas within MPRB's vegetated landscapes. Developing a quality ranking system and preliminary assessments of representative natural areas with associated photo documentation were also goals of this project.

Working closely with MPRB staff, existing GIS data and other documents were compiled and reviewed. A GIS "geodatabase" was developed, representing digital mapping of the entire park system and integrated with previous land cover mapping. Through an iterative process, a plant community classification system was developed to meet the specific needs of MPRB staff. The classification system identifies 15 plant communities. MPRB's reduced mowing and stormwater management areas also were added to the geodatabase as overlay layers, but not as part of the plant community classification. An ecological ranking system was developed to help assess the quality, rarity, and extent of the park system's plant communities, as well as recognize the relative level of effort to manage these natural areas. Through desktop data analyses and field reconnaissance, existing natural plant communities were mapped throughout the park system, and many were assigned a preliminary ecological quality rank, which will be refined in Phase 2 of the MPRB's Natural Areas Plan work.

A total of 2,832 acres of natural areas exist in the MPRB system, of which 1,168 acres are upland or wetland plant communities, with the rest primarily open water. As expected in a highly urbanized park system, many natural areas have been degraded by invasive species, accelerated erosion, and other human disturbances. However, many are already under MPRB management, expanding their size and improving their quality.

This report and the associated geodatabase provide the MPRB with detailed baseline information from which to initiate Phase 2 of the Natural Areas Plan. Phase 2 will include more detailed inventory and assessment of natural areas, natural resource management planning, task prioritization, and baseline ecological monitoring.



1 BACKGROUND, PROJECT PURPOSE AND GOALS

1.1 Background

Created in the late 19th century, the Minneapolis Park and Recreation Board (MPRB) was chartered by Minnesota state statute to develop a system of parks for residents of the City of Minneapolis. Over the years, the Minneapolis park system has grown from a few city parks to a large, nationally recognized regional park system, earning top marks in national surveys. The MPRB is an independently elected, semi-autonomous body responsible for governing, maintaining and developing the Minneapolis park system.

Totalling more than 6,700-acres, the MPRB park, trail and open space system (hereafter referred to as the “system”) consists of local and regional parks, playgrounds, golf courses, gardens, biking and walking paths, nature sanctuaries, lakes, and a 55-mile parkway system. It includes a network of 160 neighborhood parks and 49 recreation centers providing year-round programming. The MPRB also hosts many special events that attract thousands of visitors each time. The system as a whole receives more than 23 million visits each year. Additionally, the MPRB has been named the number one park system in America by the Trust for Public Land in 2013, 2014, 2015, 2016, and 2017.

MPRB is committed to protecting and maintaining essential habitat for diverse plant and animal communities, as well as providing quality natural areas for park users. As part of ongoing system-wide maintenance and planning efforts, the MPRB initiated this Phase 1 Natural Areas Plan to address how park spaces are classified and ranked for purposes of natural resource management.

1.2 Project Purpose

The mission of the MPRB is to “preserve, protect, maintain, improve and enhance” the natural resources of its land holdings, “for current and future generations.” This goal can be met only through a thoughtful process of inventorying and classifying MPRB’s natural resources,

assessing their condition, establishing system-wide priorities, and developing and implementing strategic management plans to ensure their preservation.

Of the 6,700 acres of land within the Minneapolis park system, approximately 2,800 acres consist of natural areas, including: upland and lowland forests, woodlands, shrublands, and grasslands; a variety of wetlands and stormwater management areas; and lakes. Of these natural areas, approximately 400 acres are actively managed native plant communities (e.g., forests undergoing buckthorn control) and planted natural areas (e.g., prairie restorations). Given that the City of Minneapolis is fully urbanized and that plant communities generally require some level of maintenance in perpetuity to sustain their health and cultural benefits, MPRB recognizes the need to implement land management based in sound ecological principles as well as to perpetuate intentional stewardship - guided by science-based data and ensured by adequate funding.

Towards this end, MPRB retained Applied Ecological Services, Inc. (AES) and SRF Consulting Group, Inc. (SRF) to categorize, inventory, and map through GIS-based mapping the various natural areas within MPRB’s vegetated landscapes. Additional goals of this project are to develop a quality ranking system and complete preliminary assessments of representative natural areas with photo documentation.

This Phase 1 plan describes the existing plant communities found in natural areas of MPRB parklands. It also conveys the general conditions of those areas, as well as other ecological and cultural attributes. As mentioned above, the detailed GIS mapping and attribute data are a significant deliverable that accompanies this phase of the plan. A glossary of technical terms and acronyms is provided in Appendix A.

1.3 Project Goals

The following goals were identified for Phase 1 of the Natural Areas Plan:

1. Develop and define a plant community classification that encompasses and adequately describes the wide array of MPRB's vegetated natural areas.
2. Develop an ecological quality ranking system appropriate for guiding and prioritizing natural area management.
3. Conduct a preliminary inventory and assessment of representative natural areas, including photo documentation.
4. Deliver a GIS-based landscape inventory of MPRB's natural areas, integrated with existing MPRB data.



2 DATA AND METHODS

2.1 Existing Data Review

Existing data and reports were used to define the geographic extent of the project and to assist with plant community classification, quality assessment, inventory, and mapping. AES/SRF compiled and reviewed numerous plans and datasets, including:

Other MPRB Plans/Documents

- **Aquatic and Natural Areas Nomenclature Proposal (2012)**
- **Ecological System Plan background material (2014-present)**

MPRB Geographic Information System (GIS) Data

- **Regional park boundaries**
- **Neighborhood park boundaries**
- **Maintained and planted natural areas**
- **Reduced mow areas**
- **Stormwater Best Management Practices (BMPs)**

Public GIS/Mapping Data

- **Hennepin County parcel data**
- **City of Minneapolis city limits**
- **Minnesota Land Cover Classification System (MLCCS) data**
- **MnDNR National Wetlands Inventory (NWI) Central Minnesota Update**
- **MnDNR County Biological Survey data (Sites of Biological Significance and Native Plant Communities)**
- **MnDNR Regionally Significant Terrestrial and Wetland Ecological Areas**
- **MnDNR Natural Heritage Information System (NHIS) – rare natural features**
- **Hennepin County Open Space Corridors and Priority Natural Resource Corridors**
- **Original Vegetation of Minnesota (Marschner 1974)**
- **Elevation data from LiDAR (MnTOPO)**
- **Aerial photography (historical and recent, from Metropolitan Council/MnGeo and Hennepin County)**

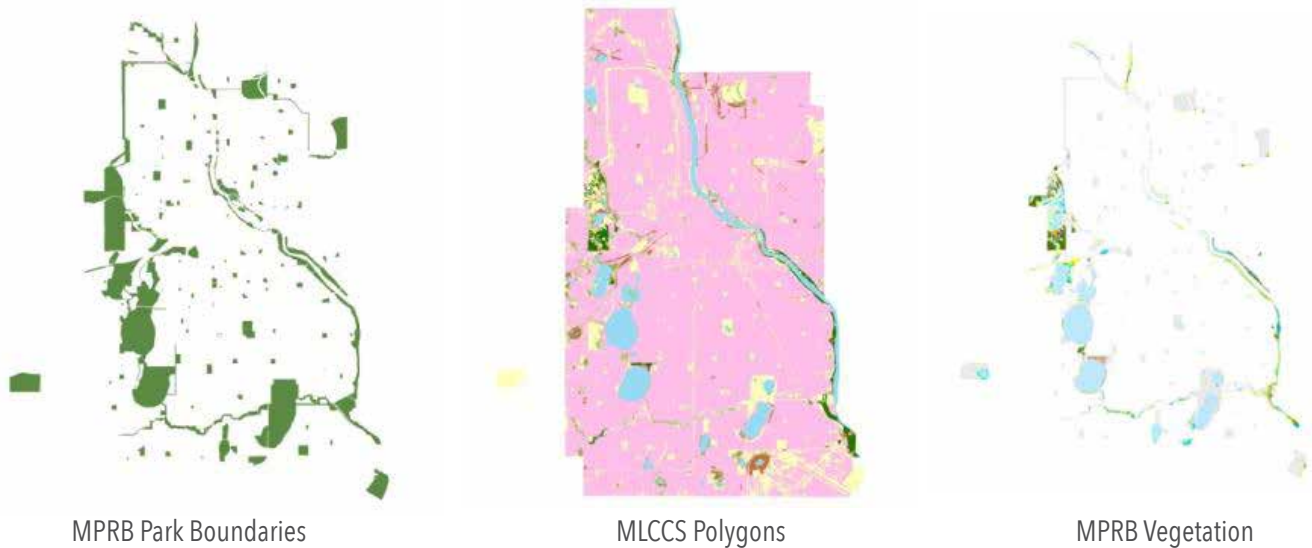
2.2 Desktop Mapping Methods

As a platform for developing and managing MPRB natural area vegetation data, SRF Consulting Group, Inc. (SRF) built an ArcGISTM geodatabase. (A geodatabase is a collection of geographic datasets of various types held in a common file system folder or database.) Development of the MPRB geodatabase began with the following steps:

1. Combined MPRB-owned and -leased properties (including regional and neighborhood parks) with MPRB's stormwater BMPs.
2. Created a "clean" project boundary file that eliminated any overlaps between the regional and neighborhood parks.
3. Edited project boundaries to remove any internal "donut holes" and extended the boundaries of river-adjacent properties to extend slightly over the water. This facilitated accurate vegetation classification within park areas.
4. Assimilated Minnesota Land Cover Classification System (MLCCS) data into the MPRB geodatabase. (MLCCS data were created for Hennepin County by Critical Connections Ecological Services, Inc. in 2008 and incorporated in the statewide MLCCS dataset maintained by the MnDNR.)

Figure 1 summarizes the initial steps taken to develop the MPRB geodatabase.

Figure 1. MPRB Geodatabase Development Steps.



All MLCCS polygons inside the MPRB park boundaries were extracted from the MLCCS geodatabase and assimilated into the MPRB geodatabase. There were 89 different types of MLCCS land covers and hundreds of polygons. MLCCS uses a minimum mapping unit of 1.23 acres for natural areas and a minimum polygon width of 50 feet. This means that smaller or narrower vegetated areas may not have been mapped in the MLCCS process.

Next, a "crosswalk table" was created to combine the more complex and specific MLCCS land cover types to the user-friendly plant community types used in this study. This resulted in 15 types being assigned under the column (or "field") "MPRB_Veg." Ecological quality ranks assigned during MLCCS 2007 field-mapping (under the field "M_34X") were copied over to the preliminary ecological quality rank field "MPRB_EQ_Prelim."

A powerful feature of geodatabases is that multiple characteristics or "attributes" can be assigned to each area or "polygon." SRF retained attributes of the original data layers (described in the steps above) and created additional attribute fields to describe each area (a user-friendly alias is given in parentheses).

- MPRB_ParkID (MPRB Park ID): the unique code used for each park in the MPRB system
- MPRB_VegStudy (MPRB in Veg Study?): a modifier that indicates if the park area is included in this vegetation study
- MPRB_AreaType (MPRB Area Type (Natural Areas)):

- MPRB_Veg (MPRB Vegetation): the MPRB vegetation classification
- MPRB_VegSubType (MPRB Vegetation Sub Type): a more detailed classification used for some plant communities
- MPRB_Acres (no alias): size of polygon in acres
- MPRB_EQ_Prelim (MPRB Preliminary Ecological Quality): preliminary ecological quality rank
- MPRB_S-rank (MPRB State Rank): statewide conservation rank based on rarity (a five-point scale)
- MPRB_M-rank (MPRB Minneapolis Rarity): conservation rank based on rarity within MPRB natural areas (a five-point scale)
- MPRB_E-rank (MPRB Minneapolis Extent): conservation rank based on extent within MPRB natural areas (a five-point scale)
- MPRB_Effort (no alias): relative effort to restore an area to good to moderate quality
- MPRB_Notes (no alias): space for miscellaneous notes
- MPRB_EQ_Final (MPRB Final Ecological Quality): final ecological quality rank (to be populated in Phase 2 of this project)
- MPRB_EQ_FinalDate (MPRB Final Ecological Quality Date): date in Phase 2 on which ecological quality rank is confirmed

Figure 2 is a snapshot of a portion of the attribute table associated with the MPRB geodatabase. It shows how the top three polygons (rows) were originally classified in MLCCS as three different types of oak forest/woodland (first column, or “field”). These all were cross-walked to “Dry-Mesic Forest/Woodland” in the MPRB classification

system (third field). Some of the MLCCS ecological quality ranks (second field) were revised/updated in the MPRB Preliminary Ecological Quality Ranks (fourth field). The far right field shows the acreage of each individual polygon.

Figure 2. Screenshot of a Section of the MPRB Geodatabase.

C_TEXT (from MLCCS)	M_34X (from MLCCS)	MPRB_Veg	MPRB_EQ_Pr	MPRB_Acres
Oak forest dry subtype	C	Dry-Mesic Forest/Woodland	C	0.62
Oak forest mesic subtype	C	Dry-Mesic Forest/Woodland	CD	6.61
Oak woodland-brushland	C	Dry-Mesic Forest/Woodland	CD	1.13
Altered/non-native deciduous woodland - saturated	NN	Floodplain Forest	D	0.92
Altered/non-native deciduous woodland - temporarily flooded	NN	Floodplain Forest	D	0.27
Floodplain forest	C	Floodplain Forest	CD	6.75
Floodplain forest silver maple subtype	C	Floodplain Forest	C	7.44
Lowland hardwood forest	D	Floodplain Forest	D	3.14

Using primarily GIS data layers and some other sources, a variety of quality assurance/quality control (QA/QC) procedures were followed to ensure vegetation mapping was as accurate as possible. This entailed making visual, on-screen comparisons among GIS datasets. The MPRB polygons were compared to recent aerial imagery and the MnDNR County Biological Survey mapping and rare natural features data to ensure that high quality natural areas had been mapped where they still existed. LiDAR-generated elevation contours and the MnDNR's National Wetlands Inventory (NWI) Update were used to ensure that wetlands were mapped accurately. Other MPRB polygons were compared to recent aerial imagery to detect differences with polygon boundaries. Many of these data were unavailable when the original MLCCS mapping was conducted. The geodatabase was also sorted for a variety of attributes and spot checked throughout the MPRB system. Edits to polygon geometry and attribute codes were made as warranted.

Based on field verification observations (described under Section 2.3), AES made additional edits, including splitting polygons into multiple plant communities, re-classifying plant communities (editing “MPRB_Veg”), and adjusting ecological quality ranks (“MPRB_EQ_Prelim”).

In addition to this detailed park land cover and plant community layer, the geodatabase was augmented with two additional layers:

reduced mow areas (digitized by MPRB and SRF staff) and stormwater BMPs (digitized by MPRB and AES staff). These layers are used as overlays and are not part of the land cover classification. For example, a reduced mow area could contain a Savanna, a Non-Native Grassland, and a Prairie, which are mapped as separate MPRB plant community polygons.

2.3 Field Methods

On May 4 and 5, 2017, an AES ecologist conducted field verification of many of the MPRB’s natural areas (including most of those that are actively managed). Desktop mapping was used to create maps for use in the field. The field maps were then used to verify and/or refine plant community classification and plant community boundaries, and to validate the accuracy of the 2008 MLCCS assessment of ecological quality. (Final ecological quality ranks will be assigned to natural areas in Phase 2.) Digital photography (georeferenced, using Collector for ArcGIS and ArcGIS Online) was used to document representative plant communities, specific locations, and stormwater BMPs throughout the park system. Desktop refinement of GIS data was conducted after this field verification.



3 PLANT COMMUNITY CLASSIFICATION

3.1 Developing a Vegetation Classification

MPRB parkland contains a wide variety of natural landscapes. These range from forests to grasslands and from uplands to lowlands/wetland communities. Natural areas can be classified in a variety of ways, depending on how the information will be used. For this study, a vegetation classification was developed to help with prioritization and management of natural areas.

An understanding of a region's natural history is useful for developing an appropriate vegetation classification system. Retreat of the last glaciers (circa 10,000 years ago) left behind moraines and outwash plains, and these have evolved into immature drainage patterns with many kettlehole wetlands. The Mississippi River is a defining feature of MPRB parkland, forming much of the park system's east edge. Work by the MnDNR and Marschner (1974) indicates that at the time of European settlement (circa 1850), much of MPRB's parkland was dominated by "Oak Openings and Barrens" – commonly referred to as savanna with trees and brush. Significant tracts (around the Minneapolis Chain of Lakes and Wirth Park) contained "Big Woods – Hardwoods (Oak, Maple, Basswood, etc.)." Several "Lakes (open water)" were identified at the current locations of City lakes. An expanse of "Prairie" was mapped east of the Chain of Lakes (outside of MPRB parkland) and a few patches of "Wet Prairie" were also documented. While some areas identified as Wet Prairie are within present day wetlands or surface waters, many were filled and developed.

Existing MLCCS data provided a detailed preliminary inventory of land cover throughout the park system, including plant communities. These data, published in 2008, were used to understand the range of land covers found within the MPRB system and to assist with vegetation classification.

Of particular interest are remaining natural communities, where the historical composition, structure, and functions of native plant communities persist to a greater or lesser degree. Within MPRB's natural areas, MnDNR County Biological Survey (CBS) mapping (completed in 1998) identified a variety of native vegetation or ecological communities, including:

- Black Ash - (Red Maple) Seepage Swamp – along the Minnehaha Creek gorge, below the Falls

- Mesic Prairie (Southern)
- Red Oak - Sugar Maple - Basswood - (Bitternut Hickory) Forest
- Red Oak - White Oak - (Sugar Maple) Forest
- Silver Maple - (Virginia Creeper) Floodplain Forest
- Sugar Maple - Basswood - (Bitternut Hickory) Forest
- Tamarack Swamp (Southern) – in Theodore Wirth Park's "Quaking Bog"
- Moist Cliff (Southeast) – along the Minnehaha Creek gorge, below the Falls

3.2 MPRB Vegetation Classification

The classification was based on an established system, the MnDNR's scientifically-rigorous and state-standardized native plant community classification system (MnDNR 2005). This system was modified for ease of use and made specific to MPRB's parklands after considering the MPRB's goals and intended uses. Each plant community type is descriptive enough to be useful for vegetation management, but not overly detailed and cumbersome for staff working in the field. This classification refinement will also help to improve communication among MPRB staff managing natural areas and to make the work more understandable to residents, volunteers, and stakeholders.

The following vegetation classification (Table 1) was developed in collaboration with MPRB staff. The table presents a hierarchical classification scheme, with each level indented according to the level of organization. For instance, at the first level upland communities with dry soil are separated from lowland communities with typically wet soil. At the second level, the dominant form of the vegetation separates types. (Open water with no obvious vegetation is also at this level.) At the third and fourth levels additional information is brought into the classification, such as the dominant plant species or a unique feature of the habitat, such as organic soil.

Table 1. MPRB Natural Area Vegetation Classification

Plant communities	Defining Characteristics
Upland Communities	High, dry ground
Forest/Woodland	50-100% tree canopy
Mature Forest/Woodland	Large trees
1. Dry-Mesic Forest/Woodland	Often oaks
2. Mesic Forest	Often maples
3. Altered Forest/Woodland	Often box elder, green ash
Savanna/Brushland	5-50% tree canopy
4. Savanna	Tree dominated
5. Shrub/Scrub	Shrub dominated
Grassland	<5% tree canopy
6. Prairie	Native plants dominate
7. Non-Native Grassland	Little native plant cover
Sparse/Absent Vegetation	<10% vegetation cover
8. Sand/Soil	Often beaches or cleared areas
Lowland Communities	Low areas, including wetlands
Forest/Woodland Lowland	50-100% tree canopy
9. Floodplain Forest	Near water body; typically mineral soil
10. Wet Forest/Swamp	Organic soil; saturated or inundated
11. Forested Peatland	Tamarack bog
Shrub/Scrub Lowland	5-50% tree canopy
12. Lowland Shrub/Scrub	Often willows and/or dogwoods
Herbaceous Lowland	<5% tree canopy
13. Wet Meadow	Grasses and sedges dominate
14. Marsh	Often invasive cattails
15. Open Water	Submerged or floating vegetation

Higher (un-numbered) classification levels are not mapped because they contain more than one plant community at a lower, more detailed classification level. These lower, more detailed (numbered) plant communities were mapped. Cultural land covers or “cultural landscapes” are not included in the vegetation classifica-

tion. Cultural landscapes include buildings, impervious surfaces, and regularly maintained landscapes such as mowed turf areas.

A description follows for each mapped plant community type (i.e., numbered community).

1. Dry-Mesic Forest/Woodland



Dry-Mesic Forest/Woodland, south of Lake Calhoun/Bde Maka Ska (William Berry Park).

Characteristic Plant Species

- Bur oak (*Quercus macrocarpa*)
- Northern pin oak (*Q. ellipsoidalis*)
- White oak (*Q. alba*)
- Red oak (*Q. rubra*)
- Black cherry (*Prunus serotina*)
- Big-toothed and quaking aspen (*Populus grandidentata*, *P. tremuloides*)

Other Plant Community Characteristics

- Tree canopy typically has scattered openings, where direct sunlight dapples the forest floor.
- Compared to Mesic Forest, Dry-Mesic Forest/Woodland tends to be more susceptible to invasion by common buckthorn (*Rhamnus cathartica*) and invasive honeysuckles (*Lonicera tatarica*, *L. x bella*, etc.).
- Generally falls within the “Fire-Dependent Forest/Woodland System” of the Minnesota Native Plant Community Classification (MnDNR 2005).

Soil and Slopes

- Often occurs in well- to moderately well-drained soils.
- Often found on south- or west-facing slopes, but can also occur on relatively flat landscape settings.

Historical Conditions

- Historically burned relatively frequently (approximately once every 10 years).
- Low-intensity surface fires were important for maintaining plant community structure and species composition. Without fire, sun-requiring species disappear, reducing the variety of plants and insects in the community.

2. Mesic Forest



Mesic Forest, on the east-facing bluffs of Mississippi Gorge Regional Park (along West River Parkway).

Characteristic Plant Species

- Sugar maple (*Acer saccharum*)
- Black maple (*A. nigrum*)
- Red, white and bur oaks (*Quercus rubra*, *Q. alba*, *Q. macrocarpa*)
- Basswood (*Tilia americana*)
- Hackberry (*Celtis occidentalis*)
- American and slippery elm (*Ulmus americana*, *U. rubra*)
- Ironwood (*Ostrya virginiana*)

Other Plant Community Characteristics

- Tree canopy closure often is nearly 100 percent, which limits or excludes shrub and groundstory vegetation that requires direct sunlight.
- Invasive garlic mustard (*Alliaria petiolata*) is a problem in many Mesic Forests, especially those in low-lying or moist areas.
- Generally falls within the “Mesic Hardwood Forest System” of the Minnesota Native Plant Community Classification (MnDNR

2005), and includes mesic oak forests as well as maple-basswood forests.

Soil and Slopes

- Often occurs in moderately well-drained soils.
- Often found on north- or east-facing slopes, but can also occur on relatively flat landscape settings.

Historical Conditions

- Historically, burned rarely (approximately once every 20-50 years).
- Tends to become dense stands of maple in the natural process of forest succession.
- Researchers have shown that non-native, invasive earthworms harm Minnesota forests, particularly Mesic Forest. Earthworms reduce forest duff, increase erosion, and change soil structure in a way that prevents the regeneration of many native herbaceous plants and trees. It is likely that most, if not all, of MPRB's Mesic Forest stands contain these invasive animals.

3. Altered Forest/Woodland



Altered Forest/Woodland, in the northeast portion of Cedar Lake Park.

Characteristic Plant Species

- Box elder (*Acer negundo*)
- Green ash (*Fraxinus pennsylvanica*)
- American and slippery elm (*Ulmus americana*, *U. rubra*)

Other Plant Community Characteristics

- Some areas contain planted trees of native and non-native deciduous and coniferous species.
- Invasive plants are common, including common buckthorn, non-native honeysuckles, garlic mustard, motherwort (*Leonurus cardiaca*), and burdock (*Arctium minus*).

- Not considered a natural community.

Soil and Slopes

- Occurs in a broad range of soils and slope positions.

Historical Conditions

- Often formerly disturbed areas that were colonized by pioneering species of bottomlands, which have light, highly mobile seeds (see Characteristic Plant Species above); these trees may range in age from young to mature.

4. Savanna



Savanna, restoration site along West River Parkway near East 36th Street.

Characteristic Plant Species

- Bur oak (*Quercus macrocarpa*)
- Northern pin oak (*Q. ellipsoidalis*)
- American plum (*Prunus americana*)
- Chokecherry (*P. virginiana*)

Other Plant Community Characteristics

- Savanna is used to describe landscapes with less canopy cover than forests and woodlands (typically <50 percent canopy cover), and where the woody (i.e., tree and shrub) vegetation is dominated by trees as opposed to shrubs.
- The broken tree canopy allows sunlight to reach the groundlayer, often supporting substantial herbaceous vegetation where shrubs and colonizing trees are not dominant.
- The term “Savanna” does not necessarily mean a high quality native community, such as an intact oak savanna with native groundcover; rather, Savanna in the MPRB classification means a community has the physical structure of a savanna, with 10-50 percent canopy cover, mostly of trees, and a shrubby or herbaceous groundlayer. Ecological quality ranks discussed later

in this plan can be used to easily differentiate savannas having oaks and native groundlayer plants from those savannas comprised of species not characteristic of historical, species-rich savannas.

- Many of the grand, arching oaks seen throughout Minneapolis originated in savannas, and often still present the look of a natural savanna even though the groundlayer is mowed or composed of non-native plants.
- Common buckthorn is an invasive shrub that dominates the understory of many Savannas.

Soil and Slopes

- Occurs in a broad range of soils and slope positions.

Historical Conditions

- Historically, experienced frequent fires (approximately once every 2-4 years). However, where canopy cover approached 50 percent, these fires were not severe, with flame lengths only a few feet in height. Where trees covered only 10 percent of the ground, fires were like those in prairies, with much longer flame lengths due to the abundance of dry groundlayer vege-

tation as fuel. While shrubs and seedlings were often to-killed by these fires, they resprouted from rootstocks. Fire-tolerant trees such as the thick-barked bur oak and also trees that grew rapidly from root masses (called “grubs”), like northern pin oak, were usually able to reach a size that survived the surface fires. Fire helped maintain an open and patchy vegetation structure

in the community, with some areas in full sun and others in partial shade.

- Variety of tree canopy cover and different amounts of light promoted a diversity of flowering shrubs, grasses, and wildflowers, combining forest and prairie flora, and made these habitats productive and able to support a wide range of wildlife.
- Attractive to people because of their park-like quality.

5. Shrub/Scrub



Shrub/Scrub, in the northeast portion of Cedar Lake Park.

Characteristic Plant Species

- Smooth and staghorn sumac (*Rhus glabra*, *R. typhina*)
- Asian honeysuckles (primarily *Lonicera tatarica*, *L. x belli*) - invasive
- Eastern red cedar (*Juniperus virginiana*)
- Siberian elm (*Ulmus pumila*) - invasive
- Smooth brome (*Bromus inermis*) - invasive

Other Plant Community Characteristics

- Like Savanna, Shrub/Scrub describes landscapes with less canopy cover than forests and woodlands (<50 percent cover); however, the woody vegetation is primarily shrubs and not trees.

- Generally not considered a natural community in the MPRB system, but prior to 1850, Shrub/Scrub communities on high ground were common and supported a wide array of native plants and animals.

Soil and Slopes

- Occurs in a broad range of soils and slope positions.

Historical Conditions

- Most are former grassland areas that became overgrown with shrubs and scattered trees.
- If previously farmed or heavily grazed, groundlayer often consists of non-native plants, similar to those of Non-Native Grasslands.

6. Prairie



Prairie, restoration site near Shingle Creek, north of 52nd Avenue North near Russell Avenue North.

Characteristic Plant Species

- Big bluestem (*Andropogon gerardii*)
- Indian grass (*Sorghastrum nutans*)
- Switch grass (*Panicum virgatum*)
- Little bluestem (*Schizachyrium scoparium*)
- Black-eyed Susan (*Rudbeckia hirta*)
- Common oxeye (*Heliopsis helianthoides*)
- Purple prairie clover (*Dalea purpurea*)
- Bergamot (*Monarda fistulosa*)

Other Plant Community Characteristics

- Herbaceous plant community, often dominated by grasses.
- Invasive species include spotted knapweed (*Centaurea maculata*) in dry prairies, and reed canary grass (*Phalaris arundinacea*) in wet prairies.

- Falls within the "Upland Prairie System" or "Wetland Prairie System" of the Minnesota Native Plant Community Classification (MnDNR 2005).

Soil and Slopes

- Occurs in a broad range of soils and slope positions: dry prairie is often on sandy soils and/or south- or west-facing slopes, the hottest, driest locations in the region; moist or mesic prairie is found in a variety of settings, but never excessively dry or wet; wet prairie grows in low, flat areas with shallow groundwater or seepage.

Historical Conditions

- Historically burned frequently (return intervals less than 10 years). Currently, however, a return interval of less than 4 years is required to combat the many invasive plants which were not present in Minnesota 150 years ago.

7. Non-Native Grassland



Non-Native Grassland northeast of Wirth Lake (with early invasion by woody species).

Characteristic Plant Species

- Smooth brome (*Bromus inermis*) - invasive
- Kentucky bluegrass (*Poa pratensis*) - invasive
- Dandelion (*Taraxacum officinale*) - invasive
- Yellow and white sweet clover (*Melilotus officinalis*, *M. alba*) - invasive
- Ground clovers (primarily *Trifolium repens*, *T. pratense*) - invasive
- Canada goldenrod (*Solidago canadensis*) - invasive
- Common ragweed (*Ambrosia artemisiifolia*) - invasive
- Reed canary grass (*Phalaris arundinacea*) - invasive

- Giant ragweed (*Ambrosia trifida*) - invasive
- Stinging nettle (*Urtica dioica*) - invasive

Other Plant Community Characteristics

- Dominated by non-native herbaceous vegetation that is not typically mowed or maintained.
- Not considered a natural community.

Soil and Slopes

- Occurs in a broad range of soils and slope positions.

Historical Conditions

- Often previously farmed or grazed.

8. Sand/Soil



Cedar Lake East Beach.

Characteristic Plant Species

- Vegetation typically absent or very sparse.

Other Plant Community Characteristics

- Bare (or nearly bare) soil, including constructed and natural sand beaches, sandbars, and areas of cleared and disturbed soil.
- While these areas may originate with natural processes, they generally lack vegetation and are not considered a natural community.

Soil and Slopes

- Soils typically sand, found in disturbed areas or low-lying, flood-prone locations in sandy outwash and moraines.

Historical Conditions

- Prior to construction of dams, sand bars were common along and in the Mississippi River and supported a variety of species, including sedges (*Carex* spp.), prairie cordgrass (*Spartina pectinata*), and indigo bush (*Amorpha fruticosa*).

9. Floodplain Forest



Floodplain Forest, near East River Parkway, south of Franklin Avenue Bridge.

Characteristic Plant Species

- Silver maple (*Acer saccharinum*)
- Eastern cottonwood (*Populus deltoides*)
- American and slippery elm (*Ulmus americana*, *U. rubra*)
- Green ash (*Fraxinus pennsylvanica*)
- Common hackberry (*Celtis occidentalis*)
- Stinging nettle (*Urtica dioica*) – invasive
- Wood nettle (*Laportea canadensis*)
- Spotted touch-me-not (*Impatiens capensis*)

Other Plant Community Characteristics

- Low-lying woodlands that experience flooding or shallow water tables for a period of time; these floods often occur annually or at least once every few years.

- In contrast to Wet Forest/Swamp, Floodplain Forests usually have mineral soil (as opposed to organic, mucky soils typical of swamps).
- Falls within the “Floodplain Forest System” of the Minnesota Native Plant Community Classification (MnDNR 2005).

Soil and Slopes

- Occurs in low-lying areas, often consisting of sands or silts.

Historical Conditions

- Some Floodplain Forests still experience unaltered floodplain dynamics and resemble historical forests, but others have changed due to hydrological alterations (e.g., dam, levees).

10. Wet Forest/Swamp



Wet Forest/Swamp, in Roberts Bird Sanctuary, north of Lake Harriet.

Characteristic Plant Species

- Black ash (*Fraxinus nigra*)
- Black willow (*Salix nigra*) and its hybrid with crack willow (*S. fragilis*)
- Eastern cottonwood (*Populus deltoides*)
- Silver maple (*Acer saccharinum*)
- Common elderberry (*Sambucus nigra*)
- Spotted touch-me-not (*Impatiens capensis*) or yellow touch-me-not (*I. pallida*) near groundwater seeps and springs
- Clearweed (*Pilea pumila*)

Other Plant Community Characteristics

- Typically grow in saturated or inundated organic soils, which were formed by plants that died but did not fully decompose. Centuries of plant death and compression produced the layer of organic soil in which these communities formed. Peat, muck and other familiar gardening soils are mined from these organic soil plant communities. Sometimes the organic soils are saturated with groundwater emerging from the bases of glacial hills or bedrock bluffs, especially limestone and dolomite.

- Not typically found in floodplains, but rather in isolated basins and low points of the landscape. By contrast, Floodplain Forests usually have ordinary mineral soils made up of silt and sand. Many of the same species of Floodplain Forests occur in Wet Forest/Swamp.
- Wet Forest/Swamp of the seepage type, however, are often dominated by black ash and may support skunk cabbage (*Symplocarpus foetidus*) and marsh marigold (*Caltha palustris*).
- Falls within the "Wet Forest System" of the Minnesota Native Plant Community Classification (MnDNR 2005).

Soil and Slopes

- Occurs in low-lying areas containing saturated or inundated organic soils.

Historical Conditions

- Some Wet Forest/Swamp areas represent historical conditions, while others have experienced partial drainage due to ditching and other hydrological modifications.

11. Forested Peatland



Forested Peatland, the “Quaking Bog” in Theodore Wirth Park.

Characteristic Plant Species

- Tamarack (*Larix laricina*)
- Willow shrubs (*Salix* spp.)
- Sedges (*Carex* spp.)
- Sphagnum moss (*Sphagnum* spp.)

Other Plant Community Characteristics

- Characterized by mature trees growing in organic soils of peat or muck.
- Notable among all plant communities for supporting the largest number of orchid species.

- Like other saturated wetlands, can be invaded by species such as glossy buckthorn (*Frangula alnus*), reed canary grass (*Phalaris arundinacea*), and giant reed (*Phragmites australis*).
- Falls within the “Forested Rich Peatland System” of the Minnesota Native Plant Community Classification (MnDNR 2005).

Soil and Slopes

- Occurs in low-lying areas, where organic soils have developed.

Historical Conditions

- Uncommon in the Twin Cities region due to development, hydrologic changes, and central Minnesota’s climate, which is not favorable to the development of organic soils; however, Forested Peatland is abundant in northern Minnesota.

12. Lowland Shrub/Scrub



Lowland Shrub/Scrub, south of Wirth Lake.

Characteristic Plant Species

- Willow shrubs (*Salix* spp.)
- Red-osier dogwood (*Cornus stolonifera*)
- Sedges (*Carex* spp.)
- Marsh marigold (*Caltha palustris*)

Other Plant Community Characteristics

- Shrub-dominated wetland community.
- Often contains highly invasive reed canary grass (*Phalaris arundinacea*), which can completely dominate the groundlayer.

- Falls within the "Wet Meadow/Carr System" of the Minnesota Native Plant Community Classification (MnDNR 2005).

Soil and Slopes

- Occurs in saturated or groundwater-fed soils, usually in shallow, inundated depressions.

Historical Conditions

- Some Lowland Shrub/Scrub areas represent historical conditions, while others developed after woody plants invaded wet meadows following drainage and the cessation of haying or grazing.

13. Wet Meadow



Wet Meadow (dominated by the invasive reed canary grass) in Theodore Wirth Park, near Bassett's Creek, north of Highway 55.

Characteristic Plant Species

- Sedges (*Carex* spp.)
- Canada bluejoint grass (*Calamagrostis canadensis*)
- Manna grass (*Glyceria* spp.),
- Reed canary grass (*Phalaris arundinacea*) – invasive
- Swamp milkweed (*Asclepias incarnata*)
- Spotted Joe-pye weed (*Eutrochium maculatum*)
- Blue flag iris (*Iris versicolor*)
- Beggar ticks (*Bidens* spp.)
- Sensitive fern (*Onoclea sensibilis*)
- Marsh fern (*Thelypteris palustris*)

Other Plant Community Characteristics

- Herbaceous wetlands.
- Most in the Twin Cities region are dominated by the invasive, non-native reed canary grass.
- Falls within the “Wet Meadow/Carr System” of the Minnesota Native Plant Community Classification (MnDNR 2005).

Soil and Slopes

- Occurs in depressions and at edges of marshes, lakes, ponds, and some streams and rivers. It is found in saturated soils and sometimes in shallow water.

Historical Conditions

- Wet meadows depend on a predictable, though not static, hydrologic regime, sometimes including damming by beavers. The seasonal water level changes in response to spring runoff, May-June rains, and late summer dry periods sustained the large variety of plants in historical wet meadows. Currently most wet meadows across the Midwest have been converted to a simple plant community of reed canary grass with a few scattered other species. This was due to the introduction of aggressive strains of reed canary grass for pasture, as well as draining to facilitate haying and cropping. Sediment and nutrient inputs greatly favor reed canary grass, as does fixed water levels resulting from dams and berms. In dry periods, wet meadows were subject to fire, but the plants, including the shrubs, survived such fires and resprouted.

14. Marsh



Marsh dominated by the invasive narrow-leaved cattail, associated with constructed wetlands south of Lake Nokomis, east of Cedar Avenue South.

Characteristic Plant Species

- Narrow-leaved and blue cattail hybrids (*Typha angustifolia*, *T. x glauca*) – invasive
- Purple loosestrife (*Lythrum salicaria*) – invasive
- Giant reed (*Phragmites australis*) – invasive
- Bulrushes (*Scripus* spp., *Schoenoplectus* spp., *Bolboschoenus* spp.)
- Spikerushes (*Eleocharis* spp.)
- Giant bur-reed (*Sparganium eurycarpum*)
- Broad-leaved arrowhead (*Sagittaria latifolia*)

Other Plant Community Characteristics

- Wetlands that are typically dominated by emergent wetland plants growing in shallow to deep water.
- In the Twin Cities region, marshes are most often dominated by the invasive cattails. Purple loosestrife and giant reed are two additional invasive plants commonly found in Marsh. These species often spread throughout a wetland, reducing vegetation diversity and habitat value.

- Falls within the “Marsh System” of the Minnesota Native Plant Community Classification (MnDNR 2005).

Soil and Slopes

- Occurs in depressions and at edges of lakes, ponds, streams, and rivers. It is found in shallow to deep water over mineral or organic soil.

Historical Conditions

- Invasion by cattails and other aggressive species have resulted in the dramatic degradation of this type of wetland throughout the Upper Midwest. Hydrological regimes were dynamic but predictable historically. With the current shunting of excessive runoff from roads, pavement, rooftops, and agricultural fields, marshes experience water level fluctuations out of the normal range that the historical vegetation can tolerate. Both narrow-leaved and blue cattail grow well with this overly-dynamic flooding regime; these species also use the higher phosphorus concentrations in most marshes receiving stormwater runoff to develop dense, tall stands.

15. Open Water



Open Water, at south end of Lake Harriet, near West Lake Harriet Parkway at West 47th Street.

Characteristic Plant Species

- Yellow water lily (*Nuphar variegata*)
- White water lily (*Nymphaea odorata*)
- Eurasian watermilfoil (*Myriophyllum spicatum*)
- Curly-leaf pondweed (*Potamogeton crispus*)
- Coontail (*Ceratophyllum demersum*)
- Pondweeds (*Potamogeton* spp.)
- Lesser duckweed (*Lemna minor*)

Other Plant Community Characteristics

- While not a focus of this study, Open Water areas often contain a variety of floating and/or submerged aquatic plants. Aquatic

habitats in the Minneapolis park system are affected by urban stormwater runoff and aquatic invasive species (AIS), including plants such as Eurasian watermilfoil and curly-leaf pondweed, and non-native animals, such as zebra mussel (*Dreissena polymorpha*) and common carp (*Cyprinus carpio*).

Soil and Slopes

- Occurs in lakes and ponds, containing mineral or organic soils.

Historical Conditions

- Many Open Water areas represent historical conditions (e.g., natural lakes, rivers, and open water wetlands), while some represent constructed stormwater ponds.

3.3 MPRB Vegetation Overlays

Some of MPRB's natural areas have special management regimes or are designed and managed for a particular purpose. Rather than incorporate them into the classification of plant communities, such areas are identified in the geodatabase as separate layers, or overlays. This is a common GIS mapping practice and protects the integrity of the underlying vegetation classification. When an overlay is placed on the vegetation classification, a map can be produced that displays both the management regime and the plant communities where the management regime is applied. Two such overlays were developed for MPRB's natural areas:

Reduced Mow Areas

MPRB reduced mow areas are mowed 2-3 times per year to maintain the vegetation. This maintenance strategy is used in areas where there are steep slopes, limited use by the public, and /or safety concerns. This reduced mowing regime not only lessens operations costs for MPRB, but also reduces carbon emissions and nuisance noise from mowers.

Stormwater Best Management Practices (BMPs)

Stormwater management is an important strategy employed by the MPRB to help protect water resources. Best Management Practices (BMPs) is a term used to describe a variety of stormwater management techniques that control the rate (speed) of runoff, reduce its volume (amount), and improve water quality by capturing sediment and other pollutants. Stormwater BMPs can be incorporated into parks and other landscapes, providing benefits beyond runoff management, including making native plant gardens, creating wetlands and ponds, and providing pollinator habitat.

The MPRB has installed the following BMPs throughout their park system:

- **Permeable paver** – a structural surface (for walking or driving/parking) with gaps between paver blocks, allowing runoff to soak, or "infiltrate," into the underlying soil, reducing the potential for erosion and transportation of pollutants to water bodies.
- **Rain garden** - a planted depression that allows rainwater runoff from hard (impervious) surfaces (parking lots, roads, roofs, etc.) to infiltrate into the underlying soil.
- **Swale** – a gently sloped linear depression that conveys runoff through vegetation, providing filtration and infiltration. Swales may be accompanied by check dams, which create small pooling areas, increasing sediment/pollutant capture and infiltration.
- **Wetland** – an intermittently wet, saturated, or shallowly inundated vegetated area that provides a variety of sediment/pollutant capture and treatment services.
- **Dry pond** – designed to store runoff for a short period of time (usually <24 hours) to provide rate control and flood protection.
- **Wet pond** – designed to have a permanent pool of water throughout the year, allowing for sediment/pollutants to settle and remain in the wet pond for later clean-out and disposal.
- **Stormwater pond** – designed as either a dry pond or wet pond (see above)



4 ECOLOGICAL RANKING SYSTEM

An ecological ranking system of MPRB plant communities will aid in planning, prioritizing, and budgeting vegetation management throughout the park system. The focus of this plan is ecological criteria; however, MPRB may address cultural criteria as part of future planning efforts to guide master planning and vegetation management prioritization.

In this plan, five ecological criteria were developed. These criteria describe important aspects of MPRB's natural areas.

- Ecological Quality – What is the current ecological health of a specific plant community (i.e., polygon)?
- Ecological Rarity in Minnesota – How rare is the plant community in the state?
- Ecological Rarity in MPRB Parkland – How rare is the plant community in the MPRB system?
- Ecological Extent in MPRB Parkland – How much land does the plant community cover in the MPRB system?
- Restoration Effort – How much effort (i.e., cost) is required to improve the quality of a plant community?

4.1 Ecological Quality

An integral step in MPRB's Natural Areas Plan will be to assign an ecological quality rank to individual plant community polygons. This rank estimates the relative health of a specific plant community. The criteria for assigning a rank are:

- Diversity of native species
- Level of disturbance
- Presence of invasive species
- Structural and spatial diversity (i.e., vegetation layers and plant variety across the natural area)
- Connectivity with other plant communities or turf or active use park areas
- Degree of erosion due to processes such as excessive runoff or foot traffic
- Other negative existing management impacts

Several ecological quality ranking systems were reviewed and considered. Departments of Natural Resources across the country have adopted a standardized ecological ranking system used by State Natural Heritage Programs when conducting inventories of natural areas. In Minnesota, this system was refined by the MnDNR as

the Natural Community Element Occurrence Ranking Guidelines (MnDNR 2001). This robust (91-page) methodology provides definitions and criteria for assigning an ecological quality rank to any given native plant community in Minnesota. For more general application of ecological quality ranks, MLCCS (version 5.4) adopted a simplified version of the MnDNR's system, whereby more general guidelines are provided to help the user assign an appropriate quality rank.

Based on the ecological criteria described above, it was decided that the MLCCS ecological quality ranking system would be modified slightly for use in MPRB parklands. The following ecological quality ranks are recommended for MPRB parklands.

- **A** = Highest quality natural community, no disturbances and natural processes intact.
- **B** = Good quality natural community. Has its natural processes intact, but shows signs of past human impacts. Low levels of exotic plants.
- **C** = Moderate condition natural community with obvious past disturbance but still clearly recognizable as a native community. Not dominated by weedy species in any layer.
- **D** = Poor condition of a natural community. Includes some natives, but is dominated by non-natives and/or is widely disturbed and altered.
- **NN** = Altered / non-native plant community. These semi-natural communities do not receive a natural quality rank.

Often, a mapped plant community may be somewhat heterogeneous and contain characteristics of multiple quality ranks. For instance, a moderate quality forest (C rank) may have large, dense patches of invasive buckthorn (justifying a D rank). In this case, it would be acceptable to assign multiple ranks to this single plant community (i.e., CD). It is best to limit the number of ranks to two "adjacent" ranks, and if this does not accurately characterize the plant community's quality, the plant community (polygon) should be split and each portion assigned its appropriate quality rank.

4.2 Ecological Rarity in Minnesota

The rarity of plant communities is of interest to MPRB. One way to look at the issue of rarity is through the lens of the entire state. The MnDNR has developed state conservation status ranks for native plant communities in Minnesota (MnDNR 2009). These "S-ranks" are:

- S1 = critically imperiled
- S2 = imperiled
- S3 = vulnerable to extirpation
- S4 = apparently secure, uncommon but not rare
- S5 = secure, common, widespread, and abundant

4.3 Ecological Rarity in MPRB Natural Areas

A local perspective on rarity is also useful. To that end, AES developed a five-category classification of the rarity of different plant communities in the MPRB system. These “M-ranks” are:

- M1 = extremely rare (1 occurrence)
- M2 = rare (2-10 occurrences)
- M3 = uncommon (11-30 occurrences)
- M4 = common (31-100 occurrences)
- M5 = widespread and abundant (>100 occurrences)

4.4 Ecological Extent in MPRB Natural Areas

It is also instructive to consider the total amount of land (or spatial extent) covered by each particular plant community type in the MPRB system. The following “E-ranks” were developed to categorize vegetation types by their spatial extent.

- E1 = very small area (<10 acres total across the MPRB system)
- E2 = small area (11-30 acres)

- E3 = moderate area (31-110 acres)
- E4 = large area (111-300 acres)
- E5 = very large area (>300 acres)

Table 3 in Section 5 summarizes the plant communities of MPRB natural areas with regard to the above ecological criteria.

4.5 Restoration Effort

Different types of plant communities and communities of varying ecological quality will require a different level effort to improve their ecological health and function. For instance, restoring an overgrown woodland to the native savanna it once was will require more effort compared to improving an existing poor quality prairie. This is because the savanna restoration would typically involve removal of large canopy trees, removal of invasive shrubs, and installation of native vegetation; the prairie enhancement may only involve removal of some invasive shrubs and spot treatment of weeds.

For the purposes of this plan, a rank is assigned based on the effort required to restore a plant community to an ecological quality rank of BC. In other words, how much effort will it take to restore a poor quality plant community to a fair to good quality plant community? AES’s experience with ecological restoration and management was used to assign the relative level of effort required to restore different plant communities to fair to good ecological quality (Table 2).

Table 2. Restoration Effort to Achieve BC Ecological Quality Rank

Existing Ecological Quality Rank	A, AB, B, BC	C	CD	D	NN
Existing Plant community	Restoration Effort				
Mature Forests/Woodlands	NA	Medium	Medium	High	High
Altered Forest/Woodland	High				
Savanna	NA	Medium	Medium	High	High
Shrub/Scrub	NA	Medium	Medium	High	High
Prairie	NA	Low	Medium	High	High
Non-Native Grassland	Medium				
Sand/Soil	NA				
Floodplain Forest	NA	Medium	Medium	High	High
Wet Forest/Swamp	NA	Medium	Medium	High	High
Forested Peatland	NA	Medium	Medium	High	High
Shrub/Scrub Lowland	NA	Low	Medium	High	High
Wet Meadow	NA	Low	Medium	High	High
Marsh	NA	Medium	High	High	High
Open Water	NA				

NA = not applicable

Notes:

- An altered/non-native plant community or one with a D quality rank will require a high degree of effort to restore to a BC quality community. Effort for restoring C or CD plant communities varies from low to high, depending on existing quality and the type of restoration activities required (e.g., removing and planting woody vegetation is typically more costly than removing herbaceous weeds and installing native seed).
- Initial restoration per-acre costs: Low \$1,000-5,000; Medium \$5,000-10,000; High: \$10,000-25,000.
- Costs applicable to areas ≥ 1 acre, and forest restoration may exceed cost ranges depending on approach.



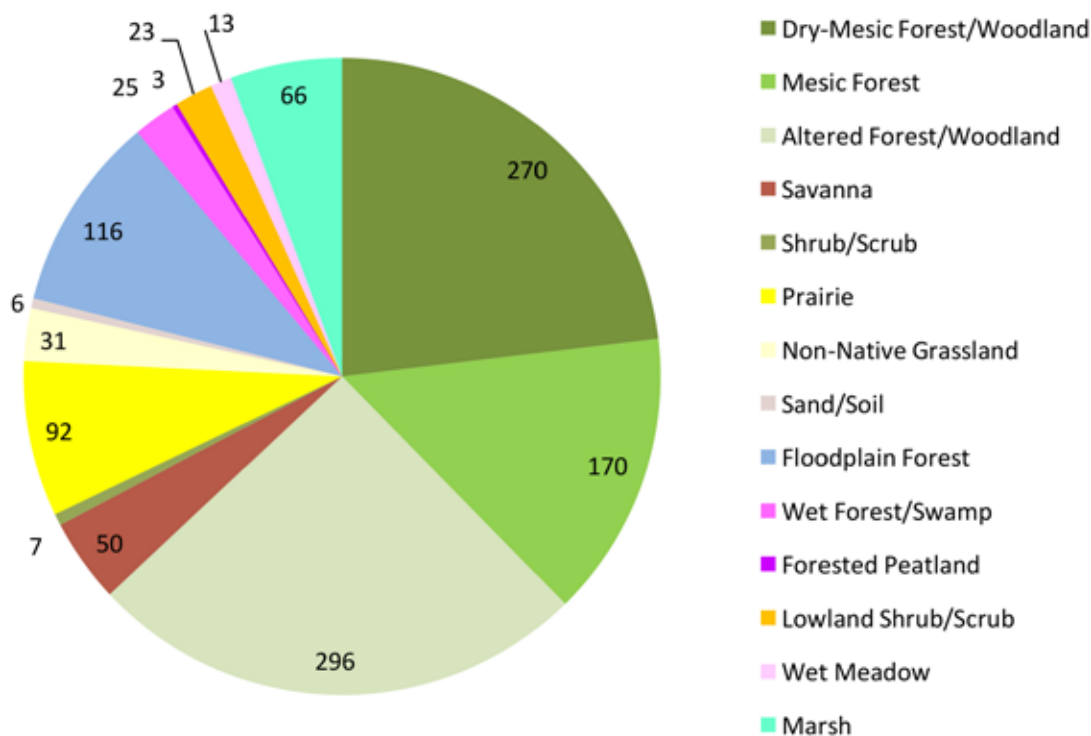
5 PRELIMINARY INVENTORY AND ASSESSMENT FINDINGS

5.1 Plant Communities

Over 1,480 vegetation polygons were assessed, and all MPRB natural plant community types (Table 1) were identified within the MPRB system. Desktop analysis coupled with field verification confirmed that MLCCS land cover type mapping and ecological quality ranks were generally quite accurate. An overview/index map (Exhibit 1)

and area maps (Exhibits 2 through 8) show mapped natural plant communities throughout the MPRB system. A total of 2,832 acres of natural areas exist in the MPRB system, of which 1,168 acres are upland or vegetated wetland plant communities (i.e., not Open Water, Figure 3). Each is discussed below. Open Water is excluded from Figure 3, since that habitat lacks terrestrial vegetation, which is the focus of this plan.

Figure 3. Acreage Distribution of Plant Communities in MPRB System (Acres in Chart).



If desired, the detailed vegetation species inventories which will be conducted during Phase 2 can be used to determine the specific MnDNR native plant community subtypes, which are discussed on the following pages.

1. Dry-Mesic Forest/Woodland (270 acres)

Dry-Mesic Forest/Woodland is the second most abundant natural plant community type in the MPRB system; it is common and covers a large area of parkland. MPRB's Dry-Mesic Forest/Woodland areas are found mostly within Theodore Wirth Park and along the east bank of the Mississippi River gorge (black areas in inset graphic to right represent Dry-Mesic Forest/Woodland). Several additional Dry-Mesic Forest/Woodland areas are scattered around the Chain of Lakes. Preliminary ecological quality ranks range from BC to D; most of these forests/woodlands have been invaded and degraded by invasive common buckthorn (*Rhamnus cathartica*). Buckthorn control efforts have improved the quality of some of these areas. Conservation Status Ranks (MnDNR 2009) for native Dry-Mesic Forest/Woodland subtypes indicate that they are S3 (vulnerable to extirpation) or S4 (apparently secure; uncommon, but not rare).



2. Mesic Forest (170 acres)

MPRB's Mesic Forests are found mostly along the west bank of the Mississippi River gorge and along Minnehaha Creek; some are also scattered around the Chain of Lakes. Within the MPRB system, Mesic Forest is common and covers a large area of parkland. Preliminary ecological quality ranks range from C to D. Some of these forests have been invaded and degraded by invasive common buckthorn; however, control efforts have improved the quality of some forests. Several native Mesic Forest subtypes are S3 (vulnerable to extirpation) or S4 (apparently secure; uncommon but not rare); however, one subtype, "Sugar Maple Forest (Big Woods)," is ranked as S2 (imperiled).



3. Altered Forest/Woodland (296 acres)

MPRB's Altered Forest/Woodland areas are the most abundant natural plant community type in the MPRB system, covering a large area of parkland. They are found mostly in the central and northern portions of the park system, with some scattered in the southern portion. These altered wooded habitats, often dominated by native tree species but containing abundant non-native shrubs and/or herbaceous plants, are not representative of a natural community.



4. Savanna (50 acres)

MPRB's Savannas are found scattered throughout the park system, including around the Chain of Lakes, in Wirth Park, and along the Mississippi River. A native prairie remnant exists within the Savanna mapped along the Mississippi River. Within the MPRB system, Savanna is uncommon and covers a moderate area of parkland. Preliminary ecological quality ranks range from C to NN. Buckthorn control efforts have converted some previous "woodland" areas to Savanna. Subtypes of native Savanna, "Southern Dry Savanna" and "Mesic Savanna," are ranked as S1 and/or S2 (critically imperiled and/or imperiled).



5. Shrub/Scrub (7 acres)

MPRB's few Shrub/Scrub areas are scattered in the central and northern portions of the park system, and they all represent altered or non-native communities. Within the MPRB system, Shrub/Scrub is rare and covers a very small area of parkland. The dry and mesic Savanna subtypes discussed above also apply to MPRB's Shrub/Scrub communities.



6. Prairie (92 acres)

MPRB's Prairies are scattered throughout the park system, with larger tracts along the Cedar Lake Trail and North Mississippi Regional Park. Within the MPRB system, Prairie is common and covers a moderate area of parkland. Preliminary ecological quality ranks range from C to D. All but one of these prairies are restorations, created by planting seed or live native plants. A native prairie remnant exists adjacent to the Mississippi River off-leash dog park in the southeast portion of the park system. Subtypes of native Prairie, "Southern Dry, Southern Mesic, and Southern Wet Prairies," are ranked as S1, S2, and/or S3 (critically imperiled, imperiled, and/or vulnerable to extirpation).



7. Non-Native Grassland (31 acres)

MPRB's Non-Native Grasslands are scattered mostly in the central and northern portions of the MPRB system. Within the MPRB system, Non-Native Grassland is common and covers a moderate area of parkland. These altered habitats, generally dominated by Eurasian grasses and a mixture of native and non-native weeds, are not representative of a natural community.



8. Sand/Soil (6 acres)

MPRB's few Sand/Soil areas are found scattered throughout the park system; they are uncommon and cover a very small area of parkland. These sparsely vegetated areas are not representative of a natural community, although some sandbars on the Mississippi River may be of natural origin.



9. Floodplain Forest (116 acres)

MPRB's Floodplain Forests are found scattered throughout the park system, with most found along the Mississippi River, Minnehaha Creek, and Bassett Creek. Within the MPRB system, Floodplain Forest is common and covers a large area of parkland. Preliminary ecological quality ranks range from C to D. A subtype of native Floodplain Forest, "Elm-Ash-Basswood Terrace Forest," is ranked as S2 (imperiled).



10. Wet Forest/Swamp (25 acres)

MPRB's few Wet Forest/Swamp areas are found in Roberts Bird Sanctuary (north edge of Lake Harriet), Theodore Wirth Park, and along the Minnehaha Creek Glen. Within the MPRB system, Wet Forest/Swamp is rare and covers a small area of parkland. Preliminary ecological quality ranks range from BC to D. Subtypes of native Wet Forest/Swamp, "Black Ash - (Red Maple) Seepage Swamp" and "Black Ash - Sugar Maple - Basswood - (Blue Beech) Seepage Swamp," are ranked as S1 and/or S2 (critically imperiled and/or imperiled).



11. Forested Peatland (3 acres)

MPRB's single Forested Peatland is the "Quaking Bog" at Theodore Wirth Park. Within the MPRB system, Forested Peatland is extremely rare and covers a very small area of parkland. The preliminary ecological quality rank of this peatland is B, due in large part to removal and control of glossy buckthorn by MPRB staff. The subtype of native "Tamarack Swamp (Southern)", representative of MPRB's Quaking Bog, is ranked as S2 or S3 (imperiled or vulnerable to extirpation).



12. Lowland Shrub/Scrub (23 acres)

MPRB's few Lowland Shrub/Scrub areas are found in the western and southern portions of the park system. Within the MPRB system, Lowland Shrub/Scrub is rare and covers a small area of parkland. Preliminary ecological quality ranks range from D to NN. A subtype of native Lowland Shrub/Scrub, "Willow-Dogwood Shrub Swamp," is ranked as S5 (secure, common, widespread, and abundant). Seepage areas of Lowland Shrub/Scrub community, if they are discovered, may be ranked like the Southern Seepage Sedge Meadow/Carr (S2 or S3, imperiled or vulnerable to extinction).



Wet Meadow (13 acres)

MPRB's few Wet Meadows are found in the western and southern portions of the park system. Within the MPRB system, Wet Meadow is rare and covers a small area of parkland. Preliminary ecological quality ranks range from D to NN. A subtype of native Wet Meadow is "Sedge Meadow," which is ranked as S4 (apparently secure; uncommon but not rare) or S5 (secure, common, widespread, and abundant). A seepage version of Wet Meadow, if it exists, may be ranked like the Southern Seepage Meadow/Carr (S2 or S3, imperiled or vulnerable to extirpation).



14. Marsh (66 acres)

MPRB's Marshes are found mostly in the western and southern portions of the park system. Within the MPRB system, Marsh is common and covers a moderate area of parkland. Preliminary ecological quality ranks range from C to NN, with the poorest quality Marshes dominated by invasive cattails. Subtypes of native Marsh are "Northern Mixed Cattail Marsh," which is ranked as S2 (imperiled) and "Northern Bulrush-Spikerush Marsh," ranked as S2 or S3 (imperiled or vulnerable to extirpation).



15. Open Water (1,664 acres)

Open Water represents the most extensive natural cover type in the MPRB system. However, since these habitats lack terrestrial vegetation, the focus of this study, Open Water areas are not considered in the "Percent of Natural Vegetation Acres" column of Table 3 or in Figure 3. MPRB's Open Water areas include the following surface water features.

Lakes

- Lake Harriet
- Lake Calhoun/Bde Maka Ska
- Lake of the Isles
- Cedar Lake
- Brownie Lake
- Wirth Lake
- Lake Nokomis
- Lake Hiawatha
- Diamond Lake

Rivers and Streams

- Mississippi River
- Minnehaha Creek
- Bassett's Creek
- Shingle Creek

Numerous small ponds and open water wetlands are also mapped as Open Water.

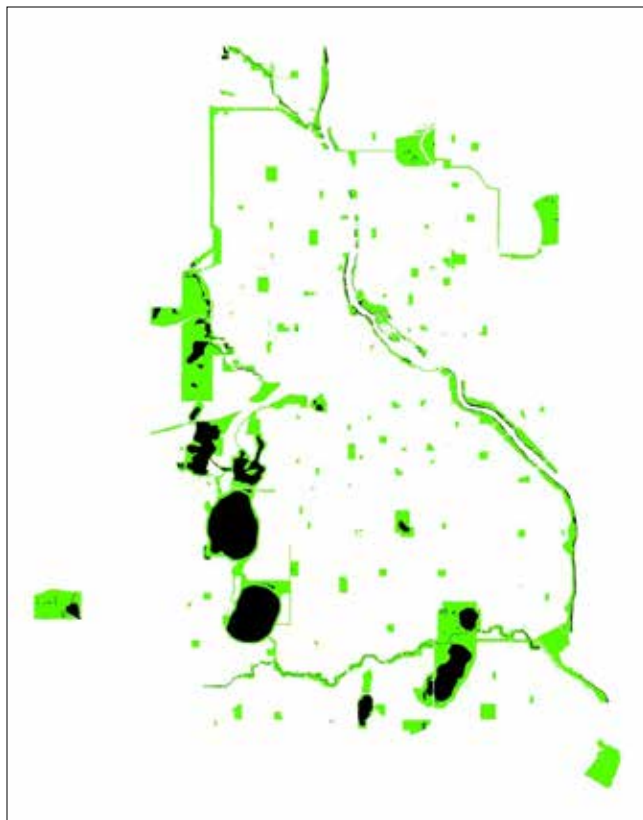


Table 3 summarizes plant communities identified in the MPRB system. For each plant community, the table indicates the range of preliminary ecological quality ranks, state conservation status ranks (S-rank), MPRB rarity and extent ranks (M-ranks and E-ranks), acres, and the percent of natural vegetation acres (not including Open Water areas) in the MPRB park system).

Table 3. Plant Communities of MPRB Natural Areas

Plant Communities	Preliminary Ecological Quality Ranks (range)	State Conservation Status Rank ¹ (for intact communities)	MPRB Rarity ²	MPRB Extent ³	Acres	Percent of Natural Vegetation Acres ⁴
Upland Communities						
Forest/Woodland						
Mature Forest/Woodland						
1. Dry-Mesic Forest/Woodland	BC-D	S3-S4	M4	E4	270	23.1
2. Mesic Forest	C-D	S2-S4	M4	E4	170	14.5
3. Altered Forest/Woodland	NR	NR	M5	E4	296	25.4
Savanna/Brushland						
4. Savanna	C-NN	S1-S2	M3	E3	50	4.3
5. Shrub/Scrub	NN	S1-S2	M2	E1	7	0.6
Grassland						
6. Prairie	C-D	S1-S3	M4	E3	92	7.9
7. Non-Native Grassland	NR	NR	M4	E3	31	2.7
Sparse/Absent Vegetation						
8. Sand/Soil	NR	NR	M3	E1	6	0.5
Lowland Communities						
Forest/Woodland Lowland						
9. Floodplain Forest	C-D	S2-S3	M4	E4	116	9.9
10. Wet Forest/Swamp	BC-D	S1-S2	M2	E2	25	2.2
11. Forested Peatland	B	S2-S3	M1	E1	3	0.2
Shrub/Scrub Lowland						
12. Lowland Shrub/Scrub	D-NN	S2-S3,S5	M2	E2	23	1.9
Herbaceous Lowland						
13. Wet Meadow	D-NN	S2-S5	M2	E2	13	1.1
14. Marsh	C-NN	S2-S3	M4	E3	66	5.7
15. Open Water	NR	NR	M5	E5	1664	
Totals					2832⁵	100.0⁵

See footnotes on next page

Judging from the Phase 1 field verification and preliminary ecological quality ranking, no A or AB quality plant communities were identified in the MPRB system. This absence of high quality natural areas is typical of most of the Twin Cities metropolitan area. The highest quality plant communities in the MPRB system appear to be in the southern portion of Theodore Wirth Park. These consist of a B-quality Forested Peatland (the Quaking Bog), three BC-quality Dry-Mesic Forest/Woodlands, and a BC-quality Wet Forest/Swamp. These and other ecological quality ranks will be re-assigned on closer investigation during Phase 2 of the Natural Areas Plan.

Among all plant community types in the MPRB system (Table 3), native, intact Savanna, Shrub/Scrub, Prairie, and Wet Forest/Swamp are the rarest from a statewide perspective (S1-S2). Native Floodplain Forest, Forested Peatland, and Marsh (S2-S3) are not as rare as this rarest group, but they are at least vulnerable to extirpation on a statewide basis. MPRB's remaining natural plant community types

exhibit a wider range of rarity, with some native subtypes imperiled and some secure (S2-S5). These types are Dry-Mesic Forest/Woodland, Mesic Forest, Lowland Shrub/Scrub, and Wet Meadow.

MPRB rarity and extent ranks indicate that Forested Peatland is the rarest (M1) natural plant community in the MPRB system and covers the smallest area (less than three acres). Rare plant communities in the MPRB system (M2) are Shrub/Scrub, Wet Forest/Swamp, Lowland Shrub/Scrub, and Wet Meadow. Plant communities that cover small or very small areas of parkland are Shrub/Scrub, Sand/Soil, Wet Forest/Swamp, Forested Peatland (mentioned above), Lowland Shrub/Scrub, and Wet Meadow.

These quality, conservation, rarity, and extent ranks will be used to establish the MPRB priorities for vegetation management throughout the park system, after Phase 2 of this effort is completed.

Footnotes for Table 3 from previous page

NR = Not ranked

¹ State Conservation Status Ranks (MnDNR 2009): S1 = critically imperiled; S2 = imperiled; S3 = vulnerable to extirpation; S4 = apparently secure, uncommon but not rare; and S5 = secure, common, widespread, and abundant.

² MPRB Rarity: M1 = extremely rare (1 occurrence); M2 = rare (2-10 occurrences); M3 = uncommon (11-30 occurrences); M4 = common (31-100 occurrences); M5 = widespread and abundant (>100 occurrences)

³ MPRB Extent: E1 = very small area (<10 acres); E2 = small area (11-30 acres); E3 = uncommon (31-110 acres); E4 = large area (111-300 acres); E5 = very large area (>300 acres)

⁴ Open Water not included in calculation of percent of natural vegetation acres.

⁵ Rounding of values may make totals appear inaccurate.



6 PROJECT OUTCOMES

This Natural Areas Plan - Phase 1 resulted in the following deliverables.

1. A comprehensive spatial database of lands owned and/or managed by MPRB.
2. An inventory of natural plant communities throughout the regional park system and select neighborhood parks.
3. A preliminary assessment of the ecological quality of the MPRB system's natural areas.
4. An overlay of reduced mow areas.
5. An overlay of stormwater BMPs owned and/or managed by MPRB.

The spatial database (organized as an ArcGISTM geodatabase) represents a detailed, interactive, electronic map of the entire MPRB system. This database is an inventory of MPRB natural areas included in this Phase 1 plan. Data collected previously by others, and the data collected in this effort, are summarized in a user-friendly, accessible, geospatial format.

This spatial database is centralized and updatable, and will integrate with the MPRB's Enterprise Asset Management (EAM) system, currently under development. It will facilitate record-keeping to track management activities completed, trends in ecological quality, and costs, and also inform those management needs and guide the future management work. ArcGISTM Online (a service used by MPRB) allows the spatial database to be accessed and edited from any web-enabled device (e.g., smart phone, tablet) with required permissions. This functionality will be invaluable for MPRB man-

agement staff as they review mapped data and past management activities while in the field. They will also be able to document their work in real-time. This will include geo-locating photographs of field conditions, problem areas, and plant communities before and after management is conducted.

The database information included now and to be added later will facilitate adaptive management of MPRB's natural areas. Adaptive management is a term describing structured decision making in the face of uncertainty, with an aim to reducing uncertainty over time by a cycle of implementation, monitoring, evaluation, and adjustment. Adaptive management is fundamental to the most successful ecological management programs, and produces better results that are achieved more cost-effectively than other management planning approaches.

The preliminary assessment of ecological quality conducted in Phase 1 is based on previous quality ranks by others (2008 MLCCS data) and brief field reconnaissance of many MPRB natural areas by AES (Spring 2017). These preliminary quality ranks provide the basis for Phase 2 of this Natural Areas Plan to create more detailed vegetation species inventories of MPRB natural areas, including more accurate assessments of ecological quality and specification of management tasks needed to improve ecological quality over time. The reduced mow areas and stormwater BMPs overlays also will facilitate MPRB's special management regimes in these areas, enabling field staff with web-enabled devices to more quickly locate management areas, review past information, take georeferenced photos, and record activities.



7 PHASE 2 CONSIDERATIONS

7.1 Ecological Inventory and Assessment

Building on the preliminary inventory and assessment work completed in Phase 1 of this plan, Phase 2 will involve detailed vegetation species inventories and assessments. Vegetation species inventories use a variety of techniques, each with strengths and weaknesses. Vegetation species inventory methods are listed below in order of increasing detail, required skill, and cost.

- **Walkabout.** Provides an overview of a given natural area, and may include documentation of dominant vegetation species. This rapid assessment can be useful for overall condition assessment and problem identification, especially invasive plants, eroding areas, and dump sites.
- **Timed-Meander Search.** A semi-quantitative method of documenting vegetation species within a given plant community. The surveyor wanders through a community, documenting all plant species observed within a defined time period, usually several to a couple dozen minutes. This vegetation survey method requires low to moderate effort and provides data suitable for calculating species richness and general community characterization. However, because areal cover of each species is not documented, the data are limited in their application. One cannot calculate the dominant plants or determine the level of threat posed by invasive plants based on their extent.
- **Small Survey Plots.** Typically 12m, these plots are used to inventory all vegetation species and the percent cover of each. These small plots are often located along a transect line pre-defined across a single plant community. The small plot species and cover data can be augmented with tree canopy intercept estimates and stem counts. A tree canopy intercept takes measurements of the degree of tree canopy by species over the transect line. Stem counts tally the number of woody stems and trunks by species in a narrow "belt" transect, usually a meter or so wide. Both techniques accurately characterize the structure of the plant community and can be used in statistical analyses.
- **Large Plots/Relevés.** Typically 102m or larger, these plots are inventoried like the small plots. That is, all species are noted and assigned to a cover class category. Vegetation species, however, are documented in different height categories, or strata. Typical strata are canopy trees, subcanopy trees and tall shrubs, shrubs, and groundlayer. This helps to describe the vertical structure of the community, and also the abundance of individual species

by stratum. (The canopy intercept and stem count methods also describe the vertical structure). Large plots/relevés are typically marked with a permanent stake and geo-referenced with a sub-meter global positioning system (GPS) for future monitoring of the same plot.

The detailed vegetation species data to be collected in Phase 2 will enable refinement of plant community classification (if warranted) and an accurate assessment of the ecological quality of each natural area. In the Natural Areas Plan - Phase 2, these data will become a solid baseline for use in repeated sampling and identification of trends, and to guide adaptive management.

7.2 Natural Resource Management Plans

In Phase 2, a Natural Resources Management Plan (NRMP) could be prepared for natural areas. A NRMP maps and describes the current conditions of a natural area, establishes an ecological vision and quality outcome goals for that natural area, lists the tasks necessary to achieve the goals, and presents a schedule and estimate of costs to carry out the work.

7.3 Management Plan and Task Prioritization

The five ecological ranking criteria described in Section 4.0 above (ecological quality, ecological rarity in Minnesota, ecological rarity in MPRB parkland, ecological extent in MPRB parkland, and restoration effort) in combination with other factors the MPRB may desire, will be applied to the plant communities in the natural areas in Phase 2. Ranks can be converted to values and added, with the lowest sum representing the highest priority plant community areas to first implement ecological management.

Typically, protection and management are focused first on the higher quality and less common natural areas. This approach, already followed in part by MPRB, directs resources to the healthiest, least common natural areas before they further deteriorate. These natural areas also typically require the least effort to restore and maintain on a per-acre basis. In turn, this approach maximizes the acreage that can be managed early in the program, because per-acre costs are relatively low.

The MPRB will also consider which criteria and how to use them. Should some factors, such as MPRB system rarity, receive more weight in the ranking? This question, and the final approach to prioritization, will be resolved in Phase 2 when the detailed vegetation data are in hand.

Other approaches to prioritization can be employed. For example, certain geographic areas may be given greater weight than others. Knowing that common buckthorn is a problem in Dry-Mesic Forest/Woodland throughout the system, it may be desirable to simply target this species in all plant communities of this type. Ultimately the prioritization must effectively guide the budgeting and resource allocation decision of the MPRB so that the overarching vision of improving the quality of natural areas in the MPRB system is realized.

7.4 Ecological Monitoring

Monitoring gathers information to evaluate and justify proposed changes to the restoration and enhancement program, and as importantly, to track vegetation changes over time. This adaptive management (discussed in Section 6 above) sets in motion a cycle of evaluation, adjustment and refinement to make management activities most effective. It is important that adaptive management begins when restoration and enhancement begins. It requires upfront planning and data collection. Ecological monitoring gives a management program an objective measurement of project-specific performance standards. It also feeds data into the adaptive management process for a given site.

Typically, in the first three years of restoration and management, monitoring and reporting should be done annually. After that, a monitoring inspection should occur every two to three years. Detailed vegetation data collected during the Phase 2 species inventory and assessment will provide a baseline against which to measure future plant community trends, enabling MPRB to learn whether the restoration and management methods implemented are having the desired effect on the system's natural areas.

7.5 Future Planning Efforts

The data compiled here and in the future Phase 2 Natural Areas Plan will be a useful tool for MPRB in other future planning efforts as well, beyond the scope of the Environment Management Natural Resources work group. The ecological data contained within the geodatabase and accompanying maps may assist MPRB in how they maintain current assets and plan for future park improvements at the neighborhood, watershed, and regional scale. As an electronic and geographic tool, this data may support endeavors affecting the recreational, educational, interpretive, and other cultural goals of MPRB.

8 CONCLUSION

The MPRB system is a jewel of the Twin Cities region. The park's natural areas are foundational to many of the recreational and environmental benefits these parklands provide. This plan and associated GIS geodatabase provide MPRB with a baseline preliminary inventory and assessment of these natural areas, setting the stage for more detailed inventory and assessment during the Natural Areas Plan Phase 2, wherein MPRB may:

- Determine the level of detail desired for vegetation inventories to meet MPRB natural area vision and goals.
- Prepare an inventory protocol, describing field data collection methods and digital data collection and processing methods that sync with GIS and field web-enabled devices.
- Prepare a field inventory and data upload schedule, accompanied by a map related to the schedule.
- Determine the level of detail, geographic extent, and mode of use for Natural Resource Management Plans, and prepare an NRMP template accordingly.
- Complete the detailed vegetation inventory and ranking, and prioritize natural areas.
- Develop a monitoring approach and schedule that uses baseline data to detect trends in the quality ranks.
- Write NRMPs for all MPRB natural areas, according to MPRB priorities and other considerations.



9 REFERENCES AND RESOURCES CONSULTED

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Exhibit 1. MPRB Overview Map with Inset Map Locations

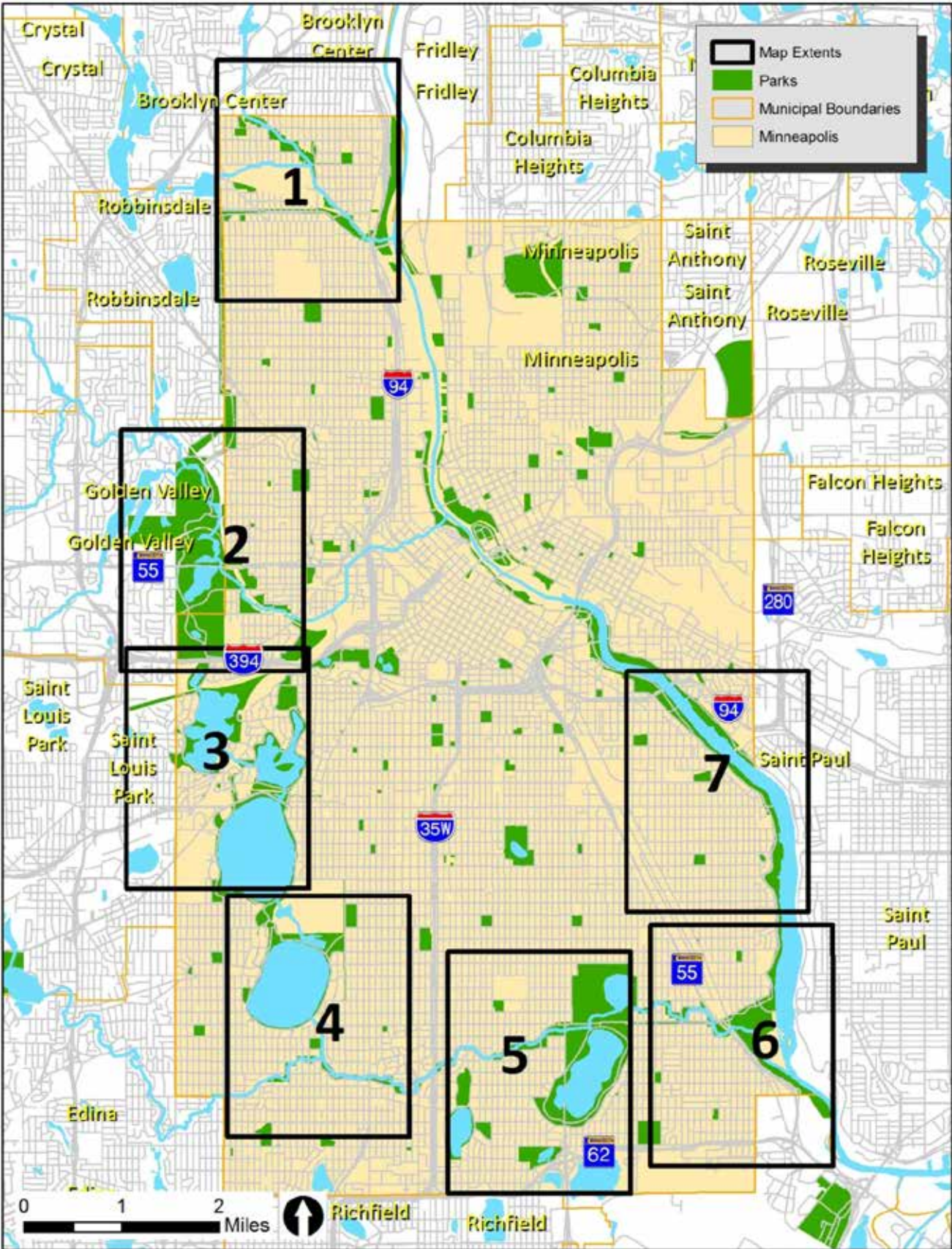


Exhibit 2. North Minneapolis

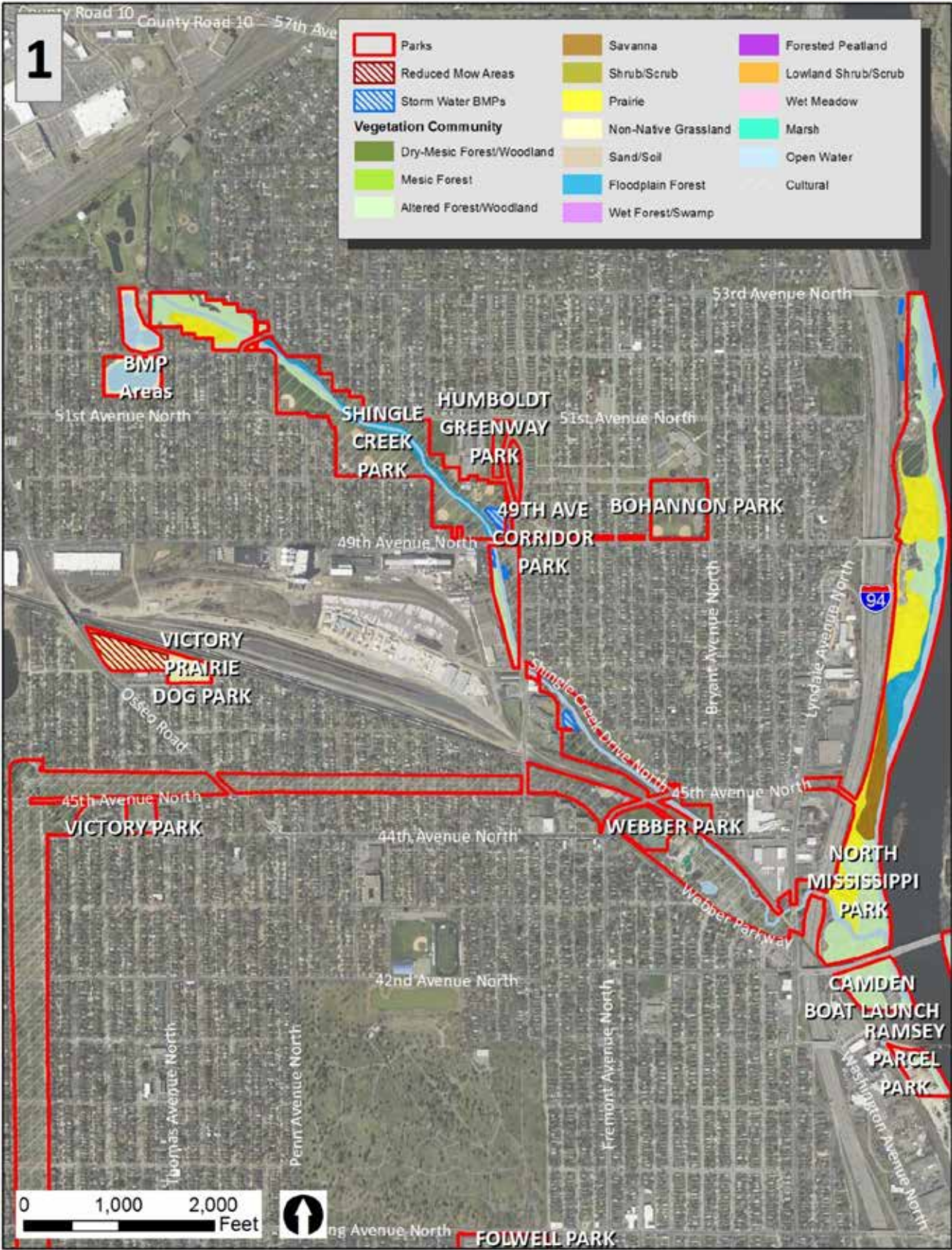


Exhibit 3. Theodore Wirth Park

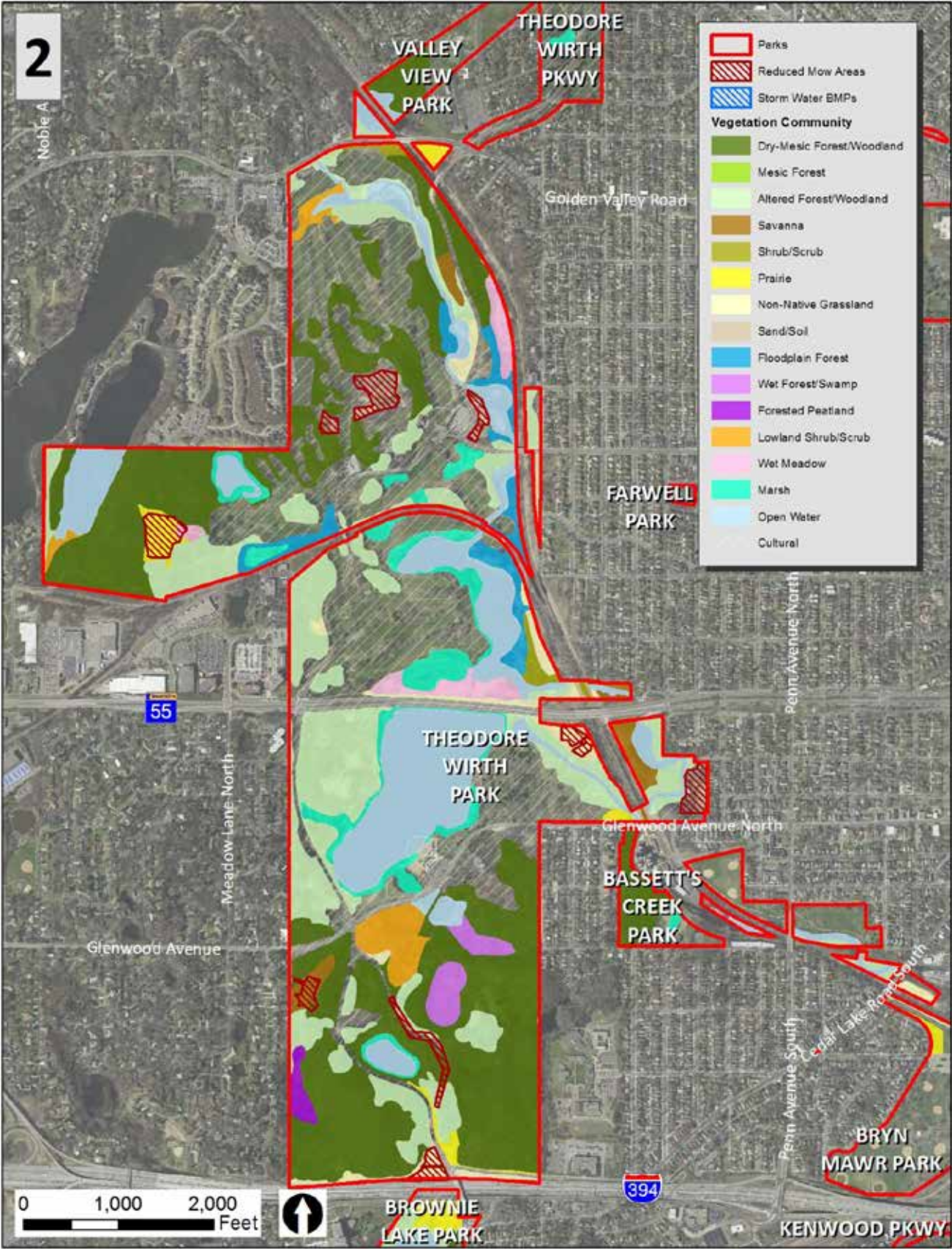


Exhibit 4. Chain of Lakes - North

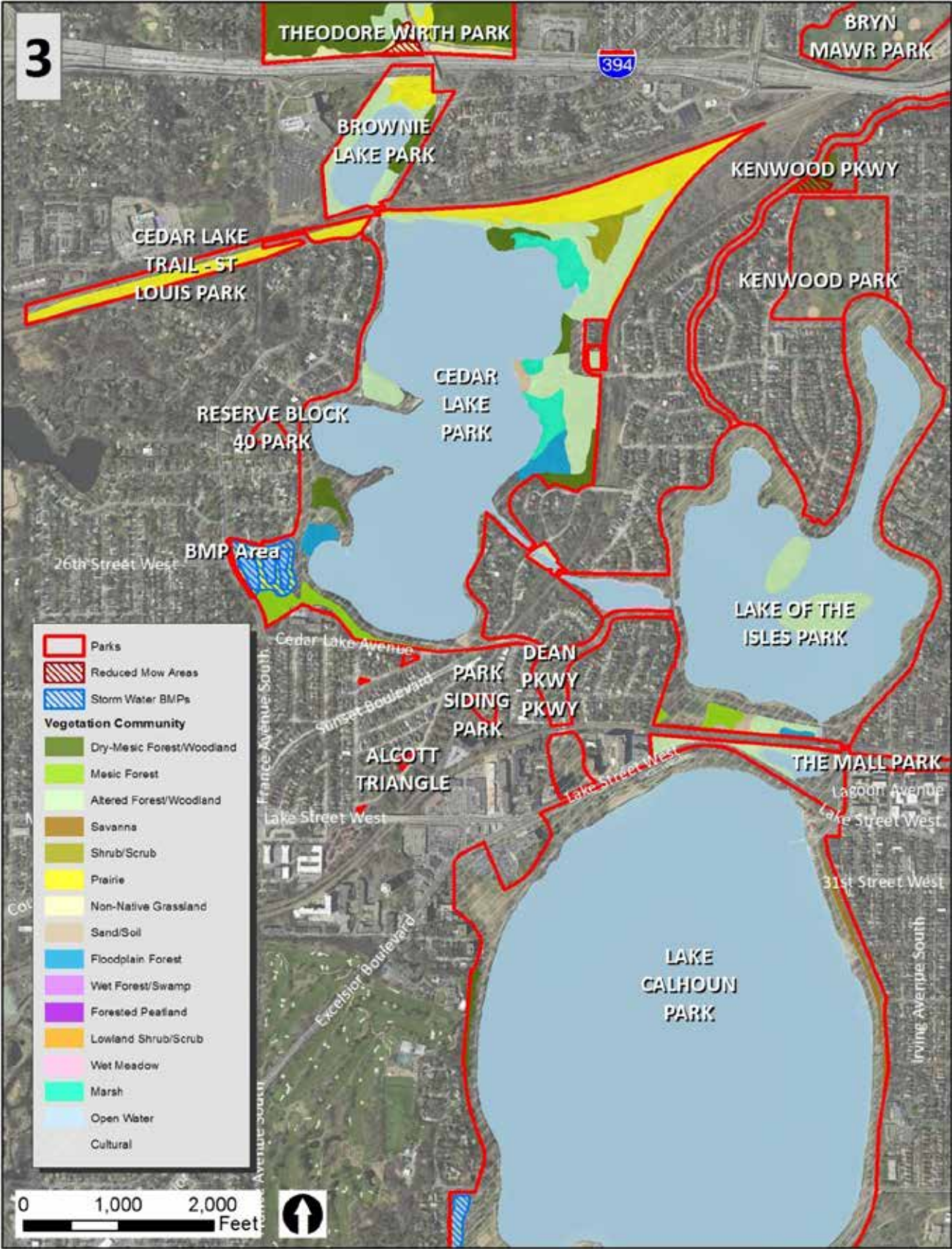


Exhibit 5. Chain of Lakes - South

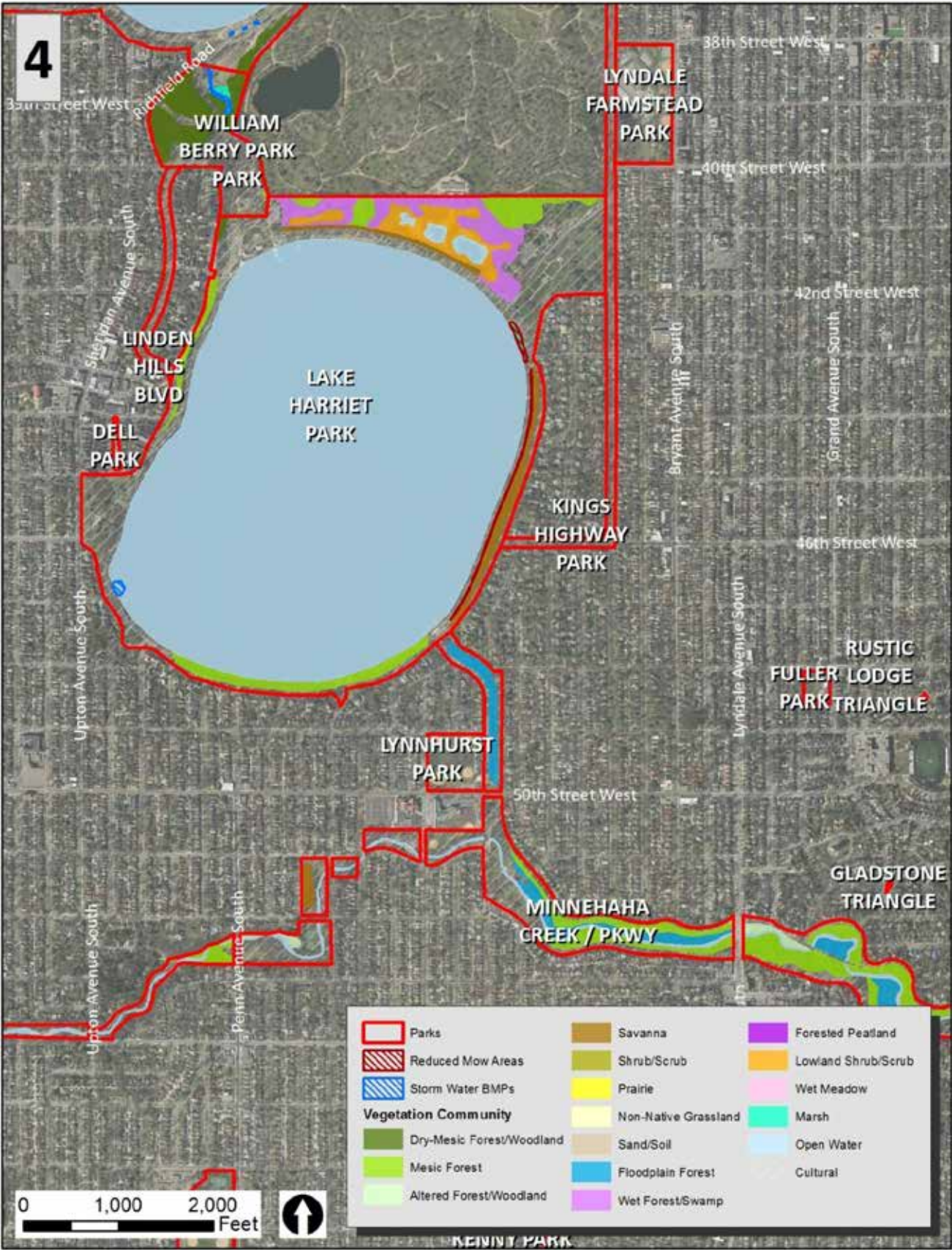


Exhibit 6. Lake Nokomis

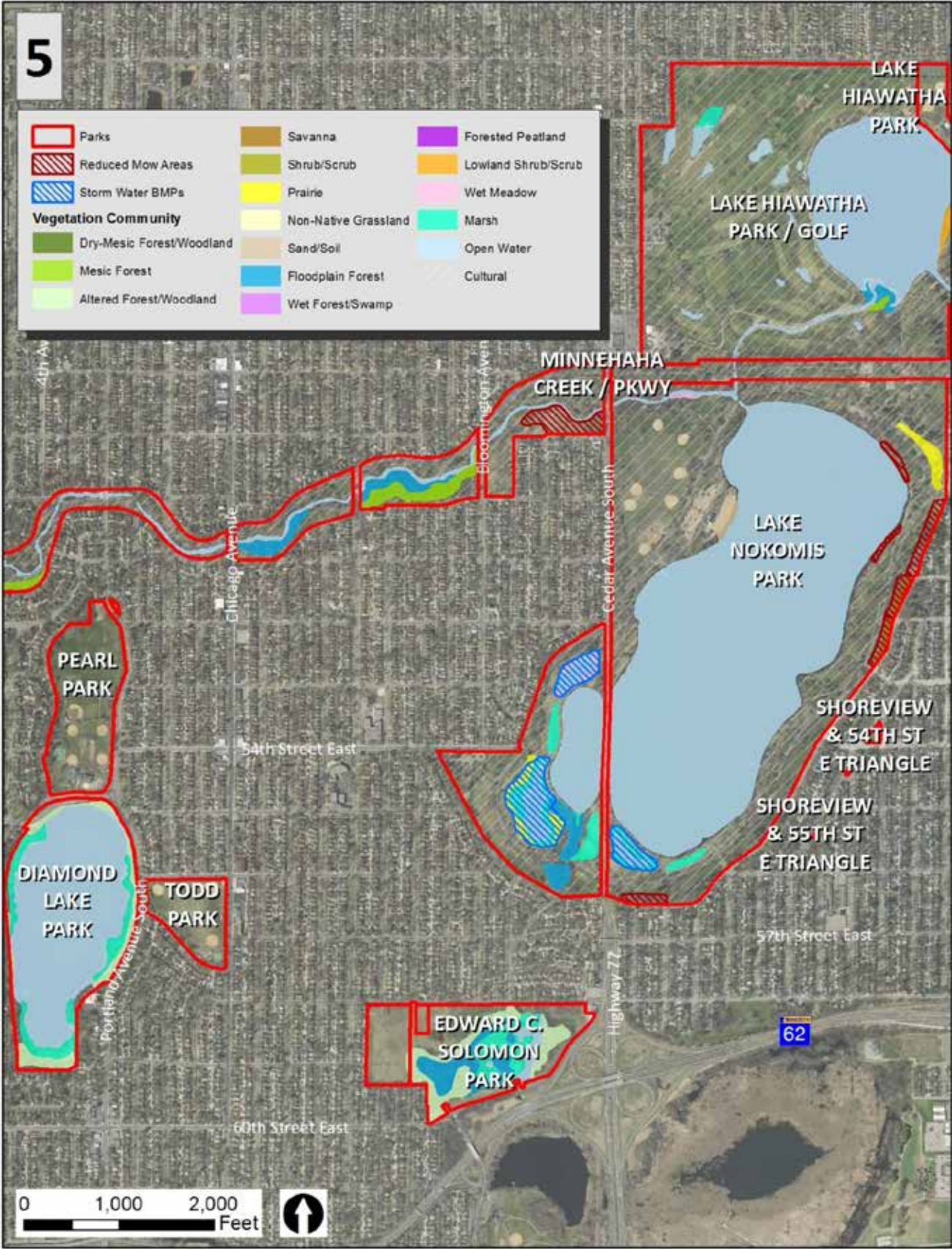
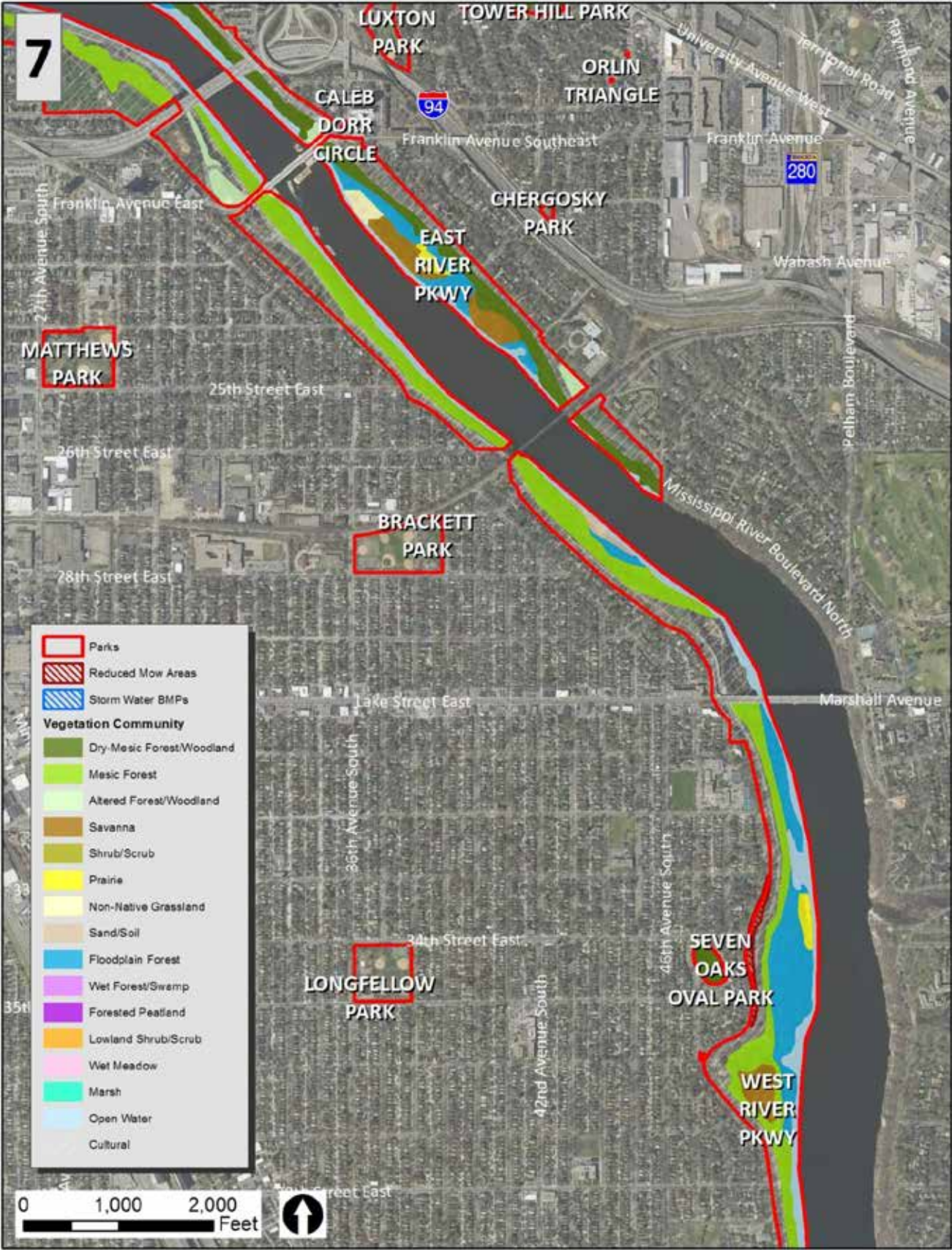


Exhibit 7. Minnehaha Park



Exhibit 8. Mississippi River Gorge



APPENDIX A. GLOSSARY AND ACRONYMS

Glossary

Adaptive Management	Structured decision making in the face of uncertainty, with an aim to reducing uncertainty over time by a cycle of implementation, monitoring, evaluation, and adjustment.
Ecological Restoration	Improving the natural environment by stabilizing and enhancing biodiversity, resilience, and ecosystem services.
Geodatabase	A geodatabase is a collection of geographic datasets of various types held in a common file system folder or database.
Invasive Species	Aggressive species whose introduction does or is likely to cause economic or environmental harm or harm to human health.
LiDAR	Light Detection and Ranging (LiDAR) is a remote sensing technology that measures distance by illuminating a target with a laser and analyzing the reflected light. It is most commonly used for elevation contour mapping.
Native Plants	Plants indigenous to a given area in geologic time. This includes plants that have developed, occur naturally, or existed for many years in an area.
Non-invasive Species	Species that are not likely to cause economic or environmental harm.

Acronyms

GIS	Geographic Information System
MnDNR	Minnesota Department of Natural Resources
NHIS	Natural Heritage Information System
WMS	Web Map Server