

CITY OF NORTHFIELD

NATURAL RESOURCES INVENTORY FINAL REPORT



DECEMBER 2005

Bonestroo 
Natural Resources
Preserving Nature's Resources



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December 19, 2005

Howard Merriam, ASLA
Director of Resource and Park Planning
City of Northfield
801 Washington Street
Northfield, MN 55057

(507) 645-3002

Dear Howard,

It is with great pleasure that I am sending you this completed Natural Resource Inventory for the City of Northfield and the associated Urban Expansion Area.

The citizens and city leaders of Northfield have some very good natural resources in the community. As the City moves forward, there will be many opportunities to apply the information in this Natural Resources Inventory. It can provide a solid foundation for the proactively managing for sustainable growth as the city grows, help with the creation of alternate development strategies, identify priority areas for conservation, and more. Most importantly, however, is its potential to help Northfield retain the character that has made it such an attractive, appealing place to live for the past 150 years.

On behalf of all of us at Bonestroo Natural Resources who worked on this project, thank you for the opportunity to assist you on this project. We wish you well on the successful application of the natural resource data. I have truly enjoyed the opportunity to work with you on this project and look forward to visiting Northfield as the city moves forward.

Sincerely,
BONESTROO, ROSENE, ANDERLIK, AND ASSOCIATES

A handwritten signature in black ink, appearing to read 'Elizabeth Gould', is written over a light blue horizontal line.

Elizabeth Gould
Project Ecologist

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Executive Summary

The Northfield Natural Resource Inventory (NRI) was undertaken in response to the significant growth and development pressures that the city is facing as the Twin Cities metropolitan area expands and outlying areas develop. City and staff recognized that effective planning considers all of the resources of the community, including natural areas and open space, and successfully balances growth with the preservation of key natural resources, and moved proactively to conduct the NRI. This inventory was designed to assess the natural areas and open space areas within the project area in order to help guide current and future planning efforts.

In February 2005, the City of Northfield retained Bonestroo Natural Resources (Bonestroo and Associates) to complete Minnesota Land Cover Classification System (MLCCS) Mapping and a Natural Resource Inventory (NRI) on all lands within the city and Urban Expansion Area (collectively referred to as the “Project Area”). In addition to completing the MLCCS mapping and natural resources inventory, the project goals also included a brief review of the streams within the project area, assessment of wildlife habitat, and identification of any rare or unique features.

Fieldwork began in June 2005, with a detailed inventory of the Hauberg Woods area. The bulk of the fieldwork was completed in July and August 2005, after the completion of landowner notification.

In all, 10,207 acres were mapped, representing 79 different cover types ranging from impervious surfaces with pavement and buildings to a rare, high quality rich fen (a type of wetland) community. Of these 10,207 acres, 3,758 acres were mapped as containing some amount of impervious surface, 750 acres as maintained areas (mainly lawn and park areas), and 3736 acres as cropland. The remaining 1963 acres were mapped as open space,

including remnant natural communities such as oak forests, and semi-natural areas such as retired pastures, early successional wooded communities and altered forests.

High quality natural areas and unique features occur throughout the project area, but are concentrated along the stream and river corridors. The best quality natural areas documented in this study include:

- Rich fen at Hauberg Woods (also listed as a unique feature)
- High quality floodplain forests along the Cannon River
- Good quality maple-basswood and oak forests along the stream corridors, especially Heath Creek

Some of the unique features noted include:

- Rich fen at Hauberg Woods
- Spring Brook (This site is of regional significance, as it is the only Trout Stream in Rice County, and is an uncommon resource type in southern Minnesota)
- Limestone Cliffs along Heath Creek
- Numerous scenic overlooks along the stream corridors and in some outlying areas
- Cannon River (which is itself a state Wild and Scenic River)

Finally, another category of interest is areas where there is a concentration of natural areas and/or open space. These areas are of high value ecologically, provide excellent wildlife habitat, and have potential to create recreation opportunities. Within the project area, these areas are defined in two ways: one, by the stream and river corridors of Heath Creek, Spring Brook, Spring Creek, and the Cannon River. Second, the campuses of St Olaf and Carleton Colleges also support important concentrations of open space, which have high ecological value due both to their overall size and the significant efforts that the colleges are making to restore and manage existing native habitat.

As the City moves forward, there are many opportunities to apply the information from this NRI. First and foremost, it provides foundation information for managing sustainable growth in Northfield. Incorporating this information into the planning process can help prioritize areas where conservation, alternative development strategies, conventional development, or other approaches may be appropriate. Two specific tools include using the data as the foundation for developing a greenways corridor system, and incorporating the information into local ordinance. Other options are available as well.

These and other tactics are becoming increasingly successful as communities around the country recognize the many aesthetic, ecological, and economic benefits of a smart-growth approach.

In addition to these benefits, however, natural areas are an important part of providing identity to the places we live. They contribute to the quality of life, and provide a *sense of place* for each of us. The information collected in this NRI will be an important part of understanding what activities and land uses the landscape can support, while preserving natural areas that define the landscape for Northfield residents.

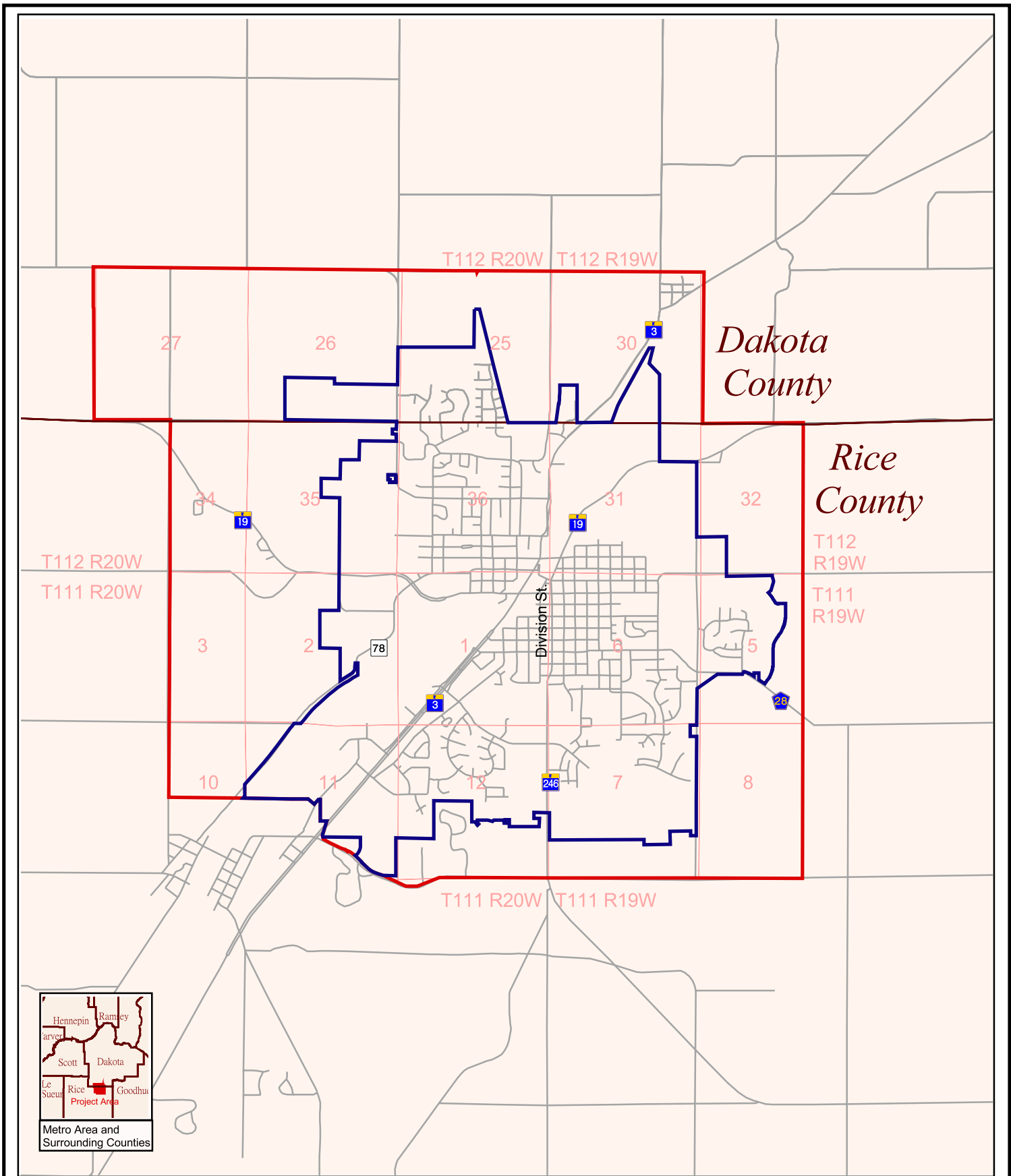
I. Introduction

The Northfield Natural Resource Inventory (NRI) was undertaken in response to the significant growth and development pressures that the city is facing as the Twin Cities metropolitan area expands and outlying areas develop. City staff recognized that effective planning considers all of the resources of the community, including natural areas and open space, and successfully balances growth with the preservation of key natural resources. In response, they moved proactively to conduct a natural resource inventory. This inventory provides the city with critical information about the natural resources, and will allow sound, informed decision making as the city grows.

In February of 2005, the City of Northfield retained Bonestroo Natural Resources to conduct land cover classification mapping and a natural resources inventory within the city and urban expansion area, (UEA), in Rice and Dakota Counties, Minnesota. Figure 1 on the following page shows the project location.

The primary objective of the project was to classify land cover for the City and UEA (10,207 acres) (collectively referred to as “project area” in this report) and to assess the relative ecological quality of the City’s remaining natural areas by performing on-the-ground vegetation surveys. Additional goals included evaluating stream condition and wildlife habitat areas. Land cover mapping was accomplished using the Minnesota Land Cover Classification System (MLCCS), Version 5.4 developed by the Minnesota Department of Natural Resources (MN DNR) and its partners.

On-the-ground vegetation surveys were accomplished using a system adapted from classification and qualitative assessment methods developed by the Minnesota Department of Natural Resources Natural Heritage Program. Field work for this inventory was conducted during June, July and August, 2005.

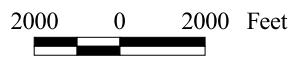


Northfield Natural Resources Inventory: Project Location Map

Figure 1



- County Boundary
- Project Boundary
- Northfield Municipal Boundary
- Sections
- Roads



II. Landscape Description and History

In general, natural resources include the soils, water, plants, animals and people. The particular resource elements present in any area and their patterns on the landscape are the result of historical processes, including climate, hydrology, plant and animal migrations and interactions, and more recently human decisions and activities. This section briefly describes the role these interactions have played in determining the present day composition of natural communities and landscapes in the Northfield area. Although this summary is general in nature, it is meant to provide some context for the existing features in the project area.

Pre-Settlement History and Major Landscape Features

Ancient Features

Ancient features of the Northfield area date to around 500 million years ago, when much of Minnesota was covered by water. These ancient seas deposited material that would later become the sandstone and dolomite bedrocks that underlie the region today. The bedrock type closest to the surface is the Prairie du Chien dolostone. This sedimentary rock layer was largely buried under a mantle of glacial deposits called till during more recent geologic events.

Glacial Landscapes. More recently, the topography of Rice County was influenced by the Illinois and Wisconsin periods of glaciation, as well as earlier, pre-Illinoian episodes. The Wisconsin period was the most recent of these glacial episodes, and ended about 10,000 years ago. During this period, massive glacial ice sheets sculpted the landscape and left behind a variety of deposits, including drift/till and outwash deposits composed of sand, gravel and sometimes fine clays. Fine, wind-blown deposits called loess were also left. An example of some of these glacial features can be found in the Bemis moraine of the Wisconsin ice sheet, which lies roughly between Northfield and Interstate 35.

The Northfield area lies on a landform known as the Minnesota & Northeast Iowa Morainal (MN/NE IA) Section. This landform extends into Iowa and is known to geomorphologists there as the "Iowan Surface".

The MN/NE IA Morainal landform in this region consists of gently to moderately rolling hills, with long, gradual slopes and open vistas that extend to the horizon. The southwestern section of this region also contains low, steep, parallel hills, old moraine ridges that formed when retreating glaciers stagnated and left piles of rocky debris along their melting edges.

These hills overlay deep layers of gravel, clay, and other materials deposited by glacial meltwater. The underlying bedrock is mostly hidden, although rocky outcrops are locally apparent along some of the stream/river corridors. On the surface, soils are strongly correlated with the dominant historic vegetation, which, in turn, is associated with the local topography and landscape. On the rolling plains, prairies predominated and soils here are generally well drained to somewhat poorly drained and fine-textured.

The topography, soils, and other features that resulted from ancient and more recent glacial activity have greatly influenced the pattern of vegetation and plant communities that developed in the Northfield area. Geomorphology for the project area is shown in Figure 2 (page 6).

Post-glacial Vegetation

Soon after the glaciers melted, spruce trees and tundra colonized the periglacial environment. This was later followed by pine barrens and forests with a bracken fern dominated ground layer. As the climate of the region warmed about 9,000 years ago, pines began to decline, and prairie species increased, along with elm and oak forests. The climate remained in this warm period until about 7,000 years ago, when midgrass prairie reached its maximum eastern extent in Minnesota, and covered most of southeast part of the state, including the Northfield area.

Prairie, oak woodlands and brushlands, and oak savanna consisting of scattered trees with a prairie-like ground cover dominated the Region until about 4,000 years ago, when the climate gradually become cooler and more moist. Oak thickets and oak became more common in ravines and along north-facing slopes. Still most southern slopes, broad expanses and areas with drier soils were dominated by prairie. About 300 years

ago, the climate became especially moist and cool, and fires became less frequent. As a result, extensive forests of elm, sugar maple, and basswood developed in eastern Minnesota. One such area extending from about Faribault to St. Cloud was known as the “Big Woods”. The east edge of this big woods area runs through Northfield and roughly occupies the northwestern half of the project area.

Native Americans

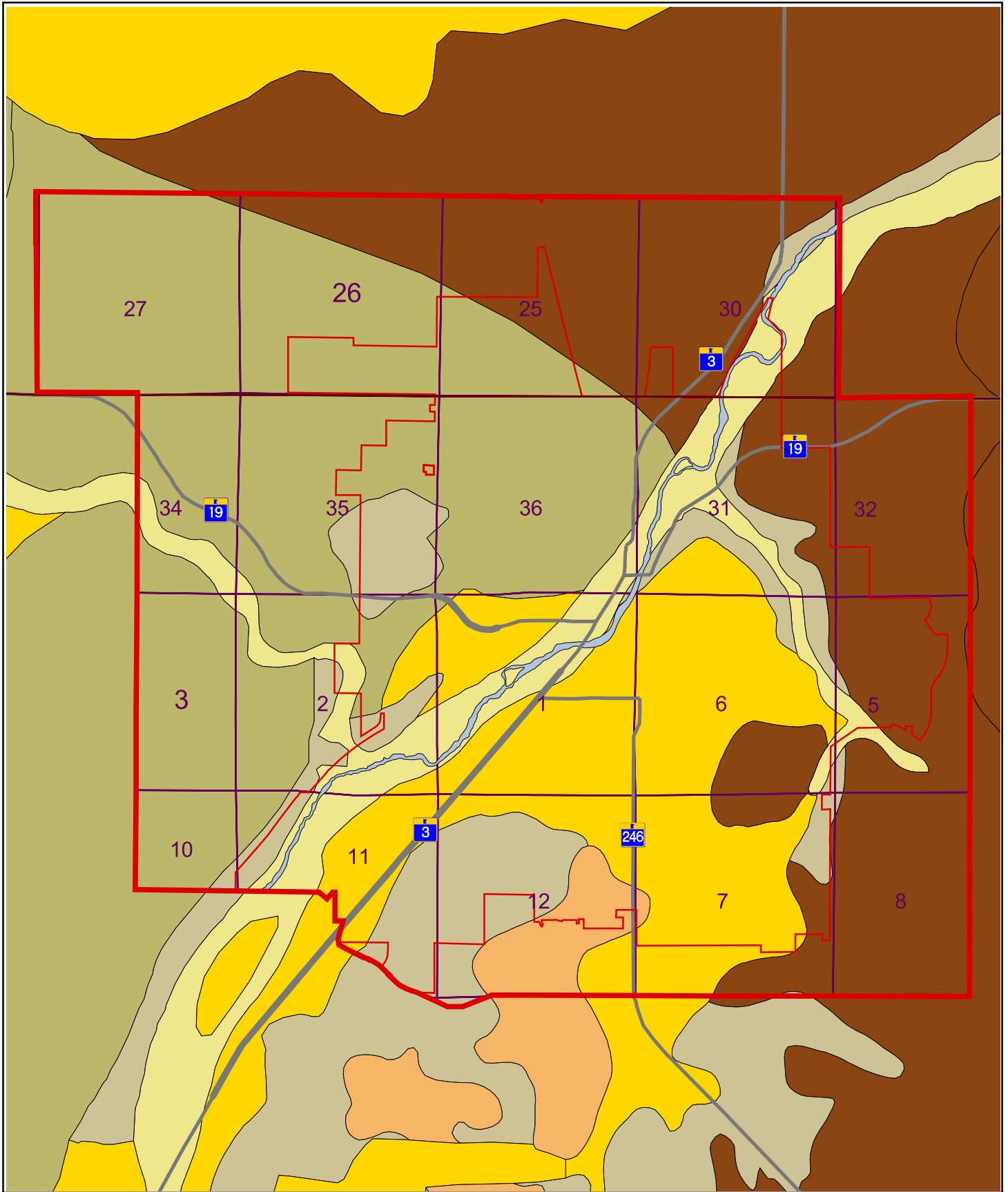
Ideas about the history of American Indians and their influence on the local landscape are still evolving. American Indians have probably inhabited and hunted in the area for about 10,000 years. While their impacts were not as great as those of European settlers, American Indians used a wide variety of plants and animals for food, and altered vegetation patterns by cultivation and by frequently burning the landscape.

The Indians (and European fur traders) used fire to hunt game, create desired game habitat, to clear the landscape for travel, communication and defense, and to obtain firewood. While some fires in the region occurred naturally, the activities of American Indians increased the frequency of fires, such that prairies in many portions of southern Minnesota may have been burned annually in the fall. Prairies and savannas are fire-dependent plant communities, and were present in the area at the time of European settlement partly because of the influence of fire.

Vegetation at the Time of the General Land Office Survey

A good source of information regarding the settlement-era vegetation in the project area can be found in the notes of surveyors for the General Land Office (GLO). When the area was settled, crews located section corners and section lines as they laid out townships. During these efforts they also documented the vegetation. In the Northfield project area, GLO workers recorded a mosaic of Big Woods forest, oak woodlands and barrens, as well as prairie and wet/ sedge meadows.

Big Woods occurred across the northwest half of Northfield. This consisted primarily of closed canopy forests, sometimes dominated by species such as sugar maple and basswood, sometimes by oaks, and



Northfield Natural Resources Inventory: Geomorphology

Figure 2



- Project Boundary
- County Boundary
- 2005 Municipal Boundary
- Sections
- Cannon River
- Major Roads

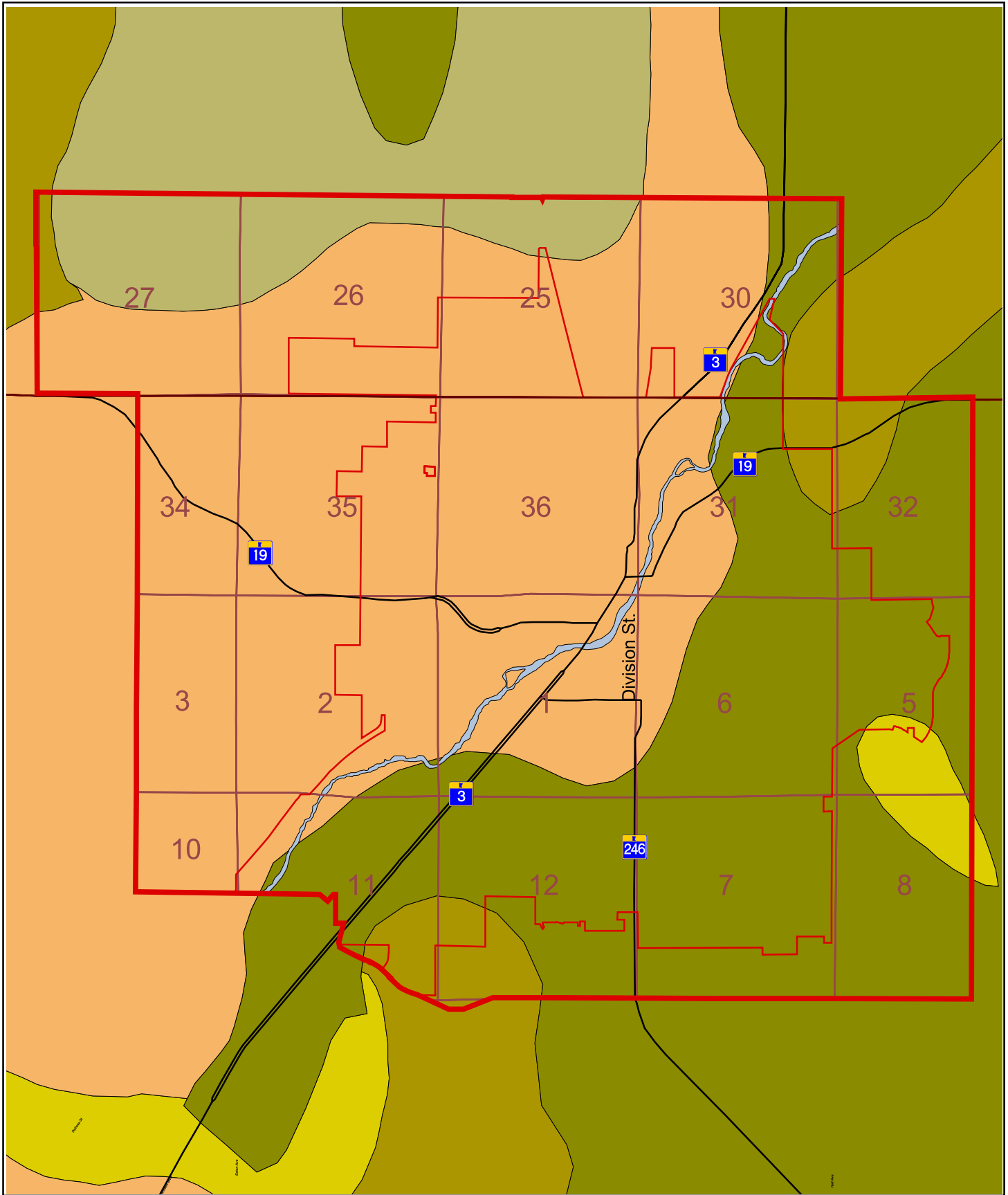
- Geomorphology
- Des Moines Lobe Outwash
 - Des Moines Lobe Supraglacial Drift Complex
 - Des Moines Lobe Till Plain
 - Dissected Bedrock Terranes Bedrock dominated
 - Fluvial Alluvium
 - Obscure glacial landscape, no glacial landforms present



November 2005








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Northfield Natural Resources Inventory: Vegetation at the Time of European Settlement

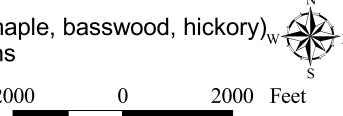
Fig. 3



-  Project Boundary
-  County Boundary
-  Sections
-  2005 Municipal Bdry
-  Cannon River

-  Aspen-Oak Land
-  Hardwood Forest (oak, maple, basswood, hickory)
-  Oak openings and barrens
-  Prairie
-  Wet Prairie

2000 0 2000 Feet




September 2005
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sometimes by a mix of other hardwood or softwood tree species. Closed forests would have most often been characterized by large, mature trees with varying levels of younger trees growing under them, along with shrubs, and a rich ground cover of flowers, grasses, and sedges. Woodlands and forests with more open canopies likely included a prominent oak component with a mix of woodland, forest and prairie shrubs and ground cover present. Grazing and fires would have helped to maintain oak dominated forests, woodlands, and savannas here.

Tall grass prairie covered the southeastern half of the project area. This grassland community was extensive, with Indian grass and big bluestem representing the dominant grasses, intermingling with colorful flowers and extending past the horizon. The gentle terrain allowed prairie fires to burn through the area regularly, and woody plant growth tended to be limited to sheltered draws and some of the steeper slopes of the moraine hills. The moraine hills burned much less frequently and tended to support populations of prairie species as well as fire-tolerant bur oak, to form savanna and oak woodland communities. In other areas, where sheltered stream ravines were more pronounced and created a dissected landscape, or where stream orientation prevented prairie fires from burning through, fire-sensitive communities such as maple-basswood forest or mesic oak forest developed. A map of the vegetation at the time of the GLO survey is shown in Figure 3 (page 7).

Post-European Settlement

As the area developed after the mid-1800s, more intense human activities such as farming, suppression of natural fire, logging, and other activities began to change the landscape and natural communities. In Rice County today, more than 95 percent of the native landscape has been altered by human activities; only a small percentage of the county remains in native natural communities. In the Northfield project area today, 776 acres, or roughly 7% of the land cover, retains native plant communities. (This number includes remnant communities and open water areas. It does not include restorations.)

III. Project Methodology

Gather and Review Background Information

To provide a more detailed understanding of the project area, available information on natural resource features was gathered and reviewed by ecologists from Bonestroo Natural Resources. These data included presettlement vegetation, Minnesota DNR biological survey information for Rice and Dakota Counties, wetland and water resource information, and the Rice and Dakota County soil surveys.

Minnesota County Biological Survey

The Minnesota County Biological Survey (MCBS) conducted an inventory of select remaining natural communities within Rice and Dakota Counties in 1995. Although much of the remnant natural vegetation within the City and UEA was checked through aerial photography and cursory ground surveys, only a small subset of these remnants were of high enough quality to be surveyed in detail and included in the on-the ground county biological survey. Other remnants were either too degraded or too small in size to be considered of high enough quality for inclusion in the survey.

MCBS records for the project area and adjacent lands are in Appendix A.

Aerial Photo Interpretation/Remote Sensing

In spring 2005, Bonestroo Natural Resources staff began the process of remote sensing of land cover types within the project area. Using a combination of 2003 full-color low-altitude aerial photographs, and 1996 color-infrared aerial photographs, preliminary cover-type boundaries were digitized in AutoCAD. These preliminary boundaries were then plotted onto the 2003 true-color aerial photographs for each section (square mile) of land within the project area as base maps. These were printed at a scale of 1"=300'. Available electronic data layers such as the National Wetlands Inventory, geopolitical boundaries, parcel boundaries, transportation information, and DNR Natural Heritage (MCBS) data were also printed on these plotted photos.

Land Owner Notification

A multi-phased approach was used to ensure that all landowners within the inventory were aware of the project. An initial announcement and brief description of the project and schedule were included in the June issue of the City Commons Newsletter, which is delivered to all utility bill payers within the project area. In July, the Northfield News ran an article about the project. Finally, a review of aerial photographs was conducted to identify any parcels in private ownership where property access was desired. A targeted mailing was sent to those property owners, requesting permission to access their land during the field inventory. Thirty-four letters were mailed, requesting that the landowner respond if they desired additional information or did not want their property included in the inventory. Of the 4 responses, 1 landowner wanted to accompany the ecologist during the field visit, one wanted more information about the project, and one chose to have their property excluded from the inventory. The fourth person could not be reached. Property of non-respondents was included in the field assessment.

Field Evaluation

Field inventory work and land cover classification took place in July and August 2005. During field review of areas, the preliminary land-cover boundary assigned to any particular area or polygon was verified or modified, if necessary. In addition, other pertinent data was recorded including land cover type, MLCCS Modifiers, dominant species, and Field Check Levels (see below).

The field survey also included identification of dominant plant species within a given natural community. Intensity of inventory effort was related to the overall quality of an area. In general, good quality natural communities were more thoroughly inventoried and more extensive searches conducted for uncommon or rare species. The field inventory emphasized gathering data on the composition, structure, and function of natural communities, including disturbance indicators such as exotic species and erosion. This information provides a solid starting point for assessing the current condition of the community and can be used to develop management recommendations.

Land Cover Classification

MLCCS Background

The MLCCS methodology, Version 5.4 was used to classify land cover within the project area. A brief explanation of the method and its application to this project is provided below.

MLCCS provides a five-level hierarchical system of land cover codes to describe natural and cultural land cover types. Natural land cover types include areas such as forests, prairies, wetlands, shrublands, and other similar areas. Cultural land cover types are areas that can be thought of as developed or substantially impacted by humans. These typically include paved (impervious) areas, agricultural fields, pastures and frequently manipulated grasslands, quarries, and others.

Progression through each of the five levels of the system represents an increased level of detail in land cover classification. In this framework, Level 1 is the least detailed and Level 5 is the most detailed. For the purposes of this project, all land cover within the city was classified to the greatest level of detail practical (Level 4 and Level 5 in most cases).

In this system, each land cover type is assigned a 5-digit code; each position within the code represents a higher level of mapping detail. For example, all codes in the 30000 series are forest communities. 32000 indicates that the site is a deciduous forest, 32100 is an upland deciduous forest, and 32150 is a maple basswood, upland deciduous forest. For descriptions of codes used in this project, see Appendix D, or refer to the MLCCS Manual (the full 266 page manual is available on-line at the MN DNR website.)

Standard MLCCS protocol was used during the mapping and inventory of the project, with several adaptations. A select subset of modifier codes was used in order to capture the information most useful to the city (discussed below), and the minimum mapping unit for developed and cultivated cover types (10,000 and 20,000 level codes) was increased to 5 acres.

The full 266 page MLCCS manual is available for review on the DNR Website: <http://www.dnr.state.mn.us/mlccs/index.html>

MLCCS Modifier Codes

Several 'classes' of MLCCS modifiers were assessed in the field while conducting the land cover classification of Northfield. These modifiers were assessed based on the methodology and definitions provided in the MLCCS training manual. Once assessed, the modifier values were entered into the GIS database for each land cover polygon.

Land Use Modifier

The M_2xx modifiers were developed to identify and describe land use. Seven categories of land use modifiers are available through MLCCS, of which 4 were used either wholly or partially in this inventory: 21x (Residential); 22x (Commercial); 222 (industrial) 23x Transportation (roads and Railroads); and 24x Open Space Use.

Natural Community Quality Modifier (M_34x): Natural Community Quality Assessment

During the field checking of natural community land cover types, the project ecologist assessed the overall ecological quality of natural vegetation remnants using a standardized method developed by the MN DNR Natural Heritage Program. Restored communities, such as planted prairies, were not given a qualitative rank. For the purposes of this project, certain minimum standard criteria that are part of this DNR methodology were not applied. A specific example would be the minimum size (area) standard where the minimum threshold established by the DNR would prevent inclusion of smaller natural areas that occur within the project area.

Natural community quality is expressed as the M_34x modifier. This modifier has four general categories: High Quality Natural Community (A), Good Quality Natural Community (B), Moderate Condition Natural Community (C), and Poor Condition Natural Community (D). The assessment method is based on general ecological variables, and is

applied in the same manner for all natural community types. The following is the description of the M_34x modifier from the MLCCS manual:

341 (A rank) = highest quality natural community, no disturbances and natural processes intact. Site must be visited entirely or partially to accurately assess its natural quality at this level (fld_level = 3 or 4).

342 (B Rank) = good quality natural community. Has its natural processes intact, but shows signs of past human impacts. Low levels of exotics. Site must be visited entirely or partially to accurately assess its natural quality at this level (fld_level = 3 or 4).

343 (C Rank) = moderate condition natural community with obvious past disturbance but is still clearly recognizable as a native community. Not dominated by weedy species in any layer. Minimally, the site must be visited from the edge to accurately assess its natural quality at this level (fld_level = 2, 3 or 4).

344 (D Rank) = poor condition of a natural community. Includes some natives, but is dominated by non-natives and/or is widely disturbed and altered. Herbaceous communities may be assessed with this ranking from a distance (fld_level = 1) if large masses of invasive species are present and the entire community is visible.

In addition to the 341 – 344 ranking for natural communities, MLCCS also uses the following for semi-natural communities:

345 (NA) = Non-native/altered community type with native species present. Field check level 2 or higher.

346 (NN) = Non-native/altered community type with no native species present. Field check level 2 or higher.

Invasive Species Modifiers (M_4xx)

The M_4xx modifiers represent invasive plant species occurring within land cover polygons. For the purpose of this project, the percent cover of each species of interest was estimated. These species are important to track due to their invasive nature and potential threats to native plant communities and biological diversity of native habitats. The cover classes used to assess invasive species aerial cover (i.e. as viewed from above) is as follows:

Cover Class/Estimated Percent Cover for Invasive Species

Cover Class	Description
0	<i>Unknown, or if field checked, plants not observed</i>
1	<i>Observed, unknown quality</i>
2	<i>1 to 5% coverage</i>
3	<i>6 to 25% coverage</i>
4	<i>26 to 50 % coverage</i>
5	<i>51 to 75% coverage</i>
6	<i>76 to 100% coverage</i>

The following page includes a list of invasive plant species and their associated modifier numbers that were recorded for aerial coverage within land cover polygons within the project area.

Modifier	Common Name	Scientific Name
401	Overgrown woodland	----
402	Purple loosestrife	<i>Lythrum salicaria</i>
408	Common buckthorn	<i>Rhamnus cathartica</i>
410	Tartarian honey suckle	<i>Lonicera tatarica</i>
412	Reed canary grass	<i>Phalaris arundinacea</i>
413	Smooth brome	<i>Bromus inermis</i>
414	Spotted knapweed	<i>Centaurea maculosa</i>
415	Thistle	<i>Cirsium spp.</i>
416	Siberian elm	<i>Ulmus pumila</i>
419	Amur maple	<i>Acer ginnala</i>
422	Dame's rocket -	<i>Hesperis matronalis</i>
499	Other invasive species:	
	Sweet Clover	<i>Melilotus spp.</i>
	Birdsfoot trefoil	<i>Lotus corniculatus</i>
	Wild Parsnip	<i>Pastinaca sativa</i>

Field-check Level

A field-check level modifier was assigned to all polygons. The field-check level indicates the degree to which an individual polygon was checked in the field during the land cover assessment. Most polygons were visited at least partially (i.e. field check levels 3, 4), while cultural areas (20xxx and 10xxx codes) were viewed from the edge (field check level 2) or from a short distance (field check level 1). The following is a list of field check modifier values and their associated description:

<i>Field Check Level</i>	<i>Description</i>
<i>4</i>	<i>Visited Entirely</i>
<i>3</i>	<i>Visited Partially</i>
<i>2</i>	<i>Viewed From Edge</i>
<i>1</i>	<i>Viewed From a Distance</i>
<i>0</i>	<i>Not Visited/Remote sensed</i>

Wildlife Habitat Assessment

The potential habitat value was checked for each natural area and many of the semi-natural areas visited. Factors considered include plant species diversity, structural diversity, water availability, food availability, and connectivity between the site and other natural/semi-natural areas. Potential nesting areas for bald eagles and osprey were also noted.

Unique/Rare Features

These features were identified in the field by the project ecologist. Features identified include scenic overlooks and vistas, geologic features, or other unusual natural history features.

Stream Assessment

Several stream reaches were selected to be investigated in the field to evaluate their current physical condition. The segments of the streams were selected by using the 2003 FSA true color low altitude aerial photographs, USGS topographic maps, and DNR stream centerline data (which was generated using the USGS topographic maps). Areas that were selected showed stream segments that may be undergoing change, exhibited signs of being disturbed by channelization or straightening activities, or showed signs of being repaired in the past.

Field visits were completed at each of the selected reaches, and the physical conditions present at each location were documented. Photographs of each site were also taken to augment the field data.

Field data that was collected evaluated the current size of the stream channel, evaluated bed and bank materials, noted the land uses and vegetation cover adjacent to the segment of interest, documented whether the current banks appeared stable or noted the failure modes present at the banks, and noted where active aggradation or degradation appeared to be occurring.

The data was collected in a database format and reviewed by an engineer trained in stream morphology and restoration techniques. Comments based on the observations from the field and interpretation of land use activities from aerial photography were combined to provide an objective analysis for each segment reviewed.

IV. MINNESOTA LAND COVER CLASSIFICATION SYSTEM (MLCCS) FINDINGS

Land Cover Classification (MLCCS) Results

Level One Land Cover Summary

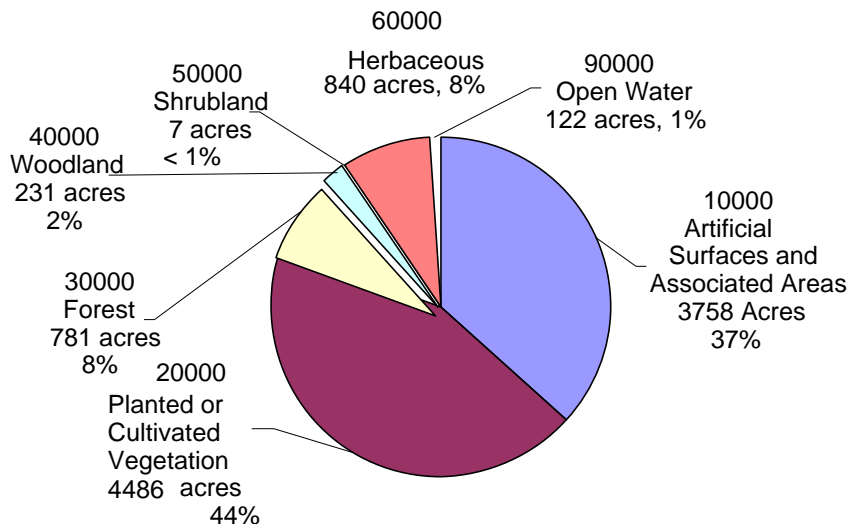


Chart 1: Level One Land Cover Summary

MLCCS 10,000 Codes: Artificial Surfaces and Associated Areas 3,758 Acres, 37% of Total Land Cover

Artificial surfaces and associated areas are the second most common cover type in the project area. This represents areas where the land cover ranges from 11% - 100% impervious. Cover types typically captured in this cover class include residential development and homesteads, roads, and commercial and industrial areas. Areas of exposed earth such as gravel mines, landfills, and similar activities are also included in this category.

MLCCS 20,000 Codes: Planted or Cultivated Vegetation

4,486 Acres, 44% of Total Land Cover

Planted and cultivated vegetation is the most common cover type within the project area. This category includes land cover types from mowed grassland such as that found in large lawns and recreational parks, to large gardens or tree plantings, as well as agricultural uses such as pasture and crop production. Of the 4,486 acres, 3,776 are crop or pastureland.

MLCCS 30,000 Codes: Forests

781 Acres, 8% of Total Land Cover

Forest areas in the project area occur most frequently along stream and river corridors, as well as within spaces preserved in city parks and on college properties. The majority of the sites mapped are mesic forest, either maple-basswood forest or mesic oak, or floodplain forest. A number of additional sites were mapped as MLCCS code 32170—altered or non-native forest. These areas were typically dominated by green ash, boxelder, elm, basswood, and black walnut, with only occasional sugar maple and/or oaks. In the Northfield area these communities represent a successional stage in forest development, and occurred in areas that were pastured or logged historically. In some instances they may be relics of old savannas and woodlands which have become significantly overgrown in the past 70 -100 years, through a variety of factors. Regardless of their origin, they often support a number of native species and can provide very good wildlife habitat value.

MLCCS 40,000 Codes: Woodlands

231 Acres, 2% of Total Land Cover

Woodlands are typically described as areas with scattered to patchy tree cover (usually with touching or overlapping crowns) over brush and shrubs. The DNR recognizes one category of woodland as native (oak woodland-brushland). Northfield has 4 sites, composed primarily of bur or white oak over brush—often European buckthorn, or mixed dogwood, sumac, and other native species. There are a number of non-oak dominated woodlands in the area as well, where elm and boxelder have colonized fallow pastures or agricultural land, and there is dense undergrowth of native shrubs such as gray dogwood, highbush cranberry,

nannyberry, and others. These areas typically offer outstanding wildlife value due to the rich assortment of cover types and food availability.

MLCCS 50,000 Level Codes: Shrubland

7 acres, <1% of total cover

Shrublands are surprisingly rare in Northfield, possibly because the landform does not support many wetlands and shrublands frequently occur in wetlands. One area of willow swamp was encountered in the project area, in a low wetland near the Cannon River.

60,000 Level Codes: Herbaceous Cover

840 acres, 8% of Total Land Cover

This cover class includes both wetland and non-wetland areas dominated by grasses, grass-like plants, and forbs (wildflowers). Cover types included in this category included fallow agricultural fields and pastures dominated by the non-native species smooth brome and Kentucky bluegrass, remnant and restored prairies, and wetland communities such as cattail marshes, fens, and wet meadows. This is the most diverse cover category within the city.

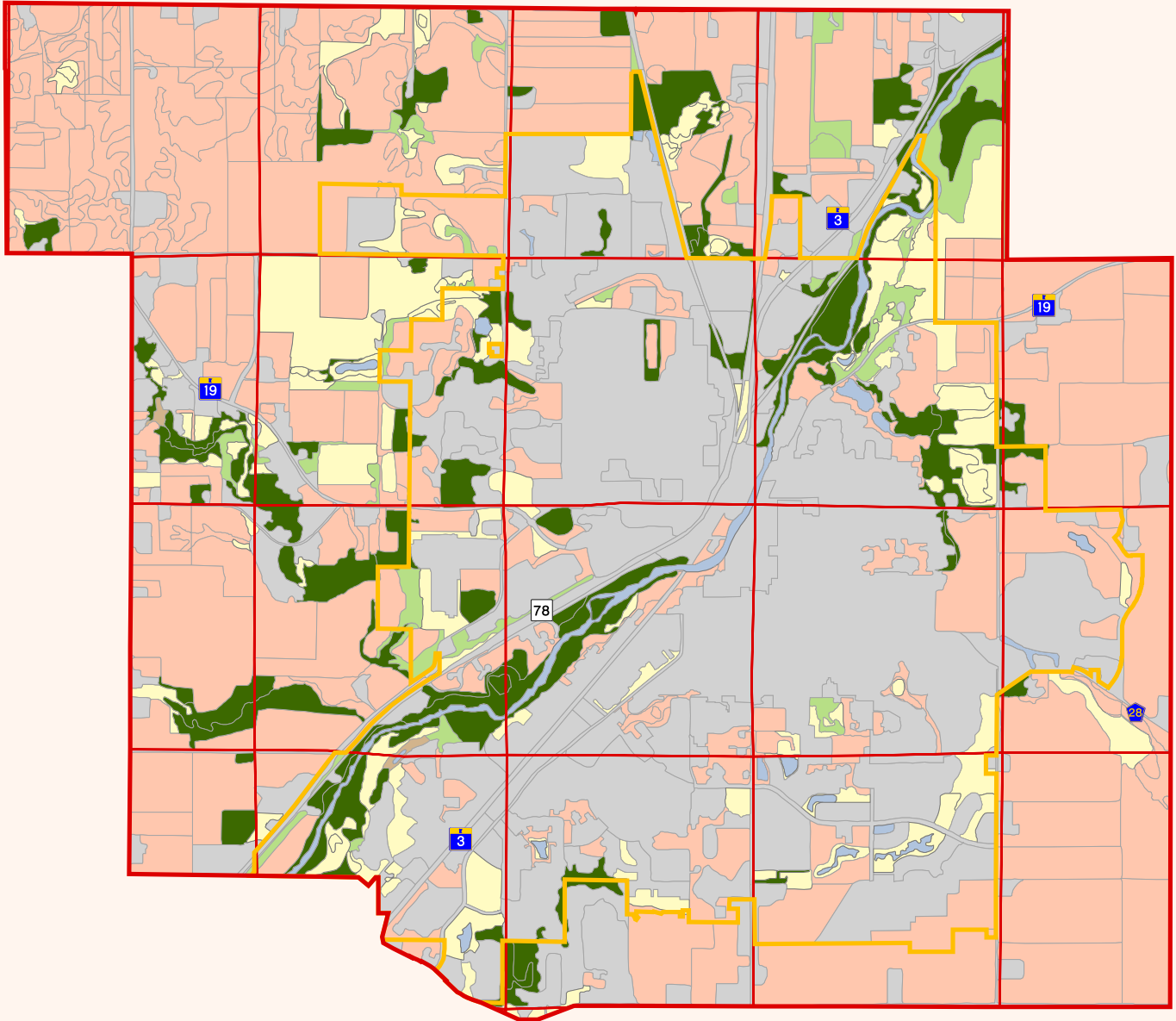
90,000 Level Codes: Open Water

122 Acres, 1%

Open water areas include streams and rivers large enough to appear as water on the aerial photographs, as well as open water ponds and wetlands. The Cannon River is the defining water feature for the project area. Other important water features include Spring Creek, Heath Creek, and Rice Creek, although these features were too small to map separately. All of these water bodies are important resources for the city and the region, and should be afforded appropriate safeguards to maintain or improve their quality.

Figure 4 (page 22) illustrates the land cover for the Northfield project area at MLCCS Level One. Figure 5 on page 23 illustrates the land cover at MLCCS Level Three. **Summaries for MLCCS at Level 1, Level 3, and Level 4-5 are also included in Appendix D.**

A digital version of the land cover data has been provided with the Final Report to City Staff in a format that can be used within a geographic information system (GIS) such as ArcView or ArcGIS.



Northfield Natural Resources Inventory: Level One Land Cover Summary

Fig. 4



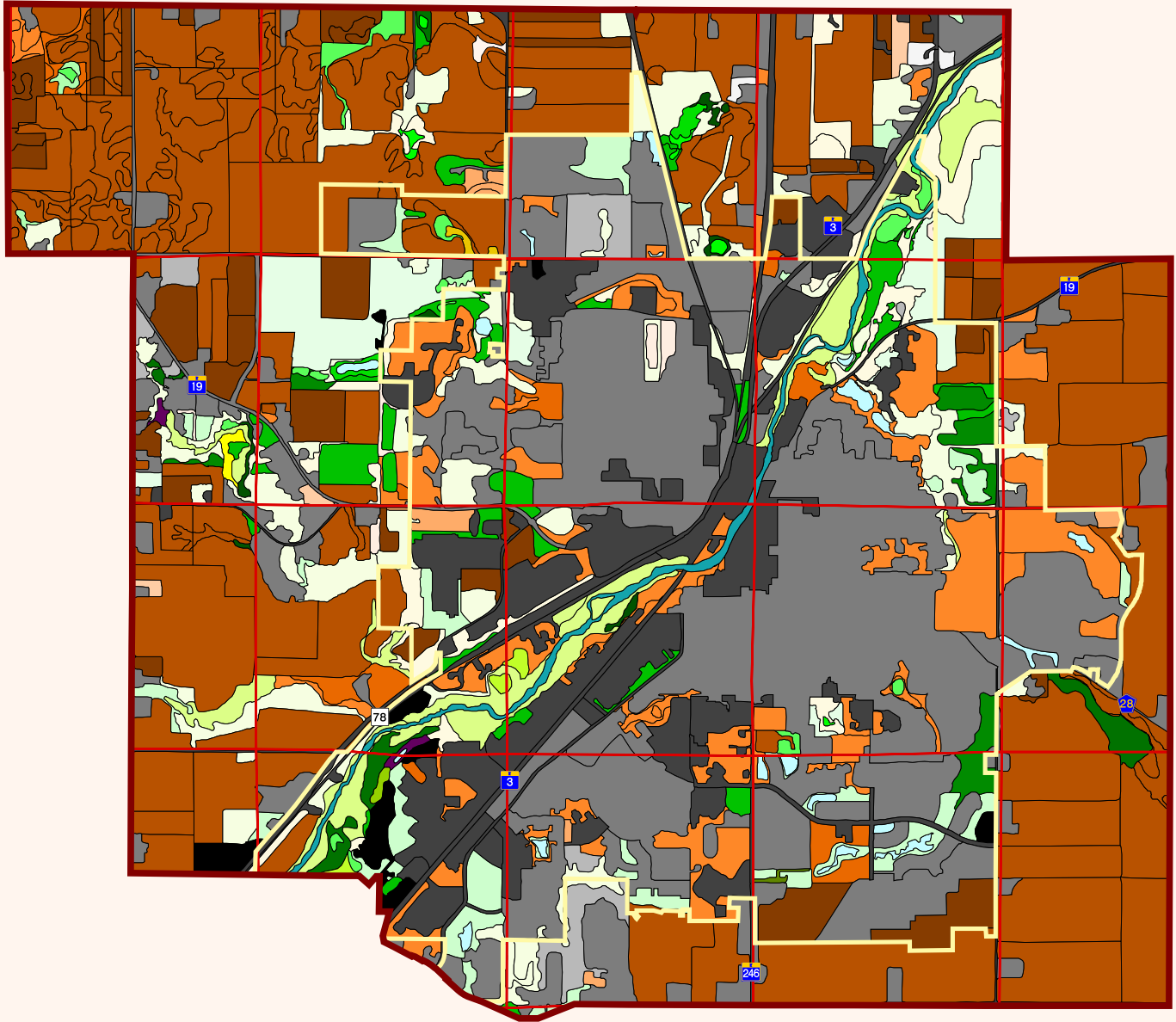
- Project Boundary
- Unique Features
- ~ Streams/Waterways

- Land Cover**
- Artificial Surfaces and Related Areas
 - Planted or Cultivated Vegetation
 - Forests
 - Woodland
 - Shrubland
 - Herbaceous
 - Water

2000 0 2000 Feet



September 2005
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Northfield Natural Resources Inventory: Level Three Land Cover Summary

Fig. 5



- Project Boundary
- 2005 Municipal Boundary

2000 0 2000 Feet







See Following Page for Detailed Legend.








November 2005
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Level Three Summary: Legend






10000

-  11200-Artificial surfaces with deciduous tree cover
-  13100-Artificial Surfaces with Deciduous Trees and Perennial Grasses
-  14100-Buildings and Pavement
-  14200- Exposed Earth




20000

-  21100-Planted Coniferous Trees
-  21200-Planted Deciduous Trees
-  21300-Planted Mixed Deciduous and Coniferous Trees
-  23100-Planted or Maintained Grasses with Sparse Tree Cover
-  23200-Planted or Maintained Grasses
-  24100-Row Crops
-  24200-Close Grown or Solid Seeded Cropland

30000

-  32100-Upland deciduous forest
-  32200-Temporarily flooded deciduous forest
-  32300-Saturated deciduous forest
-  32400-Seasonally flooded deciduous forest
-  33100-Upland mixed coniferous-deciduous forest











40000

-  42100-Upland deciduous woodland
-  42200-Temporarily flooded deciduous woodland
-  42400-Seasonally flooded deciduous woodland



50000

-  52300-Saturated deciduous shrubland

60000

-  61100 -Tall grassland
-  61200 - Medium-tall grassland
-  61300 - Temporarily flooded graminoid vegetation
-  61400 - Saturated graminoid vegetation
-  61500 - Seasonally flooded emergent vegetation
-  61600 -Semipermanently flooded emergent vegetation
-  62100 - Grassland with sparse deciduous trees
-  62200 - Grassland with sparse conifer or mixed deciduous/coniferous trees
-  62300 - Temporarily flooded grassland with sparse deciduous trees
-  62400 - Saturated grassland with sparse deciduous trees

90000

-  91200-Slow Moving Linear Water (River)
-  93300- Shallow open water

Summary of Natural Cover Types

Ninety-one individual natural communities were documented, covering a total of 968 acres. These remnants represent a variety of distinct natural community types including forest, woodland, shrubland, grasslands, and herbaceous wetlands, as well as areas of open water (lakes and ponds). The following pages include a summary of the major natural community types encountered in the City, with general descriptions as described in the MLCCS User Manual. Descriptions for specific sites surveyed during the inventory can be found in Chapter 6: Natural Community Sites and Stream Assessment Site Descriptions. For locations of specific community types, please refer to the GIS layer provided with the project. Additional summary information is provided in the MLCCS Summary Tables in Appendix D.

Natural Communities

Forest (Upland)

Upland Deciduous Forest (MLCCS Code 32100 / 15 Total Acres)

One upland deciduous forest was documented in Northfield. Deciduous Forests occur primarily in the deciduous forest-woodland zone; they are less common in the prairie zone and the conifer-hardwood forest zone. On dry sites, the most common canopy dominants of Deciduous Forests are oak, aspen, and birch trees. Sugar maple, basswood, elm, and ash trees are common dominants on moist sites. Pines, especially white pine, sometimes form a minor part of the forest canopy. Where the forest canopy is broken or interrupted (typically in oak-dominated forests) there is usually a dense layer of tall shrubs, including hazelnuts, dogwoods, prickly ashes, and cherries. Beneath the denser canopies formed by mesic tree species such as sugar maple, the shrub layer is sparse or absent.

The canopy tree species of Deciduous Forests occur in combinations determined primarily by environmental features (including soil texture, parent material, presence of hardpans and firebreaks, depth to the water table, topography, aspect, and local climate) that affect soil moisture and the local fire regime. These features produce a gradient of Deciduous Forest types from dry, fire-prone forests composed of fire-adapted species, to mesic forests composed of fire-sensitive species.

Many of the dry Deciduous Forests in the deciduous forest-woodland and prairie zones appear to have succeeded from deciduous brushland and savanna in the past 100 to 125 years following widespread forest fragmentation and fire suppression. Mesic Deciduous Forests in these zones occur in areas protected from fire, especially areas of rough topography and along bodies of water. In the conifer-hardwood forest zone, mesic Deciduous Forests occur on sites with impeded drainage (having impermeable banding or textural pans in the soils) and in areas of locally high precipitation or humidity, such as along the shore of Lake Superior. The dry deciduous forests of the conifer-hardwood zone, especially Aspen, Aspen-Birch, and Paper Birch forests, occur on fire-prone sites and are considered early successional communities.

Oak Forest (All subtypes)

(MLCCS Code 32100, 32110, 32112 / 166 Total Acres)

Within Northfield, 14 oak forest remnants were documented totaling 166 acres. The most common of these was oak forest of mesic subtype (12 occurrences totaling 133 acres). Other oak forests include oak forest of unspecified subtype (2 occurrences totaling 33 acres).

Northern red oaks, white oaks, or bur oaks dominate the more mesic stands of Oak Forest. These stands occur on sites that had fewer severe fires before European settlement than the sites on which dry Mixed Oak Forest occurs. These mesic stands most likely were always forest, rather than woodland or savanna. They have tall (> 20 meters), straight, single-stemmed trees that lack spreading lower branches. Commonly, mesic fire-sensitive tree species are present with the oaks in these stands, especially in the understory. These species include basswood, green ash, bitternut hickory, big-toothed aspen, and butternut.

The shrub layer in mesic stands is sparser than in dry stands and, correspondingly, the forb layer is denser and more diverse and there are more graminoid species. Like the drier stands, however, there is little oak regeneration, and most mesic Oak Forests appear to be succeeding to Maple-Basswood forest. Heavy selective logging of the oaks in mesic stands may accelerate this trend, producing young stands of Maple-

Basswood Forest. The mesic stands often grade into drier stands of Maple-Basswood Forest, but differ from them by having a somewhat denser shrub layer and the herbs woodrush (*Luzula acuminata*) and pointed-leaved tick-trefoil (*Desmodium glutinosum*) in their understory.

Maple-Basswood Forest

(MLCCS Code 32150 / 110 Total Acres)

A total of 11 maple-basswood forests were documented throughout Northfield. The tree canopy of Maple-Basswood Forests is dominated mostly by basswoods, sugar maples, and (formerly) American elms. Other mesic trees, such as slippery elms, northern red oaks, bur oaks, white ashes, and green ashes, are sometimes dominant locally. The canopy is very dense, with tall, straight, relatively narrow-crowned trees. The understory is multi-layered and patchy. It is composed of saplings and seedlings of the canopy species (especially sugar maple), along with American hornbeam, ironwood, bitternut hickory, pagoda dogwood, and leatherwood.

Because the tree canopy permits so little light to reach the forest floor during the summer, Maple-Basswood Forests have a suite of forb species that bloom, produce seeds, and die back in May and early June before tree leaves are fully developed. These species-- the spring ephemerals and the winter annuals-- include spring beauties (*Claytonia* spp.), Dutchman's breeches (*Dicentra cucullaria*), trout-lilies (*Erythronium* spp.), and cleavers (*Galium aparine*). Other herbs, such as the sedge *Carex pedunculata*, bottlebrush grass (*Hystrix patula*), and bearded short-husk (*Brachyelytrum erectum*), are commonly present in the groundlayer but usually not abundant.

Of special note in maple-basswood forests in the Northfield area is the potential for the dwarf trout lily to occur. This species occurs only in SE Minnesota, and nowhere else in the world. It is typically associated with stream channels in



Maple-Basswood Forest in the southwest portion of the city.

maple-basswood forests, such as along Prairie Creek in the nearby Big Woods State Park.

Maple-Basswood Forest occurs only on protected sites, where catastrophic forest crown fires were rare historically. Across most of its range, the community develops most commonly on well-drained loamy soils that lack mottling or other evidence of water-table levels within the tree-rooting zone. In north-central Minnesota, Maple-Basswood Forests develop on soils with fine-textured subsurface layers that slow the downward movement of water and nutrients. Maple-Basswood Forest is a late-successional community, tending to succeed Mixed Oak Forest (and other forest types) on mesic sites. It is self-perpetuating in the absence of catastrophic disturbance and climate change because the dominant tree species readily reproduce by gap-phase replacement. The very shade-tolerant sugar maple seedlings and saplings, especially, may exist in a suppressed state in the understory for many years until the death of a mature tree when one or a few grow rapidly into the canopy gap. Maple-Basswood Forests often develop into old-growth forests, because catastrophic disturbances are rare in the community and because the dominant tree species are long-lived (> 250 years). The trend in most stands of Maple-Basswood Forest is toward greater dominance by sugar maple.

Aspen Forest (MLCCS Code 32160 / 2 Total Acres)

One aspen forest was documented within the city, on the campus of St. Olaf. Aspen Forest occurs throughout the deciduous forest-woodland zone, with isolated patches in the prairie zone. The community develops primarily on sites with wet, poorly drained soils and high water tables, although the water table is usually not high enough to affect the groundlayer composition of the community or to cause peat accumulation.

The tree canopy most often is dominated by quaking aspens. Paper birches, balsam poplars, bur oaks, pin oaks, green ashes, or basswoods are minor canopy trees, although they may be abundant in the understory as seedlings and saplings. On low, poorly drained sites balsam poplars are sometimes more abundant than quaking aspens in the tree canopy.

The understory of Aspen Forests tends to be brushy. American hazelnut is almost always abundant in the understory. Other shrubs vary in

presence and abundance with soil moisture, which ranges from wet-mesic to dry. The groundlayer is composed mostly of forest herbs and grasses capable of surviving in the shade under the dense shrub layer. These species include wild sarsaparilla (*Aralia nudicaulis*), Canada mayflower (*Maianthemum canadense*), the sedge *Carex pensylvanica*, false melic grass (*Schizachne purpurascens*), and mountain rice-grass (*Oryzopsis asperifolia*).

Aspen Forest is an early-successional community. With prolonged absence of fire or other disturbances, Aspen Forests succeed to mid-successional forests composed of the minor canopy tree species listed above. An analysis of land survey records indicates that relatively pure stands of quaking aspen historically occurred on level terrain rather than on rough topography, suggesting that these stands were maintained by fire and windthrow. The aspen trees were present most commonly on somewhat poorly drained mineral soils, especially drumlin fields and other landforms with heavy soils, while paper birch, pin oak, and bur oak trees associated with the aspens were probably present on local areas of better drained soils.

Plots of aspen trees from early public land survey records show that aspen also occurred on areas of relict prairie soils within the deciduous forest-woodland zone. These sites are now mainly forested, but the land survey records indicate that the aspen trees previously were scattered widely enough on them to constitute woodland rather than forest. This is consistent with the surveyors' written descriptions of these sites, which state that they had relatively dense shrub layers dominated by American hazelnut, and groundlayers dominated by prairie forbs and graminoids. Aspen forests that occur on prairie soils and have prairie understories eventually may be recognized as a subtype of Aspen Forest or as a phase of Aspen Woodland, following further research and analysis of survey records. No sections of Aspen Forest are anticipated.

Upland Mixed Coniferous-Deciduous Forest (MLCCS Code 33100 / 3 Total Acres)

One upland mixed coniferous-deciduous forest was documented within the city; the site was a mix of maturing planted coniferous trees, and naturally recruited deciduous trees.

Mixed Coniferous-Deciduous Forests are upland forest communities made up of significant amounts of both coniferous trees and broad-leaved deciduous trees. They are most common in the conifer-hardwood forest zone but also occur in the deciduous forest-woodland zone. The communities in this class occur on dry to wet-mesic sites, may be early successional or late successional, and originate following either natural catastrophic disturbance or clear-cutting. The logging and burning of Coniferous forests that came with European settlement caused widespread loss of pine seed sources and the subsequent conversion of large acreages of Coniferous Forests to Mixed Coniferous-Deciduous Forests and Deciduous Forests.

There are four Mixed Coniferous-Deciduous Forest community types, which are delimited by dominant canopy species. The abundance and distributions of these dominant canopy species are determined mainly by landform, soils, and the frequency and nature of disturbance at a site.

Forests (Lowland)

Floodplain Forest (MLCCS Code 32210, 32211 / 176 Total Acres)



Floodplain Forest along the Cannon River.

A total of 14 floodplain forests were documented within the city totaling 176 acres. The most common of these was floodplain forest of unspecified subtype (12 occurrences totaling 171 acres). Other floodplain forests include floodplain forest of silver maple

subtype (2 occurrences totaling 5 acres).

Floodplain Forest is a seasonally wet forest community that occurs throughout Minnesota on the active floodplains of major rivers and their tributary streams. The canopy of the community is dominated by deciduous tree species tolerant of inundation, abrasion, and other disturbances associated with flooding. The canopy is variable in composition, either composed of a mixture of tree species or strongly dominated by a single tree species.

The species composition of Floodplain Forests varies both geographically and in relation to such features as substrate type or flood cycles. In southern Minnesota, silver maples, black willows, and cottonwoods are common canopy dominants. They occur either in nearly pure stands or in mixed stands. Scattered individuals or patches of river birch, American elm, slippery elm, green ash, and swamp white oak are also common in stands in southern Minnesota.

The tree canopy cover is highly variable within Floodplain Forests. The canopy is continuous in some stands while other stands have open areas caused by repeated erosion, ice-scouring, and soil and debris deposition, all of which prevent the growth of trees and shrubs. In recent decades, Dutch elm disease has also caused significant canopy openings in Floodplain Forests in which mature American elm trees were abundant in the canopy. Areas beneath tree-canopy openings in the forests are either dominated by short-lived herbaceous plants or, where erosion and disturbance from flooding tend to be repeated and severe, remain unvegetated. The common herbaceous plants in these open patches include those mentioned above in the Floodplain Forest class description.

The Silver Maple subtype occurs mainly in the deciduous forest-woodland zone along the Minnesota, lower Mississippi, and St. Croix rivers and their tributaries, although there are some stands to the north in the conifer-hardwood forest zone, such as along the Prairie River in Carleton and southern St. Louis counties. The Silver Maple Subtype seems to be best developed in broad, deep glacial meltwater-cut river valleys that have been filling with coarse alluvium ever since the glacial meltwaters subsided. (The Mississippi and St. Croix River valleys are exemplary of these.)

As the name implies, silver maples dominate the tree canopy in this subtype, and are present in the subcanopy and shrub layer as well. Green ashes, cottonwoods, and American elms are often present in the canopy, but are most common as seedlings and saplings. Trees such as hackberry, bur oak, and box elder are sometimes present in the

community, but most often occur only on natural levees along active river channels.

The understory of the Silver Maple Subtype is open, with less than 25% cover by tree seedlings and saplings. Herbs in the nettle family, including wood nettle (*Laportea canadensis*) and clearweed (*Pilea pumila*), dominate the groundlayer. Woody and herbaceous climbers are common, especially wild grape (*Vitis riparia*), wild cucumber (*Echinocystis lobata*), bur-cucumber (*Sicyos angulatus*), groundnut (*Apios americana*), and hog-peanut (*Amphicarpa bracteata*).

Lowland Hardwood Forest (MLCCS Code 32220 / 35 Total Acres)

A total of three lowland hardwood forests were documented within the city.

Lowland Hardwood Forest is a wet-mesic forest that is present throughout Minnesota. It is transitional between the terrestrial and palustrine systems, occurring on sites with seasonally high water tables (within the tree-rooting zone) but that do not flood regularly and that have mineral rather than peat soils. In accord with the poorly drained sites on which the Lowland Hardwood Forests occur, species tolerant of periodic soil saturation dominate the tree canopy. American elms and black ashes are common canopy dominants, but most stands are mixed, with slippery elms, rock elms, basswoods, bur oaks, hackberries, yellow birches, green ashes, black ashes, quaking aspens, balsam poplars, and paper birches as important species. The tall-shrub layer is usually discontinuous and is composed of a mixture of upland and lowland shrubs. The ground layer is composed mostly of upland herbs that do not root to the water-table.

Lowland Hardwood Forest usually occurs in fire-protected areas, although even in unprotected areas the community burns infrequently because the woody vegetation is usually hydrated, especially in the spring. Lowland Hardwood Forest soils differ from Hardwood Swamp Forest soils by being mineral rather than peaty and from the mineral soils of other mesic upland forest types by being seasonally saturated (at depths greater than 0.5 meters).

Lowland Hardwood Forest is often composed of late-successional species, but few stands in Minnesota have old canopy trees, presumably because of windthrow and infrequent episodes of killing floods. Lowland Hardwood Forest is topographically transitional between upland forests and forested peatlands and is best developed on flat terrain where such transition zones are broad (e.g., on river terraces above normal flood levels, on loamy ground moraine, and on drumlin fields).

Currently, there are no recognized subtypes or sections of Lowland Hardwood Forest. Following further field review, stands of Lowland Hardwood Forest may be reclassified as wet subtypes of Aspen-Birch or Aspen Forest, or dry subtypes of Hardwood Swamp Forest.

Mixed Hardwood Swamp (MLCCS Code 32320 / 11 Total Acres)

A total of three mixed hardwood swamps were documented throughout Northfield.

Mixed Hardwood Swamp is present in the deciduous forest-woodland and conifer-hardwood forest zones. The community has a mixed canopy of hardwoods, including paper birches, yellow birches, American elms, black ashes, red maples, quaking aspens, and green ashes. Black ashes, although commonly present, never form more than 50% of the canopy cover in the community. Tamarack or white pine are also occasionally co-dominant canopy tree species. The tree canopy cover ranges from sparse to dense, with the density of the shrub cover varying inversely with the density of the tree canopy.



Mixed Hardwood Swamp along Cannon River

Mixed Hardwood Swamp occurs most commonly on muck and shallow peat on lake plains and floodplains. It is a long-lived community and has old-growth potential, and is perhaps the most species-rich community in east-central Minnesota.

Woodlands

Oak Woodland/Brushland (MLCCS Code 42120 / 75 Total Acres)

A total of 4 occurrences of oak woodland/brushland were documented in the project area.

Oak Woodland-Brushland occurs on dry to mesic sites throughout the deciduous forest-woodland zone and locally in the prairie zone near the ecotone between the prairie zone and the deciduous forest-woodland zone. Oak Woodland is floristically and structurally intermediate between Oak Savanna and Oak Forest, with a patchy tree canopy and an understory dominated by shrubs and tree saplings.

The principal species in the tree canopy are bur oak, northern pin oak, white oak, and northern red oak. Aspens may form up to 70% of the tree canopy cover. The brush layer ranges in density from sparse (with 10-30% cover), to an impenetrable thicket. It is often especially dense in openings between clumps or groves of trees. Most of the floristic diversity in the community exists in the brush layer, which most commonly is composed of blackberries, raspberries, gooseberries, dogwoods, cherries, hazelnuts, prickly ashes, and sprouts of oak and quaking aspen. Prairie vegetation, if present, occurs only in small openings in the tree or shrub canopy.



Overgrown Oak Woodland-Brushland in Northfield. The characteristic brush layer is not visible in this photograph, but note the spreading, semi-open-grown form of the oak.

Except in these scattered prairie openings, the herbaceous layer is sparse and floristically poor. It is usually composed of woodland species capable of surviving in the dense shade beneath the brush layer.

Oak Woodland-Brushland is a fire-maintained community. It is most common on rich sites where trees and shrubs grow well but where recurrent fires prevent the formation of true forest. Historically, Oak Woodland-Brushland was probably one of the most extensive community types in Minnesota, comprising much of the vegetation described as oak

barrens, brushland, and thickets by the early surveyors. The fires that maintained Oak Woodland-Brushland usually started on nearby prairies. Following the conversion of these prairies to agricultural land, Oak Woodland-Brushland burned less frequently and rapidly succeeded to Oak Forest. Oak Woodland-Brushland is defined broadly enough here to include also communities in which the predominant cover is oak brush or oak-aspen brush (that originated following fire or limited human disturbance) instead of a well-developed tree canopy. .

In the Southeast, Oak Woodland-Brushland is present on southwest-facing slopes on the blufflands and on outwash terraces of the Mississippi River and its tributaries. It generally occurs on more gentle slopes than Bluff Prairie or on lower slopes below Bluff Prairies. Bur oaks are common canopy dominants and northern red oaks are common associates. Northern pin oaks, basswoods, and black cherries may also occur in the canopy. White oaks are rare and aspens are absent. Chokecherries are common in the shrub layer, with shrub cover averaging 30-50%. On droughty sites with thin soils or steep slopes these woodlands may persist even in the absence of fire.

In the Big Woods, woodland dominated by white oak is present in areas with coarse-textured soils, such as on kames or eskers, or in areas prone to occasional fires. Natural woodlands are now extremely rare in this section because of logging, grazing, and fire suppression.

Mesic Oak Savanna (MLCCS Code 62130 / 1 Total Acre)

One mesic oak savanna was documented in Northfield, at the prairie restoration at Carleton Arboretum.

Mesic Oak Savanna is very rare in Minnesota. Historically, it occurred in the prairie and deciduous forest-woodland zones. The characteristic trees were bur oaks and to a lesser extent northern pin oaks. Northward, quaking aspens were probably



Savanna Restoration at Carleton Arboretum

common in moister parts of Mesic Oak Savannas. The stature and spacing of the oaks in the community probably varied considerably, primarily with differences in fire history, which were themselves related to differences in soils, landforms, and climate. Grubs and small, gnarly, open-grown trees were probably most common. The distribution of trees ranged from evenly spaced to strongly clumped. Shrub cover, likewise, was probably quite variable. The shrub layer included chokecherries (*Prunus virginiana*), low juneberries (*Amelanchier humilis*), gray-bark dogwoods (*Cornus foemina*), wolfberries (*Symphoricarpos occidentalis*), and on lighter soils, prairie willows (*Salix humilis*), New Jersey tea (*Ceanothus americanus*), and American hazelnuts (*Corylus americana*). Leadplant (*Amorpha canescens*) was always present. The herbaceous vegetation was dominated by species typical of Mesic Prairie, but herbs typical of Oak Woodland and Oak Forest were probably present as well, especially beneath tree or shrub canopies.

Mesic Oak Savanna occurred on dry-mesic to mesic, gently undulating to moderately sloping sites. These sites were on glacial till or outwash, with soil texture ranging from clay loam to sandy loam. Mesic Oak Savanna generally occurred on sites where fire was frequent enough to prevent trees and shrubs from forming closed canopies, thereby permitting heliophilous prairie herbs to dominate the groundlayer. However, fire frequencies were lower than in prairies on similar topography and soils. Native grazing and browsing animals may also have helped maintain the open character of Mesic Oak Savanna. Out in the prairie zone, Mesic Oak Savanna occurred where topographic features or wetlands, lakes, or streams created local fire "shadows" (areas of reduced fire frequency). Occurrences here were usually small. Closer to the deciduous forest-woodland zone and within it, where landscape character reduced fire frequency on a larger scale, Mesic Oak Savanna often covered larger areas. With settlement and the suppression of prairie fires, savannas in the deciduous forest-woodland zone that escaped clearing and cultivation quickly succeeded to woodland unless heavily and continuously grazed. No good quality examples are known.

Shrublands

Willow Swamp – Saturated Soils (MLCCS Code 52360 / 4 Total Acres)

One record of willow swamp was documented within Northfield.

Willow Swamp is a minerotrophic wetland with a canopy of medium to tall (>1m) shrubs dominated by willows (especially pussy willow, slender willow, and Bebb's willow) and red-osier dogwood. Other shrubs, such as speckled alder, bog birch, poison sumac, and alder buckthorn, may be common in the tall shrub layer, although speckled alder is never the most abundant species present. Herbaceous species (especially graminoids) characteristic of Wet Meadow/Fen communities are common in the more open occurrences of the community. However, in Willow Swamps, unlike Wet Meadow/Fen communities, these graminoid-dominated patches are poorly separated from clumps of shrubs. The most common herbs are tussock sedge (*Carex stricta*), prairie sedge (*Carex prairea*), lake-bank sedge (*Carex lacustris*), broad-leaved cattail (*Typha latifolia*), blue-joint (*Calamagrostis canadensis*), northern marsh fern (*Thelypteris palustris*), and jewel-weed (*Impatiens capensis*).

Willow Swamps dominated by bog birch are closely related to the Shrub Subtype of Rich Fen but have more minerotrophic indicator species [such as *Alnus rugosa*, *Ilex verticillata*, *Impatiens capensis*, and *Lycopus uniflorus*] than are present in Rich Fens. Following fire in Conifer Swamps or in the Shrub Subtype of Rich Fens there may be initially a dense cover of willows (usually balsam willow and bog willow), but these stands are best classified as successional stages of Conifer Swamp or Rich Fen rather than as Willow Swamp. The dense groves of sand-bar willow or juvenile black willow that occur on sand bars along rivers are not considered Shrub Swamp communities but instead River Beach communities, as they occur on mineral rather than peat or muck substrates.

Upland Grasslands

Mesic Prairie (MLCCS Code 61110 / 230 Total acres)

Nine areas within the city were assigned the MLCCS code of mesic prairie as a result of the dichotomous key structure. While these areas are planted restorations rather than remnant prairies and thus do not replicate all of the functions of a true remnant prairie, a number of them contain a nice diversity of native species and provide some of the benefits of native prairie.

Mesic Prairie is a type of Upland Prairie, which occurs primarily in the prairie zone, with scattered occurrences in the deciduous forest-woodland zone. It is dominated by grasses. The tall grasses, big bluestem (*Andropogon gerardii*) and Indian grass (*Sorghastrum nutans*), are the major dominants on moist sites.



Prairie Restoration at Carleton Arboretum

Prairie dropseed (*Sporobolus heterolepis*) is common on both dry and moist sites. Forbs typically are abundant (but subdominant to the grasses) and may have high local diversity. Forb species composition varies with site moisture, although some forb species occur on almost all sites, moist or dry. Several low shrub or sub-shrub species are common on Upland Prairie; the most characteristic is leadplant (*Amorpha canescens*). Taller brush and trees are absent or scattered, however brush or woodland areas may be interspersed with prairie, usually in association with topographic and aquatic features that provide protection from fire.

The most important cause of variation in species composition in prairie communities is variation in soil moisture. The local soil moisture regime is determined by slope, aspect, proximity to the water table, and soil texture. On a regional scale, variation in species composition is primarily caused

by climatic variation (i.e., the westward decline in precipitation and northward decline in temperature in Minnesota).

Upland Prairies occur on a range of landforms in the prairie zone, from nearly flat glacial lake plains to steep morainic slopes. In the deciduous forest-woodland zone, prairies occur on droughty, level outwash areas and steep south- and west-facing slopes. The pre-European settlement distribution of prairie was related to the interaction of local fire frequency with growth rates of woody species: where conditions were favorable for rapid growth, more frequent fires were necessary to maintain prairie over savanna, woodland, or forest. Fragmentation of Upland Prairie since European settlement has reduced fire frequency throughout the prairie and deciduous forest-woodland zones, and most prairie remnants have more brush and trees than were present in the past.

Mesic Prairie is a dry-mesic to wet-mesic grassland that occurs mainly in the prairie zone in southern and western Minnesota and sporadically in the deciduous forest-woodland zone. Mesic Prairie is dominated by grasses. Big bluestem (*Andropogon gerardii*), Indian grass (*Sorghastrum nutans*), and prairie dropseed (*Sporobolus heterolepis*) are the major native species on most sites, with little bluestem (*Schizachyrium scoparium*) and porcupine grass (*Stipa spartea*) important on drier sites, and switchgrass (*Panicum virgatum*) and prairie cordgrass (*Spartina pectinata*) common on wetter sites. The introduced grass Kentucky bluegrass (*Poa pratensis*) is present at most sites; it is a function of the site's disturbance history.

Forbs are abundant (but usually subdominant to grasses) and have high local diversity. Forb species-composition also varies locally with soil moisture. There is greater regional variation among forbs than among grasses. Common forb species include purple prairie-clover (*Petalostemon purpureum*), white prairie-clover (*P. candidum*), ground-plum (*Astragalus crassicaarpus*), prairie-turnip (*Psoralea esculenta*), rough blazing-star (*Liatris aspera*), Canada goldenrod (*Solidago canadensis*), stiff goldenrod (*S. rigida*), Missouri goldenrod (*S. missouriensis*), prairie thistle (*Cirsium flodmani*), smooth aster (*Aster laevis*), stiff sunflower (*Helianthus rigidus*), Maximilian sunflower (*H. maximiliani*), smooth rattlesnake-root (*Prenanthes racemosa*), white sage (*Artemisia ludoviciana*), wood lily (*Lilium philadelphicum*), white camas

(*Zigadenus elegans*), heart-leaved alexanders (*Zizia aptera*), prairie larkspur (*Delphinium virescens*), downy phlox (*Phlox pilosa*), hoary puccoon (*Lithospermum canescens*), tall cinquefoil (*Potentilla arguta*), alum-root (*Heuchera richardsonii*), wood-betony (*Pedicularis canadensis*), northern bedstraw (*Galium boreale*), prairie bird-foot violet (*Viola pedatifida*), oval-leaved milkweed (*Asclepias ovalifolia*), and showy milkweed (*A. speciosa*). Purple coneflower (*Echinacea angustifolia*) is common on drier sites in the western part of the community's range. Leadplant, prairie rose, sand cherry, wolfberry, and prairie willow are common low-shrub or sub-shrub species. Fragrant false indigo is common on moister sites. Trees and taller brush often occur along the margins of wetlands adjacent to Mesic Prairies.

Mesic Prairie is a fire-dependent community. In the absence of fire, occurrences of Mesic Prairie are invaded by brush and trees. In the prairie zone, Mesic Prairie occurs on nearly level glaciolacustrine and glaciofluvial deposits, and on flat or gently rolling morainic landforms. In southeastern and, to a lesser extent, southwestern Minnesota, the glacial deposits are overlain by loess. Bedrock subtypes of Mesic Prairie exist in a few areas where bedrock is within about one-and-one-quarter meters of the ground surface and there are numerous small patches of exposed rock. Within the deciduous forest-woodland zone, Mesic Prairie usually occurs on level outwash areas or on broad, sandy river terraces. The soils in Mesic Prairie are predominantly mollisols with thick, dark mineral surface layers that have high base saturation and dominantly bivalent cations. They range in texture and drainage from silty and somewhat poorly drained to sandy and somewhat excessively drained, with moderately well-drained to well-drained, loamy soils being most common. Mesic Prairie grades into Wet Prairie on moister sites and into the Hill and Sand-Gravel subtypes of Dry Prairie on drier sites. Separation of Mesic Prairie from other prairie types is based primarily on landform or substrate characteristics rather than on species composition, as floristic boundaries between Mesic Prairie and other prairie types are not well defined.

Herbaceous Wetlands

Wet Meadow (MLCCS Code 61420/ 1 Total Acres)

One wet meadow was encountered during the Northfield inventory.

The groundlayer of the community is composed of dense, closed stands of predominately wide-leaved sedges (e.g., *Carex lacustris*, *C. stricta*, *C. aquatilis*, *C. rostrata*, *C. haydenii*) or grasses (e.g., *Calamagrostis canadensis*, *C. inexpansa*). On saturated soils *C. stricta* is more common, while on seasonally flooded soils *C. lacustris* is more common. Forb cover and diversity usually are high. Forbs such as spotted joe-pye weed (*Eupatorium maculatum*), common mint (*Mentha arvensis*), turtlehead (*Chelone glabra*), and swamp milkweed (*Asclepias incarnata*) are conspicuous. Shrub cover in Wet Meadows ranges from 0 to 70% and is composed of Bebb's willows and pussy willows. Mosses are rare or absent.

Wet Meadow occurs on wet mineral soil, muck, or shallow peat (<0.5 m). Standing water (generally stagnant) is present in the spring and after heavy rains, but the water table is generally below the soil surface for most of the growing season. The drawdown of the water table as the growing season progresses enables the oxidation of dead organic matter that has accumulated on the ground surface from previous years. This process makes available nutrients for some of the nutrient-demanding species present in the community. Occurrences of Wet Meadow along stream courses or adjacent to lakes often have fairly constant water levels relative to Wet Meadows in depressions or basins. On these sites siltation may be important in maintaining high nutrient levels.



Wet Meadow Community above Heath Creek

Wet Meadow tends to succeed to Shrub Swamp communities in the absence of fire. Water-table lowering caused by drought or by ditching promotes succession of Wet Meadow to Shrub Swamps. Wet Meadows

on organic soils, like other communities that occur on organic soils, recover very slowly, if at all, once altered by artificial flooding or draining.

Seasonally Flooded Emergent Vegetation (MLCCS Code 61500/ 2 Total Acres)

Two areas of seasonally flooded emergent vegetation were encountered within the city.

Surface water is present for extended periods during the growing season, but is absent by the end of the growing season in most years. The water table after flooding ceases is very variable, extending from saturated to a water table well below the ground surface. Includes Cowardin's Seasonal, Seasonal-Saturated, and Seasonal-Well Drained modifiers.

Cattail Marsh – Seasonally Flooded (MLCCS Code 61510/ 3 Total Acres)

There was one cattail marsh documented with in Northfield throughout the inventory.

Cattail Marsh is an emergent marsh dominated by cattails (including *Typha angustifolia*, *T. latifolia*, and their hybrids). It occurs most commonly along lake margins and in shallow basins, although it is sometimes also present in river backwaters.

Lacustrine cattail marshes typically have a muck-bottom zone bordering the shoreline, where cattails are rooted in the bottom substrate, and a floating mat zone, where the roots do not contact the bottom but instead the plants grow suspended in a buoyant peaty mat. Associated species vary widely, but some of the most common ones are sedges of the genus *Carex* (*C. aquatilis*, *C. rostrata*, and *C. lanuginosa*), bulrushes

(*Scirpus americanus*, *S. acutus*, and *S. heterochaetus*), and broad-leaved herbs such as northern marsh fern (*Thelypteris palustris*), swamp milkweed (*Asclepias incarnata*), jewel-weed (*Impatiens capensis*), broad-



Cattail Marsh, Northfield

leaved arrowhead (*Sagittaria latifolia*), mad-dog skullcap (*Scutellaria lateriflora*), marsh skullcap (*Scutellaria galericulata*), and blue vervain (*Verbena hastata*).

Mixed Emergent Marsh (MLCCS Code 61520, 61620/ 7 Total Acres)

Two mixed emergent marshes were encountered in the city during the inventory. One was classified as being seasonally flooded and covered two acres, the other was listed as semi-permanently flooded, and covered slightly more than 5 acres.

Mixed emergent marsh is dominated by wetland species other than cattails. Bulrushes are the most common dominants, especially hard-stemmed bulrush (*Scirpus acutus*), river bulrush (*Scirpus fluviatilis*), softstem bulrush (*Scirpus validis*), *Scirpus americanus*, and *Scirpus heterochaetus*. Common reed grass (*Phragmites australis*), spike rushes (*Eleocharis* spp.), and (in some river backwaters) prairie cordgrass (*Spartina pectinata*) are less common dominants. In general, Mixed Emergent Marsh tends to occur on harder pond, lake, or river bottoms than Cattail Marsh and is less likely to contain the forbs that grow on the floating peat mats present in many cattail marshes. Broad-leaved arrowhead (*Sagittaria latifolia*) and aquatic macrophytes are the most common non-graminoid associates. Many Mixed Emergent Marsh species are sensitive to fertilizer run-off and other artificial disturbances, and disturbed Mixed Emergent Marshes (especially in the Prairie Zone) tend to convert to Cattail Marshes or become strongly dominated by reed canary grass (*Phalaris arundinacea*) or common reed grass (*Phragmites australis*), species that increase in abundance with disturbance.

Mixed Emergent Marsh is a broad community type, encompassing all marshes dominated by species other than cattails. Therefore, subtyping or recognition of new marsh types is likely following more thorough inventories of these marshes. New divisions most likely will be made according to dominant species or basin types (e.g., lacustrine versus riverine), or both. There are two geographic sections, a Forest Section and a Prairie Section. The dominant species in the Prairie Section tend to have a Great Plains distribution while those in the Forest Section tend to have a Great Lakes distribution.

Rich Fen Floating-Mat Subtype – Semipermanently Flooded (MLCCS Code 61650/ 6 Total Acres)

One rich fen was discovered during the inventory and is a floating-mat subtype.

Rich Fen occurs in the conifer-hardwood forest and deciduous forest-woodland zones. The groundlayer is dominated by wiregrass sedge (*Carex lasiocarpa*), brown sedge (*Carex buxbaumii*), livid sedge (*Carex livida*), *Calamagrostis neglecta*, or bog reed-grass (*Calamagrostis inexpansa*). Although generally open communities, Rich Fens may have



Rich Fen at Hauberg Woods Site

up to 70% cover of woody shrubs, especially bog birches, sage-leaved willows, and shrubby cinquefoils. Mosses range from scarce to abundant in the community. Where mosses are abundant, the dominant species are species other than *Sphagnum* spp.

Surface waters within the community are slightly acidic to circumneutral (pH 5.8 - 7.8) with moderate nutrient levels ($[Ca^{2+}] = 10-32$ mg/l). Rich Fen grades into Poor Fen but is distinguishable from Poor Fen by its higher species diversity and by the more frequent occurrence and greater abundance of minerotrophic indicator species, including livid sedge (*Carex livida*), brown sedge (*C. buxbaumii*), swamp lousewort (*Pedicularis lanceolata*), spike-rush (*Eleocharis compressa*), marsh muhly (*Muhlenbergia glomerata*), and Kalm's lobelia (*Lobelia kalmii*).

There are two geographic sections of Rich Fen, a Transition Section and a Boreal Section. In the Boreal Section, Rich Fen usually occurs on deep peat and contains characteristically northern species such as bog-rosemary (*Andromeda glaucophylla*) and other ericaceous shrubs, the bulrush *Scirpus hudsonianus*, and pitcher-plant (*Sarracenia purpurea*). In the Transition Section Rich Fen may be present on relatively shallow peat, or on very shallow, highly decomposed, low-buoyancy peat, or even on wet mineral soil. Floristically, Rich Fen in the Transition Section differs

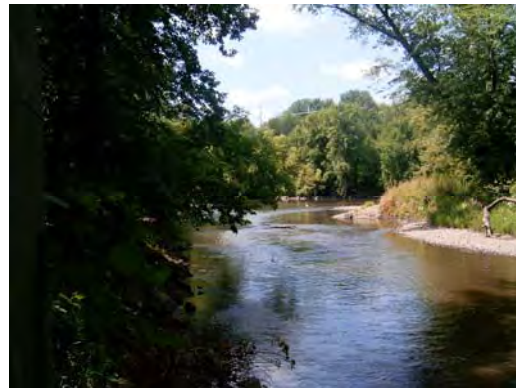
from Rich Fen in the Boreal Section mainly by containing prairie species, such as grass-leaved goldenrod (*Euthamia graminifolia*), Sartwell's sedge (*Carex sartwellii*), and wooly sedge (*C. lanuginosa*).

Water

91100 Slow moving linear open water habitat⁺

One slow moving linear open water habitat was identified during the survey in Northfield—the Cannon River.

This is described as a lower perennial riverine system. The gradient is low and water velocity is slow. The substrate consists mainly of mud and sand. Oxygen deficits may sometimes occur, the fauna is composed mostly of species that reach their maximum abundance in still water, and true planktonic organisms are common. The gradient is lower than that of the Upper Perennial System and the floodplain is well developed.



Cannon River

Palustrine Open Water (MLCCS Code 93300/ 49 Total Acres)

Twenty palustrine open water areas were found throughout the survey of Northfield.

Palustrine systems classified under this subclass include wetlands lacking vegetation and the following three characteristics; 1) areas less than 20 acres, 2) active wave-formed or bedrock shoreline features lacking, and 3) water depth in the deepest part of the basin is less than 6.6 feet at low water. Palustrine systems may be



Pond on the St Olaf Campus

adjacent to, or contain upland islands, vegetated palustrine wetlands, riverine systems, or lacustrine systems. If these areas are larger than one acre they are not to be included in this classification and should be classified individually under other Natural/Semi-Natural classes

Select Semi-Natural Communities

The following descriptions are for the most commonly encountered semi-natural community types within the city. For complete descriptions for all cover types, please refer to the MLCCS manual.

Altered/non-native deciduous forest (MLCCS Code 32170 / 209 Total Acres)

Thirty-four sites of altered/non-native deciduous forest were identified during the Northfield natural resource inventory. This upland deciduous forest type is not dominated by oaks, aspens, balsam poplars, paper birches, yellow birches, sugar maples, or basswoods. Boxelder, green ash, and cottonwood are typical canopy dominants, sometimes together and sometimes singly. Elms are common associates, and black walnut is a common component in the Northfield area forests. Hackberries, aspens, oaks, and basswoods may also be present. The shrub layer is often dominated by buckthorn and Tartarian honeysuckle, but gooseberries and elderberries can also be common. The ground layer is also dominated by species tolerant of disturbances, including white snakeroot, motherwort, and garlic mustard. Occasionally, when higher quality forests are nearby, the understory can be more diverse.

In the project area, a number of forest sites were assigned to this category because they did not fit into any of the native forest categories. Typically, these sites are dominated by green ash, boxelder, elm, and black walnut, often with natives such as oak and maple present in low numbers. Many of these sites appear to be former oak or maple-basswood communities which were logged historically, and have thus had the composition of the canopy altered, or sites which have had the species composition altered through past grazing and a change in the natural disturbance regime. These sites often still support a mix of native plant species, and generally provide good wildlife habitat. Many of the sites have moderate to very heavy levels of European buckthorn, however.

Medium-tall altered/non-native dominated grassland (MLCCS Code 61220/215 Total Acres)

Thirty six sites of non-native grassland were documented within the project area. This community type is generally <1m tall, with <10% tree cover and <50% shrub cover, and is dominated by non-native species, such as brome, Kentucky bluegrass, reed canary grass, and spotted knapweed. Native species may be present, but usually occur in low numbers and natives do not dominate the community. **62140** and **62220** are similar, but have sparse deciduous or mixed deciduous/coniferous trees also present.

V. Summary of Natural Resource Inventory Findings

Natural Areas of High and Moderate Quality, Concentration of Natural Areas, Rare Species, and Unique Features

Quality Natural Areas

A number of good quality sites were encountered during the field survey. Of special note is the high quality (AB Rank) rich fen found on the Hauberg Woods site. In addition to its high ecological quality, rich fen communities are uncommon to rare in southern Minnesota, and this site may have regional ecological significance in addition to its local value.



Limestone Cliffs along Heath Creek

Other identified quality natural areas include the floodplain forest communities along the Cannon River. With the exception of a three-quarters mile gap in downtown Northfield and along Highway 3, the floodplain forest and adjacent communities form a continuous corridor through the project area. Most of this community is mapped as moderate to good quality, and the portions in section 31 (north of downtown) and sections 1 and 2 have been mapped as sites of Biodiversity Significance by the Minnesota DNR.

The Heath Creek corridor also supports a number of moderate to good quality forest communities, including good quality mesic oak forest on the south side of the creek in section 34, floodplain forests on a shallow terrace above the stream in section 35, and some moderate and good quality maple-basswood forest communities in section 34. Other sites of note include a 40 acre stand of moderate to good quality maple-basswood forest in section 10, in the southwest corner of the project area, Hauberg woods, and the oak forest preserved as an open space park in section 12.

Finally, the prairie restorations and forested areas preserved on the campuses of St Olaf and Carleton are extremely valuable components of the local ecology. Not only are these managed areas frequently in good ecological condition and of large size, thus providing valuable habitat for local wildlife and potential refugia for uncommon species, they provide excellent examples of the benefits that can occur when disturbed areas are managed.

Concentration of Natural /Semi-natural Areas

A review of the inventory data for the area reveals that natural communities, as well as a number of semi-natural areas that provide connectivity between the natural communities, are primarily concentrated along the river and stream corridors. Key areas include:

- Cannon River corridor, both north and south of downtown
- Cannon River and Cowling Arboretum
- St Olaf campus forest communities, semi-natural areas and prairie restorations
- Forests and lowlands along Spring Brook
- Upland and lowland forest communities along the Heath Creek

Rare Species

Two rare species were encountered during the inventory. A red-shouldered hawk, listed as a Special Concern species in the state of Minnesota, was observed flying at Hauberg Woods, and a bald eagle was sighted just north of the St Olaf campus buildings. In addition, the MN DNR has records for the state Threatened ovate leaved skull cap (*Scutellaria ovata*) and the state Endangered narrow-leaved pinweed (*Lechea tenuifolia*) within the project area. There are also records for wood turtles, Blanding's turtles, and an assortment of state Threatened and Special Concerned mussels within the project area. Appendix A contains a complete listing of DNR records for the project area and vicinity.

The accompanying large map includes high and moderate quality natural areas, as well as sites where unique features were encountered during the inventory.

Unique Features

A number of unique features and items of interest were encountered during the inventory. Many are scenic in nature, where steep hills and woods overlook one of the creeks or the surrounding landscape and offer attractive views, such as in sections 10 and 2. Others, such as the sheer limestone cliff along Heath Creek in section 35 and the old beach ridges and meander scars along the Cannon River in section 1, are both scenic as well as providing evidence of prehistoric geologic activities. Another site, along Heath Creek in section 2, marks the location of an unusually large bur oak, with a diameter estimated at greater than 42", which provides evidence of the mature forests and open oak woodlands that were found in the area 100-150 years ago. High quality natural areas and rare resources, including the Rich Fen near Hauberg Woods and Spring Brook, the only trout stream in Rice County, are also mapped as unique features. Unique features are included on the large map that accompanies this report.

Wildlife Habitat

Habitat areas within the project area generally qualified as high quality habitat, with few sites of low or moderate quality. This is in part because the natural and semi-natural areas within the city tend to be concentrated along existing river or stream corridors rather than dispersed through the city. As a result, most sites tended to rate high for connectivity, variety of habitat types, and availability of food and water resources. Smaller, isolated communities tended to score poorly, but these sites were not common. The few isolated sites with a moderate to good ecological value also scored well.

Habitat areas are concentrated along the stream and river corridors, as well as in the remnant natural areas and restorations on the campuses of St. Olaf and Carleton College.

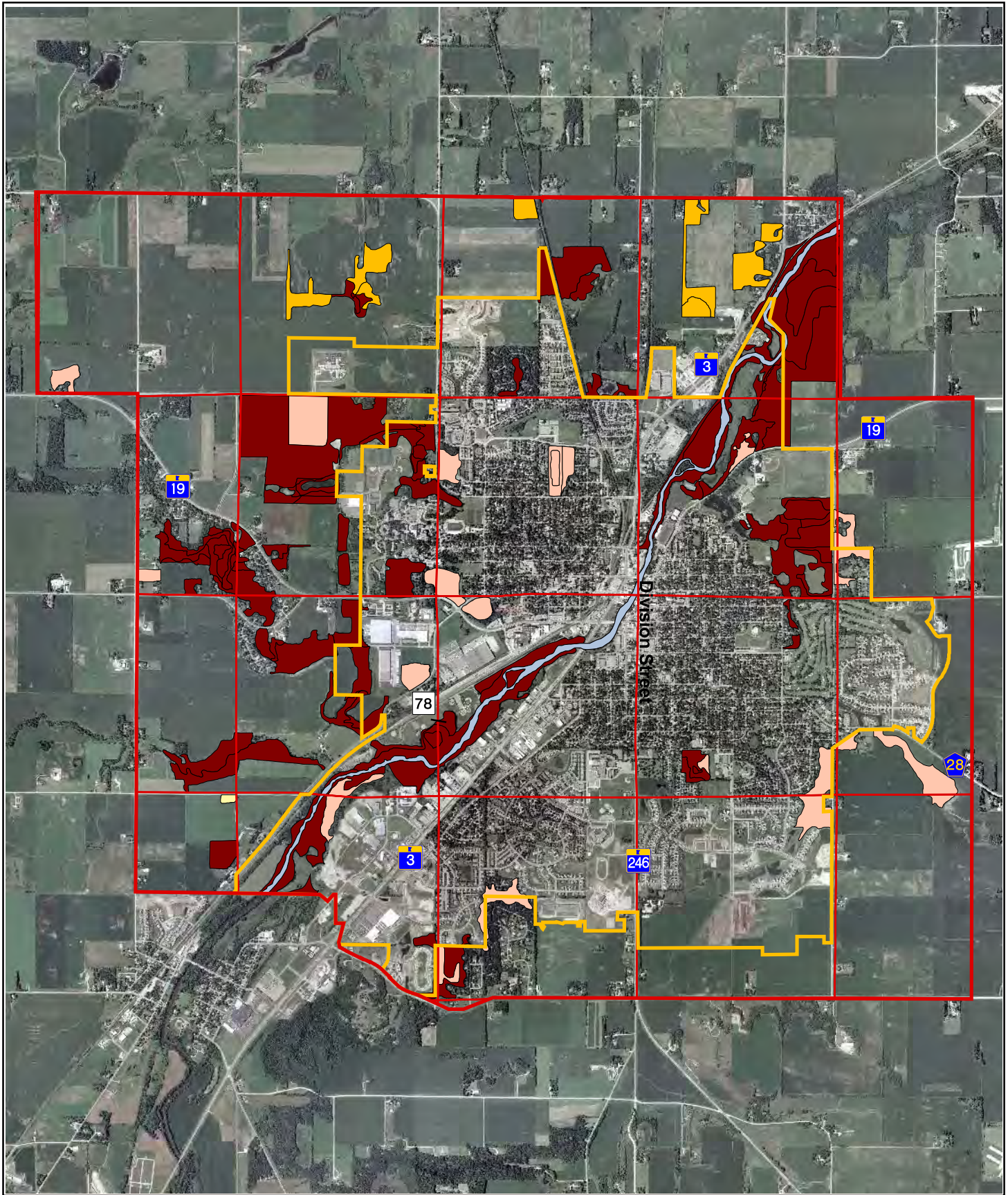
Bald eagles and ospreys both prefer to nest in trees, in wooded areas near water. While no nests were encountered during the survey, potential habitat exists for both species, particularly along the Cannon River. Protecting areas of continuous forest or woodland areas along the Cannon and other stream channels will ensure that nesting habitat remains available for these species. One Bald eagle was sighted during the survey, flying in the vicinity of a pond just north of the St. Olaf campus buildings. A map of high and medium wildlife habitat areas is shown in Figure 6 (page 51).

Stream Assessment

The streams and rivers flowing through the City of Northfield are generally in good shape, though signs of current and past stress are apparent. Past stresses from agricultural activities have disturbed stream channels from their stable configurations. Other channels are beginning to show the stress of new upstream developments disturbing an equilibrium that has been previously established.

In general, stream channels without development occurring in the watershed appear stable. Streams in watershed where development activity is actively occurring are beginning to show signs that more stormwater controls may be required.

The areas inventoried are shown on the large wall map that accompanies this report.



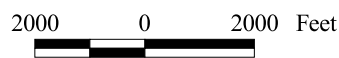
Northfield Natural Resources Inventory: Wildlife Habitat Value

Fig. 6



- Project Boundary
- 2005 Municipal Boundary

- Wildlife Habitat Value
- High
 - Medium
 - Medium Low
 - Low



VI. Natural Resource Inventory and Stream Assessment Site Descriptions

In the following sections, the Site number refers to a specific assessment area for which field data was collected. Refer to the accompanying large maps for site locations.

Watershed Descriptions

Mud Creek Watershed

Communities with field data recorded for this watershed:

Site number	Community Type	Quality
26-1	Altered/non-native forest	Not Ranked
27-1	Mesic Oak Forest	Good

Semi-natural community types present include reed-canary grass dominated wetlands and altered/non-native forest and woodland communities.

Number of natural and semi-natural communities: 16

Acres of natural and semi-natural communities: 86

Smallest natural or semi-natural community mapped: 1 acre

Largest natural or semi-natural community mapped: 18 acres

The Mud Creek Watershed lies partially within the northwest corner of the project area, on gently rolling terrain. Within the project area, most of the land is agricultural and used for row crop and hay. There is a small stand of good quality oak forest in the SE corner of section 27, on a farmstead/home site adjacent to Highway 19. Other natural and semi-natural communities are in the north half of section 26, where there is a complex of approximately 40 acres of disturbed forest and wetland communities. These areas show significant impact from past land use activities including grazing and contain dense populations of European buckthorn, but provide valuable areas of open space and wildlife habitat in this otherwise agricultural region.

Although the natural and semi natural areas in this watershed are somewhat isolated, there may be opportunities to develop corridor connections to some of the resource areas to the south, along Heath Creek and the Cannon River.

Heath Creek Watershed

Communities with field data recorded for this watershed:

Site number	Community Type	Quality
2-2	oak woodland brushland	Low
2-3	Floodplain Forest	Moderate
2-7	Maple-Basswood Forest	Moderate
34-1	Mesic Oak Forest	Good
34-2	Mesic Oak Forest	Good
35-4	Planted Prairie	Not ranked
35-6	Mesic Oak Forest	Good

Semi-natural community types present include non-native dominated grasslands (with and without trees), non-native/altered woodlands, non-native/altered forests, and reed canary grass dominated wetland communities.

Number of natural and semi-natural communities: 42

Acres of natural and semi-natural communities: 400

Smallest natural or semi-natural area mapped: 1 acre

Largest natural or semi-natural area mapped: 123 acres

Much of the Heath Creek Watershed lies on a rolling, hilly landscape in the west-central portion of the project area. Within the project area, this watershed contains more natural and semi-natural communities than any of the watersheds except for the Cannon River. It is also home to several of the unique features identified during the field survey. Natural communities are concentrated along the stream corridor and associated ravine, and include quality native oak and maple-basswood forest remnants as well as altered/non-native communities. Additional sites occur on the St Olaf campus, where there are good quality maple basswood forest sites as well as prairie, woodland, and wetland restorations, and near the industrial park.

This watershed also contains a number of attractive vistas, due in part to the hilly landscape providing scenic overlooks over the creek as well as of the surrounding land.

The stream inventory found the stream channel stable, with some instability in the banks where shoreline vegetation is lacking,

Spring Brook Watershed

No remnant natural community types were mapped in the Spring Brook watershed.

Semi-natural community types present include non-native dominated grasslands and altered forests, include wetland forest communities.

Number of natural and semi-natural communities: 4

Acres of natural and semi-natural communities: 62

Smallest natural or semi-natural area mapped: 3.3 acres

Largest natural or semi-natural area mapped: 32 acres

Spring Brook Watershed, in the southwest portion of the project area, is the smallest watershed in the project. The landscape is gently rolling, and the stream valley is not as deeply incised as that of Heath Creek. With the exception of the woods and wetland communities along Spring Brook and a few farmsteads, land within the watershed in the project boundary is agricultural—either row crops or pastureland. Non-agricultural land along the stream corridor consists primarily of green ash and boxelder over dense brush, and these densely vegetated areas provide a valuable buffer for the trout stream.

The stream channel was not assessed during the stream assessment, as an aerial photo review found no signs of channeling or other alteration (see Stream Assessment Methodology on pg. 15).

Spring Brook stands out as a unique resource within the project area, due to its designation as a DNR Trout Stream. Spring Brook is the most sensitive of the stream resources within the city, and has special protections that prevent any alteration to the quantity, quality, or

temperature of the waters discharging into the creek. Additional local protection for the watershed may be appropriate as well.

Spring Creek Watershed

Communities with field data recorded for this watershed:

Site number	Community Type	Quality
6-1	Lowland Hardwood Forest	Low
31-3	Altered/non-native forest	Not ranked
32-1	Mesic Oak Forest	Low

Semi-natural community types present include numerous non-native dominated grasslands (with and without trees), non-native/altered forests, and reed canary grass dominated wetland communities. In addition, there are a number of open water areas.

Number of natural and semi-natural communities: 26

Acres of natural and semi-natural communities: 226

Smallest natural or semi-natural area mapped: 1.8

Largest natural or semi-natural area mapped: 27

Spring Creek watershed, in the southeast portion of the project area, contains a mix of urban, agricultural, residential, and natural environments. It covers more area in the project than any of the other watersheds except the Cannon River Watershed. Natural and semi-natural communities are concentrated along Spring Creek and some of the tributary streams, as well as on the arboretum at Carleton College. This watershed also contains a number of parks and open spaces. These are primarily along the stream, and include the golf course at the east side of town. Numerous ponds are also present. These are primarily excavated ponds on the Carleton campus, on the golf course, and in the developments along Jefferson Parkway, south of town.

Three stream sites were visited during the stream assessment. Overall, these indicate that the stream is undergoing some changes as the watershed develops, and periodic monitoring would be appropriate to determine stream stability as development occurs.

Cannon River Watershed

Communities with field data recorded for this watershed:

Site number	Community Type	Quality
1-1	Altered/non-native deciduous forest	NA
2-1	Maple-basswood forest	B
2-4	Floodplain forest	B
2-4	Floodplain forest	B
2-4	Floodplain forest	B
2-4	Floodplain forest	B
2-5	Mixed hardwood swamp	B
2-5	Mixed hardwood swamp	B
2-6	Mixed hardwood swamp	C
10-1	Maple-basswood forest	B
10-2	Maple-basswood forest	C
12-1	Oak forest	C
25-1	Oak forest mesic subtype	D
25-2	Oak forest mesic subtype	C
25-2	Oak forest mesic subtype	C
25-3	Rich fen floating-mat subtype - semipermanently flooded	A
30-1	Floodplain forest	C
30-2	Oak woodland-brushland	C
30-3	Lowland hardwood forest	C
31-1	Oak woodland-brushland	C
31-4	Floodplain forest	B
31-5	Floodplain forest	B
35-1	Oak forest mesic subtype	B
35-5	Oak forest	B

Semi-natural community types present include numerous non-native dominated grasslands (with and without trees), non-native/altered forests, and reed canary grass dominated wetland communities.

Number of natural and semi-natural communities: 26

Acres of natural and semi-natural communities: 226

Smallest natural or semi-natural area mapped: 1.8

Largest natural or semi-natural area mapped: 27

The Cannon River Watershed runs through the center of the City and project area from the southwest to the northeast, and covers more area within the project than any of the other watersheds. This watershed includes downtown Northfield and most of the developed land within the City. Agricultural land is common around the hospital, and in the northwestern segment of the watershed. Open space, semi-natural areas, and natural communities occur along the Cannon River banks and floodplain, as well as on the campus of St. Olaf College. Some of the key natural resource features of this watershed include the high quality Rich Fen community at Hauberg Woods Park and the associated oak forest, as well as the good quality floodplain forest along the Cannon River. Of special note are the prairie and savanna/woodland restorations at Carleton College, which provide significant habitat value.

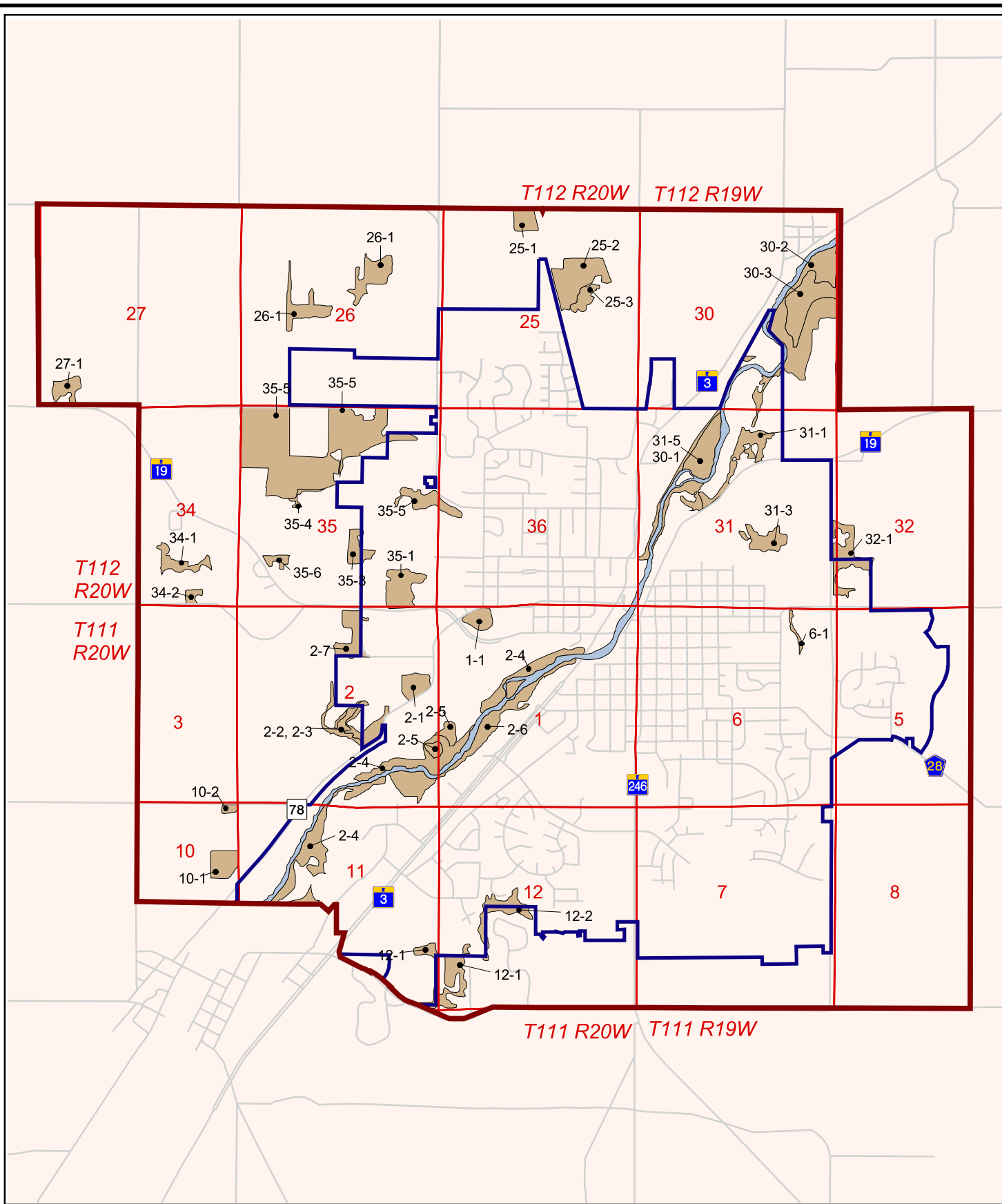
This watershed also provides some scenic views and other unique features, ranging from the historic mill in downtown Northfield to a complex of beach ridges and meander scars along the Cannon near Lions Park.

The stream inventory found no significant problems for the area surveyed.

The Cannon is a state-designated Wild and Scenic River.

Natural Community Site Descriptions

The following descriptions are primarily for remnant natural communities within the city. Descriptions for a few altered/non-native communities and planted prairie restorations that were also site-visited are also included. For site locations, refer to Figure 7 (page 58). A key to the descriptions is provided on the page 59. For a summary of sites, locations, community type, quality, and acreages see Appendix B



Northfield Natural Resources Inventory: Project Location Map

Fig. 7



- Project Boundary
- 2005 Municipal Boundary
- Sections
- Trails

- Parks
- Cannon River
- Roads
- Natural Communities



2000 0 2000 Feet



September 2005
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Key to Site Descriptions

Section Number
(communities may extend into adjacent sections)

Community ID Number.

Site Number

General site location. see large plotted map for exact location

Community: 1-1

Township, Range, Section, ¼ section: T111N R20W S1, NW 1/4

Watershed: Cannon River

Community Type: Altered/non-native deciduous forest

Qualitative Rank: NA - Native species present in a non-native dominated community

Field Check Level: Visited part of the site

Restoration Potential:

MCBS Site: Biodiversity Significant: Threatened / Endangered

Community Description:
Woods at Odd Fellows Park. This young woods supports a canopy dominated by green ash, basswood, & some black walnut, all with diameters ranging from 3-6" over a patchy understory of boxelder & hackberry. 5-8' tall elderberry covers 80% of the shrub layer. Prickly gooseberry is also present. Native species characteristic of mesic forests dominate the ground layer. Species encountered include Sprengel's sedge, some wild ginger, False Solomon's seal, & charming sedge. A few very large, well-rotted oak stumps are also present.

Based on standards defined by MLCCS manual vers. 5.4, and as described on page 12 of report.

Description of Community type (Cover Type)

Describes whether the MN DNR has mapped site as a good quality area (MCBS), a site of state-wide biodiversity significance, or whether the site has known occurrences of state or federally listed Threatened or Endangered Species.

SITE DESCRIPTIONS

Community: 1-1

Township, Range, Section, ¼ Section: T111N R20W S1, NW 1/4

Watershed: Cannon River

Community Type: Altered/non-native deciduous forest

Qualitative Rank: NA - Native species present in an altered/ non-native Community

Field Check Level: Visited part of the site

MCBS Site: **Biodiversity Significant:** **Threatened / Endangered**

Community Description:

Woods at Odd Fellows Park. This young woods supports a canopy dominated by green ash, basswood, & some black walnut, all with diameters ranging from 3-6" over a patchy understory of boxelder & hackberry. 5-8' tall elderberry covers 80% of the shrub layer. Prickly gooseberry is also present. Native species characteristic of mesic forests dominate the ground layer. Species encountered include Sprengel's sedge, some wild ginger, False Solomon's seal, & charming sedge. A few very large, well-rotted oak stumps are also present. Stand age is estimated at 30-40 years & is quite typical of the disturbed forests encountered in the area.

Community: 2-1
Township, Range, Section, ¼ Section: T111N R20W S2, NE 1/4
Watershed: Cannon River
Community Type: Maple-basswood forest
Qualitative Rank: BC - Good quality natural community
Field Check Level: Visited the entire site
MCBS Site: Biodiversity Significant: Threatened / Endangered

Community Description:

Good quality maple-basswood forest on level terrain, along the north side of Dundas Ave/Co Rd 78.. Stand maturation phase. Canopy dominated by uniform cover of 8-15" sugar maple w/ some Red oak, yellow bud hickory & hackberry present. Understory & subcanopy layers sparse to absent, as is the shrub layer. This lack of structural layer suggests a grazing history at the site. The ground layer ranges from extensive patches of Jack in the pulpit & enchanters nightshade, to nearly bare. Leaf litter, fine twigs, & fallen logs carpet the area.

Quality will continue to improve as the site matures. Spring visit recommended to better evaluate ground layer. BC rank.

Community: 2-2
Township, Range, Section, ¼ Section: T111N R20W S2, SE 1/4
Watershed: Heath Creek
Community Type: Oak woodland-brushland
Qualitative Rank: D - Poor condition natural community
Additional: Overgrown woodland
Field Check Level: Checked part of the site
MCBS Site: Biodiversity Significant: Threatened / Endangered

Community Description:

Heavily overgrown oak woodland along Dundas Ave/Co Rd 78, on St Olaf

property, near the intersection of Heath Creek and Co Rd 78. . . Open canopy of large, open grown oaks over dense secondary growth of mesic hardwoods. European buckthorn forms a very dense shrub layer between 2-8' tall. Ground layer sparse due to very heavy shade. Enchanters nightshade & bedstraw/cleavers are common. Vertical structure & species composition suggests a grazing history for the site.

Low quality due to extreme buckthorn levels & low diversity, but the framework is present for restoration to an oak savanna or woodland, due to the presence of some attractive mature oaks.

Community: 2-3
Township, Range, Section, ¼ Section: T111N R20W S2, SW 1/4
Watershed: Heath Creek
Community Type: Floodplain forest
Qualitative Rank: C - Moderate condition natural community
Field Check Level: Visited part of the site
MCBS Site: Biodiversity Significant: Threatened / Endangered

Community Description:

Floodplain forest on broad terrace above Heath Creek, just north of intersection between Heath Creek and Co Rd 78. Young canopy dominated by 3-5" diameter sugar maple with occasional basswood, hackberry, & quaking aspen. A few larger diameter (24" +) maple present as well, these w/ broad spreading crowns suggesting that they grew in an open site historically. Shrub cover includes a nearly continuous layer of young, 1-2' tall buckthorn & prickly gooseberry. Ground cover is sparse. Young mesic hardwood seedlings dominate, with some native forbs also present.

Forest cover is interspersed with clearings dominated by reed canary grass & scattered trees.

Community: 2-4
Township, Range, Section, ¼ Section: T111N R20W S2, SE 1/4

Watershed: Cannon River
Community Type: Floodplain forest silver maple subtype
Qualitative Rank: B - Good quality natural community
Field Check Level: Visited part of the site
MCBS Site: X Biodiversity Significant: Threatened / Endangered

Community Description:

Good quality floodplain forest along the banks of the Cannon River, north of the confluence of Heath Creek and the Cannon River.. Landform varies, from low, level terraces and scattered shallow basins, to areas composed of alternating high ground formed by old beach ridges & long narrow wetland basins in old meander scars.

Canopy cover varies. Drier ridges have a more closed canopy typically dominated by silver maple, boxelder, & occasional sugar maple, over a dense layer of wood nettle. Terrace areas support a more open (40- 60% cover) canopy dominated by a mixed size class of multiple-stemmed trees, primarily silver maple & occasional green ash. Ground layer in these areas is dominated by Virginia wild rye, reed canary grass, with Jewel-weed, wild cucumber, nettle, & clearweed also common. The multiple trunks of canopy trees, rows of driftwood on the upstream side of trees, & open understory & shrub layers clearly indicate regular flooding.

Low areas in meander scars appear to be seasonally flooded. At the time of survey, these areas were typically dominated by dried exposed mud and patches of annual wetland vegetation.

Overall, a moderate to good quality site, with natural processes intact. Excellent wildlife value, with a nice assortment of cover available, large habitat area, & easy access to water.

Community: 2-5
Township, Range, Section, ¼ Section: T111N R20W S1, NW 1/4
Watershed: Cannon River
Community Type: Mixed hardwood swamp

Qualitative Rank: B - Good quality natural community

Field Check Level: Visited the entire site

MCBS Site: **Biodiversity Significant:** **Threatened / Endangered**

Community Description:

Site is a mosaic of mixed hardwood swamp on slightly elevated areas, & seasonally flooded mixed emergent marsh in lower areas that are too wet for trees. Swamp areas tend to be dominated by a mix of silver maple, cottonwood, & some black ash, generally of small diameter. Subcanopy, understory & shrub layers grade together. Ground cover is variable, w/ patches of sedge, moneywort, clearweed, & marsh skullcap on hummocks & other areas of high ground & patches of exposed peaty soil in low areas. Marsh areas were exposed & dry at time of survey, & in areas had been colonized by annual wetland species such as nut sedges and pepperweed. Water plantains & arrowhead were also noted. Nice quality site subject to seasonal inundation during spring flood, followed by gradual drying during the course of the summer.

Excellent wildlife value. A variety of herpefauna noted, as well as a variety of songbird habitats.

Community: 2-6

Township, Range, Section, ¼ Section: T111N R20W S2, SE 1/4

Watershed: Cannon River

Community Type: Mixed hardwood swamp

Qualitative Rank: C - Moderate condition natural community

Field Check Level: Visited part of the site

Restoration Potential:

MCBS Site: **Biodiversity Significant:** **Threatened / Endangered**

Community Description:

Mixed Hardwood Swamp between the Cannon River and Lions Park picnic area. . Open to patchy canopy of 4-5" dbh peach-leaved willow,

boxelder, & silver maple, over shrubby thickets of down trees & red osier dogwood. Ground layer hummocky & uneven . Reed canary grass, Virginia wild rye, & Jewelweed are common. Overall, of moderate quality.

Community: 2-7
Township, Range, Section, ¼ Section: T111N R20W S1, NW 1/4
Watershed: Heath Creek
Community Type: Maple-basswood forest
Qualitative Rank: C - Moderate condition natural community
Field Check Level: Visited part of the site
MCBS Site: **Biodiversity Significant:** **Threatened / Endangered**

Community Description:

Moderate quality Maple Basswood/ Big woods forest on steeply rolling terrain, just west of Industrial Drive and south of Hwy 19. Canopy is composed of widely spaced, large (28" dbh) semi-open grown sugar maples & occasional red oak, over an understory & subcanopy with abundant 1-4" sugar maple. Shrub layer cover 50-80%. Dominant species include numerous young maple, as well as bitternut hickory, hackberry, a few elm, & scattered prickly gooseberry. Ground cover is sparse; a spring follow, up visit is recommended to evaluate presences absence of characteristic spring wildflowers.

Past grazing is evident in the vertical structure & size class of the trees, but site remains in moderate to good condition, & it will continue to improve w/ time as the subcanopy/canopy matures.

Wildlife value is moderate.

Community: 2-8
Township, Range, Section, ¼ Section: T111N R20W S2, NW 1/4
Watershed: Heath Creek
Community Type: Maple-basswood forest

Qualitative Rank: D - Poor condition natural community

Additional Stand initiation phase

Field Check Level: Visited part of the site

MCBS Site: **Biodiversity Significant:** **Threatened / Endangered**

Community Description:

Stand of early successional mesic forest on terrace above Heath Creek, immediately south of 90th Street SE.. Canopy consists of scattered 3-6" ash & basswood over dense secondary growth of mostly sugar maple. The site also supports at least one strikingly large bur oak, with an estimated dbh > 42", and a full crown. Specimen has a form indicating that it was forest grown, rather than open grown, which is unusual in such a large tree. Other items of note include some giant puffball.

Community: 6-1

Township, Range, Section, ¼ Section: T111N R19W S6, NE 1/4

Watershed: Spring Creek

Community Type: Lowland hardwood forest

Qualitative Rank: D - Poor condition natural community

Additional Stream(s) present

Field Check Level: Visited the entire site

MCBS Site: **Biodiversity Significant:** **Threatened / Endangered**

Community Description:

Intermediate between lowland hardwood & disturbed forest community, on sloping terrace above stream. Open Canopy composed of large basswood & cottonwood over a dense subcanopy /understory layer dominated by boxelder, w/ green ash, ironwood, & occasional silver maple. Shrub cover dense & brushy, w/ much buckthorn. Ground layer strongly dominated by disturbance adapted spp., including common blue violet, Creeping Charlie, & enchanters nightshade.

Rank reduced due to high buckthorn levels.

Community: 10-1
Township, Range, Section, ¼ Section: T111N R20W S10, NE 1/4
Watershed: Cannon River
Community Type: Maple-basswood forest
Qualitative Rank: B - Good quality natural community
Field Check Level: Visited the entire site
MCBS Site: **Biodiversity Significant:** **Threatened /**
Endangered

Community Description:

Moderate to good quality maple- basswood forest on hill, just west of Dundas Blvd/So Rd 78. . Canopy cover is 70-85% & dominated by mixed size/ age class sugar maple, with red oak and bitternut hickory also present. There are numerous canopy gaps where ageing trees have died; the remaining trees all have narrow crowns & relatively straight trunks, indicating that the site has been forested for many years (vs. having been more open historically.)

Subcanopy & understory layers are quite sparse-this lends an open, spacious feel to the site. Shrub cover varies. Some areas, especially below canopy gaps, support dense dumps of common elder & young maple & hickory. In other areas the shrub layer is nearly absent. Ground cover is nearly continuous, though of apparently low diversity-this may be due to the timing of the survey, (late summer) a due to the dense layer of 3-4' tall wood nettle that carpets portions of the site & restricts the view of the ground layer.

Woody debris of all size classes is present.

Wildlife value is moderate. Valuable due to size of site & the lack of other habitat in the vicinity, but the isolation of the site & lack of good water source also restrict the wildlife value. Squirrels (gray), various songbirds, & a mix of spiders & other insects noted.

Piles of field stones & an old dump are present along w/ NW side. Site

may have been grazed at some point, causing structural layers to be absent, but the shade created by the canopy & dense nettles may have also restricted development. Tree inventory recently completed for site, and site appears targeted for development.

Rolling terrain allows for some attractive views through the woods to the surrounding terrain, and the site would make an valuable and attractive open-space reserve adjacent to adjoining development.

Community: 10-2
Township, Range, Section, ¼ Section: T111N R20W S10, NW 1/4
Watershed: Cannon River
Community Type: Maple-basswood forest
Qualitative Rank: C - Moderate condition natural community
Field Check Level: Visited part of the site
MCBS Site: **Biodiversity Significant:** **Threatened / Endangered**

Community Description:

Still is a small stand of formerly grazed maple-basswood forest along the south side of 100th St E. Community is of low to moderate quality- characterized by a patchy canopy of sugar maple, green ash, & basswood, over a sparse subcanopy & understory. Shrub layer is somewhat variable, but generally brushy & thick w/ clumps of elder, some buckthorn, & young maple. Ground layer is dominated by natives that tend to increase in grazed areas such as wood nettle & enchanter's nightshade.

Community: 12-1
Township, Range, Section, ¼ Section: T111N R20W S12, SW 1/4
Watershed: Spring Creek and Cannon River
Community Type: Oak forest
Qualitative Rank: C - Moderate condition natural community

Field Check Level: Visited part of the site

MCBS Site: Biodiversity Significant: Threatened / Endangered

Community Description:

Moderate quality oak forest on sloping terrain, bordered approximately by 110th St E along the south side, and Farrel Ave along the east. Patchy canopy dominated by moderate sized (14-20" dbh) red oak, over a subcanopy/ understory dominated by mesic hardwoods. Shrub layer is sparse lending an open, somewhat spacious feel to the site. Pennsylvania sedge forms a nearly continuous ground layer, w/ scattered native forbs such as sweet cicely also present.

Site appears to have been much more open historically, as many of the canopy trees have branch scars where large lower branches have been shed, suggesting a more open grown form in the past.

Community: 12-2

Township, Range, Section, ¼ Section: T111N R20W S12, SW ¼

Watershed: Spring Creek and Cannon River

Community Type: Oak forest mesic subtype

Qualitative Rank: B - Good quality natural community

Additional Trail corridor

Field Check Level: Visited part of the site

MCBS Site: Biodiversity Significant: Threatened / Endangered

Community Description:

Moderate to good quality oak forest on sloping terrain between 1st Timberlane Drive and Adams Street. . Canopy cover approx. 75% and dominated by a mix of red & bur oak, and a few sugar maple. Subcanopy & understory not clearly distinct, dominated by young mesic hardwoods including hackberry, ironwood & sugar maple. Shrub cover varies. In areas, it is quite sparse & open, allowing a clear line of site through the woods. Elsewhere, dense elderberry, chokecherry, & prickly gooseberry limit the view. Wood nettle forms a carpet across the ground layer. Native

species characteristic of the community type, including red baneberry, blue cohosh, enchanter's nightshade & others are also present. Woody debris ranging from partially rotted legs to faller branches & twigs is common. Footpaths cross through the site.

Good wildlife value-variety of birds heard, Oaks provide good foods & nesting cover

Community: 25-1
Township, Range, Section, ¼ Section: T112N R20W S25, NW 1/4
Watershed: Cannon River
Community Type: Oak forest mesic subtype
Qualitative Rank: D - Poor condition natural community
Field Check Level: Visited part of the site
MCBS Site: Biodiversity Significant: Threatened / Endangered

Community Description:

Stand of mesic forest along RR tracks and 320th Street W, N of Hauberg woods on mostly level terrain. Canopy dominated by medium size (12-15" dbh) mesic hardwoods including green ash, hackberry, & some black walnut. Subcanopy & understory of patchy cover & also dominated by mesic hardwoods. Shrub layer is tangled & thick, w/ abundant European buckthorn, common elder, & prickly gooseberry.

The ground layer is relatively diverse, w/ a number of species typical of mesic forest communities including blue cohosh, red baneberry, rue anemone, & others. Species that tend to increase in grazed areas, including enchanter's nightshades and big-leaved avens, are also common. Down branches & logs crisscross the site.

Quality rank is reduced by the high levels of buckthorn, but there is good potential for site to improve if buckthorn is managed.

Community: 25-2
Township, Range, Section, ¼ Section: T112N R20W S25, N ½
Watershed: Cannon River
Community Type: Mesic Oak Forest
Qualitative Rank: C
Field Check Level: Visited all of the site
MCBS Site: **Biodiversity Significant:** **Threatened /**
Endangered Species: Red –Shouldered Hawk

Oak forest at Hauberg Woods. The forest occurs on a gently rolling landscape here and has a canopy that is relatively uniform in character across the site. The most common species of mature trees in this forest are bur and pin oak. These are generally widely spaced, average about 18-24+ inches in diameter, and exhibit signs of regrowth/resprouting after disturbance, including multiple stems. Other large trees include more widely scattered elm, hackberry, boxelder and others.

There is abundant, thick, and relatively even-aged second growth between the more mature trees mentioned above. The most common species encountered here include bitternut hickory, elm, boxelder, and ash. By far the most common second growth tree is the bitternut hickory. These second growth trees are estimated to generally average about 6-12 inches in diameter.

The shrub layer is moderately thick to somewhat sparse and dominated by the nonnative European buckthorn, which occurs in moderately dense to dense stands of mature shrubs, some exceeding eight to ten inches in diameter. Other frequently encountered species in the shrub and subcanopy layer include chokecherry, common elder, nonnative honeysuckle (*Lonicera cf. tatarica* and *L. cf. mackii*). The European buckthorn here is recognized as a significant impact on the quality of the forest and to help understand the location and density.

The ground layer includes a moderately diverse mix of grasses, sedges and forbs characteristic for this type of forest. Some of the forbs seen frequently include wild geranium, wood nettle, jack-in-the-pulpit, Canada

mayflower, toothwort, nodding trillium, pyrola, blue cohosh, wild leek and others. Commonly encountered sedges include Sprengell's sedge, graceful sedge, Pennsylvania sedge, plus several others.

There is abundant evidence of wildlife, including deer, squirrels, and a nice complement of songbirds observed by sight and/or song. Some of the more common bird species encountered include white-crowned sparrow, black-capped chickadee, house wren, rose-breasted grosbeak, wild turkey, ringneck pheasant, cardinal, catbird and blue jay.

One significant species of bird noted here was a nesting pair of red-shouldered hawks, a species of Special Concern in Minnesota. The MN DNR defines Special Concern species as "a species that is extremely uncommon in Minnesota, or has unique or highly specific habitat requirements and deserves careful monitoring of its status". This medium-sized hawk prefers nesting in larger tracts of low forest. They have enjoyed a modest comeback in recent years. They have some interesting and distinct features that make them readily identifiable in the field, including extensive barring (thick striping) of colors, a reddish color on some underparts, and a light patch or "window" at the base of the primary flight feathers (outer wing tips).

Conditions present at the site (as well as review of the historic air photos below) indicate that this forest was likely more open in the past, and also likely grazed. In addition, the area was partially logged at some point, perhaps 60-75 years ago. There are unimproved hiking trails in forest segments on either side of the rail line. Overall, the quality of the forest is moderate to good with a good chance for additional improvement with some active management.

Community: 25-3
Township, Range, Section, ¼ Section: T112N R20W S25, NE 1/4
Watershed: Cannon River
Community Type: Rich fen floating-mat subtype – semi-permanently flooded
Qualitative Rank: AB
Field Check Level: Visited all of the site

**MCBS Site: Biodiversity Significant: Threatened /
Endangered**

Rich Fen community at Hauberg Woods. This shallow wetland basin covers a substantial portion of the south side of the park. The fringe of the wetland has a substantial amount of the nonnative reed canary grass, with lesser amount of native sedge, forbs, and grasses (see description below for MLCCS Code community 61530). Further toward the center of the basin, the quality improves dramatically. Here, a remarkably rich collection of native species are encountered on a floating mat. Some of the more frequently encountered graminoid species here include retrorse sedge, lakebank sedge, Canada rush, wiregrass sedge, woolly sedge, broadleaf cattail, three-way sedge, and bluejoint grass. Forbs encountered here include water dock, arrowhead, water parsnip, tufted loosestrife, bulblet water hemlock, Virginia bugleweed and others. No significant cover of mosses was encountered here.

Although there is no readily apparent drainage infrastructure in this wetland, conversations with Mrs. Hauberg indicate that a ditch was created some time after 1950 just to the east of this wetland to help improve the ability to grow corn in the adjacent crop field.

Overall, this fen is in good to excellent condition despite being surrounded by the nonnative reed canary grass on its perimeter. Additionally, rich fens are uncommon to rare in southern Minnesota, making this wetland significant for not only Northfield, but perhaps in this region of the state as well.

Community:	26-1
Township, Range, Section, ¼ Section:	T111N R20W S26, NE ¼ & SW 1/4
Watershed:	Mud Creek
Community Type:	Altered/non-native deciduous forest
Qualitative Rank:	NA - Native species present in an altered/ non-native Community type

Field Check Level: Visited part of the site

**MCBS Site: Biodiversity Significant: Threatened /
Endangered**

Community Description:

Altered disturbed forest remnants located in the center of section 26, between 320th St W on the north and 80th Street E on the south. Both areas appear grazed &/or logged historically. Open canopy of medium diameter ash and occasional boxelder. Subcanopy & understory dominated by abundant European buckthorn & occasional young ash or basswood. Ground layer of green ash seedlings, young buckthorn, & a few disturbance-tolerant native species such as Jack in the pulpit & enchanters nightshade.

Size of some of the ash suggest the site may have been mesic forest historically, but area is highly altered.

Management would require significant buckthorn control.

Moderate wildlife value. Various birds heard calling.

Community: 27-1

Township, Range, Section, ¼ Section: T112N R20W S27, SW 1/4

Watershed: Mud Creek

Community Type: Maple-Basswood Forest

Qualitative Rank: B - Good quality natural community

Field Check Level: Visited part of the site

**MCBS Site: Biodiversity Significant: Threatened /
Endangered**

Community Description:

Nice quality Big Woods woodlot adjacent to farmstead, just north of Highway 19. Canopy is somewhat open and patchy & composed of a mix of mature maple, red oak, & green ash w/ tall straight trunks & narrow crowns characteristic of forest-grown trees. Subcanopy, understory, & tall shrub layers grade together, & are dominated by abundant young sugar maple & occasional red oak, especially in the subcanopy. The shrub layer

of young maple trees creates dense shade w/in the site, & ground cover is correspondingly sparse. Ground layer species present include characteristic mesic forest forbs including bloodroot, false Solomons seal, & Jack-in-the-pulpit. Woody debris in all size classes is abundant.

Some past grazing evident in the sub canopy & sparse subcanopy. Age of understory suggests grazing ceased 15-20 years ago.

Overall, moderate to good quality site, which will improve over time. Spring visit recommended for better evaluation of ground layer.

Wetlands (low forest of boxelder & wood nettle) are present on NW corner.

Community: 30-1
Township, Range, Section, ¼ Section: T112N R19W S30 & 31, SW ¼ and NW 1/4
Watershed: Cannon River
Community Type: Floodplain forest
Qualitative Rank: C - Moderate condition natural community
Field Check Level: Visited part of the site
MCBS Site: **Biodiversity Significant:** **Threatened / Endangered**

Community Description:

Strip of borderline Floodplain Forest/ disturbed forest between Cannon River & RR tracks, north of downtown Northfield. Canopy tall, dominated by cottonwood & Silver maple over younger green ash, boxelder & elm. Shrub layer patchy & dominated by European buckthorn. Ground layer sparse to absent, w/ patches of creeping Charlie, Buckthorn seedlings, & much fine woody debris. Site is a patchwork of wooded areas as described above, bushy thickets of young trees, & small patches of wet meadow.

Restoration Comments:

Floods only occasionally. Buckthorn control recommended.

Community: 30-2
Township, Range, Section, ¼ Section: T112N R19W S30, E 1/2
Watershed: Cannon River
Community Type: Oak woodland-brushland
Qualitative Rank: C - Moderate condition natural community
Additional Undefined vegetation management
Field Check Level: Visited part of the site
Restoration Potential:
MCBS Site: Biodiversity Significant: Threatened / Endangered

Community Description:

Attractive oak woodland-brushland in the Carleton Arboretum. Canopy formed of large (14-22" open grown bur Oak w/ interlocking canopy branches. Understory variable, with much buckthorn and other shrubs in unmanaged areas, managed areas lacking buckthorn. Portion surveyed is along west facing slope above the Cannon River.

Restoration Comments:

Excellent Restoration potential, foundation is in place w/ nice canopy of open-grown bur oak. Buckthorn control in shrub/ ground layer and species enrichment would be appropriate management activities.

Community: 31-1
Township, Range, Section, ¼ Section: T112N R20W S1, NW 1/4
Watershed: Cannon River
Community Type: Oak woodland-brushland
Qualitative Rank: C - Moderate condition natural community
Additional Overgrown woodland
Field Check Level: Checked part of the site
Restoration Potential: Medium
MCBS Site: Biodiversity Significant: Threatened / Endangered

Community Description:

Site is located near the shop entrance to the Carleton Arboretum, off of Highway 19. The site has an open, park-like canopy dominated by scattered, large open grown oak (bur and white), with some box elder. Understory /shrub layers are dense and tangled, w/ young mesic hardwoods, European buckthorn, chokecherry, & other native shrubs. The native vines, Virginia creepers, wild grape, climb throughout the shrubby thickets.

Ground layer cover is a mix of native woodland species & nonnative or weedy species typical of old fields. Burdock, honewort, brome grass, & Canada goldenrod are common.

Restoration Comments:

Significant effort would be required to thin understory layers, if managed towards oak Woodland- Brushland, but there is good potential for restoration and habitat improvement.

Community: 31-2
Township, Range, Section, ¼ section: T112N R19W S 31, NW ¼
Watershed: Cannon River
Community Type: Lowland hardwood forest
Qualitative Rank: C - Moderate condition natural community
Additional Trail corridor
Field Check Level: Visited part of the site
Restoration Potential: Medium
MCBS Site: Biodiversity **Significant:** Threatened /
Endangered

Community Description:

Narrow band of forest above Cannon River, in the Carleton Arboretum. Open canopy composed of mixed mesic hardwoods, most of small diameter, over dense understory & shrub layer. Ground layer cover patchy. Typical tree species encountered include black walnut, Basswood,

elm, & hackberry. Shrub layer is composed of dense patches of dogwood, nannyberry, much prickly gooseberry, and occasional European buckthorn. Tartarian honeysuckle is common especially along the trail & other edge habitat, where light levels are higher. Ground layer is native dominated, although % cover varies widely, in relation to how dense/ sparse shrub layer and tree layers are. Blue violets, creeping Charlie, & Jack in the pulpit occur frequently, & the native Virginia wild rye & various woodland sedges are common.

The young age of canopy & dense gooseberry & honewort suggest a grazing history at the site. Overall, moderate quality. Borderline lowland hardwood forest & early to mid successional upland community.

Community: 31-3
Township, Range, Section, ¼ section: T112N R19W S 31, SE 1/4
Watershed: Spring Creek
Community Type: Altered/non-native deciduous forest
Qualitative Rank: NA
Additional Trail corridor
Field Check Level: Visited part of the site
Restoration Potential:
MCBS Site: **Biodiversity Significant:** **Threatened / Endangered**

Community Description:

Disturbed woodland/ Forest at Cowling Arboretum. Broken canopy dominated by green Ash, boxelder, & black walnut with dbh ranging from 4-6" Other structural layers indistinct & merging. Shrub cover is nearly continuous & dominated by non- native honeysuckles, blackberry & Buckthorn. Ground layer dominated by weedy natives & exotic species. Overall, disturbed forest. Unclear what the site will mature to, w/out management.

Community: 31-4
Township, Range, Section, ¼ section: T112N R19W S 31, W 1/2

Watershed: Cannon River
Community Type: Floodplain forest
Qualitative Rank: C - Moderate condition natural community
Additional Trail corridor
Field Check Level: Visited part of the site

Restoration Potential:

MCBS Site: **Biodiversity Significant:** **Threatened / Endangered**

Community Description:

Floodplain Forest on banks of Cannon River north of town. Canopy cover approximately 60-70% and dominated by a mix of cottonwood, basswood, green ash, & some silver maple; many individuals have multiple trunks, indicative of resprouting in the wake of spring flood events. As is typical for this community type, other structural layers are sparse & not clearly defined.

Shrub cover is patchy, of numerous young trees, gooseberry (prickly) & European buckthorn. Wood nettle, goldenglow, & Virginia wild rye are native species characteristic of the community type & are common throughout the site. Other native species encountered here include wild ginger, calico aster, & an occasional blue cohosh. Poison ivy occurs sporadically along the trail.

Overall, site is in good condition. The somewhat dense shrub layer, presence of some spp more characteristic of upland sites suggest it may not flood frequently. Overall, community is in good condition, though

Community: **31-5**
Township, Range, Section, ¼ section: T112N R19W S 31, NW ¼
Watershed: Cannon River
Community Type: Floodplain forest
Qualitative Rank: B - Good quality natural community
Field Check Level: Visited part of the site

MCBS Site: Biodiversity Significant: Threatened / Endangered

Community Description:

Good quality floodplain forest on terrace above Cannon River. Site is north of town, and bordered on the west by the railroad tracks. Patchy canopy cover dominated by a mix of green ash, elm, & occasional cottonwood, over a patchy understory with much boxelder. Shrub layer sparse. Groundcover tangled & continuous, w/ numerous downed logs, wood nettle, Jewelweed, & a carpet of moneywort on the ground. Reed canary grass is common in clearings, where light levels are higher.

Community: 32-1

Township, Range, Section, ¼ section: T112N R19W S 32, SW ¼

Watershed: Spring Creek

Community Type: Oak forest mesic subtype

Qualitative Rank: D - Poor condition natural community

Field Check Level: Visited part of the site

MCBS Site: Biodiversity Significant: Threatened / Endangered

Community Description:

Formerly grazed oak forest on N side of cemetery, on the NE corner of Spring Creek Road and 90th St E. Terrain is sloped to gently rolling. Canopy cover is approx. 50%, and dominated by a mix of mature oaks, w/ narrow crowns & straight trunks. Subcanopy layer is essentially absent. Disturbance tolerant species including Boxelder & European buckthorn dominate the dense understory & tall shrub layer. Elderberry is also common. The ground layer is dominated by disturbance- tolerant natives that tend to increase in grazed woods including Enchanters nightshades and yellow avens. Virginia creeper is common throughout.

Community: 34-1

Township, Range, Section, ¼ section: T112N R20W S 34, SE ¼

Watershed: Heath Creek

Community Type: Oak forest mesic subtype

Qualitative Rank: C - Moderate condition natural community

Field Check Level: Visited the edge of the site

MCBS Site: **Biodiversity Significant:** **Threatened / Endangered**

Community Description:

Moderate to good quality mesic forest on slopes above Heath Creek. Canopy cover ~60% dominated by red oaks and sugar maple w/ dbh 18-24". Understory layer patchy to sparse, with many 1" dbh sugar maple saplings. Ground cover sparse, with scattered pockets of natives. Spring visit recommended.

Community: 34-2

Township, Range, Section, ¼ section: T112N R20W S 34, SW ¼

Watershed: Heath Creek

Community Type: Oak forest mesic subtype

Qualitative Rank: C - Moderate condition natural community

Field Check Level: Visited part of the site

MCBS Site: **Biodiversity Significant:** **Threatened / Endangered**

Community Description:

Small woodlot w/ moderate quality mesic oak forest. Half- rotted stumps scattered throughout site. Remaining trees of medium dbh (10-14", some larger) & good form, w/ tall, straight trunks & narrow crowns. Subcanopy & understory dominated by younger red oak & maple, indicating eventual transition to a maple dominated woods. Shrub layer is low growing (2' tall) and composed primarily of young mesic hardwoods & some chokecherry. Ground cover is sparse. Characteristic mesic forest forbs are present, including blue cohosh, rue anemone, false Solomon's seal, & others. Would receive a higher rank if larger area, but will continue to improve as site matures.

Moderate wildlife value due to small size & relative isolation from other natural/open space areas.

Community: 35-1
Township, Range, Section, ¼ section: T112N R20W S 35, SE ¼
Watershed: Cannon River
Community Type: Oak forest mesic subtype
Qualitative Rank: B - Good quality natural community
Field Check Level: Visited part of the site
MCBS Site: Biodiversity Significant: Threatened / Endangered

Community Description:

Good to somewhat variable quality site on the east side of the entrance to St Olaf College. Forest dominates the top and flanks of hill, and ranges from maple- Basswood forest on the sheltered, east facing slope to mesic oak on hilltop, & dry-mesic oak on S & W flanks. A small gravel road leads to a grassy clearing @ center of site, where water towers are located. Canopy cover across most of the site is from 80-90%, dominated by large (14-22) diameter sugar maple & Red oak w/ occasional basswood. Subcanopy. & understory cover ranges from absent to patchy & are typically dominated by young sugar maple & ironwood. Shrub layer cover varies considerably across the site, from nearly continuous on the upper parts of slope & hilltop to patchy or nearly absent on the slopes. Shrub layer diversity is good & includes a mix of young mesic hardwood trees as well as native shrubs such as chokecherry, Pagoda dogwood, elderberry, and others. Ground layer diversity is high, & includes many species characteristic of the habitat type. (see species list) Exotic species & disturbance-indicator species are scarce.

College has undertaken buckthorn control at the site, and this has had a noticeable and very beneficial effect on site quality.

Community: 35-2
Township, Range, Section, ¼ section: T112N R20W S 35, SE ¼
Watershed: Heath Creek
Community Type: Maple-basswood forest

Qualitative Rank: D - Poor condition natural community

Field Check Level: Visited the entire site

MCBS Site: **Biodiversity Significant:** **Threatened / Endangered**

Community Description:

Small woodlot on the St. Olaf campus. Site characterized by scattered large trees w/ open to semi-open grown form, over continuous cover by 1-4" dbh maple, ironwood, some basswood. Shrub cover sparse; Species include young sugar maple, honeysuckle, & prickly ash. Ground layer sparse to absent; occasional tree seedlings present but few other species noted. Site is on gradual west to SW facing slope. CD Quality, due in part to early successional status.

Restoration Comments:

Young stand, will improve of time. Low levels of Buckthorn present, (1-5% cover). Recommend buckthorn control & periodic inspection of site to prevent buckthorn infestation.

Community: **35-4**

Township, Range, Section, ¼ section: T112N R20W S 35, NW ¼

Watershed: Heath Creek and Cannon River

Community Type: Mesic prairie

Qualitative Rank: planted, no rank

Additional Planted community

Field Check Level: Visited part of the site

Restoration Potential:

MCBS Site: **Biodiversity Significant:** **Threatened / Endangered**

Community Description:

Planted prairie at St Olaf. Strongly dominated by the native prairie grasses big bluestem and Indian grass, w/ other grasses also present. Nice assortment of forbs present. Site would also benefit from activities to enhance forb population size and diversity/ reduce grass levels.

Supplemental forb seeding may be appropriate, as overall forb levels are low.

Community: 35-5
Township, Range, Section, ¼ section: T112N R20W S 35, NE ¼
Watershed: Cannon River
Community Type: Oak forest
Qualitative Rank: B - Good quality natural community
Field Check Level: Visited part of the site
MCBS Site: **Biodiversity Significant:** **Threatened / Endangered**

Community Description:

Moderate to good quality site on generally east facing slope, immediately north of the campus buildings on the St Olaf Campus and bordered on the east by Cedar Avenue. Soils are a very sandy loam. Canopy cover is approximately 80%, with a few widely scattered red oak (dbh 28-34"+) on higher, more exposed areas (E to SE facing slopes), & 15-22" dbh sugar maple and red oak on more sheltered (E & NE) facing slopes. Subcanopy/ understory cover varies, but is generally dominated by sugar maple, basswood; occasional elm & ironwood. Shrub cover is 20-30%. Typical species include Elderberry, chokecherry, & some scattered young buckthorn.

The ground layer is dominated in areas by extensive carpets of pale touch me not. Other areas of the site support an extensive layer of diverse species that are characteristic of mesic forests. Species encountered include Enchanter's nightshade, lopseed, wild leek, early meadow rue, red baneberry, blue cohosh, & others. This diversity contributes to the quality of the site. Long-tailed aster & Poison ivy are more common adjacent to trail areas.

Community: 35-6
Township, Range, Section, ¼ section: T112N R20W S 35, SW ¼
Watershed: Heath Creek

Community Type: Oak forest mesic subtype
Qualitative Rank: B - Good quality natural community
Additional Common buckthorn
Field Check Level: Visited the entire site
Restoration Potential:
**MCBS Site: Biodiversity Significant: Threatened /
Endangered**

Community Description:

Good quality mesic oak forest in narrow band behind several homes, immediately north of Lonsdale Boulevard/Hwy 19. Site has been logged w/in the last 30 years, as evidenced by the young canopy and numerous red Oak w/ multiple trunks. However, site retains good structural & species diversity & has excellent potential to mature into a very nice tract of forest, so receives a good quality rank.

Canopy cover ranges from 50-75% closure and is dominated primarily by young, multi-stemmed red oak, bitternut hickory, & other mesic hardwood species. The understory, subcanopy, & shrub layers are all present & support a range of mesic hardwoods & shrubs, including young black cherry, chokecherry, bitternut hickory, and prickly gooseberry. Ground layer diversity is surprisingly good. Native species encountered include blue cohosh, red baneberry, rue anemone early meadow rue, wild geranium, and others. Graminoids occur less frequently, but patches of stary sedge as well as other sedges are dispersed throughout the site. Woody debris in all size classes is present, though few large items are present due the relatively young age of the canopy.

STREAM DESCRIPTIONS

Note on MPCA Beneficial Use Classes

The MPCA, in accordance with the EPA and the Clean Water Act, is required to designate beneficial uses for water resources in the state of Minnesota. The MPCA has seven different beneficial use classes as defined below:

Class 1	Drinking Water
Class 2	Aquatic Life and Recreation
Class 3	Industrial Use and Cooling
Class 4	Agricultural Use
Class 5	Aesthetics and Navigation
Class 6	Other Uses
Class 7	Limited Resource Value Waters

No priority ranking to the beneficial uses is to be assumed from the class numbers as assigned.

A Subclass is associated with Class 1 to Class 4 waters. The subclass defines actual numerical standards for a wide variety of various types of water pollution and other parameters. Subclasses are assigned from A to D, with A being the most stringent requirements.

All water resources in the state that are not a wetland, and not otherwise classified, are designated Class 2B waterbodies.

Trout streams are often protected as Class 1 water resources, although they are not used for drinking water purposes.

Stream assessment areas are shown the accompanying large wall map.

Stream Site ID: 30-1
Stream Name: Cannon River
DNR Stream Type: Recreational River
MPCA Impaired Waters: Fecal Coliform, Turbidity, and Mercury
MPCA Beneficial Use: 2B, 3B
Field Check Visited part of the site
Restoration Potential: Low

Community Description:

This segment of the Cannon River is located on the northeast side of the City of Northfield. The river channel was visually estimated to be approximately 40 feet wide at this location.



The streambank consisted of a reaches of bare soil and grass to the bankfull elevation on the streambank. Above the bankfull location, the vegetation is dominated by a floodplain forest with extensive woody vegetation.

Active sandbars were visible in the channel. Channel materials were generally gravel in nature, with larger gravel present along the lower portions of the streambanks. Bank materials consisted of mainly silt and clay materials. Woody debris was also present in the channel, ranging in size from small 2-3" diameter limbs to large trees.

Bank erosion, where present, appears to be caused by toe slope failures. This can be prevented using rip rap or other structural means, or by incorporating some bioengineering concepts in conjunction with softer armoring.

The channel appears to be functioning well and in balance with its floodplain.

Recommendations:

None.

Stream Site ID: 6-1
Stream Name: Spring Creek
DNR Stream Type: N/A
MPCA Impaired Waters: Not Listed
MPCA Beneficial Use: 2B

Field Check Visited part of the site
Restoration Potential: Medium

Community Description:

This site is a relatively stable-appearing channel located on Spring Creek adjacent to the golf course and private residences. Local vegetation consists of forest vegetation, with only a narrow band of forest left on the east side adjacent to the golf course. The west bank forest has been disturbed and altered in the past.



The stream channel appears to be approximately 10 feet wide through this reach. Channel bed materials consists of gravels and sands with larger gravel pieces present. Bank materials are primarily silts and clays in this area. Vegetation extends to the streambank and down to the water surface, with some woody vegetation present.

The stream channel forms a series of pools and riffles through sections of large gravel deposits. Active sandbars are present

Undercutting of the streambanks is present throughout the reach. Flows on the day of observation extended beneath the existing bank locations, indicating the undercutting. The undercutting is likely a response to increased flows and durations in the channel as a result of upstream development. The streambank ultimately will fail, fall into the creek, and be carried away over time.

Evidence of a recent streambank repair is apparent on the western bank. A repair using fieldstone appears to have been completed in the last year by a private landowner. Grass has been established on the repaired area and appears to be holding well.

Recommendations:

Overall, the stream appears to be in relatively good health through this area. However, signs of changes in the watershed are apparent from the undercutting banks in the reach. This reach should be monitored in future to verify if the condition is maintained or becomes worse over time. It may be that development occurred many years ago and the cumulative affect is only now appearing at this point in the stream.

In addition, rate and volume controls should be incorporated into any development that occurs in the upstream watershed.

Stream Site ID: 6-2
Stream Name: Spring Creek
DNR Stream Type: N/A
MPCA Impaired Waters: Not Listed
MPCA Beneficial Use: 2B
Field Check Visited part of the site
Restoration Potential: High

Community Description:

This reach of Spring Creek is located within a golf course. The stream

itself is relatively narrow, with an approximate width of 4 feet at low flow levels. Vegetation on both streambanks is grass cover that appears to be lightly maintained within the channel itself. The vegetation above the bankfull level of the stream channel appears to be heavily maintained golf course grass. Channel bottom materials are a mixture of silt and gravel, with some evidence of channel armoring by the gravel components present. Bank materials were a mixture of materials, including silts, clays, and sands. Grading activities on the golf course may have replaced some of the native materials in this area.



The stream channel appears to have been channelized and/or straightened in the past, likely during the creation of the surrounding golf course. Channel response to these factors is typically an initial attempt to widen the channel and recreate a floodplain, followed by remeandering activities (lateral migration) once a new floodplain has been established. Evidence of these activities are present along the golf course in form of failing or failed streambanks, and a channel that is beginning to meander slightly from its initial channelized state.

In addition to the potential channelization that has occurred over time, the upstream areas of the watershed appear to be undergoing extensive development at this time. Upstream development often results in a change in the flows that determine the stable bank configuration. The typical initial response is also a widening of the channel over time.

The absence of native vegetation also plays a role in the failing streambanks. Grass offers little erosional resistance to higher streamflows, exposing soil to erosional forces. The establishment of buffer zones around the riparian area of the stream may assist in

maintaining the existing channel in its current condition.

Recommendations:

Two items are of the most interest in this reach. First, the establishment of a riparian buffer should be considered. Establishment of such a buffer would allow for better filtration and attenuation of flows entering the creek directly and offer a chance for deep rooted vegetation to be established that provide much greater protection against erosional forces.

Second, rate and volume controls are important as the upstream watershed continues to develop. Additional impervious coverage results in greater volumes of water running off of the landscape in greater frequency. These changes in flows, particularly from small storms, can result in areas of the channel that appear to have reached relative equilibrium becoming unstable. Adequate controls on rates of runoff, particularly for small storm events (such as the 1- or 2-year frequency), can maintain existing flow rates. However, the duration of flows may also become higher if a rate control only approach is used. Volume controls, such as infiltration, may reduce the changes caused by an increased volume of runoff.

Stream Site ID:

6-3

Stream Name:

Spring Creek

DNR Stream Type:

N/A

MPCA Impaired Waters:

Not Listed

MPCA Beneficial Use:

2B

Field Check

Visited part of the site

Restoration Potential:

High



Community Description:

The stream channel in this location is nearly undefined at this point due to previous livestock grazing practices. This area was historically used as a pasture, and the stream channel was not protected from grazing activities. The results of such practices are generally a largely undefined channel that meanders and braids its way through the site. This generally is a result of aggradation that takes place in the channel as soil material from the loose bank material enters the stream channel and is not carried downstream.

Recommendations:

If left alone, the site will eventually return to a natural stream channel, provided that previous grazing practices are not returned to the site. However, the process will take decades to complete and will feature a largely unstable and variable stream system for many years. This section could be considered for a stream rehabilitation project to bring a natural stream channel to the area in a much shorter time period.

Upstream development activities should also provide small storm rate controls and potentially volume controls to maintain pre-development conditions. As an alternative, any new channel may be sized to handle changes from upstream development, though downstream reaches do not have this advantage.

Stream Site ID:	2-1
Stream Name:	Heath Creek
DNR Stream Type:	N/A
MPCA Impaired Waters:	Not Listed
MPCA Beneficial Use:	2B
Field Check	Visited part of the site
Restoration Potential:	Low

Community Description:

This section of Heath Creek is located adjacent to residential housing development and woods on the west side of the City of Northfield. The stream is approximately 20 feet wide at this location. Channel materials appear to be silt with a large quantity of cobbles and gravels in the channel offering some armoring protection. Woody debris is also present in the channel.



The east bank of the stream is covered by heavy forest growth. The west bank, adjacent to the neighboring residential properties is grass with sparse tree cover. There is evidence that the sparse vegetation on the west bank may need reinforcement to prevent sheet erosion from occurring on this bank location.

The channel in this location appears to be stable with little bank erosion currently present. The establishment of a riparian buffer strip adjacent to the river may enhance local stream bank stability.

Recommendations

This section of the stream should be monitored to verify that it remains stable. As development occurs in the watershed surrounding the area, ensure that small storm rate controls are incorporated and volume control such as infiltration be considered for future plans.

Stream Name: Spring Brook
DNR Stream Type: Trout Stream
MPCA Impaired Waters: Not Listed

MPCA Beneficial Use: 1B, 2A, 3B

Field Check Stream channel not assessed

Restoration Potential: N/A

Community Description:

This stream channel was not analyzed as part of this report, as an aerial photo review did not reveal any areas of instability, channelization, or repair. (See Project Methodology). A visit to the stream during the NRI found well-vegetated banks and meandering channels that appeared stable; thus a detailed analysis of the channel was not conducted. However, as a DNR designated Trout Stream, Spring Brook is the most sensitive of the stream resources within the city, and has protections that prevent any alteration to the quantity, quality, or temperature of the waters discharging into the creek.



Trout streams are uncommon in southern Minnesota. Spring Brook is the only trout stream in Rice County, and as such has county- wide and perhaps region-wide significance, and has been designated as a unique resource for the Natural Resources Inventory.

Higher standards for the treatment of stormwater are appropriate to ensure that it can be maintained as a trout fishery, and as development occurs, higher standards should be required to protect any existing trout fishery. In addition, the MPCA construction site permit will require that more stringent controls be installed on any development within 2000 feet of the stream itself. It is recommended that the more stringent water protection requirements be applied to all land within the watershed in order to ensure that the stream water quality is protected.

IV. Future Opportunities

While specific recommendations are beyond the scope of this project, several general comments can be made regarding the potential for future management of the City's natural resources. As the City of Northfield continues to grow and develop, there is potential for the growth pressures to negatively impact natural resources. There is also an opportunity for the city to develop ordinances and policies that can preserve and even enhance these resources as growth occurs. Potential next steps for the city include:

- develop a greenways corridor system and a strategy for implementing
- create ordinances to protect streams, shorelines and water quality
- incorporate information from the NRI and/or greenway corridors into ordinance language

Greenways/Open Space Corridors

A greenway corridor is typically defined as "*privately or publicly owned corridors of open space which often follow natural land or water features and which are primarily managed to protect and enhance natural resources*". They can, and often do incorporate active or passive recreational trails, active recreational spaces (such as athletic fields or golf courses), and other public open spaces that may provide rudimentary ecological functions and values.

In addition to the ecological, aesthetic, and recreational benefits of developing a corridor, establishing a Greenways Plan has some other benefits as well. It can help prioritize land or easement acquisition for effective use of financial resources. It also has the potential to assist with securing outside funding for projects. Many granting agencies that fund land acquisition and/or restoration projects give funding preference for sites that are identified in a greenways corridor, as the corridors can offer significant natural resource, aesthetic and recreation value to a community.

Some possible guiding elements in establishing a greenway corridor include:

- High and Moderate quality natural areas
- Semi-natural areas that occur immediately adjacent to natural areas

- Bodies of water and large wetland complexes
- Natural corridors with natural/semi-natural areas (e.g. streams, drainage ways, ridges)
- Areas that would serve as logical links between natural and semi-natural areas, particularly those that have potential to be restored to native vegetation
- Areas of high habitat value

Other factors that may be useful to consider include:

- **Public ownership** – where possible, use corridors to connect large publicly owned open spaces. The parkland along the Cannon River provides a good example of this.
- **Habitat Size** – large, contiguous areas provide significantly better habitat than small isolated areas, as well as offering other, aesthetic benefits. As much as possible, avoid fragmenting large habitat areas into smaller, disconnect sites. Some examples of this are at Carleton Arboretum, the prairie restorations and forest communities on St Olaf campus, and the communities along the stream and river corridors.
- **Remnant natural areas** – provide connectivity between natural areas, especially those of high quality and/or potential for hosting rare species.
- **Incorporate semi-natural communities** –these are valuable additions to a corridor network to connect and/or buffer the highest quality remaining natural areas within the city. Areas along Heath Creek and Spring Brook are good examples of this type of opportunity, as are the semi-natural areas around Hauberg Woods and associated wetlands.
- **Restore/reconstruct natural areas** --to provide connectivity between natural or semi-natural areas (especially good quality sites) suitable for inclusion with greenways. An excellent example would be restoring native habitat along the Canon River, especially where it runs through town.
- **Incorporate water resources and large permanent wetland systems** within the corridor (directly or indirectly). Wetlands, lakes, and streams

provide beneficial wildlife habitat and are not usually suitable for development. The stream corridors and Cannon River could potentially provide an excellent “backbone” for a corridor system.

- **Consider opportunities for recreation and pedestrian movement** through the greenway system. Co-aligning natural and recreation features should be done in a manner that protects sensitive natural areas.

Some possible alignments include existing natural corridors along:

- Spring Creek
- Spring Brook
- Heath Creek
- Mud Creek
- Cannon River

Other natural features that may provide “nodes” or connections along a potential corridor include:

- Carleton Arboretum
- Prairie restorations and wooded/open space areas at the St. Olaf campus
- Existing city parks, including Odd Fellows Park, Lions Park, and others

If the city considers more comprehensive greenway/corridor planning, there are several outside sources of funding/in-kind assistance that is available. One of these is the MN DNR, which periodically offers funding for planning efforts such as this. Information regarding the MN DNR’s financial assistance programs may be found at:

<http://www.dnr.state.mn.us/grants/index.html> .

Stream Protection

General recommendations to protect existing stream and river resources are as follows:

- Encourage the establishment and maintenance of a permanent riparian buffer adjacent to streams and rivers
- Require small storm rate controls be implemented as development occurs
- Consider the use of infiltration (where appropriate) to reduce the volume of stormwater leaving newly developed areas

- Monitor various locations throughout the stream and river system regularly to ensure that current regulations are adequately maintaining the existing stream channels.

Ordinances

The Natural Resources Inventory provides the City with extensive data related to the location and quality of natural resources in the city. If desired, the City can use this information as a basis for updating current ordinances, or for developing new approaches for protecting and enhancing its natural resources.

Future growth, changes in land use, and development of infrastructure can impact the health and function of natural communities and natural systems. The City can use its zoning and subdivision controls to avoid or minimize these impacts, and provide incentives for developers and landowners to protect or restore natural resources. Some potential uses of ordinance are listed below. Some of these may already be part of the city code, others may be new.

- Park Dedication requirements
- Preliminary plat requirements
- Tree protection requirements
- Erosion and sediment management
- Stormwater management
- Open space plat
- Shoreline management
- Floodplain management
- Stream protection
- Wetland buffer requirement
- Steep slope/bluff setback requirement

Some resources that may be useful can be found online. The DNR Website (<http://files.dnr.state.mn.us/assistance/landprot.pdf>) contains the resource Land Protection Options, a Handbook for Minnesota Landowners. This is an outstanding tool to help individual landowners better understand their options, and also for city staff as a resource to help positively engage interested property owners. Another important resource for private landowners is the publication Beyond the Suburbs: A Landowner's Guide to Conservation

Management . This resource can also be found on the MN DNR website at:
http://files.dnr.state.mn.us/forestry/beyond_suburbs.pdf

Appendix A

Mn DNR Rare Species and Natural Community Records

NORTHFIELD NATURAL RESOURCE INVENTORY

Minnesota Natural Heritage Database
Element Occurrence Records

T112N R20W S25-27,34-36;T112N R19W S29-32;T111N R20W S1-3,10-12;T111N R19W S5-8
MnDNR, Natural Heritage and Nongame Research Program

14:37 Monday, MAY 16, 2005

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TWP	RNG	PRIMARY SECTION	FED STATUS	MN STATUS	S RANK	ELEMENT and OCCURRENCE NUMBER	MANAGED AREA
T111N	R19W	09		NON		BARTRAMIA LONGICAUDA (UPLAND SANDPIPER) #241	
T111N	R20W	01		THR		ACTINONAIAS LIGAMENTINA (MUCKET MUSSEL) #106	
T111N	R20W	01		SPC		ELLIPTIO DILATATA (SPIKE MUSSEL) #71	
T111N	R20W	01			S2	FLOODPLAIN FOREST #4	
T111N	R20W	01		SPC		LASMIGONA COMPRESSA (CREEK HEELSPLITTER MUSSEL) #13	
T111N	R20W	01		SPC		LASMIGONA COSTATA (FLUTED-SHELL MUSSEL) #65	
T111N	R20W	01		SPC		LIGUMIA RECTA (BLACK SANDSHELL MUSSEL) #119	
T111N	R20W	01				MUSSEL SAMPLING SITE #256	
T111N	R20W	01		THR		VENUSTACONCHA ELLIPSIFORMIS (ELLIPSE MUSSEL) #3	
T111N	R20W	14			S1	DRY OAK SAVANNA (SOUTHEAST) BARRENS SUBTYPE #6	
T111N	R20W	14			S2	MAPLE-BASSWOOD FOREST (BIG WOODS) #55	
T111N	R20W	14			S2	MAPLE-BASSWOOD FOREST (BIG WOODS) #72	
T111N	R20W	15		THR		ACTINONAIAS LIGAMENTINA (MUCKET MUSSEL) #107	
T111N	R20W	15		SPC		ELLIPTIO DILATATA (SPIKE MUSSEL) #72	
T111N	R20W	15		SPC		LASMIGONA COMPRESSA (CREEK HEELSPLITTER MUSSEL) #14	
T111N	R20W	15		SPC		LASMIGONA COSTATA (FLUTED-SHELL MUSSEL) #66	
T111N	R20W	15		SPC		LIGUMIA RECTA (BLACK SANDSHELL MUSSEL) #104	
T111N	R20W	15				MUSSEL SAMPLING SITE #257	
T111N	R20W	15		THR		PLEUROBEMA COCCINEUM (ROUND PIGTOE MUSSEL) #47	
T111N	R20W	15		THR		VENUSTACONCHA ELLIPSIFORMIS (ELLIPSE MUSSEL) #4	
T111N	R20W	16		THR		VENUSTACONCHA ELLIPSIFORMIS (ELLIPSE MUSSEL) #14	
T112N	R19W	30		THR		SCUTELLARIA OVATA (OVATE-LEAVED SKULLCAP) #12	CARLETON COLLEGE ARBORETUM
T112N	R19W	31		THR		ACTINONAIAS LIGAMENTINA (MUCKET MUSSEL) #105	
T112N	R19W	31		THR		CLEMMYS INSCULPTA (WOOD TURTLE) #2	CARLETON COLLEGE ARBORETUM
T112N	R19W	31		SPC		ELLIPTIO DILATATA (SPIKE MUSSEL) #70	
T112N	R19W	31		THR		EMYDOIDEA BLANDINGII (BLANDING'S TURTLE) #33	CARLETON COLLEGE ARBORETUM
T112N	R19W	31			S2	FLOODPLAIN FOREST #8	CARLETON COLLEGE ARBORETUM
T112N	R19W	31		SPC		LASMIGONA COMPRESSA (CREEK HEELSPLITTER MUSSEL) #12	
T112N	R19W	31		SPC		LASMIGONA COSTATA (FLUTED-SHELL MUSSEL) #64	
T112N	R19W	31		SPC		LIGUMIA RECTA (BLACK SANDSHELL MUSSEL) #103	
T112N	R19W	31				MUSSEL SAMPLING SITE #255	
T112N	R19W	31		THR		PLEUROBEMA COCCINEUM (ROUND PIGTOE MUSSEL) #45	
T112N	R19W	31		THR		VENUSTACONCHA ELLIPSIFORMIS (ELLIPSE MUSSEL) #2	
T112N	R20W	34				MUSSEL SAMPLING SITE #291	
T112N	R20W	35		THR		CLEMMYS INSCULPTA (WOOD TURTLE) #69	
T112N	R20W	36		END		LECHEA TENUIFOLIA (NARROW-LEAVED PINWEED) #2	

RECORDS PRINTED = 36

Appendix B

Summary of Community ID Numbers

Community ID Number	Community Type	Quality Rank	MLCCS Code	Acres	Township	Range	Section	site	Watershed
1-1	Altered/non-native deciduous forest	NA	32170	7.76	111	20	1	1	Cannon River
2-1	Maple-basswood forest	B	32150	9.43	111	20	2	1	Cannon River
2-2	Oak woodland-brushland	D	42120	0.93	111	20	2	2	Heath Creek
2-2	Oak woodland-brushland	D	42120	10.43	111	20	2	2	Heath Creek
2-3	Floodplain forest	C	32110	8.77	111	20	2	3	Heath Creek
2-4	Floodplain forest	B	32110	22.22	111	20	2	4	Cannon River
2-4	Floodplain forest	B	32110	2.98	111	20	2	4	Cannon River
2-4	Floodplain forest	B	32110	15.26	111	20	2	4	Cannon River
2-4	Floodplain forest	B	32110	27.91	111	20	2	4	Cannon River
2-5	Mixed hardwood swamp	B	32320	4.46	111	20	2	5	Cannon River
2-5	Mixed hardwood swamp	B	32320	3.35	111	20	2	5	Cannon River
2-6	Mixed hardwood swamp	C	32320	3.21	111	20	2	6	Cannon River
2-7	Maple-basswood forest	C	32150	14.53	111	20	2	7	Heath Creek
2-x	Floodplain forest	C	32110	34.29	111	20	2	x	
6-1	Lowland hardwood forest	D	32220	2.06	111	19	6	1	Spring Creek
10-1	Maple-basswood forest	B	32150	11.33	111	20	10	1	Cannon River
10-2	Maple-basswood forest	C	32150	1.96	111	20	10	2	Cannon River
12-1	Oak forest	C	32110	21.49	111	20	12	1	Cannon River
12-2	Oak forest mesic subtype	B	32112	14.67	111	20	12	2	Spring Creek & Cannon River
25-1	Oak forest mesic subtype	D	32112	7.48	112	20	25	1	Cannon River
25-2	Oak forest mesic subtype	C	32112	10.87	112	20	25	2	Cannon River
25-2	Oak forest mesic subtype	C	32112	27.36	112	20	25	2	Cannon River
25-3	Rich fen floating-mat subtype - semipermanently flooded	A	61650	6.4	112	20	25	3	Cannon River
26-1	Upland deciduous forest	D	32100	15.4	112	20	26	1	Mud Creek
26-1	Altered/non-native deciduous forest	NA	32170	13.2	112	20	26	1	Mud Creek
27-1	Oak forest mesic subtype	B	32112	7.95	112	20	27	1	Mud Creek
30-1	Floodplain forest	C	32210	9.99	112	19	30	1	Cannon River
30-2	Oak woodland-brushland	C	42120	62.08	112	19	30	2	Cannon River

Site ID	Community Type	Quality Rank	MLCCS Code	Acres	Township	Range	Section	site	Watershed
30-3	Lowland hardwood forest	C	32220	29.12	112	19	30	3	Cannon River
31-1	Oak woodland-brushland	C	42120	16.42	112	19	31	1	Cannon River
31-3	Altered/non-native deciduous forest	NA	32170	11.44	112	19	31	3	Spring Creek
31-4	Floodplain forest	B	32210	9.8	112	19	31	4	Cannon River
31-5	Floodplain forest	B	32210	19.8	112	19	31	5	Cannon River
32-1	Oak forest mesic subtype	D	32112	18.2	112	19	32	1	Spring Creek
34-1	Oak forest mesic subtype	BC	32212	9.08	112	20	34	1	Heath Creek
34-2	Oak forest mesic subtype	C	32212	3.2	112	20	34	2	Heath Creek
35-1	Oak forest mesic subtype	B	32212	17.85	112	20	35	1	Cannon River
35-2	Maple-basswood forest	D	32150	8.7	112	20	35	2	Heath Creek
35-4	Mesic prairie	NA	61110	123.87	112	20	35	4	Heath Creek
35-5	Oak forest	B	32110	11.98	112	20	35	5	Cannon River
35-6	Oak forest mesic subtype	B	32112	3.48	112	20	35	6	Heath Creek
Total Acreage of sites				660.71					

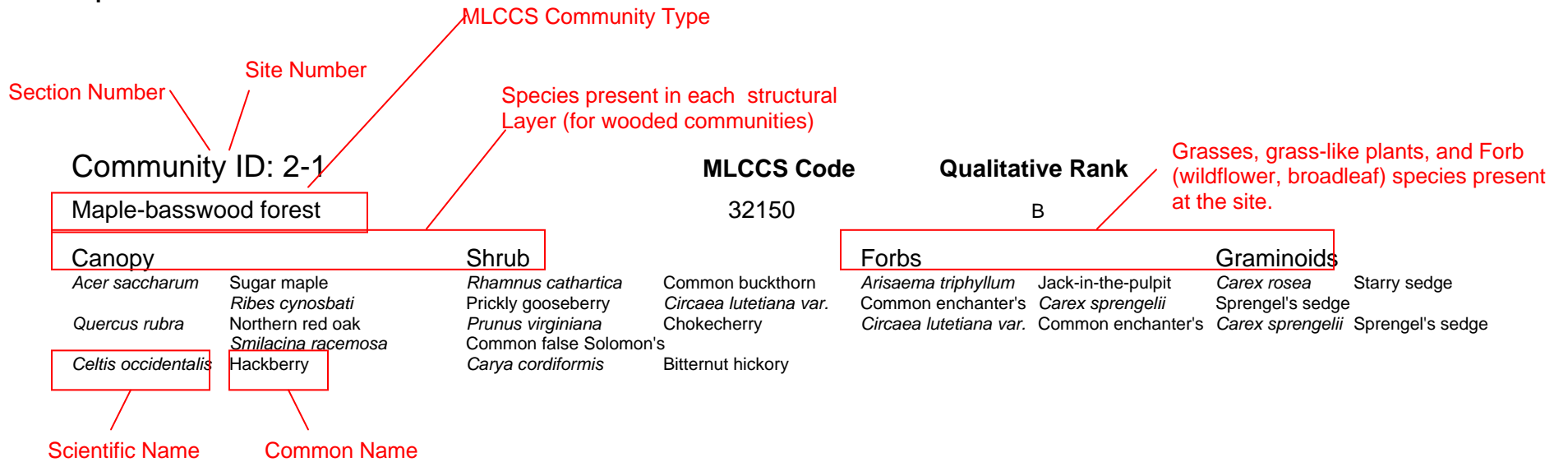
Appendix C

Species Lists

Key to Species Lists

Natural Resources Inventory

Species Lists for Community ID Sites



Key to Site Descriptions

Natural Resources Inventory

By-Community Species Lists

Area 1-1

Altered/non-native deciduous forest

MLCCS Code

32170

Qualitative

NA

Acres

Canopy

Shrub

Forbs

Graminoids

Area 2-1

Maple-basswood forest

MLCCS Code

32150

Qualitative

B

Acres

Canopy

Acer saccharum Sugar maple
Quercus rubra Northern red oak
Celtis occidentalis Hackberry

Shrub

Rhamnus cathartica Common buckthorn
Ribes cynosbati Prickly gooseberry
Prunus virginiana Chokecherry
Carya cordiformis Bitternut hickory

Forbs

Arisaema triphyllum Jack-in-the-pulpit
Circaea lutetiana var. Common enchanter's
Circaea lutetiana var. Common enchanter's
Smilacina racemosa Common false Solomon's seal

Graminoids

Carex rosea Starry sedge
Carex sprengei Sprengel's sedge
Carex sprengei Sprengel's sedge

Area 2-2

Oak woodland-brushland

MLCCS Code

42120

Qualitative

D

Acres

Canopy

Quercus alba White oak

Shrub

Rhamnus cathartica Common buckthorn

Forbs

Galium triflorum Sweet-scented bedstraw

Graminoids

Quercus macrocarpa

Bur oak

Celtis occidentalis
Lonicera tatarica

Hackberry
Tartarian honeysuckle

By-Community Species Lists

Area 2-3

Floodplain forest

Canopy

Acer saccharum Sugar maple
Populus tremuloides Quaking aspen

Shrub

Rhamnus cathartica Common buckthorn
Toxicodendron radicans var. *negundo* Common poison ivy

Forbs

Circaea lutetiana var. *Jack-in-the-pulpit*
Arisaema triphyllum Jack-in-the-pulpit
Arisaema triphyllum Jack-in-the-pulpit

Graminoids

Elymus virginicus Virginia wild rye

MLCCS Code

32210

Qualitative

C

Acres

Area 2-4

Floodplain forest silver maple subtype

Canopy

Acer saccharinum Silver maple
Fraxinus pennsylvanica var. *pennsylvanica* Green ash
Acer negundo Box elder

Shrub

Sambucus canadensis Common elder

Forbs

Lysimachia nummularia Moneywort
Impatiens capensis Spotted touch-me-not
Viola sororia Common blue violet
Boehmeria cylindrica False nettle
Rudbeckia laciniata var. *Tall coneflower*
Echinocystis lobata Wild cucumber
Laportea canadensis Wood nettle

Graminoids

Phalaris arundinacea Reed canary grass
Elymus virginicus Virginia wild rye
Carex grayi Gray's sedge

MLCCS Code

32211

Qualitative

B

Acres

Area 2-5

Mixed hardwood swamp

Canopy

Fraxinus nigra Black ash
Populus tremuloides Quaking aspen
Acer saccharinum Silver maple

Shrub

Salix exigua Sandbar willow

Forbs

Lysimachia nummularia Moneywort
Pilea pumila Dwarf clearweed
Scutellaria lateriflora Mad dog skullcap

Graminoids

Phalaris arundinacea Reed canary grass
Carex lupulina Hop umbrella sedge
Cyperus schweinitzii Schweinitz's nut sedge
Glyceria grandis Tall manna grass

MLCCS Code

32320

Qualitative

B

Acres

By-Community Species Lists

Area 2-6

Mixed hardwood swamp

Canopy

<i>Acer saccharinum</i>	Silver maple
<i>Acer negundo</i>	Box elder
<i>Salix amygdaloides</i>	Peach-leaved willow

Shrub

<i>Cornus sericea</i>	Red-osier dogwood
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Forbs

<i>Bidens cernua</i>	Nodding bur marigold
<i>Glechoma hederacea</i>	Creeping Charlie

Graminoids

<i>Carex lacustris</i>	Lake sedge
<i>Leersia oryzoides</i> var.	Rice cut grass
<i>Phalaris arundinacea</i>	Reed canary grass

MLCCS Code

32320

Qualitative

C

Acres

Area 2-7

Maple-basswood forest

Canopy

<i>Acer saccharum</i>	Sugar maple
<i>Tilia americana</i>	Basswood
<i>Quercus rubra</i>	Northern red oak

Shrub

<i>Prunus serotina</i>	Black cherry
<i>Acer saccharum</i>	Sugar maple
<i>Carya cordiformis</i>	Bitternut hickory
<i>Ribes cynosbati</i>	Prickly gooseberry
<i>Ulmus americana</i>	American elm

Forbs

Graminoids

<i>Carex pennsylvanica</i> var.	Sun-loving sedge
<i>Brachyelytrum erectum</i>	Bearded shorthusk
<i>Brachyelytrum erectum</i>	Bearded shorthusk

MLCCS Code

32150

Qualitative

C

Acres

Area 2-8

Maple-basswood forest

Canopy

<i>Tilia americana</i>	Basswood
<i>Fraxinus pennsylvanica</i> var. <i>pennsylvanica</i>	Green ash
<i>Quercus macrocarpa</i>	Bur oak

Shrub

<i>Rhamnus cathartica</i>	Common buckthorn
<i>Ribes cynosbati</i>	Prickly gooseberry

Forbs

<i>Geum canadense</i>	White avens
<i>Circaea lutetiana</i> var.	Common enchanter's
<i>Circaea lutetiana</i> var.	Common enchanter's

Graminoids

<i>Carex grayi</i>	Gray's sedge
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MLCCS Code

32150

Qualitative

D

Acres

By-Community Species Lists

Area 6-1

Lowland hardwood forest

Canopy

Populus deltoides var. *occidentalis* Cottonwood
Tilia americana Basswood

Shrub

Cornus alternifolia Pagoda dogwood
Sambucus canadensis Common elder
Ribes americanum Wild black currant
Prunus virginiana Chokecherry
Viburnum trilobum Highbush cranberry

Forbs

Viola sororia Common blue violet
Circaea lutetiana var. Common enchanter's
Laportea canadensis Wood nettle

Graminoids

MLCCS Code

32220

Qualitative

D

Acres

Area 10-1

Maple-basswood forest

Canopy

Acer saccharum Sugar maple
Quercus rubra Northern red oak
Prunus serotina Black cherry

Shrub

Sambucus canadensis Common elder
Fraxinus pennsylvanica var. *pennsylvanica* Green ash

Forbs

Laportea canadensis Wood nettle
Caulophyllum thalictroides Blue cohosh
Caulophyllum thalictroides Blue cohosh
Circaea lutetiana var. Common enchanter's
Arisaema triphyllum Jack-in-the-pulpit

Graminoids

MLCCS Code

32150

Qualitative

B

Acres

Area 10-2

Maple-basswood forest

Canopy

Acer saccharum Sugar maple
Fraxinus pennsylvanica var. *pennsylvanica* Green ash
Tilia americana Basswood

Shrub

Sambucus racemosa Red-berried elder
Rhamnus cathartica Common buckthorn
Ribes cynosbati Prickly gooseberry
Ribes cynosbati Prickly gooseberry

Forbs

Laportea canadensis Wood nettle
Circaea lutetiana var. Common enchanter's nightshade
Circaea lutetiana var. Common enchanter's

Graminoids

MLCCS Code

32150

Qualitative

C

Acres

By-Community Species Lists

Area 12-1

Oak forest

Canopy

Quercus rubra Northern red oak

Shrub

Rhamnus cathartica Common buckthorn
Prunus virginiana Chokecherry

Forbs

Circaea lutetiana var. Common enchanter's
Parthenocissus vitacea Virginia creeper
Caulophyllum thalictroides Blue cohosh
Asarum canadense Wild ginger
Geranium maculatum Wild geranium
Hackelia virginiana Virginia stickseed

MLCCS Code

32110

Qualitative

C

Acres

Graminoids

Carex pensylvanica var. Sun-loving sedge

Area 12-2

Oak forest mesic subtype

Canopy

Quercus rubra Northern red oak

Quercus macrocarpa Bur oak

Shrub

Ribes cynosbati Prickly gooseberry
Sambucus canadensis Common elder
Prunus virginiana Chokecherry

Forbs

Laportea canadensis Wood nettle
Caulophyllum thalictroides Blue cohosh
Caulophyllum thalictroides Blue cohosh
Actaea rubra Red baneberry
Thalictrum dioicum Early meadow-rue
Circaea lutetiana var. Common enchanter's

MLCCS Code

32110

Qualitative

B

Acres

Graminoids

By-Community Species Lists

Area 25-1

Oak forest mesic subtype

Canopy

Fraxinus pennsylvanica var. *pennsylvanica* Green ash
Juglans nigra Black walnut
Quercus rubra Northern red oak

Shrub

Sambucus canadensis var. *acutiloba* Common elder
Rhamnus cathartica Common buckthorn
Prunus virginiana Chokecherry
Ribes cynosbati Prickly gooseberry

Forbs

Actaea rubra Red baneberry
Caulophyllum thalictroides Blue cohosh
Smilacina racemosa Common false Solomon's
Thalictrum thalictroides Rue anemone
Geum macrophyllum var. Big-leaved avens
Maianthemum canadense Canada mayflower
Arisaema triphyllum Jack-in-the-pulpit

MLCCS Code

32110

Qualitative

D

Acres

Graminoids

Carex rosea Starry sedge

Area 26-1

Altered/non-native deciduous forest

Canopy

Fraxinus pennsylvanica var. *pennsylvanica* Green ash
Acer negundo Box elder

Shrub

Rhamnus cathartica Common buckthorn
Sambucus canadensis Common elder

Forbs

Fraxinus pennsylvanica var. Green ash
Parthenocissus quinquefolia Woodbine
Galium asprellum Rough bedstraw
Circaea lutetiana var. Common enchanter's

MLCCS Code

32170

Qualitative

NA

Acres

Graminoids

By-Community Species Lists

Area 27-1

Mixed hardwood swamp

Canopy

<i>Quercus rubra</i>	Northern red oak
<i>Acer saccharum</i>	Sugar maple
<i>Fraxinus pennsylvanica</i> <i>var. pennsylvanica</i>	Green ash
<i>Tilia americana</i>	Basswood

Shrub

<i>Acer saccharum</i>	Sugar maple
<i>Ribes cynosbati</i>	Prickly gooseberry

Forbs

<i>Arisaema triphyllum</i>	Jack-in-the-pulpit
<i>Sanguinaria canadensis</i>	Bloodroot
<i>Sanguinaria canadensis</i>	Bloodroot
<i>Laportea canadensis</i>	Wood nettle
<i>Smilacina racemosa</i>	Common false Solomon's
<i>Smilax ecirrata</i>	Erect carrion flower

Graminoids

MLCCS Code

32320

Qualitative

B

Acres

Area 30-1

Floodplain forest

Canopy

<i>Populus deltoides</i> <i>var. occidentalis</i>	Cottonwood
<i>Acer saccharinum</i>	Silver maple

Shrub

<i>Rhamnus cathartica</i>	Common buckthorn
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Forbs

Graminoids

MLCCS Code

32210

Qualitative

C

Acres

Area 30-2

Oak woodland-brushland

Canopy

<i>Quercus macrocarpa</i>	Bur oak
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Shrub

<i>Rubus idaeus</i> <i>var. strigosus</i>	Red raspberry
<i>Rhamnus cathartica</i>	Common buckthorn
<i>Ribes cynosbati</i>	Prickly gooseberry

Forbs

<i>Circaea lutetiana</i> <i>var.</i>	Common enchanter's
<i>Campanula americana</i>	Tall bellflower
<i>Parthenocissus quinquefolia</i>	Woodbine

Graminoids

<i>Carex oligocarpa</i>	Few-fruited sedge
<i>Carex blanda</i>	Charming sedge

MLCCS Code

42120

Qualitative

C

Acres

By-Community Species Lists

Area 31-1

Oak woodland-brushland

Canopy

<i>Quercus macrocarpa</i>	Bur oak
<i>Ulmus americana</i>	American elm
<i>Tilia americana</i>	Basswood

Shrub

<i>Juglans nigra</i>	Black walnut
<i>Rhamnus cathartica</i>	Common buckthorn
<i>Rubus idaeus var. strigosus</i>	Red raspberry
<i>Prunus virginiana</i>	Chokecherry
<i>Prunus serotina</i>	Black cherry
<i>Toxicodendron radicans var. negundo</i>	Common poison ivy

Forbs

<i>Aster ontarionis</i>	Ontario aster
<i>Solidago canadensis</i>	Canada goldenrod
<i>Solidago canadensis</i>	Canada goldenrod
<i>Glechoma hederacea</i>	Creeping Charlie
<i>Impatiens capensis</i>	Spotted touch-me-not

Graminoids

<i>Poa pratensis</i>	Kentucky bluegrass
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MLCCS Code

42120

Qualitative

C

Acres

Area 31-2

Lowland hardwood forest

Canopy

<i>Tilia americana</i>	Basswood
<i>Acer saccharinum</i>	Silver maple
<i>Robinia pseudoacacia</i>	Black locust
<i>Salix nigra</i>	Black willow
<i>Celtis occidentalis</i>	Hackberry
<i>Ulmus americana</i>	American elm
<i>Juglans nigra</i>	Black walnut

Shrub

<i>Ribes cynosbati</i>	Prickly gooseberry
<i>Viburnum lentago</i>	Nannyberry
<i>Rhamnus cathartica</i>	Common buckthorn
<i>Vitis riparia</i>	Wild grape
<i>Lonicera tatarica</i>	Tartarian honeysuckle
<i>Cornus amomum var. schuetzeana</i>	Silky dogwood

Forbs

<i>Cryptotaenia canadensis</i>	Honewort
<i>Rudbeckia laciniata var.</i>	Tall coneflower
<i>Rudbeckia laciniata var.</i>	Tall coneflower
<i>Arisaema triphyllum</i>	Jack-in-the-pulpit
<i>Impatiens capensis</i>	Spotted touch-me-not
<i>Aster ontarionis</i>	Ontario aster
<i>Viola sororia</i>	Common blue violet

Graminoids

<i>Carex sprengei</i>	Sprengel's sedge
<i>Carex blanda</i>	Charming sedge
<i>Carex blanda</i>	Charming sedge
<i>Elymus virginicus</i>	Virginia wild rye

MLCCS Code

32220

Qualitative

C

Acres

By-Community Species Lists

Area 31-3

Altered/non-native deciduous forest

Canopy		Shrub		Forbs		MLCCS Code	Qualitative	Acres
<i>Juglans nigra</i>	Black walnut	<i>Lonicera xylosteum</i>	European fly honeysuckle	<i>Phryma leptostachya</i>	Lopseed	32170		
<i>Fraxinus pennsylvanica</i> <i>var. pennsylvanica</i>	Green ash	<i>Rhamnus cathartica</i>	Common buckthorn	<i>Geum macrophyllum var.</i>	Big-leaved avens			
<i>Acer negundo</i>	Box elder	<i>Lonicera tatarica</i>	Tartarian honeysuckle	<i>Leonurus cardiaca</i>	Common motherwort			
<i>Quercus macrocarpa</i>	Bur oak	<i>Lonicera tatarica</i>	Tartarian honeysuckle	<i>Urtica dioica ssp. gracilis</i>	Stinging nettle			
				<i>Laportea canadensis</i>	Wood nettle			
				<i>Hydrophyllum virginianum</i>	Virginia waterleaf			
				<i>Hesperis matronalis</i>	Dame's rocket			
				<i>Impatiens capensis</i>	Spotted touch-me-not			

Graminoids
Elymus canadensis Nodding wild rye

Area 31-4

Floodplain forest

Canopy		Shrub		Forbs		MLCCS Code	Qualitative	Acres
<i>Tilia americana</i>	Basswood	<i>Ribes cynosbati</i>	Prickly gooseberry	<i>Laportea canadensis</i>	Wood nettle	32210	C	
<i>Populus deltoides var. occidentalis</i>	Cottonwood	<i>Prunus virginiana</i>	Chokecherry	<i>Phlox divaricata var.</i>	Blue phlox			
<i>Acer saccharinum</i>	Silver maple	<i>Celtis occidentalis</i>	Hackberry	<i>Phlox divaricata var.</i>	Blue phlox			
<i>Fraxinus pennsylvanica</i> <i>var. pennsylvanica</i>	Green ash	<i>Celtis occidentalis</i>	Hackberry	<i>Rudbeckia laciniata var.</i>	Tall coneflower			
<i>Acer saccharinum</i>	Silver maple			<i>Polygonella articulata</i>	Coast jointweed			
				<i>Menispermum canadense</i>	Canada moonseed			
				<i>Glechoma hederacea</i>	Creeping Charlie			
				<i>Asarum canadense</i>	Wild ginger			
				<i>Viola sororia</i>	Common blue violet			
				<i>Aster ontarionis</i>	Ontario aster			

Graminoids
Elymus virginicus Virginia wild rye
Carex blanda Charming sedge
Carex blanda Charming sedge
Brachyelytrum erectum Bearded shorthusk

By-Community Species Lists

Area 31-5

Oak forest

Canopy

Ulmus americana American elm
Fraxinus pennsylvanica Green ash
var. pennsylvanica

Shrub

Forbs

Impatiens capensis Spotted touch-me-not
Lysimachia nummularia Moneywort
Laportea canadensis Wood nettle

Graminoids

Carex lupulina Hop umbrella sedge
Elymus virginicus Virginia wild rye
Phalaris arundinacea Reed canary grass

MLCCS Code

32110

Qualitative

B

Acres

Area 32-1

Oak forest mesic subtype

Canopy

Quercus alba White oak
Quercus macrocarpa Bur oak

Shrub

Rhamnus cathartica Common buckthorn
Lonicera tatarica Tartarian honeysuckle
Sambucus canadensis Common elder

Forbs

Caulophyllum thalictroides Blue cohosh
Actaea rubra Red baneberry
Actaea rubra Red baneberry
Circaea lutetiana var. Common enchanter's
Parthenocissus quinquefolia Woodbine

Graminoids

MLCCS Code

32110

Qualitative

D

Acres

Area 34-1

Oak forest mesic subtype

Canopy

Acer saccharum Sugar maple
Quercus rubra Northern red oak

Tilia americana Basswood

Shrub

Ribes cynosbati Prickly gooseberry

Forbs

Thalictrum dioicum Early meadow-rue
Anemone quinquefolia var. Wood anemone
Asarum canadense Wild ginger
Sanguinaria canadensis Bloodroot
Hesperis matronalis Dame's rocket
Actaea rubra Red baneberry
Anemone acutiloba Sharp-lobed hepatica
Caulophyllum thalictroides Blue cohosh

Graminoids

MLCCS Code

32110

Qualitative

C

Acres

By-Community Species Lists

Area 34-2

Oak forest mesic subtype

Canopy

<i>Quercus rubra</i>	Northern red oak
<i>Quercus rubra</i>	Northern red oak
<i>Acer saccharum</i>	Sugar maple

Shrub

<i>Acer saccharum</i>	Sugar maple
<i>Carya cordiformis</i>	Bitternut hickory
<i>Prunus virginiana</i>	Chokecherry

Forbs

<i>Caulophyllum thalictroides</i>	Blue cohosh
<i>Thalictrum thalictroides</i>	Rue anemone
<i>Thalictrum thalictroides</i>	Rue anemone
<i>Uvularia grandiflora</i>	Large-flowered bellwort
<i>Smilacina racemosa</i>	Common false Solomon's

MLCCS Code

32110

Qualitative

C

Acres

Graminoids

Area 35-1

Oak forest mesic subtype

Canopy

<i>Acer saccharum</i>	Sugar maple
<i>Quercus rubra</i>	Northern red oak
<i>Tilia americana</i>	Basswood

Shrub

<i>Cornus alternifolia</i>	Pagoda dogwood
<i>Celtis occidentalis</i>	Hackberry
<i>Ulmus americana</i>	American elm
<i>Acer saccharum</i>	Sugar maple
<i>Ribes cynosbati</i>	Prickly gooseberry
<i>Prunus virginiana</i>	Chokecherry
<i>Carya cordiformis</i>	Bitternut hickory
<i>Lonicera tatarica</i>	Tartarian honeysuckle

Forbs

<i>Sanguinaria canadensis</i>	Bloodroot
<i>Solidago flexicaulis</i>	Zigzag goldenrod
<i>Solidago flexicaulis</i>	Zigzag goldenrod
<i>Viola sororia</i>	Common blue violet
<i>Circaea lutetiana</i> var.	Common enchanter's
<i>Ranunculus abortivus</i>	Kidney-leaved buttercup
<i>Parthenocissus vitacea</i>	Virginia creeper
<i>Taraxacum officinale</i>	Common dandelion
<i>Arisaema triphyllum</i>	Jack-in-the-pulpit
<i>Smilax ecirrata</i>	Erect carrion flower
<i>Actaea rubra</i>	Red baneberry
<i>Uvularia grandiflora</i>	Large-flowered bellwort
<i>Galium tinctorium</i> var.	Small bedstraw
<i>Smilacina racemosa</i>	Common false Solomon's
<i>Asarum canadense</i>	Wild ginger
<i>Caulophyllum thalictroides</i>	Blue cohosh
<i>Menispermum canadense</i>	Canada moonseed
<i>Laportea canadensis</i>	Wood nettle
<i>Thalictrum dioicum</i>	Early meadow-rue

MLCCS Code

32110

Qualitative

B

Acres

Graminoids

<i>Carex sprengei</i>	Sprengel's sedge
<i>Elymus hystrix</i>	Bottlebrush grass
<i>Elymus hystrix</i>	Bottlebrush grass
<i>Schizachne purpurascens</i>	False melic grass

By-Community Species Lists

Area 35-2

Maple-basswood forest

Canopy

Shrub

Forbs

MLCCS Code

32150

Qualitative

D

Acres

Graminoids

Area 35-4

Mesic prairie

Canopy

Shrub

Forbs

MLCCS Code

61110

Qualitative

Acres

Graminoids

<i>Zizia aurea</i>	Golden alexanders	<i>Andropogon gerardii</i>	Big bluestem
<i>Ratibida pinnata</i>	Gray-headed coneflower	<i>Sorghastrum nutans</i>	Indian grass
<i>Agastache foeniculum</i>	Blue giant hyssop	<i>Elymus canadensis</i>	Nodding wild rye
<i>Monarda fistulosa</i> var.	Wild bergamot	<i>Bromus kalmii</i>	Kalm's brome
<i>Achillea millefolium</i>	Yarrow	<i>Poa pratensis</i>	Kentucky bluegrass
<i>Phlox pilosa</i> var. <i>fulgida</i>	Prairie phlox		
<i>Solidago canadensis</i>	Canada goldenrod		
<i>Taraxacum officinale</i>	Common dandelion		
<i>Coreopsis palmata</i>	Bird's foot coreopsis		
<i>Solidago rigida</i>	Stiff goldenrod		
<i>Rudbeckia hirta</i> var.	Black-eyed Susan		
<i>Asclepias syriaca</i>	Common milkweed		
<i>Cirsium arvense</i>	Canada thistle		
<i>Ambrosia trifida</i> var. <i>trifida</i>	Great ragweed		

By-Community Species Lists

Area 35-5

Oak forest

Canopy

<i>Quercus rubra</i>	Northern red oak
<i>Populus tremuloides</i>	Quaking aspen

Shrub

<i>Sambucus canadensis</i>	Common elder
<i>Rubus idaeus</i> var. <i>strigosus</i>	Red raspberry
<i>Toxicodendron radicans</i> var. <i>negundo</i>	Common poison ivy
<i>Rhamnus cathartica</i>	Common buckthorn

Forbs

<i>Impatiens pallida</i>	Pale touch-me-not
<i>Circaea lutetiana</i> var.	Common enchanter's
<i>Circaea lutetiana</i> var.	Common enchanter's
<i>Arisaema triphyllum</i>	Jack-in-the-pulpit
<i>Osmorhiza claytonii</i>	Clayton's sweet cicely
<i>Maianthemum canadense</i>	Canada mayflower
<i>Solidago flexicaulis</i>	Zigzag goldenrod
<i>Actaea rubra</i>	Red baneberry
<i>Sanguinaria canadensis</i>	Bloodroot
<i>Phryma leptostachya</i>	Lopseed
<i>Aster sagittifolius</i>	Tail-leaved aster
<i>Uvularia grandiflora</i>	Large-flowered bellwort
<i>Caulophyllum thalictroides</i>	Blue cohosh
<i>Trillium cernuum</i> var.	Nodding trillium
<i>Thalictrum dioicum</i>	Early meadow-rue
<i>Allium tricoccum</i>	Wild leek

MLCCS Code

32110

Qualitative

B

Acres

Graminoids

By-Community Species Lists

Area 35-6

Oak forest mesic subtype

Canopy

<i>Quercus rubra</i>	Northern red oak
<i>Prunus serotina</i>	Black cherry
<i>Tilia americana</i>	Basswood
<i>Carya cordiformis</i>	Bitternut hickory

Shrub

<i>Carya cordiformis</i>	Bitternut hickory
<i>Ribes cynosbati</i>	Prickly gooseberry
<i>Parthenocissus quinquefolia</i>	Woodbine
<i>Vitis riparia</i>	Wild grape
<i>Ulmus americana</i>	American elm

Forbs

<i>Geranium maculatum</i>	Wild geranium
<i>Caulophyllum thalictroides</i>	Blue cohosh
<i>Thalictrum dioicum</i>	Early meadow-rue
<i>Circaea lutetiana var.</i>	Common enchanter's
<i>Smilacina racemosa</i>	Common false Solomon's
<i>Actaea rubra</i>	Red baneberry
<i>Thalictrum thalictroides</i>	Rue anemone
<i>Arisaema triphyllum</i>	Jack-in-the-pulpit
<i>Geum canadense</i>	White avens
<i>Smilax ecirrata</i>	Erect carrion flower
<i>Dioscorea villosa</i>	Wild yam

Graminoids

<i>Carex rosea</i>	Starry sedge
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MLCCS Code

32110

Qualitative

B

Acres

Appendix D

Minnesota Land Cover Classification System Summaries

Level 1

Level 3

Level 4-5

and

Summary of Natural and Semi-natural Cover Types

Level 1 MLCCS Land Cover Summary

MLCCS Code	Number of Polygons	Description	Total Acres
10000	191	Artificial surfaces and associated areas	3,757.72
20000	240	Planted or Cultivated Vegetation (greater than 96% vegetation cover)	4,486.12
30000	86	Forests	780.95
40000	30	Woodland	231.21
50000	2	Shrubland	6.61
60000	126	Herbaceous	840.14
90000	21	Water	121.81
		Total Acres	10,224.56

Level 3 MLCCS Land Cover Summary

MLCCS Code	Number of Polygons	Alpha-numeric Code	Description	Total Acres
11200	8	1.tt.CD.i25.cPD.	Other deciduous trees with 11- 25% impervious cover	110.0
13100	109	1.hh.CT.i25.cGS.	Short grasses and mixed trees with 11-25% impervious cover	2,519.9
14100	54	1.mv.BP.i99.cBP.	Buildings and pavement with 91-100% impervious cover	1,047.9
14200	8	1.mv.EE.e25.cLF.	Landfill with 11-25% impervious cover	67.7
21100	6	2.tt.CC.pUS.	Upland soils with planted, maintained, or cultivated coniferous trees	20.5
21200	3	2.tt.CD.pUS.cPD.	Deciduous trees on upland soils	16.5
21300	7	2.tt.CM.pHS.	Hydric soils with planted, maintained or cultivated mixed coniferous/deciduous trees	35.8
23100	61	2.ph.CT.pHS.cGS.	Short grasses with sparse tree cover on hydric soils	586.6
23200	11	2.ph.CG.pHS.cGS.	Short grasses on hydric soils	90.9
24100	114	2.ch.RC.pHS.cSB.	Soybeans on hydric soils	3,285.9
24200	38	2.ch.GN.pHS.cHF.	Hayfield on hydric soils	450.0
32100	61	3.de.UP.nOA.nOM.	Oak forest mesic subtype	502.7
32200	21	3.de.WA.nLH.	Lowland hardwood forest	279.3
32300	3	3.de.WB.nMH.	Mixed hardwood swamp	11.0
32400	1	3.de.WC.nAT.	Altered/non-native seasonally flooded deciduous forest	3.3
33100	1	3.cd.UP.	Upland mixed coniferous-deciduous forest	2.5
42100	27	4.de.UP.nAT.	Altered/non-native deciduous woodland	205.3
42200	1	4.de.WA.nAT.	Altered/non-native deciduous woodland - temporarily flooded	3.6
42400	1	4.de.WC.nAT.	Altered/non-native deciduous woodland - seasonally flooded	4.5
52300	2	5.de.WB.nAT.	Altered/non-native dominated saturated shrubland	6.6
61100	9	6.ge.TG.nMP.	Mesic prairie	230.0
61200	36	6.ge.MG.nAT.	Medium-tall grass altered/non-native dominated grassland	215.0
61300	4	6.ge.WA.nAT.	Temporarily flooded altered/non-native dominated grassland	9.7
61400	15	6.ge.WB.nAT.	Saturated altered/non-native dominated graminoid vegetation	48.1
61500	6	6.ge.WC.nAT.	Seasonally flooded altered/non-native dominated emergent vegetation	9.0
61600	2	6.ge.WF.nRM.	Rich fen floating-mat subtype - semipermanently flooded	11.7
62100	35	6.gt.GD.nAT.	Grassland with sparse deciduous trees - altered/non-native dominated vegetation	174.0
62200	6	6.gt.GC.nAT.	Grassland with sparse conifer or mixed deciduous/coniferous trees - altered/non-native dominated	70.1
62300	6	6.gt.WA.nAT.	Altered/non-native grassland with sparse deciduous trees - temporarily flooded	56.4

Level 3 MLCCS Land Cover Summary

MLCCS Code	Number of Polygons	Alpha-numeric Code	Description	Total Acres
62400	7	6.gt.WB.nAT.	Altered/non-native grassland with sparse deciduous trees - saturated soils	16.2
91200	1	9.ri.SR.	Slow moving linear open water habitat	72.3
93300	20	9.ww.OW.	Palustrine open water	49.5

Level 4-5 MLCCS Land Cover Summary

MLCCS Code	Number of Polygons	Alpha-numeric Code	Description	Total Acres
11219	1	1.tt.CD.i10.cPD.	Other deciduous trees with 4-10% impervious cover	2.0
11229	3	1.tt.CD.i25.cPD.	Other deciduous trees with 11- 25% impervious cover	21.4
11231	3	1.tt.CD.i50.cOA.	Oak (forest or woodland) with 26-50% impervious cover	83.7
11239	1	1.tt.CD.i50.cPD.	Other deciduous trees with 26-50% impervious cover	3.0
13114	18	1.hh.CT.i10.cGS.	Short grasses and mixed trees with 4-10% impervious cover	148.2
13115	1	1.hh.CT.i10.cGL.	Long grasses and mixed trees with 4-10% impervious cover	2.7
13124	44	1.hh.CT.i25.cGS.	Short grasses and mixed trees with 11-25% impervious cover	454.6
13134	35	1.hh.CT.i50.cGS.	Short grasses and mixed trees with 26-50% impervious cover	1,693.0
13144	11	1.hh.CT.i75.cGS.	Short grasses and mixed trees with 51-75% impervious cover	221.3
14112	4	1.mv.BP.i90.cPV.	Pavement with 76-90% impervious cover	50.6
14113	16	1.mv.BP.i90.cBP.	Buildings and pavement with 76-90% impervious cover	294.4
14122	10	1.mv.BP.i99.cPV.	Pavement with 91-100% impervious cover	183.0
14123	24	1.mv.BP.i99.cBP.	Buildings and pavement with 91-100% impervious cover	520.0
14212	1	1.mv.EE.e10.cSG.	Sand and gravel pits with 0-10% impervious cover	2.5
14214	2	1.mv.EE.e10.cOE.	Other exposed/transitional land with 0-10% impervious cover	7.5
14223	1	1.mv.EE.e25.cLF.	Landfill with 11-25% impervious cover	7.2
14224	2	1.mv.EE.e25.cOE.	Other exposed/transitional land with 11-25% impervious cover	23.6
14232	2	1.mv.EE.e50.cSG.	Sand and gravel pits with 26-50% impervious cover	26.9
21110	4	2.tt.CC.pUS.	Upland soils with planted, maintained, or cultivated coniferous trees	12.6
21113	2	2.tt.CC.pUS.cPR.	Red pine trees on upland soils	7.8
21211	1	2.tt.CD.pUS.cPF.	Fruit trees (apple, cherry, plum, etc) on upland soils	9.1
21213	2	2.tt.CD.pUS.cPD.	Deciduous trees on upland soils	7.4
21310	6	2.tt.CM.pUS.	Upland soils with planted, maintained or cultivated mixed coniferous/deciduous trees	32.6
21320	1	2.tt.CM.pHS.	Hydric soils with planted, maintained or cultivated mixed coniferous/deciduous trees	3.2
23111	52	2.ph.CT.pUS.cGS.	Short grasses with sparse tree cover on upland soils	541.4
23112	1	2.ph.CT.pUS.cGL.	Long grasses with sparse tree cover on upland soils	2.0
23121	8	2.ph.CT.pHS.cGS.	Short grasses with sparse tree cover on hydric soils	43.2
23211	9	2.ph.CG.pUS.cGS.	Short grasses on upland soils	81.1
23221	2	2.ph.CG.pHS.cGS.	Short grasses on hydric soils	9.8
24112	36	2.ch.RC.pUS.cCO.	Corn	1,610.9

Level 4-5 MLCCS Land Cover Summary

MLCCS Code	Number of Polygons	Alpha-numeric Code	Description	Total Acres
24114	42	2.ch.RC.pUS.cSB.	Soybeans	1,353.1
24119	1	2.ch.RC.pUS.cOV.	Other vegetable and truck crops	1.4
24120	1	2.ch.RC.pHS.	Hydric soils - row cropland	15.5
24122	26	2.ch.RC.pHS.cCO.	Corn on hydric soils	225.5
24124	8	2.ch.RC.pHS.cSB.	Soybeans on hydric soils	79.6
24211	4	2.ch.GN.pUS.cWT.	Wheat	34.2
24212	4	2.ch.GN.pUS.cOT.	Oats	39.1
24216	4	2.ch.GN.pUS.cFW.	Fallow	141.1
24217	22	2.ch.GN.pUS.cHF.	Hayfield	215.5
24222	1	2.ch.GN.pHS.cOT.	Oats on hydric soils	4.5
24228	3	2.ch.GN.pHS.cHF.	Hayfield on hydric soils	15.6
32100	1	3.de.UP.	Upland deciduous forest	15.4
32110	2	3.de.UP.nOA.	Oak forest	33.5
32112	12	3.de.UP.nOA.nOM.	Oak forest mesic subtype	132.5
32150	11	3.de.UP.nMB.	Maple-basswood forest	110.2
32160	1	3.de.UP.nAF.	Aspen forest	1.9
32170	34	3.de.UP.nAT.	Altered/non-native deciduous forest	209.2
32210	14	3.de.WA.nFF.	Floodplain forest	200.9
32211	2	3.de.WA.nFF.nFM.	Floodplain forest silver maple subtype	5.4
32220	3	3.de.WA.nLH.	Lowland hardwood forest	34.6
32240	1	3.de.WA.nAT.	Altered/non-native temporarily flooded deciduous forest	20.5
32320	3	3.de.WB.nMH.	Mixed hardwood swamp	11.0
32430	1	3.de.WC.nAT.	Altered/non-native seasonally flooded deciduous forest	3.3
33100	1	3.cd.UP.	Upland mixed coniferous-deciduous forest	2.5
42120	5	4.de.UP.nOW.	Oak woodland-brushland	91.6
42130	23	4.de.UP.nAT.	Altered/non-native deciduous woodland	131.5
42210	1	4.de.WA.nAT.	Altered/non-native deciduous woodland - temporarily flooded	3.6
42410	1	4.de.WC.nAT.	Altered/non-native deciduous woodland - seasonally flooded	4.5
52330	1	5.de.WB.nAT.	Altered/non-native dominated saturated shrubland	2.7
52360	1	5.de.WB.nWI.	Willow swamp - saturated soils	3.9

Level 4-5 MLCCS Land Cover Summary

MLCCS Code	Number of Polygons	Alpha-numeric Code	Description	Total Acres
61110	9	6.ge.TG.nMP.	Mesic prairie	230.0
61220	36	6.ge.MG.nAT.	Medium-tall grass altered/non-native dominated grassland	215.0
61330	4	6.ge.WA.nAT.	Temporarily flooded altered/non-native dominated grassland	9.7
61420	1	6.ge.WB.nWM.	Wet meadow	1.3
61480	14	6.ge.WB.nAT.	Saturated altered/non-native dominated graminoid vegetation	46.8
61500	2	6.ge.WC.	Seasonally flooded emergent vegetation	2.2
61510	1	6.ge.WC.nCM.	Cattail marsh - seasonally flooded	3.1
61520	1	6.ge.WC.nME.	Mixed emergent marsh - seasonally flooded	2.1
61530	2	6.ge.WC.nAT.	Seasonally flooded altered/non-native dominated emergent vegetation	1.6
61620	1	6.ge.WF.nME.	Mixed emergent marsh	5.3
61650	1	6.ge.WF.nRM.	Rich fen floating-mat subtype - semipermanently flooded	6.4
62130	1	6.gt.GD.nMO.	Mesic oak savanna	0.8
62140	34	6.gt.GD.nAT.	Grassland with sparse deciduous trees - altered/non-native dominated vegetation	173.2
62220	6	6.gt.GC.nAT.	Grassland with sparse conifer or mixed deciduous/coniferous trees - altered/non-native dominated	70.1
62310	6	6.gt.WA.nAT.	Altered/non-native grassland with sparse deciduous trees - temporarily flooded	56.4
62410	7	6.gt.WB.nAT.	Altered/non-native grassland with sparse deciduous trees - saturated soils	16.2
91200	1	9.ri.FR.	Slow moving linear open water habitat	72.3
93300	20	9.wv.OW.	Palustrine open water	49.5

Summary of Semi-Natural Cover Types

MLCCS Code	Number of Sites	Cover Type	Total Acres
32100	1	Upland deciduous forest	15.40
32110	2	Oak forest	33.47
32112	12	Oak forest mesic subtype	132.52
32150	11	Maple-basswood forest	110.23
32160	1	Aspen forest	1.86
32170	34	Altered/non-native deciduous forest	209.17
32210	14	Floodplain forest	200.89
32211	2	Floodplain forest silver maple subtype	5.38
32220	3	Lowland hardwood forest	34.63
32240	1	Altered/non-native temporarily flooded deciduous forest	20.53
32320	3	Mixed hardwood swamp	11.02
32430	1	Altered/non-native seasonally flooded deciduous forest	3.33
33100	1	Upland mixed coniferous-deciduous forest	2.51
42120	5	Oak woodland-brushland	91.61
42130	23	Altered/non-native deciduous woodland	131.52
42210	1	Altered/non-native deciduous woodland - temporarily flooded	3.58
42410	1	Altered/non-native deciduous woodland - seasonally flooded	4.50
52330	1	Altered/non-native dominated saturated shrubland	2.68
52360	1	Willow swamp - saturated soils	3.93
61110	9	Mesic prairie	229.97
61220	36	Medium-tall grass altered/non-native dominated grassland	214.99
61330	4	Temporarily flooded altered/non-native dominated grassland	9.75
61420	1	Wet meadow	1.33
61480	14	Saturated altered/non-native dominated graminoid vegetation	46.78
61500	2	Seasonally flooded emergent vegetation	2.24
61510	1	Cattail marsh - seasonally flooded	3.06
61520	1	Mixed emergent marsh - seasonally flooded	2.12
61530	2	Seasonally flooded altered/non-native dominated emergent vegetation	1.56
61620	1	Mixed emergent marsh	5.28

Summary of Semi-Natural Cover Types

MLCCS Code	Number of Sites	Cover Type	Total Acres
61650	1	Rich fen floating-mat subtype - semipermanently flooded	6.40
62130	1	Mesic oak savanna	0.81
62140	34	Grassland with sparse deciduous trees - altered/non-native dominated vegetation	173.15
		Grassland with sparse conifer or mixed deciduous/coniferous trees - altered/non-native dominated	
62220	6		70.06
62310	6	Altered/non-native grassland with sparse deciduous trees - temporarily flooded	56.43
62410	7	Altered/non-native grassland with sparse deciduous trees - saturated soils	16.23
91200	1	Fast moving linear open water habitat	72.33
93300	20	Palustrine open water	49.48
		Total Acres:	1980.72

Summary of Semi-Natural Cover Types

MLCCS Code	Number of Sites	Cover Type	Total Acres
32100	1	Upland deciduous forest	15.40
32110	2	Oak forest	33.47
32112	12	Oak forest mesic subtype	132.53
32150	11	Maple-basswood forest	110.22
32160	1	Aspen forest	1.86
32210	14	Floodplain forest	200.89
32211	2	Floodplain forest silver maple subtype	5.38
32220	3	Lowland hardwood forest	34.64
32320	3	Mixed hardwood swamp	11.02
33100	1	Upland mixed coniferous-deciduous forest	2.51
42120	5	Oak woodland-brushland	91.61
52360	1	Willow swamp - saturated soils	3.93
61110	9	Mesic prairie (planted communities)	229.96
61420	1	Wet meadow	1.33
61500	2	Seasonally flooded emergent vegetation	2.24
61510	1	Cattail marsh - seasonally flooded	3.06
61520	1	Mixed emergent marsh - seasonally flooded	2.12
61620	1	Mixed emergent marsh	5.28
61650	1	Rich fen floating-mat subtype - semipermanently flooded	6.40
62130	1	Mesic oak savanna	0.81
91200	1	Fast moving linear open water habitat	72.33
93300	20	Palustrine open water	49.48
		Total Acres *	1,016.46*

*Includes planted prairie communities

Summary of Semi-Natural Cover Types

MLCCS Code	Number of Sites	Cover Type	Total Acres
32170	34	Altered/non-native deciduous forest	209.174
32240	1	Altered/non-native temporarily flooded deciduous forest	20.53
32430	1	Altered/non-native seasonally flooded deciduous forest	3.333
42130	23	Altered/non-native deciduous woodland	131.519
42210	1	Altered/non-native deciduous woodland - temporarily flooded	3.578
42410	1	Altered/non-native deciduous woodland - seasonally flooded	4.5
52330	1	Altered/non-native dominated saturated shrubland	2.681
61220	36	Medium-tall grass altered/non-native dominated grassland	214.993
61330	4	Temporarily flooded altered/non-native dominated grassland	9.747
61480	14	Saturated altered/non-native dominated graminoid vegetation	46.776
61530	2	Seasonally flooded altered/non-native dominated emergent vegetation	1.555
62140	34	Grassland with sparse deciduous trees - altered/non-native dominated vegetation	173.151
62220	6	Grassland with sparse conifer or mixed deciduous/coniferous trees - altered/non-native dominated	70.063
62310	6	Altered/non-native grassland with sparse deciduous trees - temporarily flooded	56.425
62410	7	Altered/non-native grassland with sparse deciduous trees - saturated soils	16.23
		Total Acres	964.255

Appendix E

Glossary of Technical Terms

¹Glossary of Technical Terms

Acre-Foot Volume of water that would cover an acre of land to a depth of one foot (43,560 cubic feet).

Alluvium Material, such as sand and gravel, deposited by running water. River terraces and outwash plains are examples of landforms composed of alluvium.

Barrens Usually refers to an area with sparse vegetation or stunted plants, caused by harsh growing conditions such as infertile, droughty, or thin soils; also, a plant community that has very sparse cover or is composed of stunted plants.

Bedrock Any solid rock exposed at the earth's surface or covered by unconsolidated material such as till, gravel, or sand.

Best Management Practices: Methods, measures, or practices to prevent or reduce water pollution, including but not limited to structural and non-structural controls, operation and maintenance procedures, and scheduling of specific activities. Acronym is BMPs.

Blowout An area, on a dune or other sand deposit, where wind has eroded a bowl-shaped hollow in the sand. Blowouts generally are sparsely vegetated.

Bluegreen algae A type of algae whose population often increases dramatically at high nutrient concentrations in lakes. They can form objectionable surface scums, cause taste and odor problems, and secrete toxins poisonous to warm-blooded animals.

Bog A wetland composed of a layer of acidic peat on which grows a specialized group of herbs and low shrubs. Bogs are distinguished from closely related poor fens by extremely nutrient-poor conditions and the absence of most of the minerotrophic species that occur in poor fens.

Bounce In Hydrologic references, the rise in level in a wetland or lake resulting from a rainstorm event. The difference in elevation between the normal water elevation and the peak water elevation of a pond for a given size runoff event.

Brushland An upland plant community composed of shrubs and tree sprouts.

Buffer strip: A band of un-maintained, preferably native, vegetation left along the edge of a stream, lake or wetland to filter runoff and/or stabilize the shoreline

Calcareous Describes a soil or substrate that contains a significant amount of calcium carbonate.

Canopy Aerial branches and leaves of terrestrial plants; generally the tallest layer of foliage in a plant community.

Chlorophyll a The primary photosynthetic pigment in plants, a measure of the algal biomass in lakes

Colluvium A deposit of rock and soil at the base of a cliff or slope, formed by gravitational action.

Colonial nesting birds Species that nest in colonies (groups or aggregations), either with others of the same species or in mixed-species aggregations.

Cover The proportion of the ground shaded when the living plant canopy is projected vertically downward; also a general term used to describe any component of the habitat that conceals animals from view.

DBH (diameter at breast height) – a standard measure of tree trunk diameter taken approximately 4.5 feet above the ground level.

¹ Many of the definitions used in this section are borrowed from [Minnesota's St. Croix River Valley and Anoka Sandplain](#), Worcha et al, Minnesota DNR, 1995.

Dominant Describes a plant species that shapes the character of a community by virtue of its size, abundance, dense shade, or effects on soils. Dominant species generally influence the presence, growth, and distribution of other plant species in the community.

Degradation A decrease in quality.

Detention Pond A pond designed to catch and temporarily store runoff before discharging the water downstream. The volume of the pool of standing water in the pond is important in determining how effective the pond will be in treating the incoming stormwater.

Dissolved Oxygen (D.O.) Oxygen that is dissolved in water. Fish and other water organisms need oxygen for respiration to survive. Depletion of oxygen from water can occur as a result of chemical and biological processes, including decomposition of organic matter.

Downcutting The process by which a river or stream erodes and lowers its bed, eventually resulting in the formation of a valley or ravine.

Drift (glacial) Rock material, such as boulders, gravel, sand, silt, or clay, removed from one area and deposited in another by glaciers. Drift includes material deposited directly by glacial ice, such as till, as well as material deposited indirectly, such as outwash.

Ecosystem The interacting group of physical elements (such as soils, water, etc.), plants, animals, and human communities that inhabit a particular place.

Emergent Describes a plant capable of surviving indefinitely with its root system and lower stem in water and its upper stem above water (e.g., cattails).

Empirical Based on experiment and observation; used to describe water quality models which are developed from measured data.

End moraine A typically hilly landform composed of material deposited at the margin of a glacier.

Ephemeral habitat A temporary habitat created by low intensity, short-lived fluctuations in environmental factors.

Epilimnion: Upper warm layer of a lake during thermal stratification.

Esker A long, often serpentine hill or ridge composed of sand and gravel deposited by meltwater streams flowing in a channel in a decaying ice sheet.

Eutrophication A natural process caused by the gradual accumulation of nutrients and consequent increased biological production, and resulting in the slow filling in of a basin with accumulated sediments, silt, and organic matter. Man's activities can increase the rate at which eutrophication occurs.

Eutrophic Lake: A nutrient rich lake; usually shallow, green due to excessive algae growth and with limited oxygen in the bottom layer of water.

Exotic species A species that has been introduced to an area by humans or that is present in the area as a result of human-caused changes. (same as non native species.)

Export Coefficient An estimate of the expected annual amount of a nutrient carried from its source to a lake.

Fen a wetland community composed of sedges, grasses, forbs, and sometimes shrubs, that develops on peat in shallow basins.

Floating-leaved plants Aquatic plants that root on lake, pond, or river bottoms and have leaves that float on the water surface at the end of long, flexible stems (e.g., water-lilies).

Floodplain A flat area adjacent to a stream or river channel, created by erosion and deposition of sediment during regular flooding. Signs of ²flooding include debris caught in trees and ice scars at the bases of trees.

Flushing Rate The number of times per year that a volume of water equal to the lake's volume flows through the lake.

Forb A general term for broad-leaved, herbaceous plants.

Forest A plant community with a nearly continuous to continuous canopy (70 to 100% cover) of mature trees.

Forest-grown tree A tree that matured within a closed-canopy forest. Forest-grown trees tend to have narrow crowns and tall, straight trunks with few lower limbs.

Graminoid An herbaceous plant with linear, "grasslike" leaves that typically are oriented vertically. Graminoids include grasses, sedges, and rushes.

Greenway or Greenway Corridor A linear open space area, usually composed of natural vegetation, or vegetation that is more natural than surrounding land uses. May include paths or recreational trails.

Ground layer A vegetation layer, mostly less than 3 feet tall, of grasses, forbs, and woody plants.

Ground moraine A broad and level or gently undulating landform composed of material that was deposited underneath and sometimes at the margin of a glacier as the ice sheet melted; also referred to as a till plain.

Grove A general term for a patch of trees less than 2 acres in area.

Grub A tree or shrub whose aboveground shoots are repeatedly killed by fire or browsing but whose root system survives and continues to send up new shoots. The root system of a grub may be several hundred years old; the above ground shoots are generally much younger.

Habitat The locality, site, and particular type of local environment in which plants, animals, and other organisms live.

Herb A plant lacking a persistent above ground woody stem. Herbs include broad-leaved flowering plants, ferns, grasses, sedges, and others.

High Water Level (HWL) The peak water surface elevation in a ponding area as a result of a specific runoff event. Once the peak is reached, the pond water elevation eventually returns to its normal (standing) water level.

Hydrology The science and study of water in nature, including its circulation, distribution, and its interaction with the environment.

Hydrophyte A plant adapted to growing in water or on wet soils that are periodically saturated and deficient in oxygen.

Hypolimnion Lower cooler layer of a lake during thermal stratification.

Ice block lake A lake that occurs in a depression that was formed when a block of glacial ice was buried or surrounded by till or outwash sand, and then melted.

Ice scar A scar on a floodplain tree caused by abrasion by ice floes during spring flooding.

Impervious Surface A surface that is impermeable to the downward seepage of water; e.g., pavement and roof tops.

Inflorescence An arrangement of flowers on a plant, such as in a cluster or along a stalk.

Lacustrine Refers to features (such as sediments, landforms, plant communities, or animal communities) that were formed by or are associated with a lake.

² Many of the definitions used in this section are borrowed from Minnesota's St. Croix River Valley and Anoka Sandplain, Worcha et al, Minnesota DNR, 1995.

Landform A land feature, such as plain, plateau, or valley, formed by a particular geologic process.

Life form Characteristic structural features and growth pattern of plant species (e.g., broad-leaved deciduous shrub).

Litter layer Relatively undecomposed organic matter and debris on top of soil layer.

Loading The amount of a pollutant or other substance delivered to a lake, usually expressed as a weight per unit time (i.e. pounds per year). The loading of a given constituent to a receiving water is a function of the volume of incoming water and the concentration of the constituent in the incoming water.

Loess Fine material consisting predominantly of silt with fine sand and clay. Loess is often deposited by wind.

Macrophytes Higher plants which grow in water, either submerged, emergent, or floating. Reeds and cattails are examples of emergent macrophytes.

Marsh A plant community of shallow wetland basins, dominated by herbaceous, emergent aquatic plants such as cattails and bulrushes. Marshes usually have standing water throughout the growing season.

Meltwater Water released by melting glacial ice.

Mesic A general term describing upland habitats that are intermediate between wet and dry; also used to describe plants and plant communities that occur in mesic habitats.

Mesotrophic Lake Midway in nutrient levels between eutrophic and oligotrophic lakes.

Microhabitat A small, specialized habitat.

Mineral soil A soil composed mostly of inorganic matter, including clay, silt, sand, and gravel. Mineral soils usually have less than 20% organic matter but may have organic surface layers up to 12 inches thick.

Minerotrophic A general term describing wetlands with nutrient levels that fall between very low (such as in bogs) and very high (such as in seepage meadows).

Mitigation: Actions taken to reduce an impact. Water quality mitigation measures can be non-structural (such as street sweeping, regulation of fertilizer use, and creation/protection of natural buffers to filter runoff) or structural (such as installation of detention basins). Properly designed detention basins are among the most effective and reliable measures for mitigating the water quality impacts of urban developments.

Model A mathematical representation of an event or process.

Moraine Rock and mineral debris deposited directly by glacial ice. Moraines most often consist of unsorted rock and mineral particles.

Muck A dark-colored organic soil of highly decomposed plant material in which the original plant parts are not recognizable.

MUSA (Metropolitan Urban Service Area) The area designated by the Metropolitan Council of the twin cities area to receive urban services such as central sewer, urban streets, etc.

Native habitat A habitat formed and occupied by native plants and animals and little modified by logging, farming, ditching, flood control, and the like.

Native species A species that occurs naturally within a given region.

³**Native vegetation** Vegetation, composed of native plants, that has been little modified by human activities such as logging, farming, ditching, or the introduction of nonnative species.

Natural area Geographic area in which the dominant plants and animals are native species.

³ Many of the definitions used in this section are borrowed from Minnesota's St. Croix River Valley and Anoka Sandplain, Worcha et al, Minnesota DNR, 1995.

Natural community An assemblage that tends to recur over space and time of native plants and animals that interact with each other and with their abiotic habitats in ways that have been little modified by nonnative plant and animal species. Natural communities are classified and described according to their vegetation, successional status, topography, hydrologic conditions, landforms, substrates, soils, and natural disturbance regimes (such as wildfires, windstorms, normal flood cycles, and normal infestation by native insects and microorganisms).

Nonnative species A species that has been introduced to an area by humans or that is present in the area as a result of human-caused changes.

Non-Point Source Pollution: Refers to pollution other than that caused by discharge of pollutants through a pipe from a closed system to a receiving water. Pollution caused by runoff from farm fields or paved streets are examples of this non-point pollution.

Normal Water Level (NWL) The elevation of the surface of the standing water pool within a pond or wetland. Generally, the NWL is the elevation of the bottom of the primary outlet pipe or overland flow channel. **Nutrient Budget:** An itemized estimate of nutrient inputs and outputs (usually for a period of one year), taking into account all sources and losses.

Nutrient Loading The input of nutrients to a lake

Nutrient Trap A type of pond or wetland that is effective at removing nutrients from water.

Nutrients Elements such as phosphorus and nitrogen that are required for plant growth. When excess amounts are transported in stormwater they may encourage excessive algae or other plant growth in receiving water bodies.

Oligotrophic Lake A relatively nutrient-poor lake, usually clear and deep with bottom waters high in dissolved oxygen.

Open-grown tree A tree that has matured in an open setting, such as a prairie or savanna. Open-grown trees tend to have broad crowns and thick, spreading lower limbs.

Organic soil A soil in which the upper surface layers contain more than 25% organic matter.

Outcrop Bedrock that projects above the soil.

Outwash plain A plain formed of sorted and stratified material-such as layers of sand and gravel-carried from an ice sheet and deposited by glacial meltwater.

pH A measure of the acidic or basic nature of the water; it is defined as the logarithm of the reciprocal of the hydrogen-ion concentration in moles/liter.

Parent material The weathered rock or partly weathered soil material from which topsoil develops.

Parts per billion (ppb) a unit of concentration, sometimes expressed as micrograms per liter (ug/l).

Parts per million (ppm) a unit of concentration, sometimes expressed as milligrams per liter (mg/l).

Peat soil A dark brown or black organic soil consisting largely of undecomposed or slightly decomposed plants. Peat soils usually form where persistent excessive moisture slows or inhibits the decay of plant material.

Persistent vegetation Wetland vegetation formed by emergent hydrophytic plants with stems that normally remain standing until the beginning of the following growing season (e.g., cattails and bulrushes).

Phosphorus A nutrient essential to plant growth. Phosphorus is the nutrient most commonly limiting plant growth in lakes.

Phosphorus Export The amount of phosphorus carried off of a given area of land by stormwater.

Phytoplankton Open water algae; it forms the base of the lake's food chain and produces oxygen.

Prairie An upland plant community composed of grasses and forbs. Prairies generally lack trees; shrubs, if present, are not prominent.

Presettlement A term used for convenience to denote the time period before Euro-American settlers moved into the Region. The Region was actually settled by American Indians for thousands of years before European-Americans arrived.

Range (geographic) The limits of the geographic distribution of a species or group.

Rate Control: A term that refers to controlling the rate at which water is discharged from a watershed. Rate control is often accomplished by creating ponds-either by excavation or berming- to temporarily store runoff, then discharging the stored water at a slower rate to downstream areas. Further reductions in the rate at which water is released from a pond can be accomplished by reducing the size of the outlet, such as through installation of a wall in the outlet structure with a hole (orifice) through it.

Reintroduced species Species that had been eliminated from areas where they occurred historically and were later released back into the area by humans.

Remnant A portion or fragment of a natural community that has survived while the rest of the community has been destroyed by logging, urban development, clearing of land for cultivation, and other human activities.

Residence Time The amount of time it takes for water flowing into a lake to equal the lake volume. The shorter the residence time, the more incoming water the lake is receiving relative to its volume.

Rhizome A horizontal underground plant stem.

Savanna An upland plant community formed of prairie herbs with scattered trees or groves of trees. The canopy cover of trees in a savanna is generally between 10 and 70%.

Secchi Disc A device measuring the depth of light penetration in water, typically a 9-inch, white circular plate attached to a rope. Used to measure water transparency.

Sedge Any of a number of grasslike plants of the family Cyperaceae.

Sedimentation The process by which matter (usually soil particles) settles on a substrate following transport by water, wind, or ice.

Seepage The slow, diffuse oozing of groundwater onto the earth's surface.

Shallow Lake Lakes with mean depth of less than 10 feet

Shrub layer A vegetation layer, usually less than 6 feet high, of shrubs and tree seedlings.

Shrub swamp A wetland community dominated by a nearly continuous to continuous canopy (70 to 100% cover) of shrubs, such as willows and alders.

Subcanopy A vegetation layer, composed of patches of individuals of approximately equal height, that is lower than the canopy layer; often refers to a layer of saplings, tall shrubs, or small trees between 6 and 35 feet high.

Submergent Describes an aquatic plant that grows entirely under water.

Substrate The surface layer of organic or mineral material-such as till, outwash, or bedrock-from which the soil is formed.

Succession The change in vegetation over time.

Swale A broad, shallow depression in a till plain or broad river plain.

Swamp A wetland community with a fairly continuous to continuous canopy of shrubs or trees, such as speckled alder, black ash, or tamarack. Swamps generally occur in shallow basins or wet depressions.

⁴Talus Rocks and other coarse mineral debris that accumulate at the base of a cliff or steep slope.

Terrace A sandy and gravelly alluvial plain bordering a river. Terraces represent former river floodplains, left stranded when the river level dropped because of channel downcutting or decreased flow. Terraces are ordinarily level or nearly level and are seldom flooded.

Till Unstratified and unsorted material deposited directly by a glacier. Till consists of clay, sand, gravel, or boulders mixed in any proportion.

Till plain A broad and level or gently undulating landform composed of material that was deposited underneath and at the margin of a glacier as the ice sheet melted; also referred to as a ground moraine.

Total Phosphorus (TP) A measure of all of the different forms of phosphorus in water. Includes phosphorus dissolved in the water, suspended or incorporated in algae or other organisms.

Total Suspended Solids (TSS) Particulate material which floats in or is carried along in water (e.g., algae, soil particles).

Transitional habitat A habitat present between two adjacent natural communities (for example, the edge of a forest along a wet meadow). Transitional habitats often have features that set them apart from the habitats formed by either of the adjacent communities.

Trophic State The level of growth or productivity of a lake as measured by phosphorus content, algae abundance, or depth of light penetration.

Understory The vegetation occurring below the canopy in a plant community.

Vine A plant with a long, weak stem that grows along the ground or climbs on other vegetation for support.

Watershed: The area of land draining into a specific body of water.

Water Transparency A measure of the clarity of water. The depth at which an object can be seen in water.

Wetland Habitats where the soil is saturated or covered with water for part of the year.

Woodland A wooded habitat characterized by an interrupted tree canopy; also used as a general term to describe any tract of land with trees growing on it.

Woodland-brushland An upland plant community composed of a patchy canopy (10 to 70% cover) of mature trees and a dense understory of shrubs, tree shoots, and saplings. Usually the trees occur in scattered groves with dense thickets of brush between them.

Many of the definitions used in this section are borrowed from [Minnesota's St. Croix River Valley and Anoka Sandplain](#), Worcha et al, Minnesota DNR, 1995.
