Parks and Recreation Natural Resources Management Final Report

Prepared by:

Bonestroo
Rosene
Anderlik &
Associates
Engineers & Architects

Bonestroo Rosene Anderlik & Associates
Engineers & Architects

Bonestroo, Rosene, Anderlik and Associates, Inc. is an Affirmative Action/Equal Opportunity Employer and Employee Owned

Principals: Otto G. Bonestroo, P.E. ▪ Marvin L. Sorvala, P.E. ▪ Glenn R. Cook, P.E. ▪ Robert G. Schunicht, P.E. ▪ Jerry A. Bourdon, P.E.

Senior Consultants: Robert W. Rosene, P.E. ▪ Joseph C. Anderlik, P.E. ▪ Richard E. Turner, P.E. ▪ Susan M. Eberlin, C.P.A.

Associate Principals: Keith A. Gordon, P.E. ▪ Robert R. Pfefferle, P.E. ▪ Richard W. Foster, P.E. ▪ David O. Loskota, P.E. ▪ Mark A. Hanson, P.E. ▪ Michael T. Rautmann, P.E. ▪ Ted K. Field, P.E. ▪ Kenneth P. Anderson, P.E. ▪ Mark R. Rolfs, P.E. ▪ David A. Bonestroo, M.B.A. ▪ Sidney P. Williamson, P.E., L.S. ▪ Agnes M. Ring, M.B.A. ▪ Allan Rick Schmidt, P.E. ▪ Thomas W. Peterson, P.E. ▪ James R. Maland, P.E. ▪ Miles B. Jensen, P.E. ▪ L. Phillip Gravel III, P.E. ▪ Daniel J. Edgerton, P.E. ▪ Ismael Martinez, P.E. ▪ Thomas A. Syfko, P.E. ▪ Sheldon J. Johnson ▪ Dale A. Grove, P.E. ▪ Thomas A. Roushar, P.E. ▪ Robert J. Devery, P.E.

Offices: St. Paul, St. Cloud, Rochester and Willmar, MN ▪ Milwaukee, WI ▪ Chicago, IL

Website: www.bonestroo.com

June 10, 2002

Mr. Lonnie Brokke, Director
Roseville Parks and Recreation
1910 West County Road B
Roseville, MN 55113

Re: City of Roseville Parks Natural Resource Management Final Report
Our File No. 425-01-106

Dear Lonnie:

We are pleased to present you with the Final Report for the Roseville Parks and Recreation Natural Resources Management project.

This report includes sections regarding Landscape History and Setting, Natural Community Types found in the Study Area, and General Natural Community Management Recommendations. The majority of this report includes comprehensive planning information for natural communities within Acorn, Central, Langton Lake, Reservoir Woods, and Villa Parks. Inventory and management recommendations for Langton and Bennett Lakes, upland and wetland communities, and storm ponds within the five parks is located in Sections 5 and 6 of this report. In addition, a by-park summary of management recommendations for wetlands and uplands is also given at the end of each individual park's subsection in Section 6.

Thank you for the opportunity to assist you in identifying natural communities and restoration activities within Roseville's Parks. Rich Brasch , John Smyth, myself, and the other member of the Bonestroo project team that wish you the very best as you move forward with natural resource management in the city park system, the opportunities that lie ahead are impressive.

Sincerely,

BONESTROO, ROSENE, ANDERLIK & ASSOCIATES, INC.

Paul J. Bockenstedt

Paul J. Bockenstedt
Plant/Restoration Ecologist

Acknowledgments

Roseville Mayor and City Council

Roseville Parks and Recreation Commission

The Citizens of Roseville for Support and Input

MN DNR Metro Greenways Program for Partial Funding of this Study

Bonestroo & Associates Project Team
Paul Bockenstedt – Plant/Restoration Ecologist and Project Manager
Rich Brasch – Senior Scientist/Limnologist
John Smyth – Water Resource Specialist
Shabana Hameed – Watershed Specialist
Ben Meyer – Wetland Scientist
Liza Gould – GIS

Table of Contents

Page Number

Executive Summary

This report presents the ***Natural Resources Inventory and Management*** report for five parks within the City of Roseville, Minnesota. The project was initiated to inventory and provide management recommendations for natural communities within five city parks including Acorn Park, Central Park, Langton Lake Park, Reservoir Woods Park, and Villa Park. With this information the City can continue to actively manage and restore natural communities in parks as well as guide recreation so future generations may enjoy these valuable local resources.

There are a number of elements that contribute to the quality of life in any city. Social amenities, such as a healthy economy, attractive and affordable housing, efficient infrastructure and services, as well as good schools are all part of a successful community. Just as important are environmental amenities such as clean air, water and adequate open space. At the time of settlement by Euro-Americans, Roseville's rolling landscape was characterized by lakes, wetlands, savanna, and prairie. Despite having changed considerably since Euro-American settlement, this rolling landscape endures. Even more significantly, the parks within the city host a remarkable number and quality of natural communities, especially considering that Roseville is within just a few miles from two of the major urban centers of the upper Midwest.

Landforms provide the foundation, for all of the plant and animal communities that they support. Section 2 gives a very brief account of the formation of Roseville's landscape. It is a story punctuated by the many forces of nature, including glaciers, fire, and drought. Section 3 summarizes the natural communities that currently exist on the sites, or are thought to have been present in the study area in the past. General Natural Community Management Recommendations are given in Section 4.

Roseville is fortunate to have several lakes within the city that serve as important recreational and habitat resources. Two of these, Langton and Bennett Lakes lie within parks studied in this project. These lakes were assessed for the nutrient loads, water quality, plant communities, and other important factors. The summary of methods, findings, and recommendations for these lakes is found in Section 5 of the report.

Wetlands were field assessed using the Minnesota Routine Assessment Method and uplands were evaluated using methods similar to those employed by the Minnesota Department of Natural Resources Natural Heritage Program. These "standardized" systems provide a set of information that can be used, and easily interpreted by other natural resource professionals in the future. Descriptions of upland and wetland communities and specific management recommendations are found in Section 6.

Storm ponds are often overlooked as a resource, although they serve a vital function in protecting water quality and typically have some wildlife habitat value. Section 7 summarizes the methods, findings, and recommendations of the Storm Pond assessment for this project. This effort was initiated to identify opportunities for improving the overall function, habitat value, and aesthetic character of the storm ponds that occur within the five parks.

The City Staff and residents of Roseville take great pride in their parks, and are rightfully excited about their future. The continued management of natural communities within these parks presents a great opportunity to help that pride grow. Additionally, future efforts should continue to focus on linking natural areas with habitat and recreation corridors.

Managing and restoring the unique natural heritage represented in Roseville's parks will provide many opportunities for growth, learning, and citizen involvement while providing connection to the land. The process of restoration itself speaks of optimism and hope, and the ability for all of us to participate, in a hands-on fashion, in renewing the landscape while providing a deeper understanding of where it is that we live. To actively engage in creating what author Wallace Stegner referred to as a *geography of hope*. Through this process we bestow upon ourselves a heightened *sense of place.* ***Home****.*

1. INTRODUCTION

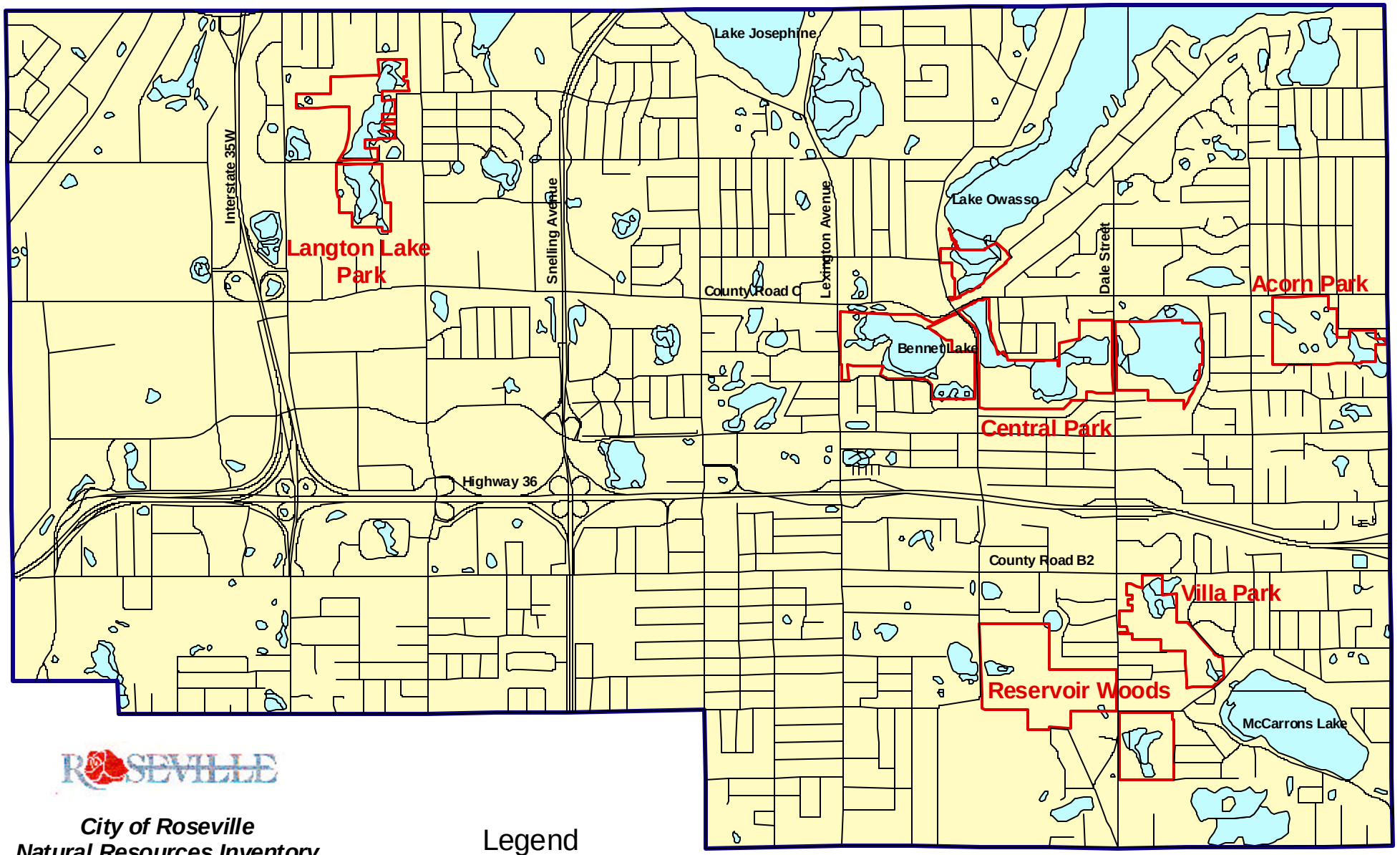
The citizens of Roseville have a strong interest in maintaining the quality of life they experience. Some of these values are associated with natural areas in City Parks such as woodland, prairies and wetlands. These areas contribute to the quality of life in Roseville by providing opportunities for active and passive recreation, wildlife habitat, and stormwater infiltration. They also serve as buffers between developed areas of the city. The aesthetic qualities and desirability of these natural areas also increase the value of properties located near them. The study area for this project includes five city parks. These include:

ACORN PARK
LANGTON PARK
CENTRAL PARK
VILLA PARK
RESERVOIR WOODS

The Roseville that we know today was shaped by ancient geology and climate, the power of glaciers, flowing water, plant and animal migrations, and by people. Native peoples used the area for thousands of years, and more recently European settlers arrived in the mid-Nineteenth century.

Although the five parks included in this study are less than 10 miles from downtown Minneapolis and St. Paul, they still support some good quality natural communities. Most fully developed cities in the Upper Midwest do not have the same opportunities to manage natural areas in city parks that Roseville does. It is with great wisdom that the city is seeking to actively manage, and in some cases undertake restoration of the natural areas within the five City parks shown in Figure 1.1.

For the purposes of the inventory portion of this project, a **"natural community"** is a distinctive group of plants and animals that typically occur together, and are native to the area, such as a sand-gravel prairie or dry oak savanna.



ROSEVILLE

City of Roseville
Natural Resources Inventory

Project Location Map

Figure 1.1

Legend

- Roseville City Limits
- National Wetlands Inventory
- Inventoried Parks
- Roads

N

0 3000 Feet

February, 2002

Bonestroo Rosene Anderlik & Associates
Engineers & Architects

425\42501106\Cad\gis\mlccs\mlccs.apr

The inventory and management recommendations included in this report suggest that natural areas be evaluated on an ecological basis. Simply put, **an ecosystem (or "habitat") is where things live. An ecosystem includes the interacting group of physical elements (soil, water, etc.) and biological elements including plants, animals and human communities.** All of these elements and their linkages to other natural areas are considered in this report.

Science suggests that a key measure of ecosystem health is the diversity of native plants and animals present in a given area. Healthy, diverse ecosystems are a desirable goal because they provide for the basic needs of all living things, and allow the landscape to adapt to changing conditions. And importantly, the unique plant communities found in Roseville serve to express the local character of the City, providing residents with *a sense of place*.

Overall Goal of Inventory and Management Plan

To inventory existing natural communities to create sound natural resource management plans for each of the five parks.

Objectives

The specific objectives identified for the five parks included in this study are:

- To identify and inventory natural areas in each park.
- To develop specific, practical, and science-supported recommendations for management of natural communities.

Guiding Ecological Principals

Some ecological principles that are important components of protecting or enhancing natural areas in City Parks include the following:

- **The health of natural communities depends on their size**. In general, smaller and more fragmented communities support fewer species, are more vulnerable to local extinction and invasions, and are less able to maintain or recover their diversity, particularly if other sources of native populations are not available nearby. Planning should emphasize improving connectivity for natural areas within parks as well as to

areas outside of the parks/city. Connections between communities along natural corridors can help to maintain diversity and health by allowing plants and animals to migrate between larger natural areas.

- **People are part of nature**. The decisions and actions of humans have been a major force shaping the natural resources of Roseville for millennia. Humans and their values will continue to be an important component in shaping the future of natural areas. Restoring natural communities in city parks will continue to involve planning for a balance of integration between urban land uses and maintaining or improving nearby natural areas.

- **Species are interdependent, and our knowledge of all the interactions within natural communities is limited**. Restoring natural communities is a relatively young field in science, and new information will continue to come to the fore. *Adaptive Management* in the restoration of natural communities requires keeping abreast of the most up-to-date information and integrating it with current practices.

- **Introductions of nonnative plants should be limited** Certain nonnative species are known to be invasive and reduce native diversity, the quality of habitat. When new landscaping is created, any nonnative plant materials proposed for use should be reviewed to prevent the unintentional introduction of a plant species that will need to be controlled in adjoining natural areas in the future.

- **Restoration of natural communities must consider long time frames.** Because natural communities are complex systems that can take years or decades to substantially respond to resource management, patience and a long-term commitment is required. For example, the positive effects of appropriate management in some degraded forests may take one to several tree generations to be realized. In the case the initial goal may not be reached for over 100 years. Conversely, some natural communities respond quickly to management and may significantly improve in a matter of years, or decades.

- **Planning for natural communities should consider ecological boundaries.** Natural resource management in other geographic areas influences some of the health of natural areas in the Roseville. For instance, species of birds seen in Roseville Parks are be influenced by habitat conditions elsewhere. As well, birds seen in other areas are dependent on the condition of natural communities within the city of Roseville. Understanding the regional and landscape-scale implications of management within these parks is important for the beneficial management of natural areas.

2. LANDSCAPE HISTORY AND SETTING

The natural resources of Roseville include the soils, water, plants, animals and people that are within the City. The particular resource elements present in the city and their patterns in the landscape are the result of historical processes, including climate, hydrology, plant and animal migrations and interactions, and human decisions and activities. This section describes the role these interactions have played in determining the present day composition of natural communities and landscapes in Roseville.

PRE-SETTLEMENT HISTORY AND MAJOR LANDSCAPE FEATURES

Ancient features. The City of Roseville is located in within10 miles of downtown Minneapolis and St. Paul. The history of the city's landscape begins around 500 million years ago, when much of Minnesota was covered by water, and the sedimentary rock layers that lie under the city were formed.

The last series of glacial advances into the Twin Cities area started about 2 million years ago and is known as the Quaternary Period. Prior to this, the landscape in the Roseville area was much different from the way it is today. Then deep valleys with steep sides that were cut into bedrock characterized it. Broad, rolling plateaus separated these deep valleys. Deposits left by the series of glacial advances in the last 2 million years has buried this landscape.

Glacial landscapes. The topography of Roseville was shaped by the last period of glaciation, which came to a close about 10,000 years ago, and was called the "Wisconsin Stage". The glaciers sculpted the landscape, and left behind a variety of deposits, referred to as "drift".

The glacial deposits at the surface in Roseville are largely associated with the Grantsburg Sublobe of the Des Moines lobe glacier, although there are some isolated deposits of Superior Lobe origin.

As the name suggests, the Superior Lobe originated near the area that is now known as Lake Superior. This ice advance occurred about 20,000 years ago. Grantsburg Sublobe deposits made later largely cover the sediments left by this event.

During the most recent ice advance, a major ice sheet moved from the northwest, through western and central Minnesota into central Iowa. While this occurred, the Grantsburg sublobe moved to the northeast through the Twin Cities approximately 16,000 to 12,000 years ago.

As ice sheets to the west and northwest began to stagnate and retreat, they left behind a variety of deposits including outwash, lake and stream sediments, and unsorted material, called till. This complex pattern of Grantsburg Sublobe glacial material resulted in different landforms among the parks that are briefly summarized below.

Acorn Park – occurs on typically loam-textured till ranging from loamy sand to clay.

Central Park – occurs on a sandy lake sediment complex (Anoka Sandplain), as well as loam-textured till. Also present in Central Park are peat deposits, which formed in wetlands since the glaciers retreated.

Langton Lake Park – includes a small amount of lake sediment (Anoka Sandplain). Langton Lake itself largely occurs on till underlying as much as 20 feet of sandy lake sediment.

Reservoir Woods – This is the only studied park that has glacial deposits at the surface from two different glacial advances. The majority of the park is comprised of Grantsburg Sublobe deposits, including till beneath stream sediment, meltwater sediment, as well as a very small area of sandy lake sediment (Anoka Sandplain) on the northwest corner of the park. The hilltop near the reservoir entrance extending to the southwest side of the park, as well as the area just southeast of Dale Street is comprised of coarse Superior Lobe meltwater stream sediments. This material was deposited earlier than the Grantsburg Sublobe material. In addition, a glacial valley extends from the northwest to the southeast in the park that is interpreted as a partly collapsed, partly buried, or subglacial drainageway.

Villa Park – is situated along a northwest-southeast trending glacial valley that is interpreted to be a partly collapsed, partly buried, or subglacial drainageway. The majority of the surface deposits in this park are composed of Grantsburg Sublobe till.

The topography, soils, and pattern of streams, lakes and wetlands that resulted from glacial activity greatly influenced the pattern of vegetation that developed later in Roseville. Plant communities such as oak savannas and prairies thrived in the sandy, well-drained soils and nearly level topography of the city's uplands, while prairie wetlands occupied low swales and depressions.

Immediately after the glaciers melted, spruce trees and tundra plants developed around the margins of the glaciers, followed by pine barrens and forests with a bracken fern understory. As the climate of the region warmed about 9,000 years ago, pines began to decline, and prairie herbs increased, along with elm and oak forests. The climate continued to warm until about 7,000 years ago, when midgrass prairie reached its maximum extent in Minnesota, and covered most of the Twin Cities region, including Roseville.

Prairie, oak woodlands and brushlands, and oak forests dominated the Region until about 3,500 years ago, when the climate became cooler and moister. Oaks, with their resilience and hardiness became the first tree species to pioneer back into the prairie. They gradually became more common and formed savannas and woodlands that were interspersed with tallgrass and wet prairies. About 300 years ago, the climate became dramatically more moist and cool, and forests of elm, sugar maple, and basswood developed in eastern Minnesota. With prairies, wetlands, and oak savannas present, the major patterns of vegetation in the north Roseville area at the time of European settlement were then in place.

Native Americans. Ideas about the history of Native Americans and their influence on the local landscape are still evolving. Native Americans have probably inhabited and hunted in the area for more than 10,000 years. While their impacts were not as great as those of European settlers, Native Americans used a wide variety of plants and animals for food, and altered vegetation patterns for cultivation and by setting fire to broad expanses of landscape. The Native Americans (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, fires set by Native Americans occurred far more frequently. Historic records indicate that portions of the upper Midwest may have been burned annually. Prairies and savannas communities that were common to Roseville are fire-dependent and the human use of fire played a critical role in sustaining this landscape.

At the time of settlement, around 1840-50, the landscape of Roseville supported a rich variety of plant communities including various types of wetlands in low areas, lakes, and oak woodlands, brushlands and prairies on drier uplands.

As the City developed after the mid-1800s, more intense human activities began to change the landscape and natural communities. In Ramsey County today, nearly all of the native natural communities have been substantially impacted by human activities. Some of the activities that have significantly impacted natural communities include the following:

- Roads and railroads began to fragment prairies, savannas, and other communities in the mid- to late 1800's.
- Agriculture affected hydrology through draining wetlands and altering streams. Farmers altered upland vegetation communities through clearing, plowing, suppression of regular fires, and overgrazing. These effects are evident in the reduction of native vegetation diversity in prairie and savanna areas. Plantings of low diversity and non-native species, such as smooth brome were carried out to replace prairie. Soil erosion by wind and water increased where native cover was removed and runoff increased, adding sediments to wetlands, and eventually the Mississippi River.
- Urbanization fragmented natural communities further with the addition of more roads, streets and utilities. Construction typically compacts soils, and changes the local hydrology. Large areas of impervious surface and drainage of wetlands increases the amount of stormwater runoff and pollutants carried to local water bodies.
- Non-native, aggressive species like honeysuckle, buckthorn, burning bush, caragana, barberry and many others have been added as landscape materials. Changes in habitat and the increasing presence of humans in the landscape have brought changes in animal populations, decreasing or eliminating some species such as meadowlarks and elk, and enabling others such as English sparrows, European starlings, and white-tail deer.

INFLUENCE OF LANDFORM AND CLIMATE ON VEGETATION TYPES

Plant communities that exist in any given area are the result of numerous biologic and non-biologic factors. These work in concert to influence plant communities in often subtle ways, but some of the influences can have rather dramatic and immediate effects such as drought, or a tornado. Biotic factors can include such varied things as the presence or absence of pollinators, burrowing activities, herbivory, or over utilization of an area by a single species or number of species. Of the abiotic factors, two have a consistently strong influence in the shaping of plant communities. These are climate and landform.

The climate of Ramsey County is considered to be continental and subhumid, with long, cold winters and relatively brief, warm summers. Wide fluctuations in temperature and precipitation also characterize this climate. These fluctuations in temperature and moisture strongly influence the plant communities present in the region and cause plants to be adapted to extremes, rather than averages.

Landforms also have a profound impact on the type of plant communities found in any area. The landforms of the Roseville area are primarily associated with activities that took place on the edge of glacial ice sheets (periglacial processes).

These well-drained characteristics of the soil tend to exaggerate drought events, thus favoring more drought tolerant communities in upland areas.

3. NATURAL COMMUNITY TYPES OF THE STUDY AREA

The following is a brief description of the major natural community types that are currently found in, or would have historically occurred in the parks inventoried for this project. The descriptions draw from field surveys in Roseville, the region, and from *Minnesota's St. Croix River Valley and Anoka Sandplain: A Guide to Native Habitats* (1995). Following the descriptions, the sections discuss management recommendations for each of the community types. These recommendations have the potential to be used to enhance the natural community areas that remain in the five parks that are part of this project.

PRAIRIE AND SAVANNA COMMUNITIES

Sand-Gravel Prairies - These prairies were once common on sandy, well drained, glacial and periglacial soils in the area of Roseville. These communities are open grasslands with patches of forbs, and exposed soil that are often created by a combination of wind erosion, and animal burrowing and digging activities. These communities are also strongly influenced by periodic fires and drought and tend to favor plant species dependent on fire for regeneration and those able to withstand droughty conditions.

Typical woody plants include smooth sumac, prairie rose, and leadplant. Characteristic graminoids and forbs include hairy grama, side oats grama, prairie dropseed, and plains muhly grass. Characteristic forbs include rough blazingstar, grey goldenrod, stiff goldenrod, dotted blazingstar, hoary puccoon, butterfly milkweed, and large-leafed pussy-toes. Rare plants found on this type of prairie include kitten-tails and Hill's thistle.

Common animal species include mourning dove, field sparrow, western meadowlark, pocket gophers, red fox, American toad, and garter snakes. Threats include invasion by nonnative grasses, such as Kentucky bluegrass and smooth brome, and invasion by woody plants.

Sand-Gravel Oak Savanna - These are relatively open communities of scattered, short, open-grown bur and pin oaks above a layer of grasses and forbs. Trees may be widely scattered, and

found in groves with hazelnut or oak brush common in areas that do not burn frequently. Natural disturbances like gopher mounds and badger excavations are common.

Common plant species include bur oak and pin oak, prairie rose, leadplant, heart-leaved alexanders, butterfly milkweed, purple prairie clover, bird-foot violet, prairie sage, and several species of asters and goldenrods. Common grasses include indian grass, little and big bluestem, prairie dropseed, and sideoats grama.

Common animal species include mourning dove, indigo bunting, sparrows, squirrels, pocket gophers, and white-tail deer. These areas have often been degraded by grazing or farming activities. The impact of overgrazing is a reduction in grass and forb diversity, and forage quality and quantity, as well as invasion by exotics such as leafy spurge, knapweed, and sweet clover.

Prior to Euroamerican settlement, regular fires maintained these communities. Without fires, the spread of woody shrubs such as sumac, prickly ash and red cedar is increased. Many areas of Roseville that historically contained oak savanna have slowly converted to oak woodland or forest. This succession has largely been brought about by the absence of fires and the use of appropriate levels of grazing in the past.

Mesic Prairie – is a fire-dependent, dry-mesic to wet-mesic grassland that has a continuous cover of tall grasses and forbs. The forb diversity of mesic prairies is typically high. Trees and shrubs are absent in better quality remnants, but may occur in localized patches in moist, protected areas such as ravines and in areas that have not been periodically grazed, hayed, mowed, or burned. Common native grasses of mesic prairie include big and little bluestem, indian grass, porcupine grass, prairie dropseed, and Kalm's brome. Some of the most common forbs found here include leadplant, sky blue aster, rough blazingstar, purple and white prairie clover, prairie phlox, stiff goldenrod, prairie coreopsis, betony, golden alexanders, and bird-foot violet.

Common bird species seen on mesic prairies include meadowlark, goldfinch, field sparrow, and eastern kingbird. Some common mammals include the meadow jumping mouse, meadow vole, thirteen-lined ground squirrel, as well as a number of frog, salamander, and toad species.

Although it once covered an area from Texas to Canada, and Kansas to Ohio, today mesic prairie is among the rarest natural community types in North America. Because the soils formed by

tallgrass prairie were ideally suited to row crop agriculture, nearly all prairies have been plowed, or otherwise lost to development. A few very small fragments of mesic prairie still remain in Roseville. Some of these are found in Reservoir Woods Park, and along the railroad right-of-way that parallels County Road C, extending to the south adjacent to Highway 280 and to the north near Lake Owasso.

Wet Prairies - An open community where the water table is frequently near the surface, wet prairies are characterized by a mix of forbs grasses and sedges 36 inches or more in height. Although infrequent, shrubs found in wet prairie include prairie willow, pussy willow and meadowsweet. Forbs include prairie and meadow blazingstar, pale-spiked lobelia, Culver's root, bedstraws, sawtooth sunflower, asters, and tall meadow rue. Common grasses include big bluestem, prairie cordgrass, blue-joint, and sedges. Common bird species include song sparrow, red-wing blackbird, and American goldfinch. Animals frequent to wet prairies include shrews, voles, mice, and a variety of frogs, toads and salamanders. Nonnative pasture grasses such as bluegrass, redtop, and reed-canary grass have often been introduced, or invaded wet prairie and can become dominant in disturbed areas. In the absence of fires, shrubs may dominate some areas, and changes in hydrology or water quality with urban development or adjacent agriculture degrade wet prairies and encourage domination by exotic and aggressive plant species. Today, almost all wet prairies have been lost in the Twin Cities metropolitan area.

FOREST COMMUNITIES

Dry Oak Forest - A deciduous forest dominated by pin, bur, and less frequently white oak mainly under 50 feet. There are few subcanopy trees, a dense shrub layer, and patchy ground layer of moderate diversity. Typical canopy trees include pin oak, bur oak, and white oak, with black cherry, trembling aspen and paper birch as second-growth trees. The shrub layer typically includes hazelnut, gray dogwood, gooseberry, and raspberries.

The ground layer includes wild sarsparilla, pointed-leaved tick trefoil, bracken fern, wild geranium, Pennsylvania sedge, and pale bellwort. Typical animal species include woodpeckers, chickadees, vireos, chipmunk, squirrels, and white-tail deer. Past logging and/or fire may be indicated by absence of larger, single-stem trees and woody debris. Grazing and fragmentation by roads and trails often reduce diversity of shrub and ground species in these forest

communities, and encourage invasion by non-native plants. European buckthorn and Tartarian honeysuckle are problem nonnative species that often invade dry oak communities.

Mesic Oak Forest - Canopy trees are typically taller and straighter in mesic oak forest than in dry forests, and northern pin oak is replaced by red oak in the canopy. Large, single-stemmed trees more than 15 inches in diameter are common, with a variety of woody plants at all heights, and a mixed ground layer of tree seedlings, grasses, and flowers. Common tree species include white, red and bur oak, and basswood. Ironwood, bitternut hickory, black cherry, and hackberry are typically infrequent in the canopy, but tend to be common in the subcanopy.

Shrubs may include chokecherry, downy arrowwood, pagoda and silky dogwood, and other fruiting shrubs. The ground layer frequently includes wild grape, Virginia creeper, wild geranium, black snakeroot and a variety of ferns and spring ephemerals, such as sharp-lobed hepatica.

Animals are typical of those found in other oak communities, including songbirds, flycatchers, bluejays, chipmunk, squirrels, white-tail deer, and a variety of frogs and American toads. Past logging and grazing may have removed canopy trees, shifting species composition and reducing diversity in ground flora. Buckthorn and Tartarian honeysuckle are common invaders in oak communities, and oak wilt may spread in disturbed stands, particularly in areas of active construction.

Oak Woodland-Brushland - Oak woodland communities are characterized by having a canopy that varies form sparse to nearly closed. They are dominated by open-grown bur, white, and pin oaks, often with a pronounced shrub layer containing young oaks and shrubs. The ground layer includes herbs and other woody plants characteristic of both dry oak forests and prairie communities. Fire scars may be evident on older trees. Common shrubs include hazelnut, leadplant, gray dogwood, and other berry or nut producing shrubs. Common ground cover in oak woodlands include various prairie and woodland edge grasses, purple giant hyssop, hog peanut, bracken fern, pointed-leaf tick trefoil, satin grass, lily-leaved twayblade orchid, and woodland sunflowers.

Animals include mourning dove, catbird, indigo bunting, squirrels, coyotes, and white-tail deer. These communities have often been degraded by overgrazing and soil compaction. These

activities lead to invasion by exotic species such as Kentucky bluegrass, European buckthorn, Tartarian honeysuckle. In Roseville, the presence of these exotic species has significantly reduced species diversity of most Oak Woodland – Brushland Communities.

Lowland Hardwood Forest - A deciduous forest with a variable canopy, with coverage from about 50 to 100 percent. Lowland hardwood forests occur on mineral soils and are often located near the margins of lakes and wetlands, in ravines, and on the lower portions of north-facing slopes.

Common tree species include, green ash, American elm, eastern cottonwood, basswood, bur oak and hackberry. Subcanopy trees may include ironwood, red elm and boxelder. Common shrubs include pagoda dogwood, prickly ash, hazelnut, and gray dogwood. The ground layer may include Virginia creeper, goldenglow, Virginia and Canada wildrye, sedges, woodland horsetail, rough hedge nettle and jack-in-the-pulpit. A wide range of common forest animals and birds use these forests as habitats. These forests are often degraded by overgrazing and/or logged using unsustainable methods.

Many Lowland Hardwood Forests have been invaded by exotic species such as buckthorn and reed canary grass. Also, in recent times the trees and other species typical of lowland hardwood forest have been successful in colonizing upland forests and open areas that they would not have historically occurred in. This is largely a result of the lack of periodic fire, grazing, haying, or mowing in these areas.

WETLAND COMMUNITIES

(As described in *Wetland Plants and Plant Communities of Minnesota & Wisconsin*, Second Edition – Steve D. Eggers & Donald M. Reed)

Deep Marshes – Deep marsh plan communities have standing water depths of between 6-inches and 3 or more feet during the growing season. Herbaceous emergent, floating, floating-leaved, and submergent vegetation compose this community, with major dominance by cattails, hard-stem bulrush, pickerel weed, giant bur-reed, phragmites, wild rice, pond weeds, and/or water lilies.

Shallow Marshes – Shallow marsh plant communities have soils that are saturated to inundated by standing water up to 6-inches in depth throughout most of the growing season. Herbaceous emergent vegetation such as cattails, bulrushes, arrowheads, and lake sedges characterize this community.

Wet Meadows – According to the description given by Eggers and Reed, Wet meadows are dominated by grasses, such as (the nonnatives) redtop and reed canary grass, and by native forbs such as giant goldenrod, growing on saturated soils. This description reflects a disturbed condition that is found in many wetlands today.

The MN DNR publication, *Minnesota's Native Vegetation: A Key to Natural Communities* describes Wet Meadows as follows: The ground layer is composed of a dense, closed stand of predominately wide-leaved sedge such as tussock, lakebank, and Hayden's sedges, and the grasses bluejoint, rattlesnake grass, rice cutgrass, and white grass. Common forbs include spotted joe pye weed, boneset, mint, turtlehead, marsh milkweed and others. Shrub cover ranges from about 0 to 70 percent and is composed of several species of willows, and red osier dogwood. Wet meadows occur on wet mineral soil, muck, or peat. Standing water from several inches to one foot deep is generally present in the spring and after heavy rain, but the water table is generally at, or below the ground surface for most of the growing season. Draining, excessive water level fluctuation and nutrient influx, as well as removal of fire can all lead to a condition of lowered quality as descried by Eggers and Reed.

Shrub Swamps – Shrub swamps are wetland plant communities dominated by woody vegetation less then 20 feet in height and a DBH of less than 6 inches. Shrub swamps of Minnesota and Wisconsin are categorized as shrub carrs and alder thickets depending on the dominant shrub species. Both occur on organic soils (peat/muck) as well as on the alluvial mineral soils of floodplains.

Wooded Swamps– Wooded swamps are forested wetlands dominated by mature conifers and lowland hardwood trees. They are usually associated with ancient lake basins and retired riverine oxbows. The wooded swamps of Minnesota and Wisconsin are divided into two types depending on whether the dominant trees are conifers or hardwoods. Roseville does not contain

coniferous swamps and the hardwood swamps are generally the outside ring of wet meadows or shallow marshes.

Hardwood swamps are dominated by deciduous hardwood trees and have soils that are saturated during much of the growing season, and may be inundated by as much as a foot of standing water. Dominant trees include black ash, red maple, yellow birch and, south of the vegetation tension zone, silver maple. The shrub layer of hardwood swamps is often composed of shrub-sized individuals of the dominant tree species, as well as the dogwoods and alder species of shrub swamps. Groundlayer species include some of the ferns, sedges, grasses and forbs of sedge meadows and wet meadows.

Seasonally Flooded Basins– Seasonally flooded basins are poorly drained, shallow depressions that may have standing water for a few weeks each year, but are usually dry for much of the growing season. These basins may be kettles in glacial deposits, low spots in outwash plains, or depressions in floodplains. They are frequently cultivated. However, when these basins are not cultivated, wetland vegetation can become established. Typical species include smartweeds, beggarticks, nut-grasses, and wild millet.

LAKES

Shallow Open Water – These communities generally have water depths of approximately 2 meters (6.6 feet). Submergent, floating and floating-leaved aquatic vegetation including pondweeds, water-lilies, water milfoil, coontail, and duckweeds characterize this wetland type. They differ from shallow and deep marshes in that they are seldom, if ever, drawn down. As a result, emergent aquatic vegetation has little opportunity to establish.

These communities provide important habitat for waterfowl, furbearers, fish, frogs, turtles, and aquatic invertebrates. They are also important aesthetic and recreational resources, particularly for cities. The deeper portions of Langton Lake and Bennett Lake fall into this category, with shallower portions better fitting the shallow and deep marsh community types.

OTHER PLANT ASSEMBLAGES

Although the plant assemblages described below may not be considered natural communities under the methods used during this Natural Community Inventory in the sense that they are assemblages of plants "created" through human activity and may not consist of plants native to the area. However, they may provide important habitat for many generalist species such as white-tail deer. They can also be aesthetically important in the landscape, providing buffers from developed areas. In some cases, such as an old field, there may be opportunity to reconstruct a natural community such as mesic prairie that has been lost in Roseville.

Conifer Plantation - Large plantations of conifers were often planted in the 1930s under the belief that they prevent erosion. Often, these are single species groves of various pines and spruces, planted closely together in rows. When young, the ground cover continues as a field or prairie, as it was previously. Eventually, the shade created by the pines, and the acid from needle-drop eliminate most ground cover vegetation and it becomes highly simplified or bare until it is colonized by plants tolerant of these conditions. The plantations provide wind protection, cover, and breeding areas for songbirds, owls and other species, but also create a dense monoculture with low diversity. Depending on the original planting density, these plantations typically require thinning with age to preserve the health of the trees.

Old Field – "old field" is a term used to describe areas that were intensively grazed or cultivated, but where those activities have ceased. Old fields often have a simplified vegetation community, dominated by smooth brome, Kentucky bluegrass, or other non-native grasses. A few prairie forbs such as yarrow remain. Also, aggressive clonal plants such as goldenrod may form large, single-species colonies, which are characteristic identifiers for these areas. The fields may also include red cedar individuals or glades, and tree/shrub thickets. While these communities may provide some food and cover for birds and other animals, they have a low diversity of native plants. Regular controlled burns may help to control non-native species, and bring back some native prairie plants. These areas are often good candidates for prairie, or savanna reconstruction.

4. GENERAL NATURAL COMMUNITY MANAGEMENT RECOMMENDATIONS

SECTION SUMMARY

This section includes some general concepts for managing natural communities that apply to the landscape in Roseville, as well as some suggestions for continuing the positive engagement of city residents about the management of resources within the five selected parks that this study focuses on.

WHERE POSSIBLE, LINK TRACTS OF NATURAL AREAS

Connectivity and size are both important factors affecting the function of natural areas. As a general rule, the larger an area is, the greater the diversity of plants and animals present. Larger natural areas are also more stable and able to withstand the affects of naturally occurring events such as drought, insects and disease, and windstorms.

Patches of natural communities and sites with good restoration potential should be used to link larger areas. Linkages should consider corridors and natural areas outside the City as well as features within the City.

USE PLANT SPECIES NATIVE TO THE ROSEVILLE AREA

Native trees, shrubs, grasses and forbs can be planted in active use portions of parks as well as other landscape and idle areas around the city. Wisely choosing, and planting species that are native to the area can complement existing natural communities and enhance an areas ecological functionality. A good source of information on indigenous plants is the species lists provided in Appendix A of this report as well as *Minnesota's St. Croix River Valley and Anoka Sandplain: A Guide to Native Habitats* (1995). Plant species should be chosen based on the specific characteristics of the site including soils, slope, aspect and adjacent natural community types and quality. If possible, restore the site to replace the original natural community type that still exists in the area, or one that existed before conversion (i.e., prairie, oak forest). An Appendix of this

report includes suggested species for reintroducing into forests, savannas, and prairie areas found within the Roseville Parks studied.

CONTROL INVASIVE EXOTIC SPECIES

Nonnative species (sometimes called "exotics") have become prominent in many of the parks in Roseville. Some of these include European buckthorn, glossy buckthorn, Tartarian honeysuckle, spotted knapweed, Chinese elm, reed canary grass, smooth brome, Kentucky bluegrass and leafy spurge. These plants often invade native plant communities and can take over rapidly, eliminating native species and causing a loss of plant diversity and wildlife habitat. To control invasion by exotics, minimize disturbance to natural areas and surrounding buffer areas as much as possible, and avoid planting exotics or providing openings for them to invade. Regular inspections of natural areas can help identify new infestations early, keeping management cost low and preventing the spread of these plants to the point where an unnecessary amount of resources must be dedicated to their control.

PURPLE LOOSESTRIFE

Roseville has already released some biocontrol agents for purple loosestrife, and a recent survey by the county Agricultural inspector found that the beetle has already colonized most of the metro area wetlands. Luke Skinner with MN DNR Ecological Services recommends that loosestrife-infested wetlands in Roseville be monitored to determine if beetles are already present, and to note what impacts they are having, if any. He made several additional points regarding Roseville:

Harriet Alexander Nature Center in Central Park has had marginal success with loosestrife control in the last three to four years since release, but it can take up to 6 or 7 years for the beetles to fully establish. Since it can take a substantial amount of time for these beetles to establish, it is prudent to adopt a "wait and see" attitude regarding these populations.
If the beetles have already colonized other loosestrife-infested wetlands and their population is quite low, it *may* be useful to implement a beetle-rearing and reintroduction program to supplement the existing population. Alternately, it may be adequate to monitor the existing

population to see if it is increasing and affecting the *Lythrum*. To determine if the wetlands have the beetle and whether the beetle population is large enough, contact the DNR (Luke Skinner) or the County Agricultural inspector in the spring and arrange a site visit.

Monitoring: A) Conduct a site visit each spring to determine the size of the beetle population. B) establish fixed photo monitoring points at each basin, and take pictures in August, at peak loosestrife bloom. Compare the pictures from year to year and note whether the plants are purple or brown, how holey the leaves are, overall level of purple in the photo, etc. The DNR has a simple one-page data sheet that can be used for monitoring. The goal is not loosestrife eradication, but rather loosestrife control. Typically, the DNR is seeing loosestrife population reductions of 50 –80% using insects.

In April, the DNR offers a short (1 – 2 hour) training workshop on biocontrol of loosestrife; this includes a beetle rearing kit. If city staff is interested in attending, contact Luke Skinner to be placed on the workshop mailing list.

For additional information about the (chemical) control of purple loosestrife, refer to the Problem Species Appendix at the back of this report

CONTINUE TO ENCOURAGE NEIGHBOR/CITY RESIDENT INVOLVEMENT

Because the parks in this study occur within a fully developed community, it will be critical for city staff to continue proactively addressing the role local residents can play in shaping the future of this natural area. This is a challenge as well as an opportunity because, on one hand it makes these areas more vulnerable to overuse and introduction of difficult to manage elements. On the other had, it invites the public to enjoy, learn about, and sustain the complex and inspirational natural world that they live in, and influence every day.

Below is a list of potential activities for creating positive public involvement in a natural areas restoration.

Provide Compatible Recreation Opportunities

Construct trails that offer the public the greatest opportunity for enjoyment of, and education about natural areas, without detriment to the ecological health of the site. Activities that are

known to cause erosion, plant invasion, changes in site hydrology, or cause mortality of desirable plants should be reviewed and limited/prohibited for the long-term health of the site.

Place new or reconstructed trails where they can play a role in resource management, such as allowing for the trails to be used as firebreaks.

Educate the Public

- Post signs on the site to explain why natural resource management activities are being conducted. This is especially important, since it may be the single means of informing the most residents.
- Offer public tours and walks for groups that explain the ecology of a particular park and the resource management activities that are being conducted. Publicize the events with newspaper announcements direct residence mailings, and local access cable TV announcements.
- Periodically submit an article to the Roseville Review or other locally circulated publication that discusses the ecology of natural resources and their management in Roseville Parks.
- Integrate resource management activities with public/school environmental education. This is particularly pertinent for Central Park, which has a Nature Center, and an elementary school nearby.
- Hold neighborhood meetings to inform citizens of proposed management activities and time lines for implementation. This is particularly important for prescribed burning, which is widely misunderstood.
- Involve local schools in planting, monitoring, and educational activities. Middle school and high school classes often need service projects or science projects related to nature.
- Citizens could be made aware of the benefits of managing their property for natural communities through public meetings and workshops and/or development and circulation of a pamphlet or brochure.

Expand the Volunteer Program

Preferably at the beginning of any city wide or individual park restoration effort. Recruiting volunteers not only provides labor that can make a project possible, it also provides a core of informed and enthusiastic stewards who will spread the work and take proprietary interest in the project.

Encourage citizen monitoring of animals that use the site. These might include frogs/toads, birds, bats, deer, and others.

MONITORING MANAGEMENT ACTIVITIES

Ecological Restoration is a process that involves active management by natural resource professionals. This management often takes place on small, isolated areas of varying quality. Management activities can influence one or more aspects of the managed community and have lasting, long-term implications. To avert any possible damages and to make sure that the best possible practices are used for restoring natural communities, it is important to monitor chosen aspects of those communities on a regular basis.

Monitoring has the potential to be an expensive, and labor-intensive process. As well, it has the potential to take valuable monetary and human resources away from the process of active management if not exercised judiciously. Deciding what to monitor and how intensively to monitor is always difficult. Some aspects of management can be monitored through visual inspection with field notes recorded and shared between the park and the resource manager. Other aspects may require that quantitative monitoring be undertaken, such as long-term monitoring of rare plants/animals, although rare species are not part of the equation with this restoration project.

As part of the process of visually inspecting areas and assessing management efficacy without quantitative monitoring, it would be recommendable to keep a field journal of management activities. The person(s) responsible for natural resource management could use this. Recorded observations may include species seen on a particular date, fire effects, unusual weather events, human disturbance, activities of work crews, and the quality of their work performed, as well as many others. Although this type of information may not be quantitative, it can help with

adapting management strategies in the future. This is especially true for the long-term, since personnel and policy changes within organizations are inevitable. This information would give future managers the benefit of insight on daily and yearly activities within the forest as they relate to resource management.

Problem Species Monitoring

Although it is largely impractical to carry out quantitative monitoring of changes in nonnative species levels, it is practical to make a yearly walk-through assessment of a particular site to determine if additional treatment of nonnatives is warranted. This should include a site visit by a trained staff person at least once a year, at approximately the same time of season. Observational notes should be made on whether there was an increase, decrease or no change in the overall population for a problem species, how well a treatment worked, as well as whether treatment is warranted in the coming year.

Keep Good Records

It is highly recommended that records of resource management activities be kept. Hard copy and/or electronic records will allow current and future managers to learn from past successes and mistakes and plan for future activities based on this knowledge. Record keeping is particularly important for budgeting. They provide a track record of costs, and justification for changes in future budgets.

An example would be using a standardized record form to track brush removal during a winter project, helping to document costs and hours for that project alone. Examples of other activities that could be put on Resource Management Records include prescribed burning, seed collection, seeding activities, problem species control, monitoring, and planning. Such a Resource Management Record could also be used to document several or all activities during a chosen cycle (year, budget period, etc.).

If time does not allow for detailed documentation, at the very least a diary-like notebook or spreadsheet of activities should be kept. Continuity of management requires a knowledge of past management activities as well as future goals.

General Management Strategies For Select Natural Community Types

Below are general management strategies for prairie, savanna, wetland and forest communities. These management strategies are intended to be generic; therefore more specific management recommendations may be necessary for individual natural communities and sites. More specific management strategies are provided in Sections 5 & 6 of this report.

Prairie and Savanna Management

The health of prairie and savanna plant communities was maintained before Euroamerican settlement by grazing and fires, both of which probably occurred annually to every few years on most sites. Some fires occurred naturally. But the vast majority were intentionally set by Native Americans. Fires maintained the open structure of prairies by controlling the growth and spread of trees and shrubs, removing accumulated plant litter, warming the soil in spring, and returning nutrients to the soil. With the spread of agriculture and urban development, fires have been suppressed, leading to the spread of shrubs, trees, and exotic plants in prairie and savanna communities, and loss of diversity of native grasses and forbs. The activities of large and small mammals and insects also helped to maintain prairie communities by spreading seeds, burrowing to loosen soils, and pollinating prairie grasses and forbs.

In addition to the suppression of fires, prairies and savannas have been degraded by inappropriate levels of grazing, which reduce forb diversity and encourage the dominance of clonal plants (such as golden rod) that are unpalatable to livestock. Other factors responsible for the decline of prairie and savanna communities include: development, ill-advised tree planting, plowing, and too frequent mowing.

Less than one percent of the prairie and savanna landscapes that once existed in southeastern Minnesota remain. The goal for managing the remaining remnants should be to maintain or restore as much of the original diversity as possible, through re-establishing or mimicking the processes that helped to maintain these plant communities.

Prairie and savanna management should consider the following actions, as appropriate for each site:

- Remove exotic species with appropriate methods. Cutting and herbicide treatment are often most appropriate for tree and shrub species such as black locust, sumac, and buckthorn. Repeated herbicide treatments or biological controls may be needed for other exotic species such as leafy spurge and reed canary grass.
- Remedy disturbance problems where possible, by closing trails where erosion is occurring, or reduce/rotate grazing to maintain plant populations.
- Use prescribed burns to control cool season grasses and other exotics, remove accumulated plant litter, encourage recruitment of prairie plants from the seedbed, and to maintain the health of the prairie for the long term. Burns may be scheduled annually at first, and reduced to every three to four years, depending on amount of litter available to successfully support a burn. Vary the burn regime over the long-term to include both fall and spring burns. Burn only a portion of any given prairie to conserve insect diversity.

- If elimination of exotics and prescribed burns over several seasons fails to restore desired diversity, consider plant community restoration through supplemental seeding of cut and burned area. Reconstructed prairies and savannas will require maintenance through infrequent mowing or prescribed burn regimes (burning is preferred over mowing when possible). Plantings should use native seed from local sources.

- In general, savannas can be burned less frequently than prairies and droughty sites burned less frequently than mesic or wet sites. Average burn frequency for the dry prairies and savannas in Roseville is approximately 2-5 years. The burn frequency should be greater during the first ten to twenty years if control of trees and brush is a management objective.

- Seasonal timing can have a profound effect on species composition. Current research information indicates that spring fires, conducted prior to April 15, tend to favor cool season grasses and summer-blooming forbs. Late spring fires (April 15 – June 1) tend to favor warm season (usually native) grasses and usually negatively effect forbs and tree/shrub species. Summer burns would mimic lightning set fires, and although

these did occur, they appear to have been less of an influence on the presettlement landscape than human-set fires. Current information indicates that fall fires (after September 15) are most effective at maintaining a balance between grass and forb species and for controlling brush. There is also reason to believe, based on historical records that frequent fall burns most closely mimic the presettlement burning pattern used by Native Americans in the tall grass prairie region of the Upper Midwest.

- Mowing can also be used on sites with adequate accessibility and low risk for site disturbance. Mowing somewhat mimics the effect of grazing and can give many of the effects that prescribed burning can. Proper timing and techniques in mowing can be used to maintain a healthy balance between grasses and forbs.

- Management of native communities, especially prairie, must also consider effects on the animal populations that are dependent on the community. The influence of management activities i.e. burning are not completely understood on animals such as butterflies (invertebrates). To minimize the potential for devastating impacts on community obligate species and/or fire sensitive species, management should be carried out so as not to influence the entire area upon which these species depend. An example would be not burning an entire prairie at once; this would leave refugia for the species of concern and allow for potential recolonization of burned areas.

- Monitor the effectiveness of management activities, and changes in plant and animal species in managed areas. Adjust activities, as needed, based on monitoring results. This is a very important part of sound natural resource management.

Wetland Management

To aid in the determination of Wetland Management strategies historic aerial photographs from 1940 and 1957 along with the National Wetland Inventory (NWI) map (Created by 1979 aerial photographs) were reviewed and compared to what was found in the field.

It was determined that agricultural impacts altered the wetlands prior to the 1970's. Aerial photographs from 1940 and 1957 indicate that in general where feasible the wetlands were ditched and tiled to maximize the land for agricultural activities. Some historic ceramic tiles still exist in the wetland basins from this era and ditches can also still be observed. As land-use changed from agriculture to urban land-uses the ditches and tile lines were not maintained and many of the wetlands re-established at the time of the NWI map development. Due to the partial drainage still occurring from the ditches and tile lines a complete restoration was not realized.

As the land-use changed to urban development the impacts to the wetlands were predominately the following:

- cutting off drainage by roadways or development
- rerouting drainage to or away from wetlands with the storm drainage system via culverts
- sedimentation and nutrients entering wetland basins from adjacent land-use
- filling or excavating for development or stormwater storage

Over the years the alterations to wetland basins have resulted in reverting from native wetland species to disturbance-adapted exotic or aggressive species that invade the basin with disturbance.

Goals for the wetlands within the study area should be to look for opportunities to restore the hydrology of basins and improve native vegetation. Hydrologic alterations along with disturbance have resulted in lower diversity in the native plant communities. Management objectives for wetlands should include maintaining or restoring native plant communities and diversity.

Some strategies for enhancing or restoring hydrology and native plant communities in wetlands include the following:

- Ditches should be blocked or outlets raised and tile lines removed or altered to restore the original hydrologic regime.
- Remove or control invasive exotic species. Removal of exotic species such as reed canary grass and purple loosestrife typically involves hand pulling, herbicide control, prescribed burns, excavation or a combination of management strategies.
- Establish a vegetative buffer around wetland areas, to filter runoff, slow stormwater flows, and provide essential upland habitat needed by many species that use both wetlands and uplands as habitat during their lifecycles.

Forest Management

Most of the forest areas in the study area have been grazed at varying levels in the past, and in some cases were logged. Excessive human disturbance encourages invasion by aggressive exotic species-particularly buckthorn and Tartarian honeysuckle. Fragmentation also reduces the value of the forest community for wildlife species such as migratory songbirds that require "interior" forest areas that are well buffered from human disturbances.

Following are management strategies for maintaining and restoring the diversity and health of forest communities:

- Avoid cutting trees in areas containing exotic shrub species. Where cutting trees is necessary, cut exotic shrubs and treat with a basal application of an appropriate herbicide. Where developments are proposed within or adjacent to forest areas, removal and treatment of exotic shrubs could be incorporated into the overall site preparation process.
- Slow growing and mast-bearing trees such as oak and butternut should be given particular protection due to their value to wildlife. Other trees also serve as important food sources for wildlife including maples, elms, aspens, basswood and birch.
- Large trees, particularly those containing cavities, should not be removed unless they present a safety hazard. While humans perceive natural areas with dead trees as

messy, they support a high number of plants and animals throughout their decomposition cycle, and are therefore important.

- The removal of weedy and/or exotic tree species such as Siberian elm, boxelder, Russian olive, black locust and eastern red cedar is encouraged. Plant higher value native trees and shrubs back into forests following problem species removal.

- Oak forest communities are adapted to fires and can often be improved through prescribed burns. Prescribed burns will generally increase diversity of grasses and forbs, encourage oak seedling germination and set back exotic or invasive shrub species. Where oak forest communities occur adjacent to prairie and savanna communities, fires from prescribed burns should be allowed to burn into the oak forest.

- Lowland hardwood forest communities should not be burned as frequently as oak forest, savanna, prairies, or some wetlands.

- Oak wilt may be of particular concern in several of the parks due to the dominance of oak. Oak wilt is spread during the growing season through damaged parts of oak trees. Canopy openings created by oak wilt can augment invasion by exotic species if not replanted or managed to restore oak woodlands. Oak trees should not be cut, pruned or injured between April 15 and July 1 of each year. Exposed roots injured by construction activities facilitate the spread oak wilt infection. If injury occurs, the wound should be treated with a tree wound dressing within 15 minutes or less to reduce the infection potential. A vibratory plow can be used to sever roots along the edge of any construction area prior to beginning work. This can prevent the transfer of oak wilt fungus between individuals through grafted roots and allow for regeneration at the point of cutting. If vibratory plowing is used, the disturbed ground should be restored to pre-plow contours and planted with an appropriate native seed mix to prevent invasion by nonnative shrubs and weeds. Tree protection zones should be fenced to prevent entry or compaction by construction equipment. Soil and construction materials should not be stored within the tree protection zone, as this can result in contamination of the tree protection zone and/or other construction sites.

5. LAKE INVENTORY METHODOLOGY AND RESULTS

INTRODUCTION

The City of Roseville directed that two lakes be included in the Natural Resources Inventory project. They are Langton Lake in Langton Lake Park and Bennett Lake in Central Park. Key information for these lakes is summarized in Table 5.1 below.

Table 5.1 - Lake Data Summary

Lake Data Summary - City of Roseville		
	Bennett	**Langton**
MN DNR-ID	**48W**	**204W & 49W**
Surface Area (ac.)	27.5	23
Direct Watershed Area (ac.)	141	121
Total Watershed Area (ac.)	706	188
Percent Watershed within Roseville	100%	100%
Watershed Area/lake area ratio	26:1	8:1
Average Depth (feet)	5	3
Maximum Depth (feet)	9	5
Residence ("flushing") time	70 days	170 days

LAKE WATER QUALITY PRIMER

One of the most acute concerns regarding management of lakes in general and urban lakes in particular is the effect of nutrient enrichment or eutrophication. The most obvious symptom of a nutrient enriched lake is an abundance of certain types of algae. Algae are small, often microscopic plants usually suspended in the water column of a lake. They obtain almost all of their nutrients from the water column in a dissolved form. A balanced population of algae is an

important part of the biological system within a lake. However, too great an abundance of algae adversely affects both the ecology of the lake as well as the suitability of the lake for use by people.

Phosphorus is the plant nutrient that most often controls the amount of algal production in a lake. This is because, compared with other plant nutrients phosphorus in a lake is generally lowest relative to demand by algae. If phosphorus concentrations are low, algal growth will be low. Conversely, high phosphorus concentrations often foster high algal productivity.

Under enriched conditions (i.e., high phosphorus concentrations in the water column), populations of certain types of algae can explode during the summer growing season. One of the most common nuisance algal types is blue-green algae or cyanobacteria. They are particularly problematic for several reasons, including:

- They decrease water clarity, which affects the perceived suitability of the lake for direct contact recreation such as swimming
- They form objectionable surface scum. The decomposition of surface scum often forms a pattern on the water's surface much like spilled paint and generates strong odors that negatively impact the recreational use an aesthetic appeal of the lake
- The ecology of bluegreen algae is such that most of the population dies off naturally. Decomposition of this organic mass depletes the lake of oxygen. The resulting lower dissolved oxygen concentration can threaten the survival of desirable game fish, make the lake more suitable for rough fish, and trigger other undesirable conditions, such as release of phosphorus held in the bottom sediments of the lake
- Excessive algal growth can cause taste and odor problems in drinking water if the lake is used as a source of raw water. This can substantially increase treatment costs for the water prior to distribution
- On occasion, bluegreen algae can secrete toxins poisonous to warm blooded animals. While few human deaths have been reported, there are many documented cases of wildlife and domestic animal deaths as a result of ingestion of these toxins

Since the supply of phosphorus usually governs the amount of algae in a lake, if the amount of phosphorus in the lake can be controlled, then algal growth can be controlled. The suitability of the lake to support recreational and other uses can thereby be maintained/improved. This is a principal objective of many lake water quality protection/improvement efforts.

Finding ways to protect/improve the quality of the lake environment for Langton and Bennett Lakes was a primary objective of this project. Of particular concern is the control and reduction of the amount of pollutants that reach these lakes, especially from developed areas in the lake's watershed. Elevated pollutant loadings from developed areas are in-part a consequence of more runoff volume as a result of coverage by impervious surfaces such as roads, parking lots, rooftops, and driveways. They are also a consequence of higher concentrations of pollutants in runoff from urbanized areas. For example, major sources of the pollutant phosphorus in urban runoff include:

- improperly applied fertilizers containing phosphorus,
- vegetative material left on hard surfaces,
- soil and dust particles, and animal waste.

Municipal storm drainage systems installed to prevent flooding provide an efficient vehicle for delivery of these pollutants from their places of origin to the receiving water.

OVERVIEW OF CURRENT LAKE WATER QUALITY

A lake water quality report card has been developed by staff from the Met Council to grade water quality in lakes in the Metro area based on summertime (May-September) values for several key parameters, including total phosphorus. The grades and total phosphorus ranges to which they apply are shown in Table 5.2.

Table 5.2 - Lake Water Quality Report Card Grade Ranges[1]

Grade	Total Phosphorus[2] (ug/l)	Chlorophyll "a"[2] (ug/l)	Water Clarity[2] (meters)	Comment/Explanation
A	<23	<10	>3.0	Exceptional quality; no recreational use impairment
B	23-32	20-30	2.2-3.0	Very good quality; minor recreational impairment, often in late summer
C	33-68	20-48	1.2-2.2	Average quality for this region; moderate impairment for recreational use, often in the later half of the summer
D	69-152	48-87	.7-1.2	Poor quality; recreational use severely impaired
F	>152	>77	<. 7	Extremely poor quality; no recreational use possible

[1] Grades characterize open-water quality of lakes. Other nuisances, such as abundance of aquatic plant growth, are not accounted for

[2] Mean values for May-September period

Source: Twin Cities Metropolitan Council

Based on data for 2001, the grades for Langton and Bennett Lakes are presented in Table 5.3.

Table 5.3 - Water Quality Grades for Roseville Lakes

(based on mean recreation season values for Total Phosphorous (TP))

Lake	Data Year	Total Phosphorus Value	Grade
		(ug/l)	
Bennett	2001	140	D^-
Langton	2001	80	D^+

The relatively low water quality grades for Bennett and Langton lakes are not unusual in an urban environment. Shallow lakes (i.e., those with mean depths of less than 10 feet) like Bennett Lake and Langton Lake are extremely productive environments, meaning that even under pristine conditions they are rich in aquatic vegetation. The main reason for this is sunlight can penetrate to the bottom almost anywhere in the lake at adequate intensities to support both vegetation rooted to the lake sediments well as other types of plants like algae that float in the water column. In addition, nutrients washed into the lake from the surrounding watershed – whether held in the lake sediments or suspended in the water column – are available to support plant growth.

In contrast, deeper lakes often have a significant portion of the lake bottom that does not receive enough sunlight to support plant growth. Also, the deep portion of a lake is separated from the upper shallow portions of a lake for much of the growing season through a process known as thermal "stratification". With the warmer water layer on top and cooler layer on the bottom, relatively little water is exchanged between the two layers for most of the recreation season. The deeper portion of these types of lakes can act as "storage" for excess nutrients, holding high concentrations in areas of the lake that are too deep to allow the light intensities necessary to support algae growth.

Each of the two lakes is described in detail below in terms of its basin and watershed characteristics as well as its ecology, use and quality.

LANGTON LAKE

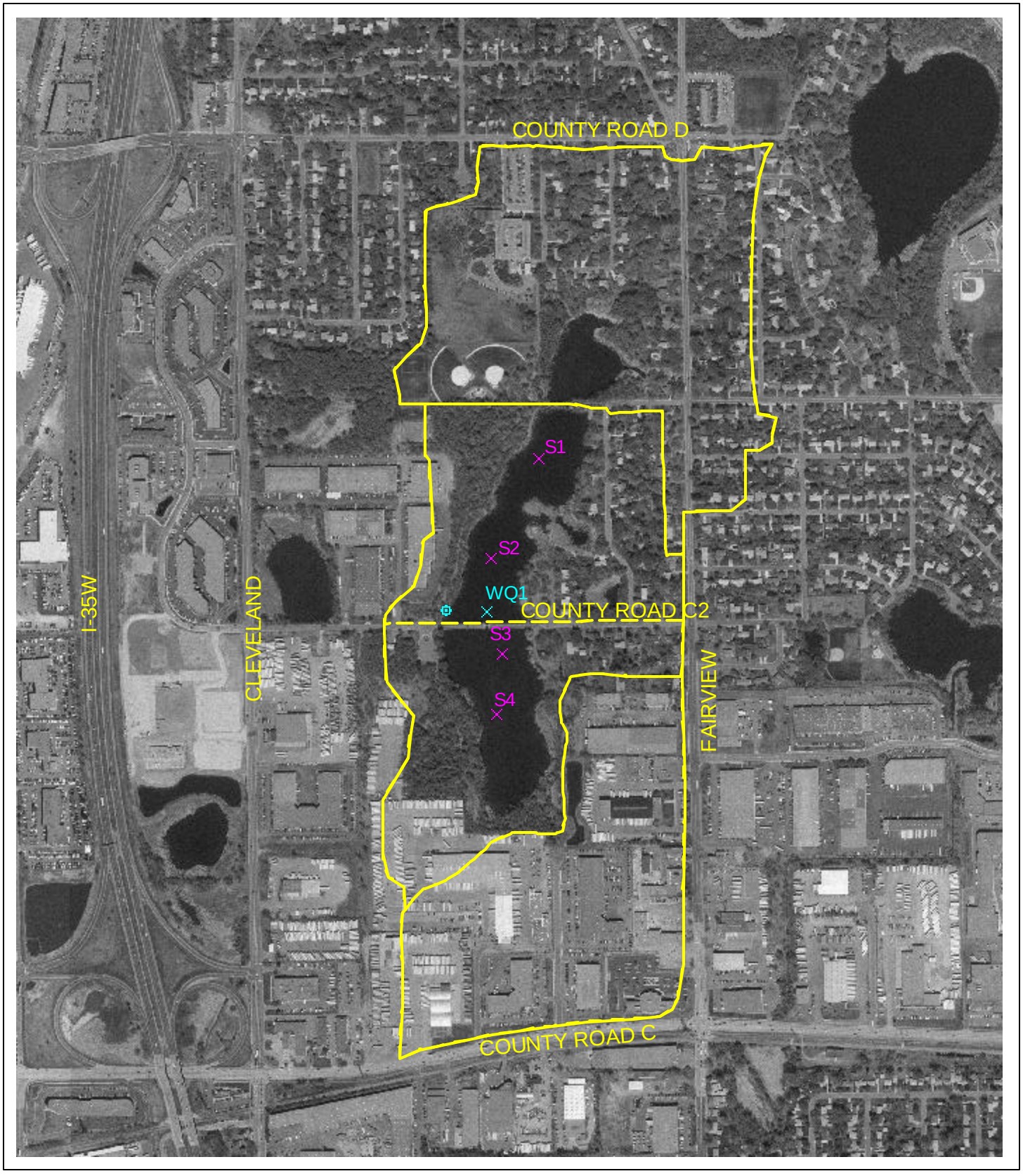
Lake and Watershed Overview

Figure 5.1 shows the location of Langton Lake and the approximate bounds of its watershed. Langton Lake occupies a total surface area of 23 acres. Average depth of the lake is around 3 feet, while the maximum depth is around 5 feet.

The watershed for Langton Lake is approximately 212 acres and is roughly bounded on the east by Fairview Avenue, the west by Cleveland Avenue, the north by County Road D and the south by County Road C. Residential and commercial/industrial land use comprises 47 % and 32.5 %, respectively, of the watershed. Open area, including woods, accounts for about 16 % and roads for about 4 % of the total area of the watershed. The watershed area is small for urban lakes and the development density is fairly low with the exception of the commercial/industrial area in the west and southern portions of the watershed.

Langton has 8 acres of land draining to it for each acre of lake surface. The ratio, known as the watershed-to-lake area ratio, often ranges between 10 acres to as high as 200 acres of land per 1 acre of lake for urban watersheds. The relatively low watershed-to-lake-area ratio for Langton Lake suggests that pollutant loadings to the lake should be relatively low and that the lake will retain the water it receives from its watershed for a fairly long time.

The lake has three cells, the north, middle and south with surface areas of 3.6, 10 and 9.5 acres respectively. These are described briefly below.



Bonestroo Rosene Anderlik & Associates
Engineers & Architects

k:\425\42501106\cad\gis\langton.apr

LEGEND

- Langton Watershed
- Direct Drainage
- Sediment sampling locations
- Water quality sampling location
- Outlet

ROSEVILLE

500 0 500 1000 Feet

Figure 5.1 - Langton Lake Watershed

North Cell. The surface area of the north cell is approximately 3.6 acres. Watershed area draining to the north cell is around 72 acres, comprising 38% of the total watershed area for Langton. The watershed has mostly single-family residential, with significant woodland pockets interspersed throughout the watershed. This is the shallowest part of Langton Lake with a mean depth of about 1.5 feet, and is dominated by emergent vegetation thereby limiting its use for recreational purposes. All of the stormwater drainage received by the north cell is untreated, causing it to function as a treatment cell for the middle cell to which it drains.

Middle Cell. Surface area of the middle cell is approximately 10 acres. Less than 32 acres or 17% of the Langton Lake watershed drains to the middle cell. Portions of the watershed from the moderate density residential to the east, and a small industrial area to the west drain direct stormwater runoff to this cell without prior treatment. The middle cell has benefited from the relatively small size of its watershed and from receiving pre-treated water from both the north and south cells. The lake outlet is a 12-inch reinforced concrete pipe and located on the west shore of this cell just north of the walking trail.

South Cell. The south cell has a surface area of 9.5 acres and a watershed area of 84.5 acres, 44 % of the total drainage area to Langton Lake. It receives direct runoff from 17 acres or 9 % of the total watershed area. Most of the direct runoff to this cell comes from residential and wooded areas. The large commercial/industrial park to the south and west of the south cell drains first to the half-acre pond located to the southeast of the cell. An open channel then brings treated water from the industrial pond to the south cell. By catching raw stormwater from the industrial/commercial area and holding it for a short period, before it enters the south cell, the industrial pond provided significant water quality protection to Langton Lake on the whole.

Langton is a popular spot for both active and passive recreation. It has a fishing pier in the south cell and short walking trails. Langton is managed by the Minnesota Department of Natural Resources (MN DNR) as a kids fishing pond. A large number of Walleye and Tiger Muskie fry were introduced into the lake in 1995 and 1996; however, in the last four years the predominant choice for stocking has been adult Bluegill and/or Black Crappie.

Langton Lake has benefited tremendously from concerted efforts by local residents and the City for its protection. Two efforts that stand out are the successful intervention to prevent filling of the southern part of the Lake in the 1970's, and the construction of a detention basin to treat runoff from much of the new industrial and commercial developments to the south of the lake. The desire to protect Langton Lake was also in large part responsible for passage of a shoreland zoning ordinance by the City in 1974, making Roseville the first city in the state to take such action.

Technical Findings

Due to a lack of available data for water quality in Langton, the City initiated a limited sampling effort for selected water quality parameters. The sampling was undertaken during the 2001 growing season on June 7th, July 17th and August 23rd.

Water Quality

Water clarity, measured by secchi depth, often indicates a lake's overall water quality, especially the amount of algae present. Growing season secchi depth for Langton averaged around 2.5 feet in 2001(Appendix A, Table 1). Generally, sunlight of adequate intensity to support rooted plant growth can penetrate a lake water column to 1.5-2 times lake secchi depth. This explains to a large extent why almost all of Langton Lake supports lush submergent vegetation since the maximum depth of the Lake, at 5 feet, is only about twice the water clarity reading.

The seasonal mean concentration for total phosphorus in Langton is 80 ug/l (ppb) (Appendix A, Table 1). This puts Langton Lake in category D, described in the Metro Lake water quality report card as "poor quality with recreational use severely impaired." It is encouraging however, to note that it is close enough to the upper limit of 69 ug/l in category C (average quality; moderate impairment for recreational use, often in the later half of summer) to make it an achievable goal for the future.

There is little historical water quality data for Langton Lake available in the state's water quality database. The Minnesota Pollution Control Agency's (MPCA) lake water quality database indicates that the summer mean water quality reading for the south bay was 1.6 feet in 1984 and

averaged 3.3 feet between 1995 and 2000 (range of 2.2 feet to 4.4 feet). Further, the 1976 environmental assessment for the Hyman Freightway truck terminal (pg. 6 of report) suggested that the water quality of Langton Lake was "very close to the analysis of roadway runoff". This is clearly not the case now and suggests that water quality in Langton Lake may have improved significantly from the 1970's and early 1980's.

With the help of volunteer Dr. Jerry Beilby, a Langton Lake watershed resident and long-time user of the Park, monitoring of water levels in the middle cell in response to rainfall events between July and September 2001 was carried out. This type of data can be of help in assessing the suitability of a wetland or lake to support a stable emergent community along the edge of the water. Development of a stable, diverse emergent community is an important component of a healthy wetland/lake system. The data collected by Dr. Beilby is presented in Appendix A. Among the findings are that the water level "bounce" in Langton Pond was just over 6 inches (.5 feet) for a 2.5 inch, 24 hour rainfall (about a "1-year" rainfall). Further, it took several weeks for the water level to return to near the pre-event elevation (only one minor rainfall event was recorded during this period). Thus, the magnitude of the water level fluctuation in Langton Lake is moderate while the duration of the high water level is fairly long. For the most part, the system has sustained a moderately diverse and extensive emergent fringe, but preventing increases in both the bounce magnitude and duration will be important to protect the existing system. This means that expansions in the size of the watershed and in the impervious coverage (at least without extensive flow rate control) should be avoided.

Aquatic Vegetation Survey

As part of the field survey for Langton Lake conducted during this project, qualitative observations of submergent and emergent aquatic vegetation were made during field visits in June, July, and August 2001. The vegetation survey was carried out with two primary objectives in mid:

1. To determine to what extent, if any, there are infestations of exotic species.
2. To determine the diversity of native species in the lake.

In general, the less dominant the exotic species and the broader the diversity of native species, the healthier the lake system

Following are the conclusions of the aquatic vegetation survey:

- There was no evidence of either eurasian water milfoil or curly leaf pondweed, the two most problematic exotic submergent plant species.
- The lake is shallow enough and the water clear enough during most of the summer to support good growths of native submergent vegetation throughout the lake. Many of the species noted during the surveys are important for wildlife food and cover.
- There is a moderately good diversity of native submergent plant species. All told, six species of native submergent aquatic plants were observed including Canadian waterweed, coontail, flat stem pondweed, slender niad, and the native northern water milfoil.
- The emergent community also appears to be in moderately good shape, especially in the middle cell of the lake where some stands of arrowhead, hardstem bulrush, and water plantain were observed.
- The northern cell was almost completely covered by various species of pond/water lilies, probably due to the fact that it is the most shallow of the three cells and receives the most (untreated) runoff.
- Cattails dominate the inshore areas in various spots along the lake shoreline. These species are aggressive, but it is unclear whether the areas that they dominate are expanding, staying about the same, or contracting.

In a historical context, the most significant finding is that the diversity of the aquatic plant species – and consequently the general health of the aquatic system – appears to have improved significantly since the 1970's. A field survey of the lake conducted in 1976 and cited in the Environmental Assessment of the proposed Hyman Freightways truck terminal south of the lake (City of Roseville, 1976) indicates that only one species of native submergent plant and two species of emergent plants were found. The emergent species identified were narrow-leafed

cattail and reed canary grass, both of which are aggressive invasive species not native to this area.

Sediment Assessment

Samples of lake sediment were also taken to get a preliminary indication of the degree of enrichment of the sediments within Langton Lake. The degree of lake sediment enrichment can be important, especially in shallow lakes, because the condition of the lake can be affected both by the phosphorus carried via runoff into the lake from the watershed as well as by the phosphorus released by the sediments within the lake. Lakes that have received large loadings of phosphorus over a long period of time tend to have much more enriched sediments than those that have not.

Sediment samples were taken at the locations shown in Figure 5.1. Samples were taken only in the open water portions of the middle and south cell. Approximately the top 2 inches of sediment were sampled, since this is roughly the profile identified as contributing the bulk of recyclable phosphorus in many lakes. Sampling results are summarized below:

- The sediments of the middle cell appear to be only moderately enriched, with a mobile phosphorus mass in the upper 2 inches of the sediment profile equal to about 2/3 the average annual loading estimated for the watershed.
- The sediments in the south cell appear to be highly enriched, especially in the southern section of the south cell. The estimated mass of phosphorus in the top 2 inches of lake sediment is over 3 times the calculated average annual loading contributed by runoff from the watershed to this cell.

Based on this information, any significant improvement in lake water quality will likely require that sediment phosphorus in the southern portion of the southern cell be dealt with, either through removal of the sediment or application of a chemical precipitant such as alum to inactivate the phosphorus. It should be noted however, that significant improvements in water clarity in the shallow lake system may increase the density of submergent as well as emergent plant communities in the open water areas of the lake.

Watershed and Lake Response Modeling

In water quality studies, two model types are typically used; a watershed model to estimate annuals loads of the pollutant of interest, and a lake response model to estimate the in-lake concentration of the pollutant.

Watershed model: In order to estimate runoff generated phosphorus loads entering Langton Lake, a watershed loading model was constructed (Appendix A, Table 4). The Pond Network (PONDNET) model (Walker, 1987) utilizes information on the annual volume, and mean total phosphorus concentrations of runoff for each type of watershed landuse. The resulting loads are then routed through the system to generate estimates of incoming loads to the downstream receiving body, or cell as in the case of Langton Lake. PONDNET is especially suitable to evaluate the effectiveness of upstream detention basins in removing phosphorus based on area, wet volume, and configuration of the pond and characteristics of the incoming runoff. Table 3 in Appendix A shows the values that were used in the PONDNET model to represent the quality and quantity of runoff from different landuses, both in the Langton and Bennet Lake watershed models.

The annual export rates for this study lie well within the range of accepted literature values for each landuse. An average annual precipitation of 28 inches/year, based on long-term precipitation records from the National Weather Service was also used as an input to the model.

Based on the model, the lake receives an estimated average annual phosphorus load of 186 pounds. The model output also provides the basis to estimate the benefit of the treatment pond serving the industrial area south of the lake. Without the treatment pond, the estimated average annual phosphorus load to Langton Lake would be about 250 lbs/yr. Thus watershed phosphorus load to Langton Lake would be 64 lbs or almost 35% higher than it is now. Clearly, the pond provides a very significant benefit to the lake.

Langton Lake enjoys relatively high water quality for a very shallow urban lake, reflected by the prevalence of rooted vegetation and relatively good water clarity. This can be attributed to the pre-treatment provided by the north cell and the industrial pond, and the relatively small contributing watershed area.

Lake Response Model: Phosphorus and water loading estimates to Langton Lake were used as inputs to a lake response model (Appendix A, Table 5). Wisconsin Lake Model Spreadsheet (WiLMS), (Panuska, et. al., 1994) comprises ten empirical lake models, developed using monitoring data from various lakes throughout North America, Canada and Northern Europe. The lake models predict either springtime or mean growing season (May-September) in-lake total phosphorus concentrations. The group of lakes models used is representative of a cross-section of many lake types and characteristics and published extensively in lake management literature.

The measured growing season mean phosphorus level along with lake morphometry and watershed loadings was used as an input to the WiLMS model. These data are used to run all of the lake response models. The in-lake total phosphorus concentrations predicted by each lake response mode are then compared to actual monitoring data from the receiving water. The model that provides the best match to the actual monitored in-lake total phosphorus concentration is usually selected as the one, which best represents system conditions.

Among several candidate models, the Rechow, 1979 general model fit the measured data best, estimating a P concentration of 74 ug/l for a normal year precipitation of 28 inches. Using the same model, hypothetical changes in phosphorus concentrations resulting from percent reduction in phosphorus loadings were calculated. It was found that in order to drop the total phosphorus concentration to 67 ug/l, to bring it up to category C in the lake water quality report card, a reduction of about 8-10% in phosphorus loading would need to be achieved.

What the Information Tells Us About Langton Lake

The most significant findings regarding Langton Lake and its watershed are as follows:

- Langton Lake enjoys relatively good water quality for a very shallow urban lake. This is reflected by the prevalence of a diverse community of native rooted aquatic vegetation and moderately good water clarity. Major positive influences on the lake's

condition include the relatively small watershed of the lake and the treatment benefits of the detention basin serving the industrial portion of the watershed.

- Both water quality and the diversity of the native aquatic plant community appear to have improved significantly over the last 15-25 years.
- Water level fluctuations in the lake in response to precipitation events are small to moderate for an urban lake. This is important in fostering a stable and diverse fringe of emergent vegetation. Expansion of the watershed and increases in impervious coverage without full rate control should be avoided to protect this condition.
- The north cell of the Lake is dominated by emergent vegetation. This condition likely exists because of the shallow depth of the basin and may be exacerbated by high nutrient loadings to this cell from its watershed.

BENNETT LAKE

Lake and Watershed Overview

Bennett Lake and the approximate bounds of the land area draining to it is shown in Figure 5.2. Bennett Lake occupies 27.5 acres, about a third or more of the total area of Central Park. The lake has mean depth of about 5 feet and maximum depth of about 9 feet.

Bennett drains to Lake Owasso to the northeast via the wetland in Central park. Prior to 1980's water was pumped out of the lake. In 1996, an open channel that connected Lake Bennet with the wetland replaced the lift station.

Bennett Lake has a total watershed area of approximately 758 acres. It extends east to Victoria Avenue, west halfway between Hamline and Snelling, north up to County Road C2 and south to Larpenteur Avenue. The direct drainage to Bennett Lake (i.e. the area whose runoff reaches the Lake without first traveling through another lake or pond) comprises about 140 acres. A large portion of the direct drainage, about 28 %, comes from Central park, while residential use accounts for 62 %. Indirect drainage (i.e., that portion of the watershed that drains through other ponds first before reaching Bennett Lake) is 620 acres and is dominated by residential use mixed with some industrial.

The watershed to lake area ratio for Bennett is 26:1, meaning that it has 26 acres of land draining to it for each one acre of lake area. This is a much higher ratio than that for Langton Lake, which has an 8:1 ratio. Bennett Lake's ratio is in the moderately high range for urban lakes and suggests that the lake is likely to receive high amounts of pollutant loads from its watershed.

The Bennett watershed contains seven ponds, ranging in surface area from 1.4 to 13 acres. These ponds catch and temporarily hold raw stormwater from the area that drains to them, partially treating the water before discharging it downstream to Bennett Lake. Ponds WP-1, in Willow Park, and BL-4 between Brooks and Transit Avenue receive runoff from watersheds of 380 and 67 acres, and have estimated phosphorus removal efficiencies of 50 % and 37%, respectively. They appear to play important roles treating stormwater before it reaches Bennett Lake.

The lake has two aerators; the one to the northeast was installed in 1998 to prevent winterkill. Another aerator located by the band shell is mostly for aesthetics purposes. The DNR has managed the lake for kids fishing for many years. Musky was the popular choice for stocking in Bennett prior to the 90's. More recently the MN DNR has stocked the lake seasonally with Walleye, Channel Catfish, Bluegill, Northern Pike and Largemouth Bass.

From water level information obtained from the MN DNR, it appears that the water levels at Bennett between 1987 and 1996 follow a different regime than those from 1997 to the present. There is a difference of at least one to one and a half feet between the mean levels for the two periods. The lowest recorded water level for Bennett was in July of 1987 at 883.94 feet and the highest was in July of 1997 at 890.54. The recorded range in elevation is around 6.6 feet. The last reading of 887.97 by the MN DNR was on October 25th of 2001.

Bonestroo Rosene Anderlik & Associates
Engineers & Architects

k:\425\42501106\cad\gis\langton.apr

LEGEND

- Bennett Watershed
- Direct Drainage
- Sediment sampling locations
- Outlet

ROSEVILLE

1000 0 1000 Feet

Figure 5.2 - Bennett Lake Watershed

Technical Findings

Since monitoring information for Bennett was available from Ramsey County, Bennett was visited only once on July 18, 2001 as part of the Natural Resources Inventory.

Water Quality

Water quality data for Bennett Lake extends as far back as 1984. Data collected between May and September of 2001 by Ramsey County staff is presented in Appendix A, Table 2 and shows that the mean secchi depth was 1.11 feet, a relatively low reading even for an urban lake in this region. The growing season mean concentration of total phosphorus for Bennett was 140 ug/l, putting it toward the poorer quality end of the D category (69-152 ug/l) for the lake water quality report card developed by the Met Council. These data indicate that Bennett Lake is hyper-eutrophic, meaning it is very nutrient enriched and can be expected to show problems with severe algal blooms for most of the recreational season.

Aquatic Vegetation Survey

A one-time reconnaissance level survey of aquatic vegetation in Bennett Lake was carried out on July 18, 2001 as part of this project. Following are the conclusions of the survey:

- There was evidence of a curly-leaf pondweed infestation in the lake but no evidence of eurasian milfoil. The survey was conducted well after the peak growth of curly-leaf pondweed usually occurs, so this exotic might be much more dominant earlier in the summer.
- The maximum depth of submergent aquatic weed growth at the time of the survey appeared to be about 3-4 feet. This is likely a reflection of the limited light penetration through the water column caused by algal blooms growing in response to high nutrient concentrations in the lake.
- The diversity of native macrophyte species observed was low, with only coontail and Canadian waterweed observed in any abundance.
- There were significant growths of filamentous algae floating in mats on top of the water in many inshore locations. This is symptomatic of a very nutrient enriched system.

- The emergent population is dominated by cattails, though some small pockets of arrowhead and bulrush were noted near the fishing pier.
- Large water level fluctuations appear to have played a major role in limiting the development of a diverse native emergent community. This is not unexpected, since Bennett Lake has served an important stormwater management function for over 750 acres of the City.

It is unclear how the aquatic vegetation community has changed over time. Clearly, historically high nutrient loadings and water level fluctuations have created a very resistant aquatic vegetation community dominated by a few aggressive species.

Sediment Assessment

Samples of lake sediment were also taken to attempt to gain a preliminary indication of the degree of enrichment of the sediments within Bennett Lake. As mentioned earlier in this report, the degree of lake sediment enrichment can be important, especially in shallow lakes, because the condition of the lake can be affected both by the phosphorus carried via runoff into the lake from the watershed as well as by the phosphorus released by the sediments within the lake. Lakes that have received large loadings of phosphorus over a long period of time tend to have much more enriched sediments than those that have not.

Sediment samples were taken at the locations shown in Figure 5.2. The maximum depth of sediment sampling was approximately 5 feet because of limitations of the sampling equipment. Approximately the top 2 inches of sediment were sampled, since this is roughly the profile identified as contributing the bulk of recyclable phosphorus in many lakes. Somewhat surprisingly, the sediments sampled generated results that suggested the potential in-lake pool of mobile phosphorus is relatively small, equal to about 25% of the estimated loads contributed by the watershed. There are two likely reasons for this. First, the estimated watershed load is high because of the large amount of developed land discharging stormwater to the lake. Second, the deeper sediments in the lake are usually the most enriched but were not sampled effectively because of equipment limitations.

Watershed and Lake Response Modeling

Watershed Model. As in the case of Langton, the PONDNET was used to estimate runoff-generated phosphorus entering Bennett. For more information on the PONDNET model refer to the Langton Lake section on modeling. Table 4 in Appendix A shows results from the PONDNET model for Bennett Lake. By model estimates, Bennett receives an average annual phosphorus load of about 540 pounds from its watershed. Total phosphorus loading per acre of lake is estimated at about 20 lbs (more than double the loading per acre for Langton Lake) and reflects much higher inputs than the lake can reasonably be expected to absorb and stay healthy.

Phosphorus removal efficiencies for ponds in the Bennett watershed range from 37% to 56%. Ponds WP-1 and BL-4 serve important roles in treating stormwater that eventually reaches Bennett Lake. Modification to increase the standing water volume of ponds in the watershed may be a cost-effective strategy to enhance the stormwater treatment functions of these ponds and decrease watershed phosphorus loads reaching Bennett Lake. Improvement efforts should focus on those ponds that receive runoff from large drainage areas and whose model estimated removal efficiencies are low (less than 40-50%).

Lake Response Models: Total phosphorus and water loading rates from PONDNET along with the actual measured growing season mean phosphorus level was used as input to the WiLMS model in order to estimate in-lake phosphorus concentrations (Appendix A, Table 6). For more information on the WiLMS model refer to the Langton section on modeling. The Rechow, 1979 general model provided the best fit for the data with measured mean phosphorus concentration of 140 ug/l.

In a fashion similar to Langton, hypothetical changes in phosphorus concentrations resulting from percent reduction in phosphorus loadings were calculated. In the case of Bennett Lake, a 40% reduction in phosphorus loads would be needed in order to bring in-lake water quality up to Grade C on the Met Council's scale. This is a very large reduction and is likely to be achieved only with significant and expensive infrastructure changes and intensive management activities in the lake itself.

What the Information Tells Us About Bennett Lake

The most significant findings regarding Bennett Lake and its watershed are as follows:

- Bennett Lake has poor water quality, characteristic of many urban lakes.
- An important contributing factor influencing the nutrient -enriched condition of the lake is the high nutrient loads from its large, mostly urbanized watershed. Another likely factor is the prevalence of the exotic aquatic weed curly-leaf pondweed, which effectively "pumps" phosphorus out of the sediments ands releases it into the water column during its annual die-off in the middle of the summer growing season.
- Based on modeling and other observations, a 40% reduction in phosphorus loads to Bennett Lake would be needed in order to bring in-lake water quality up to the Grade C range (average water quality for this region) on the Met Council's scale. This is a very large reduction and is likely to be achieved only with significant and expensive infrastructure changes and intensive management activities in the lake itself.
- The aquatic plant community is dominated by a few aggressive natives as well as exotics. This is likely due to both historic water level fluctuations in the pond and nutrient enriched conditions.

MANAGEMENT OPTIONS

General Comments

SETTING EXPECTATIONS FOR SHALLOW LAKES

The pristine state of most shallow lakes is one of relatively clear water and a diverse, rooted aquatic plant community usually dominated by relatively small-sized plants. While algae are present, they are not sufficiently abundant to create the turbid water conditions sufficient to shade out the rooted submerged plants. The increase in nutrient loading that often occurs with the development of the lake's watershed changes this situation. The lake shifts from clear to turbid water, and with this decrease in water clarity, submerged aquatic plants disappear.

Restoration of turbid shallow lakes to the clear vegetated state is difficult. Reduction of nutrient loadings from the watershed may have little affect, since during the period of high incoming

loading from the watershed, a large amount of phosphorus has been adsorbed by the sediment in the lake. If the nutrient load from the watershed is reduced – always a good idea – and its concentration in the water drops, phosphorus release from the bottom sediments of the lake can become an important nutrient source for the algae. This delays the response of the lake water concentration to the reduction of loading from the watershed. There are other ecological mechanisms associated with the biology of a disturbed lake that tend to perpetuate a turbid water state as well.

This is not to say that reducing the flow of nutrients from a lake's watershed to the lake should not be done. Reduction of incoming nutrients and other pollutants to urban lakes is always a good idea. It does mean that careful consideration of the costs and likely benefits (some of which may take a long time to appear) is needed. In addition, a lake system itself is inherently variable over time due in part to differences in precipitation and temperature patterns as well as land management activities in the watershed. Thus, visible improvements may follow a "two steps forward, one step back" track. Finally, it means that no single action is likely to change an urban lake dramatically. There are numerous "tools in the toolbox" and many need to be used in order to generate an improvement in lake quality, especially in lakes that have been severely impacted for along period of time.

Organization of Management Options

A matrix of management options was developed to guide future management activities for Langton and Bennett lakes. The options are based on the results of field surveys, watershed and in-lake water quality modeling, and – most importantly – on actual experience in restoration efforts on urban lakes elsewhere in the Metro area and the upper midwest. The management options are assigned to one of three phases. Those in Phase 1 can be pursued now with no little or no additional resources from the City, supplemented perhaps by volunteer assistance. Options assigned to Phase 2 are more costly and in some cases require a more detailed assessment beyond the scope of this study. Those assigned to Phase 3 require a significant commitment of financial resources and may not move forward unless supplemental outside funding is secured. Also, additional work to establish feasibility, refine costs, and develop designs will likely be necessary. In most cases, these management actions can also be expected to have the greatest potential for improving the quality of the target resource.

The sections below provide a summary of the options along with rough cost estimates and descriptions of what they involve.

MANAGEMENT OPTIONS FOR LANGTON LAKE

Management options for Langton Lake focus largely on achieving a small reduction in watershed loadings to the lake, since this lake is in relatively good shape for its size and depth. These are shown on the following page, in Table 5.4.

Table 5.4 – Management options matrix for Langton Lake

Activity	Phase	Estimated Cost	Comments
Targeted street-sweeping	1	$150/street mile	Sweep direct drainage In March/early April, June, October/November, remainder of drainage as budget allows
Soil phosphorus testing	1	$400-600 in analytical costs for 50-80 samples	Top priority are residential areas that drain directly to lake. Extend focus to other areas as funds and time allow.
Promotion of no-phosphorus fertilizer use	1	$500	Target areas where soil tests show no P necessary. Can work through vendors and/or volunteer groups (including neighborhood).
In-lake monitoring	1	$15	Monitoring should be conducted bi-weekly throughout May-September period. Low cost option is participation in MPCA's Clean Lake Monitoring Program (CLMP) (water clarity only).
Conduct periodic sediment removal in upper cell of industrial treatment pond	2	$3,000 – $6,000	This is an important water quality protection feature serving the industrial portion of the watershed. Periodic removal of sediments (every 5-10 years)- especially in the upper cell- will preserve the treatment capability of this pond.
Treat runoff from high priority impervious areas in direct drainage.	3	$12,000 - $30,000/site plus maintenance	Possibilities may be Park parking lot west of lake and residential streets east of lake. Treatment would utilize sub-grade swirl concentrators or equivalent, possibly discharging to filtration/infiltration feature. Conduct feasibility study to evaluate physical feasibility, estimate specific costs.
Maintain more open water in north cell.	3	$500-$35,000 depending on option pursued	Options for management of this cell to maintain more open water include: Chemical treatment Cutting and removal Excavation An MN DNR permit will be required to execute any of these options. A "do nothing" option should also be considered.

MANAGEMENT OPTIONS FOR BENNETT LAKE

Bennett Lake has multiple, systemic management challenges and will likely require a considerable commitment of resources to achieve noticeable improvements in water quality. The options presented below are made based on what we know about the system now (Table 5.5). It may make sense for the City to pursue Phase 1 management options now, but consider a more detailed technical assessment of the lake and its watershed to evaluate the specific costs, benefits, and feasibility of structural measures to decrease the pollutant loading to the lake. Outside sources of funding to support this effort may be available through MPCA's Clean Water Partnership Program and the Grass Lake Watershed Management Organization.

Table 5.5 – Management options matrix for Bennett Lake

Activity	Phase	Estimated Cost	Comments
Targeted street-sweeping	1	$150/street mile	Sweep direct drainage In March/early April, June, October/November, remainder of drainage as budget allows
Soil phosphorus testing	1	$400-600 in analytical costs for 50-80 samples	Top priority are maintained areas of Central Park and residential areas in direct drainage. Other areas as funds and time allow.
Promotion of no-phosphorus fertilizer use	1	$500	Target areas where soil tests show no P necessary. Can work through vendors and/or volunteer groups.
Stocking of piscivorous fish	1	N/A	Continue working with MN DNR to stock large predatory fish in order to try to reduce number of small fish that feed on large zooplankton. Grazing on algae by large zooplankton can help keep algal blooms in check.
In-lake monitoring	1	$15 - $1,000/yr	Monitoring should be conducted bi-weekly throughout May-September period. Go with continued monitoring by Capitol Regions Watershed District (CRWD), if possible. If not, low cost option is participation in MPCA's Clean Lake Monitoring Program (CLMP) (water clarity only). Higher cost option is participation in Met Council's Citizen Assisted Monitoring Program (CAMP).

(Table continues)

Activity	Phase	Estimated Cost	Comments
Conduct experimental in-lake treatment with barley straw	2	$1,500 - $2,500 for straw plus labor to install in lake	Decomposition of the barley straw generates natural algal growth inhibitor. This technique has been used with some success to control algal blooms in small lakes and ponds, managing the symptoms of the problem rather than addressing the causes (i.e., high nutrient loading). It is of low enough cost, however, that it may be appropriate to try it and see how it works on Bennett Lake. Appropriate initial dose is 200-400 lbs/lake acre (2.5-5 tons of straw total).
Control curly leaf pondweed	2	$800 - $2,500/yr	Curly leaf pondweed is an exotic invader that degrades water quality during the summer recreation season. Options for control are periodic harvesting or herbicide treatments. Emphasis should be to control clpw while promoting growth of native submergent macrophytes. If harvestor is used, landing may have to be constructed, presumably with City staff labor.
Treat runoff from high priority, highly maintained pervious areas in direct drainage	2	$10,000-$15,000/site plus maintenance	Possibilities include creating rainwater garden/filtration bed to catch and treat runoff from athletic fields west of Lake. Conduct assessment to evaluate feasibility (engineering, suitability of soils, etc.), estimate specific costs.
Treat runoff from high priority impervious areas in direct drainage.	3	$20,000 - $50,000/site, plus maintenance	Possibilities may be Central Park parking lot west of Lake and Lexington Avenue. Treatment would utilize sub-grade swirl concentrators or equivalent, possibly discharging to filtration/infiltration feature. Conduct feasibility study to evaluate physical feasibility, estimate specific costs. Flat pipe grades a potential problem.
Modify priority upstream ponds to increase removal efficiency	3	$10,000 - $200,000 depending on whether water level increase or excavation is necessary	Ponds BL-4, BL-5, and WP-1 look like candidates. New ponding in direct drainage also desirable but likely not acceptable. Conduct feasibility study to determine engineering feasibility, costs, and benefits. Approval needed from MN DNR if pond is designated protected water.
Implement whole-Lake alum treatment	3	$15,000 - $25,000	Only makes sense if clpw is brought under control and watershed inputs are minimized to extent practicable. Additional sediment sampling desirable. Permits needed from state for application, one time application allowed.

6. WETLAND AND UPLAND INVENTORY METHODOLOGY AND RESULTS

METHODS

The Methodology utilized for Inventory of upland and wetland natural communities in the Roseville Natural Resource Management project is given in the following pages.

EVALUATION OF WETLAND SITES

Data from the National Wetland Inventory (NWI) map was used for preliminary determination of wetland site locations in the study area. In addition, and MnDNR Forestry color infrared aerial photographs were reviewed to locate wetland sites for field visitation.

These boundaries were further refined during the field visits as part of the inventory effort to provide a more accurate location of the wetland boundaries. NOTE: These modified wetland boundaries do not replace jurisdictional wetland delineations. The boundaries have been provided for planning purposes only, to provide an estimate of wetland boundaries.

FIELD ASSESSMENT AND COMMUNITY TYPE DETERMINATION

The field assessment utilized the Minnesota Routine Assessment Method (MnRAM), Version 2.0. MnRAM was developed by the Minnesota Wetland Advisory Group as a field evaluation tool to assess wetland functions on a qualitative basis. It considers, and assigns value to, many functions associated with wetlands. As a result of discussions with City staff, the sections of MnRAM listed below were used to evaluate wetland sites in the study area:

- Floristic quality of each the plant communities within a wetland basin
- Wildlife habitat value
- Aesthetic/recreational/educational/cultural value

Community type determination follows Eggers and Reed. These wetland community descriptions are described in: *Wetland Plants and Plant Communities of Minnesota & Wisconsin* (Eggers and Reed, US Army Corps of Engineers, 1997).

Wetland Qualitative Ranking

After field evaluation of each wetland site, the next step was to assign a qualitative rank for each wetland. MnRAM differs from methods used for upland ranking in this report in that MnRAM was not designed to come up with an overall qualitative rank for each site. Rather, MnRAM allows the evaluator to assign a qualitative rank for each wetland function. According to MnRAM, the rank for each function ranges from low, medium, high, and exceptional. A summary of wetland functional value rankings and classifications for each wetland field inventoried is presented in Appendix A.

EVALUATION OF UPLAND SITES

Preliminary Assessment

The boundaries of potential upland natural communities were delineated using 1:15,840 scale, MnDNR Forestry color infrared aerial photographs. Natural community boundaries, as well as other relevant information, were then drawn on overlays of the photos.

At this time, a review of all available information on natural resource features was conducted. This existing information included such sources as National Wetland Inventory Maps, DNR County Biological Survey databases and maps, and other pertinent information.

Field Assessment and Community Type Determination

The field assessment is a qualitative evaluation of natural communities. The field survey included identification of major plant species in the canopy, subcanopy, shrub, as well as dominant graminoids (grasses, sedges, and rushes) and forbs (nonwoody broadleaf plants). The field inventory also included gathering data on disturbance indicators such as nonnative species encroachment, erosion, and other disturbances. This information provides a solid starting point for developing future management objectives.

Evaluation of upland sites to determine the natural community type was done using methodology outlined in *Minnesota's Native Vegetation, A Key to Natural Communities* (Minnesota Department of Natural Resources, 1993). This key is the best statewide guide to the classification of native plant communities.

Field inspection of some potential sites indicated that all or part of these sites are dominated by non-native vegetation, and are therefore not classified as a (native/remnant) natural community. These types of plant assemblages would be given common descriptive names of "old field" and "conifer plantation" to identify the plant community types.

Upland Qualitative Ranking

To provide further information about the quality of the upland natural communities in the study area, each natural community was assigned a qualitative ranking. Sites are ranked on a scale from A to D, with "A" quality communities being the highest in ecological quality, and "D" communities being the lowest.

Standardized ranking criteria established by MnDNR's Natural Heritage Program were used to evaluate the quality of natural communities. Some examples of criteria utilized for ranking are the degree of native species diversity, age of trees, amount of disturbance, and invasion by non-native plant species.

Rankings reflect how closely a given site resembles an intact or "pristine" community of its type. Those sites that are most like intact natural communities have an "A" rank; conversely, "D" quality communities have been highly altered. Due to the high level of human activity in urbanizing landscapes, "A" quality communities are very rare.

Communities of A to B quality, generally exhibit little disturbance and are high in species diversity. For example, forest communities would be comprised of old growth trees and have a diverse group of shrub and ground cover species characteristic of the natural community type. Disturbances from human activities and invasion by nonnative shrubs such as buckthorn would be absent or minimal.

Grazing, farming, or other activities have typically disturbed C quality natural communities, but with proper management techniques such as prescribed burning, could be upgraded to a higher quality.

D quality natural communities are severely disturbed and can only be restored to a higher quality with considerable effort and expense. Poor quality natural communities have generally had their characteristic plant species assemblage replaced by weedier native species and/or nonnative species.

Upland sites assigned an NA do not meet minimum standards to be classified as a natural community or are human created environments such as conifer plantations and old fields. The ecological ranking for each site is given with its Community Description in this report. One major area where this inventory effort differs from DNR Natural Heritage Program standards is in the "minimum size" criteria. The DNR NHP standard for minimum size varies for each community type with the minimum size for some communities being over 40 acres. During this study, all native plant communities within the five parks studied were visited and inventoried.

Because sites with a rank of "C" or better are very rare in urban areas, readers should not be alarmed at the lower rank of some natural communities within the study area. Although the qualitative rank is a reflection of current conditions, it does not take into account a natural community's potential to improve under active management. Restoration is an important aspect to take into account in the case of Roseville Parks since the City has an expressed desire to actively manage these areas and enable their recovery/improvement, where possible.

Nonnative Shrub Ranking

To assist in prioritizing areas for control of nonnative shrubs, a methodology created by Paul Bockenstedt for assessing European buckthorn *Rhamnus cathartica* infestation levels in MN State Parks was utilized. This method seeks to assess, within an individual natural community, the extent of nonnative shrub cover, shrub size, seed production, and other related parameters to determine the threat they pose to existing natural communities. The nonnative shrub assessment method yields a numerical score where the higher the score is, the greater the infestation levels of nonnative shrubs. These numeric scores can then be used within, or across parks to prioritize treatment sites.

INTRODUCTION

THE FOLLOWING SECTION CONTAINS DESCRIPTIONS FOR UPLAND AND WETLAND NATURAL COMMUNITIES IDENTIFIED WITHIN THE FIVE STUDIED PARKS. IMMEDIATELY FOLLOWING EACH NATURAL COMMUNITY DESCRIPTION IS A MANAGEMENT RECOMMENDATION TABLE THAT SUMMARIZES, RANKS, AND PROVIDES ESTIMATED COSTS FOR THE RECOMMENDED ACTIVITIES.

IN ADDITION, A SUMMARY MANAGEMENT RECOMMENDATION TABLE FOR UPLANDS AND WETLANDS WITHIN INDIVIDUAL PARKS IS LOCATED AT THE END OF THE SECTION FOR A PARTICULAR PARK. THE PURPOSE OF THIS SUMMARY TABLE IS TO PROVIDE A GENERAL OVERVIEW OF PRIORITIES ACROSS NATURAL COMMUNITIES, AND WITHIN EACH PARK.

Wetland Comments

The high, medium and low priority were provided for each recommendation. The ranking were generally based on the effort that would be required to restore the hydrology, plant composition, structure, and function for the wetland community type. Strong considerations were also given to the public benefit of the improvement. Wetland basins that are close to trails offer viewing opportunities or provide for other public recreation typically received higher rankings. Other considerations included existing public use in each park and whether the improvements would be considered beneficial to the users of the park.

Costs provided for each improvement are estimates that are based on the combining several projects under one construction contract to limit the cost of mobilization by a contractor. In most cases additional topographic survey and analysis needs to be completed to provide a more accurate cost estimate. The cost estimate should provide a good guide for comparing improvements and help making the decision between projects.

ACORN PARK

This 45.8 acres community park lies at the intersection of Matilda Street and County Road C is one of the larger parks in Roseville. Acorn Park supports a number of small, depressional wetlands, with one larger wetland on the southeast side of the park. Upland natural areas are largely composed of oak woodland/forest.

The main recreational features of Acorn Park include an 18-hole disc golf course two lighted tennis courts, two basketball courts, a lighted hockey rink and skating area with shelter and restrooms, a large play structure, and two youth ball fields.

THE FOLLOWING PAGES CONTAIN A SUMMARY OF WETLAND AND UPLAND COMMUNITY DESCRIPTIONS AND MANAGEMENT RECOMMENDATIONS.

INSERT ACORN PARK MAP/FIGURE 6.1 HERE

Upland Natural Community Descriptions and Management Recommendations

Upland natural community types present in Acorn Park include Oak Woodland-brushland, oak forest, and lowland hardwood forest. The oak forest in the southeast portion of the park is the best quality upland area here, it has good restoration potential. Other areas (those associated with the disc golf course), have been significantly disturbed. An appendix of this report contains a list of recommended species for reintroducing into forest, savanna, and prairie areas.

Community AC-U1

Lowland Hardwood Forest

Qualitative Rank: CD

Nonnative Shrub Rank: 17

This forest community occurs as a narrow strip around a wetland in the northwest side of the park. It has a few widely spaced white and pin oaks that are over 20 inches in diameter. These older, open-grown trees have dense stands of younger trees between them, including green ash, boxelder, quaking aspen, and black cherry. The shrub layer varies from dense to nearly impenetrable and is largely dominated by the nonnatives European and glossy buckthorn. Other nonnatives present include amur maple and Tartarian honeysuckle. The most frequently encountered native shrubs include black currant, chokecherry, and black raspberry. The ground layer is sparse and includes a mix of natives that are adapted to disturbance including white snakeroot, sweet cicely, and enchanter's nightshade, as well as the nonnative deadly nightshade. Overall, the quality of this community is somewhat poor as a result of past grazing and the more recent transition to shrub and tree cover.

Community	Activity	Priority	Estimated Cost	Comments
AC-U1	Remove Buckthorn and other nonnative shrubs	Medium	Approximately $1,500-3,500, or 100-300 volunteer hours	Cut and treat all stumps with 25-50% solution of Roundup or Garlon. Leave cut stems on ground
AC-U1	Reintroduce native grasses and flowers of Lowland Forest	Low	$200 – 1,0000 depending on number of species, plants, amount of seed.	Reintroduce native plant plugs or seed, Combination of seed and live plants is good combination here.

Community AC-U2
Oak Woodland-brushland
Qualitative Rank: D
Nonnative Shrub Rank: 21

Large, open-grown white and pin oak averaging over 20 inches in diameter characterize this community that occurs with a disc golf course. The oaks have intermingling crowns in some places, but are separated by some distance in others. The overall canopy cover for the community approaches 100 percent here because the gaps between the large oaks have been filled in by younger, fast-growing trees. Some of the most common of these include quaking aspen, black cherry, green ash, and cottonwood. There are also select locations where trees have been planted, including jack pine and silver maple.

The shrub layer is dense to nearly impenetrable in some locations and dominated by the nonnatives glossy and European buckthorn. Nonnatives that were planted here include caragana and maples. Native plants in that occur at least occasionally in the shrub layer include red-berried elder, black raspberry, black cherry, and boxelder. The ground layer is very disturbed here with only a few natives capable of tolerating disturbance, as well as nonnatives present. Natives found here include common milkweed, Canada goldenrod, white avens, and enchanter's nightshade. Nonnatives in the ground layer include deadly nightshade, butter-and-eggs, smooth brome, Kentucky bluegrass, and perennial ryegrass.

Although the large oaks are still present here, much of the remainder of the composition and structure of this community has been altered by grazing, encroachment by nonnative brush and trees, and very importantly soil compaction. Also, the amount of foot traffic associated with the disc golf course is causing severe soil compaction, which is slowly killing the oak trees. This compactions is also hindering recovery of the shrub and ground layer in this community. For these reasons, this oak community was given a much lowered rank of "D".

Community	Activity	Priority	Estimated Cost	Comments
AC-U2	Assess disc golf course	High	$4,000-12,000	Review course layout and develop options for to course design alterations to benefit natural communities
AC-U2	Install Resource Management interpretive sign(s)	Medium-high	$500-5,000 depending on size and quantity of signage	Resource management signs in this park should focus on minimizing disturbance by park visitors off of trails and designated disc golf areas
AC-U2	Erosion correction of trails	Medium-high	$3,000-20,000	Numerous trails have become gullied in this park. Reroute trails, or create structures that take pressure off of erosion-prone areas.
AC-U2	Install Resource Management interpretive sign(s)	Medium	$1,000-5,000 depending on size and quantity of signage	This should be done after a plan is created to address disturbance issues. Sign(s) should explain what natural communities are present, what management is being conducted, and why the areas need rest from disturbance.
AC-U2	Remove Buckthorn and other nonnative shrubs	Medium	Approximately $3,500-5,000, or 200-350 volunteer hours	Cut and treat all stumps with 25-50% solution of Roundup or Garlon. Leave cut stems on ground
AC-U2	Plant grasses and flowers that are capable of tolerating extensive foot traffic, and those typical of oak woodlands	Medium-low	$500 – 3,000 depending on number of species, plants, amount of seed.	Reintroduce native plant plugs or seed, Combination of seed and live plants is good combination here. The woodland garden at the bottom of this hill is a great source of seed. An appendix of this report contains a list of recommended species for reintroducing into forest, savanna, and prairie areas.

Community AC-U3
Dry Oak Forest
Qualitative Rank: CD
Nonnative Shrub Rank: 22

This dry oak forest is located in the southeast portion of Acorn Park. It is characterized by mostly tall, straight trees that typically have touching crowns. Most of these oaks are over 16 inches in diameter and appear to be in good health. Where gaps do exist in the canopy, they

have been, or soon will be filled by young, fast-growing tree species including quaking aspen and cottonwood. The shrub layer is very thick and similar in composition to AC-U-2, with European and glossy buckthorn common. Likewise, the ground layer is sparse with species common in disturbed woodlands prevalent. Overall, this forest has great potential to improve if actively managed to reduce nonnative shrub levels and reintroduce appropriate processes and species. It represents the best opportunity to manage an upland natural community in Acorn Park.

Community	Activity	Priority	Estimated Cost	Comments
AC-3	Cut Buckthorn and other nonnative shrubs	High	Approximately $3,000-8,000 or 150-300 volunteer hours	Cut and treat all stumps with 25-50% solution of Roundup or Garlon. Stack brush away from oak crowns and burn in winter. Cut before burning in any particular area. Re-plant with native seed/plants where bare soil exists.
AC-U3	Reintroduce appropriate native species	High	$500 – 5,000+ depending on number of species, plants, seed.	Reintroduce appropriate native grasses and flowers through planting of plugs or seed, particularly where bare ground is left from brush clearing. Along with burning, this will be an important step in long-term control of buckthorn and nonnative shrubs.
AC-U3	Apply Prescribed Fire	Medium-high	$1,000 - 2,000 per event	Burning will help keep nonnative shrubs in-check and allow desirable native graminoids and forbs to better establish. Use trails for burn breaks and create burn breaks constructed by hand in woods.
AC-U3	Recut brush	Medium	$500-1,000 every 2-3 years or 20 hours volunteer time	Brush resprouts should be cut and new recruitment of problem shrubs monitored.
AC-U3	Remove Buckthorn and other nonnative shrubs	Med-low	$1,000 per acre	Cut and treat all stumps with 25-50% solution of Roundup or Garlon. This community receives a lower priority than other communities due to the fact that it is a planting rather than a remnant natural community.

(Table continues)

Community	Activity	Priority	Estimated Cost	Comments
AC-U3	Thin pines	Low	$1,000 - 2,000 per event	Pines in the west side of the planting are growing too close to one another, these should be thinned to allow for better overall forest health.
AC-U3	Plant appropriate native species	Low	$100 – 2,000 depending on number of species, plants, seed.	Reintroduce appropriate plant materials for white pine-mixed hardwood forest by planting of plugs and/or seed across site. An appendix of this report contains a list of recommended species for reintroducing into forest, savanna, and prairie areas.

Wetland Natural Community Descriptions and Management Recommendations

From examination of historic aerial photographs, wetlands have remained relatively unchanged in size and location from before development. Some of the wetland types have changed due to influences of stormwater inputs or lower water levels due to draining or artificial outlets. Other wetlands have lost hydrologic inputs due to diversion of surface water flows from the development of curbed roads and catch basins. Invasive vegetation has also affected these wetlands. Turf areas contributing nutrients to the wetland and disc golf activities compacting soil and disturbing the vegetation have reduced the ecological integrity of many of the wetland basins within this park. Glossy and common buckthorn, purple loosestrife, and reed canary grass where all common in the park's wetlands.

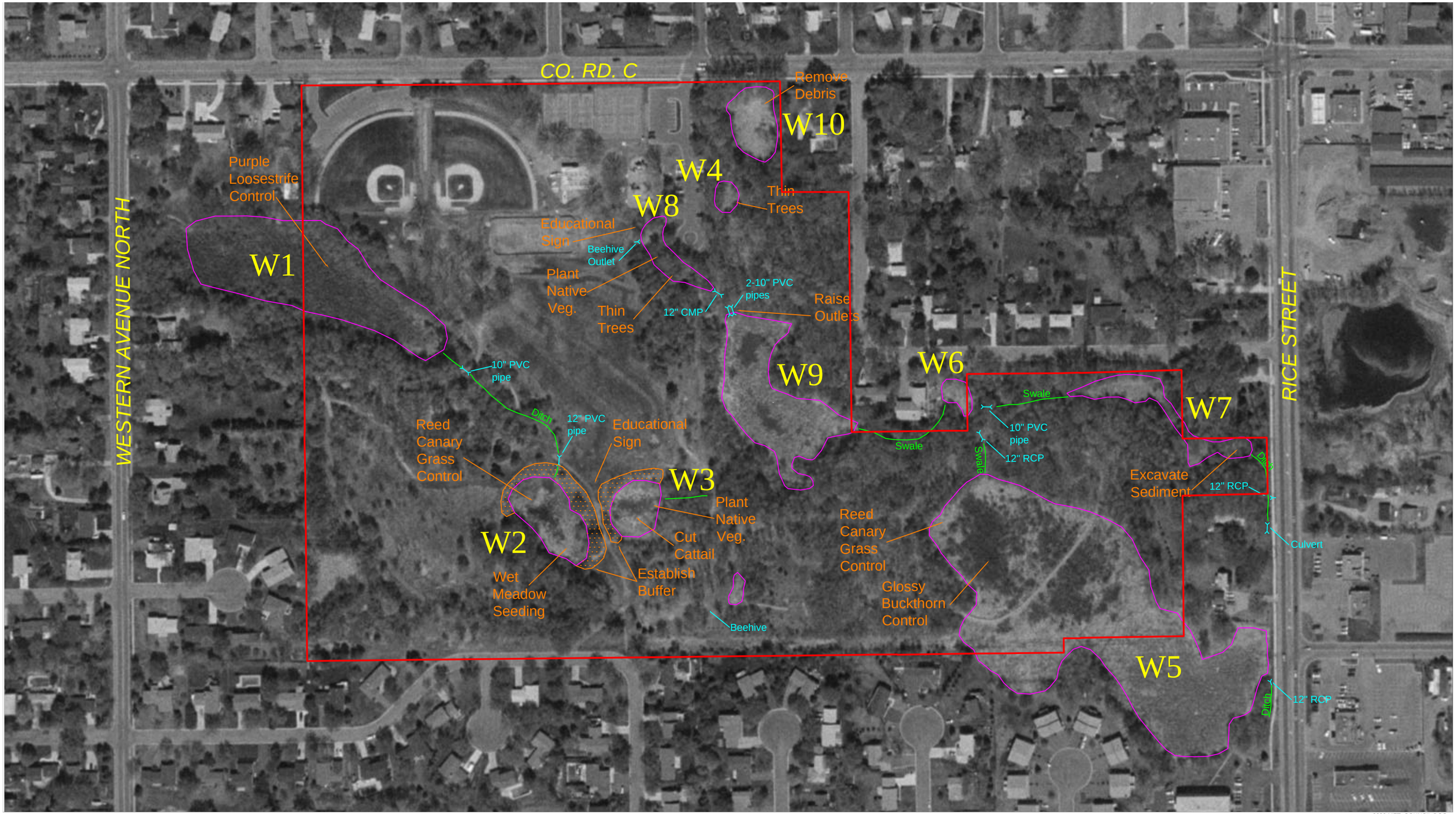
Locations of the improvements discussed in the following paragraphs are shown in figure 6.2

Community AC-W1
Shrub-carr
Qualitative Rank: Low
Area: 1.1 (2.1 total)

This is a shrub-carr wetland community that is dominated by purple loosestrife and sandbar willow. Other vegetation within the basin includes water plantain, ditch stonecrop, silver maple, horsetail, bog birch, and wool grass.

This wetland currently has a ditch that drains Wetland W2 into this basin from the southeast. It currently is a shrub-carr and has not been hydrologically altered. The main alteration to this basin is a purple loosestrife infestation that would be categorized as a high-density infestation and requires biological control utilizing beetles.

Community	Activity	Priority	Estimated Cost	Comments
AC-W1	Control purple loosestrife	High	N/A	Monitoring beetle population



ACORN PARK

FIGURE 6.2

ROSEVILLE

LEGEND:

Management Recomendations
Existing Structures
Existing Features

N W E S

0 100 200
Scale in feet

Bonestroo Rosene Anderlik & Associates
Engineers & Architects

FEBRUARY 2002

K:\425\42501106\Cad\Dwg\DOQ3.dwg

Community AC-W2
Shallow Marsh
Qualitative Rank: Medium
Area: 0.4 acres

This shallow marsh is dominated by cattail and arrowhead and has an area of wet meadow fringe that is predominately reed canary grass.

Frisbee golf is a popular recreational activity for this park. Turf areas contributing nutrients to the wetland and disc golf activities compacting soil and disturbing the vegetation have reduced the ecological integrity of the wetland basin. Improvements to this wetland basin would include a buffer strip to treat adjacent runoff. Signage to protect the wetland and buffer should be considered around this basin to limit human disturbances. Removal of reed canary grass, an invasive wetland species, could be pursued along with seeding the wetland with native wet meadow species to improve the ecological integrity

Community	Activity	Priority	Estimated Cost	Comments
AC-W2	Establish buffers	Low	$400.00	Provide treatment from turf and limit human disturbance.
AC-W2	Install educational signage	Low	3-signs $60.00	Limit human disturbance to buffer and wetland.
AC-W2	Reed canary grass control	Low	$300.00	Chemical treatment and/or prescribed burn
AC-W2	Wet Meadow Seeding and Maintenance	Low	$800.00	Seed following reed canary grass control to improve vegetative diversity and ecological integrity. Maintenance plan should be put in place to insure native seed establishment

Community AC-W3
Shallow Marsh
Qualitative Rank: Medium/Low
Area: 0.3 acres

The predominate vegetation in this basin includes cattail and duckweed. Other vegetation found in the basin is smartweed, sandbar willow and reed canary grass. This wetland was categorized as a medium/low ranking due to it containing 60% invasive vegetation.

Wetland buffer with signage around this basin would provide treatment of adjacent turf grass and limit human disturbance. This wetland basin is small and currently does not have hydrologic alteration. Natural fall draw down in this basin would allow for maintenance of the cattail by cutting. Natural flooding of this basin in the spring should remove or set back the cattail. This along with shallow marsh plantings would improve the ecological integrity of this basin.

Community	Activity	Priority	Estimated Cost	Comments
AC-W3	Cut cattail	Low	$150.00	Allow for planting of more diverse species
AC-W3	Planting shallow marsh species	Low	$700.00	Establish more diverse species.
AC-W3	Buffer Strip Signage	Low	3-signs at $60.00	Marks the upslope edge of buffer to limit human disturbance in basin and provide education.
AC-W3	Establish Buffer	Low	$250.00	Provide treatment from turf and limit human disturbance.

Community AC-W4
Shallow Open Water
Qualitative Rank: Low
Area: 0.07 acres

This is a small depression that receives runoff from the parking lot. This wetland currently does not contain any aquatic vegetation besides duckweed. This basin is impacted by the adjacent land-use of the disc golf course and a dense canopy that limits light penetration. Restoration of the vegetation community would involve canopy thinning and plant introduction for a partial shade environment.

Community	Activity	Priority	Estimated Cost	Comments
AC-W4	Tree thinning	Low	$200.00	Allow for light and revegetation
AC-W4	Seeding	Low	$200.00	Re-establish herbaceous growth.

Community AC-W5
Shrub-carr
Qualitative Rank: Medium
Area: 3.3 acres (5.3 total)

This shrub-carr has remnant native plant species that indicate at one time it had high ecological integrity and allowed it to have a medium ranking. These native species include: bog birch, canada blue joint grass, nightshade, smartweed, arrowhead, swamp milkweed, leather leaf, wool-grass, giant manna grass, willow and sedge species. It currently contains reed canary grass and glossy buckthorn, invasive species that are quickly reducing the ecological integrity of the basin by shading and out competing native species.

This basin extends beyond the park boundary to the south and east. Beyond the park boundary is over two-acres of shallow marsh dominated by cattails. A boardwalk cuts through the wetland at an angle and offers excellent viewing opportunities to the public. A green heron and songbirds, such as goldfinch, were observed the day of the inventory.

An aggressive maintenance program to reduce glossy buckthorn and reed canary grass would reduce shading and competition from these invasive species and allow the remnant native plant species an opportunity to re-establish.

Community	Activity	Priority	Estimated Cost	Comments
AC-W5	Glossy buckthorn control	High	$500-1,000 per acre, 40-100 volunteer hours per acre	Cut and treat all stumps with 25-50% solution of Roundup or Garlon.
AC-W5	3-prescribed burns	Medium	$3,000 - $6,000	Prescribed burns to set-back reed canary grass and remove thatch
AC-W5	5- herbicide treatments	Medium	$8,000.00	Herbicide treatments to target mature rhizomes and seedlings
AC-W5	Burn/mow	Medium	$500.00	Spot Herbicide treatment of reed canary grass re-establishment some mowing to eliminate reed canary grass from going to seed.
AC-W5	Light tilling	Medium	$400.00	Light tilling to expose rhizomes to frost over the winter and exposed for herbicide treatment
AC-W5	Seeding and Planting	Medium	$8,000.00	Seeding and planting to re-establish native plant population.

Community AC-W6
Seasonally Flooded Basin
Qualitative Rank: Low
Area: 0.01 acres (0.08 total)
This is a small reed canary grass dominated basin that is effectively drained by a swale to the southwest. Restoring hydrology would be difficult in this basin due to its close proximity to a house.

Community AC-W7
Seasonally Flooded Basin
Qualitative Rank: Low
Area: 0.4 acres
Sedimentation has reduced hydrology of this basin and also contributed to a change in vegetation to predominately reed canary grass. Prior to the sedimentation is like a shallow marsh that contained 6-inches or more of water with emergent species like bulrush, spikerush, arrowhead, and cattail. Sedimentation has reduced the hydrology and it currently mimics a seasonally flooded basin that is temporarily flooded after rain events but is likely often well drained during

much of the growing season. Even with the conversion to a Seasonally Flooded Basin the dense vegetation still provides an excellent natural filter to reduce nutrients and sedimentation to downstream wetlands. Restoration of the basin by excavation was ranked low due to it location away from trails and its existing function for water quality treatment being high.

Community	Activity	Priority	Estimated Cost	Comments
AC-W7	Excavate sediment	Low	$12,000.00	Provide treatment of stormwater from street.

Community AC-W8
Lowland Hardwood Swamp
Qualitative Rank: Low
Area: 0.2 acres

With the location of the Beehive at a higher elevation and the natural infiltration process in this basin it has the hydrology and resembles a plant community of a lowland hardwood swamp. The species within the basin include silver maple, cottonwood, and reed canary grass. Currently the closed canopy of the site limits herbaceous growth. Removal of undesirable tree and shrub species will enable more light penetration and development of ground cover. Its small size makes it manageable for reintroduction of species and a low cost restoration. Due to its location at a trail access point it may provide an opportunity for education.

Community	Activity	Priority	Estimated Cost	Comments
AC-W8	Thin Cottonwoods Trees	Low	$300.00	Thin canopy to establish herbaceous growth
AC-W8	Plant natives	Low	$450.00	Planting of lowland hardwood forest herbaceous species
AC-W8	Educational signage	Low	$500.00 - $1,000.00	Educational signage at entry to park about hardwood swamps

Community AC-W9
Shallow Marsh\Wet Meadow
Qualitative Rank: Medium
Area: 1.2 acres
This is a larger depressional basin with pipe outlets to the north. The wetland is a cattail dominated shallow marsh with two small portions of open water. Even though the wetland was dry at the time of the site visit, duckweed was observed as the dominant vegetation in the open areas. The basin has a small portion of meadow at the extreme south end. Other vegetation observed was arrowhead, smartweed, and nightshade.

Community AC-W10
Seasonally Flooded Basin
Qualitative Rank: Low
Area: 0.3 acres
This is a reed canary grass monotype that is almost completely bounded by impervious surfaces. Hydrology has been diverted from the wetland by development and with catch basins on the street.

Community AC-W11
Wet Meadow
Qualitative Rank: Low
Area: 0.04 acres
This is a very small depressional wetland at the base of a small hill. Due to its size and lack of connectivity with other wetlands, no management recommendations are suggested at this time.

Summary of Acorn Park Management Recommendations

Community	Activity	Priority	Estimated Cost	Comments
AC-W1	Control purple loosestrife	High	N/A	Monitoring beetle population
AC-U2	Assess disc golf course	High	$4,000-12,000	Review course layout and review options for alterations to course design and use to make it less detrimental to natural resources in the park.
AC-U3	Cut Buckthorn & other nonnative shrubs	High	Approximately $3,000-8,000 or 150-300 volunteer hours	Cut and treat all stumps with 25-50% solution of Roundup or Garlon. Stack brush away from oak crowns and burn in winter. Cut before burning in any particular area. Re-plant with native seed/plants where bare soil exists.
AC-W5	Glossy buckthorn control	High	$500-1,000 per acre, 40-100 volunteer hours per acre	Cut and treat all stumps with 25-50% solution of Roundup or Garlon.
AC-U2	Install Resource Management interpretive sign(s)	Medium-high	$500-5,000 depending on size and quantity of signage	Resource management signs in this park should focus on minimizing disturbance by park visitors off of trails and designated disc golf areas
AC-U2	Erosion correction of trails	Medium-high	$3,000-20,000	Numerous trails have become gullied in this park. Reroute trails, or create structures that take pressure off of erosion-prone areas.
AC-U3	Apply Prescribed Fire	Medium-high	$1,000 - 2,000 per event	Burning will help keep nonnative shrubs in-check and allow desirable native graminoids and forbs to better establish. Use trails for burn breaks and create burn breaks constructed by hand in woods.

(Table continues)

Summary of Acorn Park Management Recommendations

(continued)

Community	Activity	Priority	Estimated Cost	Comments
AC-U2	Install Resource Management interpretive sign(s)	Medium	$1,000-5,000 depending on size and quantity of signage	This should be done after a plan is created to address disturbance issues. Sign(s) should explain what natural communities are present, what management is being conducted, and why the areas need rest from disturbance.
AC-U2	Remove Buckthorn and other nonnative shrubs	Medium	Approximately $3,500-5,000, or 200-350 volunteer hours	Cut and treat all stumps with 25-50% solution of Roundup or Garlon. Leave cut stems on ground
AC-U1	Remove Buckthorn and other nonnative shrubs	Medium	Approximately $1,500-3,500, or 100-300 volunteer hours	Cut and treat all stumps with 25-50% solution of Roundup or Garlon. Leave cut stems on ground
AC-U3	Recut brush	Medium	$500-1,000 every 2-3 years or 20 hours volunteer time	Brush resprouts should be cut and new recruitment of problem shrubs monitored.
AC-W5	3-prescribed burns	Medium	$3,000 - $6,000	Prescribed burns to set-back reed canary grass and remove thatch
AC-W5	5- herbicide treatments	Medium	$8,000.00	Herbicide treatments to target mature rhizomes and seedlings
AC-W5	Burn/mow	Medium	$500.00	Spot Herbicide treatment of reed canary grass re-establishment some mowing to eliminate reed canary grass from going to seed.
AC-W5	Light tilling	Medium	$400.00	Light tilling to expose rhizomes to frost over the winter and exposed for herbicide treatment
AC-W5	Seeding and Planting	Medium	$8,000.00	Seeding and planting to re-establish native plant population.

(Table continues)

Summary of Acorn Park Management Recommendations

(continued)

Community	Activity	Priority	Estimated Cost	Comments
AC-W2	Reed canary grass control	Low	$300.00	Chemical treatment and/or prescribed burn
AC-W2	Wet Meadow Seeding and Maintenance	Low	$800.00	Seed following reed canary grass control to improve vegetative diversity and ecological integrity. Maintenance plan should be put in place to insure native seed establishment
AC-W3	Cut cattail	Low	$150.00	Allow for planting of more diverse species
AC-W3	Planting shallow marsh species	Low	$700.00	Establish more diverse species.
AC-W3	Buffer Strip Signage	Low	3-signs at $60.00	Marks the upslope edge of buffer to limit human disturbance in basin and provide education.
AC-W3	Establish Buffer	Low	$250.00	Provide treatment from turf and limit human disturbance.
AC-W4	Tree thinning	Low	$200.00	Allow for light and revegetation
AC-W4	Seeding	Low	$200.00	Re-establish herbaceous growth.
AC-W7	Excavate sediment	Low	$12,000.00	Provide treatment of stormwater from street.
AC-W8	Thin Cottonwoods Trees	Low	$300.00	Thin canopy to establish herbaceous growth
AC-W8	Plant natives	Low	$450.00	Planting of lowland hardwood forest herbaceous species. An appendix of this report contains a list of recommended species for reintroducing into forest, savanna, and prairie areas.
AC-W8	Educational signage	Low	$500.00 - $1,000.00	Educational signage at entry to park about hardwood swamps

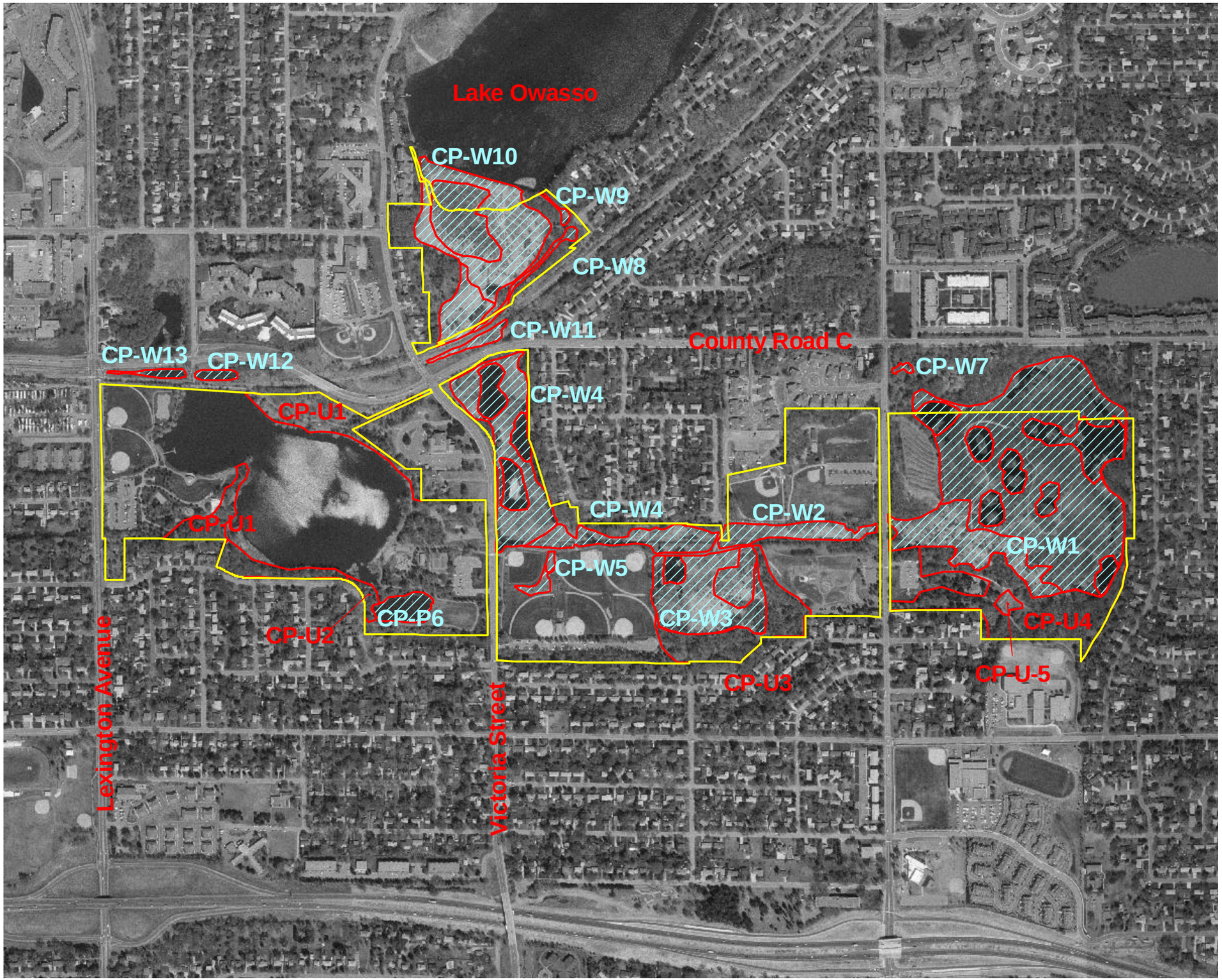
CENTRAL PARK

At 225 acres, Central Park is the largest park in Roseville, and one of the larger urban parks in Ramsey County. Central Park is divided by roads and other city infrastructure into five areas connected by a series of walking and biking trails.

Upland natural communities here include and oak woodland-brushland with a small, restored prairie, but is largely composed of lowland hardwood forests that are pioneering into formerly open upland areas. The wetlands include a number of larger basins with varying degrees of past disturbance, including ditching, and dredging that attempted to create waterfowl habitat. In addition to these natural communities, Central Park also hosts Bennett Lake, which is discussed in an earlier section of this report.

Recreationally, Central Park features an outdoor amphitheater, picnic pavilions and a fishing dock on Bennett Lake. There are also a number of ball fields, volleyball courts, tennis courts, bocce ball courts and play areas. Central Park (Dale West) features the Harriet Alexander Nature Center, situated on a 52 acre nature preserve. Floating boardwalks provide for an exciting tour of Roseville's premier nature preserve.
The Central Park Arboretum across Dale Street from the Harriet Alexander Nature Center has 8 acres of beautiful gardens, trees, and rock landscaping with benches for contemplation and trails for strolling.

THE FOLLOWING PAGES CONTAIN A SUMMARY OF UPLAND AND WETLAND COMMUNITY DESCRIPTIONS AND MANAGEMENT RECOMMENDATIONS.



City of Roseville
Natural Resources Inventory

Central Park

Figure 6.3

Legend

- Park Boundary
- Wetlands
- Upland Communities

Community ID	Community Type
CP-U-1	Oak woodland-Brushland
CP-U-2	Floodplain forest
CP-U-3	Floodplain Forest
CP-U-4	Lowland Hardwood
CP-U-5	Prairie Planting
CP-P6	Storm Pond
CP-W1	Shallow Open Water
	Shallow Marsh
	Shrub Carr
CP-W2	Shallow Marsh
CP-W3	Shallow Open Water
	Shallow Marsh
	Shrub Carr
CP-W4	Deep Marsh
	Wet Meadow
	Shallow Marsh
CP-W5	Shallow Marsh
	Wet Meadow
CP-W7	Seasonally Flooded Basin
CP-W8	Wet Meadow
CP-W9	Shallow Marsh
CP-W10	Shallow Marsh
	Shrub-Carr
	Wet Meadow
CP-W11	Shallow Marsh
CP-W12	Shallow Open Water
CP-W13	Shallow Open Water

0 900 Feet

N

Bonestroo Rosene Anderlik & Associates
Engineers & Architects

425\42501106\Cad\gis\mlccs\mlccs.apr

Upland Natural Community Descriptions and Management Recommendations

Central Park hosts a number of upland natural communities, including oak woodland-brushland and lowland hardwood forest. Some 50 to 100 years ago, most of the upland landscapes within the park would have been more open, with scattered groves of oak trees near Bennett Lake and grasses, perhaps prairie, under them.

More recently, in the absence of periodic fire and grazing, these open areas were pioneered by trees typical of low-lying areas. Many areas in the upper Midwest exhibit similar characteristics and will go through a maturation process.

Community CP-U1
Oak Woodland-brushland
Qualitative Rank: D
Nonnative Shrub Rank: 15

This community includes two parcels one on the northeast side of Bennett Lake and the other on the southwest side of Bennett Lake.

The northeast segment includes a narrow strip of floodplain forest along the shore of the lake, as well as the trail system and some tree/shrub plantings. Here, the oldest trees are widely scattered larger bur oak, with stands of younger boxelder, quaking aspen, green ash, and cottonwood present. Nonnatives black locust and Siberian elm are also present here in moderately low numbers. Most of the younger trees are less than 10 inches in diameter.
The shrub layer is moderate in thickness in most places with young green ash and boxelder being most common. Other notable members of the shrub layer here include common elder, juneberry, and the nonnatives European and glossy buckthorn, Tartarian honeysuckle, Siberian elm, Russian olive, black locust, and white mulberry.

The ground layer varies from sparse and poor quality in areas that have recently been colonized by trees, to moderate quality in areas where prairie species persist. Nonnatives are common in

the more disturbed areas, particularly the grasses smooth brome and Kentucky bluegrass. Also, Cyprus spurge, a nonnative forb is well established in one area near the rail right-of-way. Some of the prairie species present are big bluestem, little bluestem, prairie cordgrass, sky blue aster, harebell, windflower, northern bedstraw, Culver's root, and three-seeded mercury.

The southwest portion of this community has a more typical structure for oak woodlands with large, open-grown oaks as the defining feature. A portion of this area is maintained as active park area, while a small area is not maintained. The unmaintained area has a moderately thick layer of buckthorn, and ground layer species similar to the portion of this community on the northeast side of the lake.

Because of the amount of past disturbance and the recent colonization of the area by weedier trees and nonnatives, this community received a low rank. Despite this, it has moderately good potential for improvement, partly because the infrastructure present in the park enables active management. The recommendations below assume management toward a savanna and prairie complex away from the lake.

Community	Activity	Priority	Estimated Cost	Comments
CP-U1	Remove Buckthorn and other nonnative shrubs	High	Approximately $2,500, or 100-200 volunteer hours	Cut and treat all stumps with 25-50% solution of Roundup or Garlon. Stack and burn brush in winter. Cut before prescribed burning in any particular area. Also plant with native prairie/savanna flowers and grasses where bare soil exists.
CP-U1	Reintroduce Prescribed Fire	High	$1,000 - 2,000 per event	Highest priority burn is between trail and railroad, second priority is between trails and lake. Burning should not be conducted until brush clearing is completed. Burn 2-3 times in first ten years and every 5-10 years as community stabilizes. Conduct concurrently with seeding and cutting

Table continues

Community	Activity	Priority	Estimated Cost	Comments
CP-U1	Reintroduce native prairie and savanna species	High	$100 – 2,000 depending on number of species, plants, amount of seed.	Reintroduce appropriate local origin plant materials through planting of plugs or seed, particularly where bare ground is left from brush clearing. Dormant season seed and/or Broadcast during growing season. An appendix of this report contains a list of recommended species for reintroducing into forest, savanna, and prairie areas.
CP-U1	Girdle aspen	Medium-high	$500-1,000 or 30-50 volunteer hours	Prairie planting is being overtaken by quaking aspen. If the goal is to manage for the prairie planting in this area, the aspen should be controlled. Girdle aspen April to June with girdling spud (see invasive species control Appendix).
CP-U1	Install interpretive signage	Medium-high	$1,000-5,000 depending on size and quantity of signage	This high profile area is a great place to install interpretive signage that explains the natural communities present, what management is being conducted, and why natural areas are an important part of Central Park and Roseville

Community CP-U2
Floodplain Forest
Qualitative Rank: CD
Nonnative Shrub Rank: 13

This floodplain forest is found along the south part of Bennett Lake in a narrow strip between the lakeshore and a neighborhood street. The most common trees in the somewhat broken canopy are cottonwood and boxelder that average 20 and 10 inches in diameter, respectively. Other less common trees include American elm, black willow, bur oak, and the nonnative weeping willow.

The shrub layer is mostly dominated by native species characteristic for this community type. The most common are red osier dogwood, boxelder saplings, green ash, common elder, and black currant. Also found here occasionally are a few nonnative shrub species, including European buckthorn and Tartarian honeysuckle.

The ground layer is dominated by a handful of species, some of which are aggressive nonnatives. The most common nonnative species in the ground layer include creeping Charlie, deadly nightshade, reed canary grass, and smooth brome. Overall, this community received a lowered rank due to the relatively young age of the trees, the frequency of nonnatives, and the lack of sufficient native cover in the ground layer.

Community	Activity	Priority	Estimated Cost	Comments
CP-U2	Remove Buckthorn and other nonnative shrubs	Medium	Approximately $1,500, or 50-100 volunteer hours	Cut and treat all stumps with 25-50% solution of Roundup or Garlon. Leave cut brush on ground, except where very thick, then stack or chip.
CP-U2	Reintroduce native flowers and grasses typical of Lowland Hardwood Forest	Medium	$500 – 2,000 depending on number of species, plants, amount of seed.	Reintroduce native plant plugs or seed, Combination of seed and live plants is good combination here. An appendix of this report contains a list of recommended species for reintroducing into forest, savanna, and prairie areas.
CP-U2	Install Resource Management interpretive sign(s)	Medium-low	$1,000-5,000 depending on size and quantity of signage	This is another high profile area that would be suitable for interpretive signage to explain what natural communities are present, what management is being conducted, and why.

Community CP-U3
Floodplain Forest
Qualitative Rank: CD
Nonnative Shrub Rank: 11

This forest is similar in species composition and character to CP-U-2, with the exceptions that it has larger cottonwood trees and quaking aspen present. The shrub layer here contains silky dogwood as its most common member, with buckthorn being less common. Also, the nonnative white mulberry is found in the shrub layer. The ground layer is similar to CP-U-2 and is dominated by a mix of nonnatives and weedier natives. However, there are some pockets of native graminoids and forbs including boneset, sedges, and blue vervain, concentrated along the wetland edge. Overall, the quality of this forest is moderate.

Community	Activity	Priority	Estimated Cost	Comments
CP-U3	Remove Buckthorn and other nonnative shrubs	Medium	Approximately $3,500-5,000, or 150-200 volunteer hours	Cut and treat all stumps with 25-50% solution of Roundup or Garlon. Leave cut stems on ground, except where very thick, then stack or chip.
CP-U3	Reintroduce native plants typical of Lowland Hardwood Forest	Medium	$500 – 3,000 depending on number of species, plants, amount of seed.	Reintroduce native plant plugs or seed, Combination of seed and live plants is good combination here. An appendix of this report contains a list of recommended species for reintroducing into forest, savanna, and prairie areas.

Community CP-U4
Lowland Hardwood Forest
Qualitative Rank: CD
Nonnative Shrub Rank: 14

This forest is located on a north-facing slope and a low-lying area adjacent to the largest wetland in Central Park. Although there is a portion of the hillside that is dominated by oak trees and has characteristics of an oak forest, it is small and disturbed, and was combined with the surrounding forest for the purpose of classification and qualitative ranking. Interestingly, aerial photos from the 1940's and 1950's only show the oak trees on this hillside. The most common tree species here include boxelder, quaking aspen, green ash, basswood, pin and bur oak, black cherry, and American elm. In all, 17 species of trees were documented in this community, including nonnatives and natives that were introduced by planting.

The shrub layer here varies from absent in the woodland garden area to very thick on the dry, upper slopes. The most common shrub across the community is buckthorn, with silky dogwood being the most common shrub in the lower-lying areas. Other shrubs that are found at least occasionally here include currant, common elder, black raspberry, smooth sumac, American elm, as well as the nonnatives Tartarian honeysuckle, amur maple and black locust.

The ground layer has somewhat poor species richness, with most species present being those that can tolerate some disturbance. Some of the more common species in the ground layer here

include the natives white snakeroot, Canada goldenrod, and Virginia stickseed, as well as the nonnatives burdock, creeping Charlie, and deadly nightshade.

Although the oak-dominated area of this forest is somewhat better quality, the remainder is in moderate to moderately low condition. In addition, some substantial erosion has been taking place due to excessive runoff from the upslope school property. Despite this, it is an excellent environmental education spot and offers a wide variety of learning opportunities. As well, the garden planting of forest and woodland edge flowers and ferns could serve as the beginnings of a nursery for native plant seeds that can be used for restoring natural communities throughout the Roseville Park system.

Community	Activity	Priority	Estimated Cost	Comments
CP-U4	Expand woodland garden	High	$1,000 – 2,000	This garden has the potential to provide a significant portion of the seed needed for savanna/forest restoration efforts in Roseville Parks. Collecting seed from here will substantially lower the cost of restoration efforts and shorten the amount of time for actively managed forests.
CP-U4	Erosion correction of trail	Medium-high	$3,000-10,000	Trail from school that goes through woods is eroding and causing substantial sedimentation downslope. Use reshaping, bioengineering, water bars and other methods to correct problem.
CP-U4	Remove Buckthorn and other nonnative shrubs	Medium-high	Approximately $3,500-5,000, or 200-350 volunteer hours	Cut and treat all stumps with 25-50% solution of Roundup or Garlon. Leave cut stems on ground
CP-U4	Install Resource Management interpretive sign(s)	Medium-high	$1,000-5,000 depending on size and quantity of signage	Because of the proximity to the school and nature center, this is a high profile area that would be good to install interpretive signage at. Sign(s) should explain what natural communities are present, what management is being conducted, and why.

(Table continues)

Community	Activity	Priority	Estimated Cost	Comments
CP-U4	Reintroduce native grasses and flowers typical of Lowland Hardwood Forest	Medium-high	$500 – 3,000 depending on number of species, plants, amount of seed.	Reintroduce native plant plugs or seed, Combination of seed and live plants is good combination here. The woodland garden at the bottom of this hill is a great source of seed An appendix of this report contains a list of recommended species for reintroducing into forest, savanna, and prairie areas.
CP-U4	Underplanting and desirable tree release	Medium	$500-3,000	Plant semi-shade tolerant native trees more typical of upland forest. Cut select, low-quality canopy trees to enable desirable saplings to reach canopy.

Community CP-U5
Prairie Planting
Qualitative Rank: NA
Nonnative Shrub Rank: NA

This area is a prairie planting associated with the interpretive center. It does have some brush and small tree encroachment, but is in overall good condition. The most common native grasses here include little bluestem, Indian grass, big bluestem and sideoats grama. Nonnative grasses found occasionally include smooth brome and Kentucky bluegrass. The most frequently encountered native forbs here include purple prairie clover, anise hyssop, yellow coneflower, heath aster, showy sunflower, stiff goldenrod, Culver's root, bergamot and prairie sage.

Several forbs included in the planting are not native to Minnesota, but are native to other states and commonly used in garden plantings. These include blue wild indigo and purple coneflower. This planting provides an appropriate source of seed for reintroducing some plant species back into existing prairies in other Roseville parks, such as around Bennett Lake and at Reservoir Woods.

Also, there is a split-rail fence around this planting that separates visitors from the planting and complicates management with prescribed fire/mowing. This fence should be considered for removal

Community	Activity	Priority	Estimated Cost	Comments
CP-U5	Collect seed	High	$500-1,000, or 10-60 volunteer hours per year	This prairie planting has the potential to provide a significant portion of the seed needed for prairie restoration efforts in Roseville Parks. Focus should be on collecting high-priced forb seed. Collecting seed from here for planting in other areas will substantially lower the cost of restoration efforts for prairie areas.
CP-U5	Prescribed burning and/or mowing	Medium	$500-1,000 per event, or 30 volunteer hours	Continue maintenance of prairie with burning and mowing. Alternate between activities and season of application i.e. fall vs. early spring. Late spring burns tend to favor grasses and should be limited if forb seed collection is desired.
CP-U5	Cut shrubs and trees encroaching into planting	Medium-low	Approximately $100-200 every other year, or 10-30 volunteer hours	Cut and treat all stumps with 25-50% solution of Roundup or Garlon to prevent resprouting

Wetland Natural Community Descriptions and Management Recommendations

Much of the original alterations to the wetland basins occurred when the land was in agricultural production. Under agricultural land-use there was a main ditch that extended from W1 thru W2, W4, and into W10. Lateral ditches extended into the main ditch from W3. Wetlands have experienced additional changes during the transition from agriculture to urban development in the last sixty years. W1 has been altered through the excavation of open water areas and the infestation of purple loosestrife and reed canary grass. Wetlands W2, W3, W4, and W5 were part of an agricultural drainage ditch system and have benefited by the return of hydrology to the system. The wetlands on the south tip of Lake Owasso are relatively unchanged. Bennett Lake has changed significantly from a drained wetland to an open water lake. Stormwater and urban runoff has probably influenced this change. Locations of the improvements discussed in the following paragraphs are shown in figure 6.4.

Community CP-W1
Shallow Marsh/Shrub-Carr/Shallow Open Water
Qualitative Rank: Low
Area: 32.0 acres (38.4 total)

This wetland complex contains several different wetland communities, including shallow marsh, open water, shrub-carr and wet meadow. The different wetland communities provide the valuable wildlife habitat and aesthetic values that the users of the park enjoy. Dominant vegetation within the wetland complex include: cattail, arrowhead, reed canary grass, bur-reed, red osier dogwood, willow, and duckweed

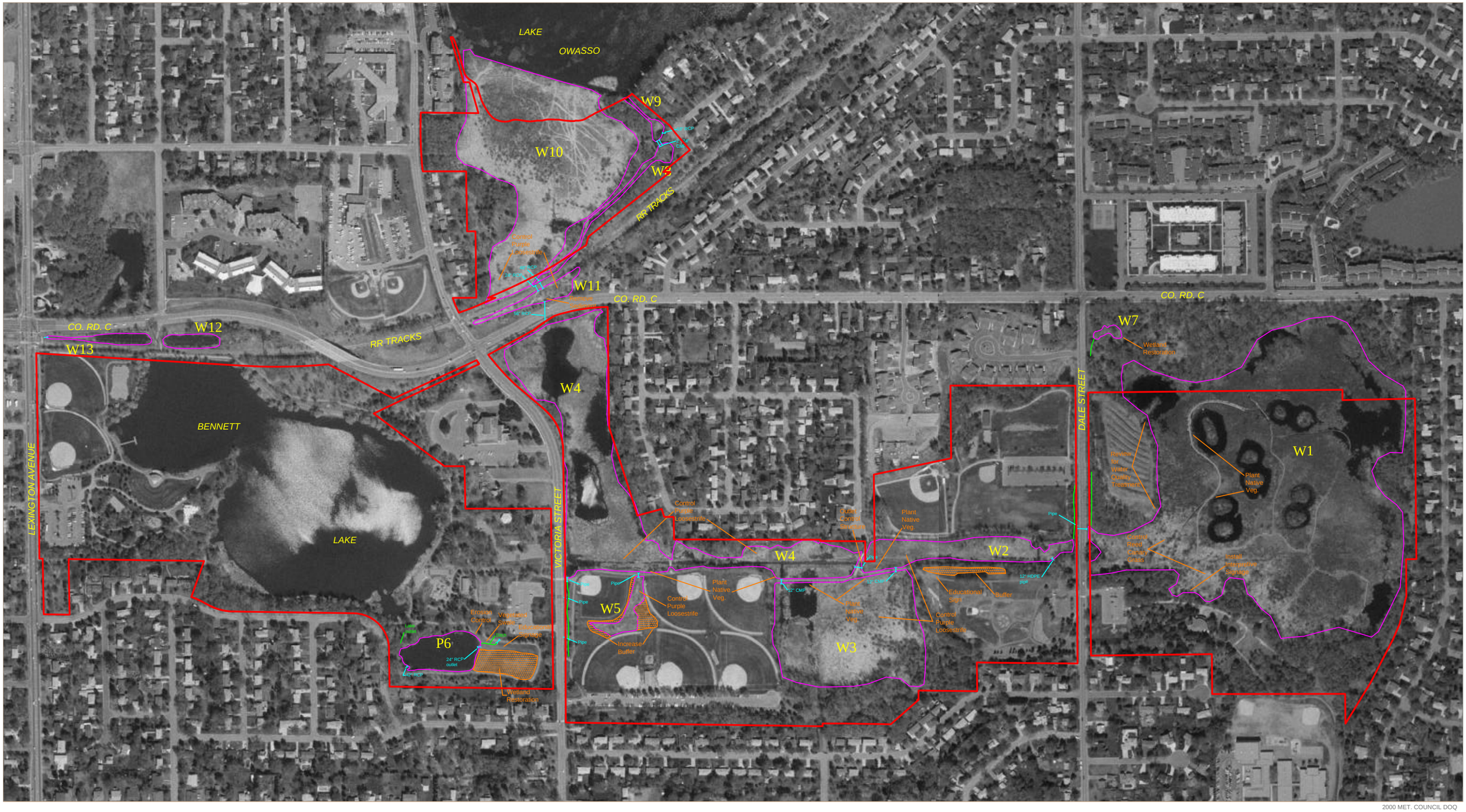
This is a large wetland basin associated with the interpretive center in the park. It has a boardwalk system providing access to most of the wetland and appears to be heavily used by the public. Five areas of duck pond excavations are near the center of the basin. This basin also receives stormwater and may receive chemical runoff from roads, houses on east side, and the compost site on the west side. This basin has the most prolific area of purple loosestrife infestation of all the parks surveyed and is considered to have a high density of purple loosestrife.

The purple loosestrife is currently being managed utilizing biological control methods that include beetles by the Nature Interpretive Center. Purple loosestrife is causing other species of the wetland such as swamp milkweed, wool grass, soft-stem bulrush, bottlebrush sedge, spike rush, and manna grass to have lower densities and reduces the ecological integrity of the basin.

The biological program should be continued by the Nature Interpretive Center.
A large compost pile exists on the west side of the wetland basin. Compost piles can contribute a significant amount of nutrients to a wetland basin that can affect the wetland's plant communities by promoting aggressive species that are not susceptible to nutrients. A review of this site for water quality treatment should be completed to make sure appropriate treatment is occurring prior to discharge to the wetland.

Community	Activity	Priority	Estimated Cost	Comments
CP-W1	Plant native vegetation along boardwalk	Low	$1000.00 - $4,000.00 depending on area of planting	Enhance vegetative diversity and aesthetics along the boardwalk
CP-W1	Control reed canary grass	Medium	$2,000.00 - $8,000.00	Herbicide treatment to set-back reed canary grass
CP-W1	Install interpretive signage	Medium	$500-5,000 depending on size, quantity of signage and material	This high profile area is a great place to install an interpretive sign that explains purple loosestrife and other invasive veg. threatening wetlands.
CP-W1	Review water quality treatment of compost site	High	$1,500.00	Review of treatment of runoff from compost site

Community CP-W2
Shallow Marsh
Qualitative Rank: Medium
Area: 2.5 acres
This is a narrow drainage channel that leads from a ditch and culvert under Dale Street to an outlet pipe at a gravel access path. The open water areas near the channel exhibits the most diversity in this basin. Cattail, arrowhead, duckweed, lake sedge, wool grass, spike rush, willows, and water plantain are the most noticeable. The majority of the basin is a reed canary



2000 MET. COUNCIL DOQ

CENTRAL PARK

FIGURE 6.4

LEGEND:

Management Recomendations
Existing Structures
Existing Features

N
W
E
S

0 225 450
Scale in feet

FEBRUARY 2002

Bonestroo Rosene Anderlik & Associates
Engineers & Architects

K:\425\42501106\Cad\Dwg\DOQ3.dwg

grass monotype. This is the area that is only temporarily flooded as most normal flows are confined to the channel.

The outlet under the trail on west end of this basin allows water levels in the wetland to be lowered. Currently the basin contains reed canary grass and draw down of the water levels in the basin occurs between storm events. In order to control the reed canary grass, the water levels will need to be maintained at 16-inches below top of trail outlet. This could be accomplished with a wood control structure. There is also connectivity to W3 to the south through a 12-inch CMP.

An upland buffer of native vegetation could be planted upslope of the wetland on the south side to replace the turf directly adjacent to the wetland basin. The recommended width of this buffer is 25 feet to provide pretreatment of the adjacent turf area. It would be a good location for educational signage regarding buffers due to the pedestrian traffic and proximity to the arboretum area.

Purple loosestrife in this basin appears to be at a manageable level to be spot sprayed. Due to the trails close proximity to the shallow marsh portion of these basin active landscaping with native shallow marsh plant material could be pursued to enhance the plant community and aesthetics along portions of the trail.

Community	Activity	Priority	Estimated Cost	Comments
CP-W2	Control purple loosestrife	High	$800.00	Spot spray to prevent spread.
CP-W2	Plant native vegetation along trail	Medium	$750.00	Aesthetic
CP-W2	Outlet control structure	Medium	$3,500.00	Restore hydrology outside of main channel.
CP-W2	Plant buffer	High	$150.00	Replace turf between trail and wetland near arboretum area.
CP-W2	Install educational signage	High	$500.00	Use in conjunction with buffer planting.

Community CP-W3
Shallow Marsh/Shrub-carr/Shallow Open Water
Qualitative Rank: Medium
Area: 8.7 acres

This basin is connected to W2 and W4 through 12-inch CMPs under the trail on the north side. From the outlets along the east and west edge are open water ditch areas. The majority of the wetland is reed canary grass with cattails, red osier dogwood, sandbar and other willows, and a few wool grass and soft stem bulrush.

Purple loosestrife in this basin appears to be at a manageable level to be spot sprayed. Due to the trails close proximity to the shallow marsh portion of these basin active landscaping with native shallow marsh plant material could be pursued to enhance the plant community and aesthetics along the trail.

Community	Activity	Priority	Estimated Cost	Comments
CP-W3	Control purple loosestrife	High	$800.00	Spot spray to prevent spread.
CP-W3	Shallow Marsh Plantings	High	$750.00	Shallow marsh plantings along the trail to improve the aesthetics and wildlife habitat values of the basin

Community CP-W4
Shallow Marsh/Wet Meadow/Deep Marsh
Qualitative Rank: Medium/Low
Area: 13.0 acres

The southern portion of this wetland is a well-defined ditch similar to W2. The northern portion has several large open water areas. Reed canary grass dominates most of this basin. The open water areas contain duckweed and cattails. Other vegetation in the basin includes arrowhead, swamp milkweed, cattail, and sandbar willow. The wetland receives drainage from W2, W3, W5, and also receives hydrology from Bennett Lake by culverts under Victoria Street. A 56-inch pipe under Co. Rd. C functions as the outlet to the north towards Lake Owasso.

Purple loosestrife in this basin appears to be at a manageable level to be spot sprayed. Due to the trails close proximity to the shallow marsh portion of these basin active landscaping with native shallow marsh plant material could be pursued to enhance the plant community and aesthetics along portions of the trail.

Community	Activity	Priority	Estimated Cost	Comments
CP-W4	Control purple loosestrife	High	$2,500.00	Spot spray to prevent spread.
CP-W4	Shallow Marsh Plantings	High	$1,500.00	Shallow marsh plantings along the trail will improve the aesthetics and wildlife habitat values of the basin

Community CP-W5
Wet Meadow/Shallow Marsh
Qualitative Rank: High/Medium
Area: 0.5 acres

This is a small wet meadow that is a remnant from a large wetland that was filled at the time of the ball fields' construction. Even though ball fields surround the basin it has a high plant diversity that allowed it to have a High/Medium ranking. The species in this wetland include: reed canary grass, cattail, green bulrush, wool grass, soft stem bulrush, swamp milkweed, arrowhead, spike rush, water plantain, duckweed, smartweed, purple loosestrife and fox sedge. The basin has an outlet to W4 and probably provides nutrient filtering from the ball fields before entering the larger wetland.

Community	Activity	Priority	Estimated Cost	Comments
CP-W5	Control purple loosestrife	Low	$100.00	Spot spray to prevent spread.
CP-W5	Increase upland buffer size	Low	$200.00	This would help filter nutrients from ball fields into wetlands.

Community CP-W7
Seasonally Flooded Basin
Qualitative Rank: Low
Area: 0.1 acres

Historic photos from the 1940's and 1950's indicate this wetland was effectively drained for agricultural production, it then had its hydrology restored, likely due to failing tiles and ditches, in the 1970's at the time of that the National Wetlands Inventory (NWI) map was developed by the United States Fish and Wildlife Service. The NWI map indicates the wetland was a shallow marsh. A swale was subsequently excavation after the 1970's to drain the wetland and convert it from a shallow marsh to a seasonally flooded basin. Currently reed canary grass, Canada thistle, burdock, and goldenrod dominate this basin. Other species include red-osier dogwood, buckthorn, cottonwood, boxelder, Siberian elm, Kentucky bluegrass, timothy, wheatgrass, American elm, and riverbank grape. Restoration of this wetland can be accomplished with a berm and spillway across the swale.

Community	Activity	Priority	Estimated Cost	Comments
CP-W7	Restore wetland	Medium	$5,000.00	Construct a berm and spillway or trail crossing with culvert raised to historic outfall elevations

Community CP-W8
Wet Meadow
Qualitative Rank: Medium/Low
Area: 0.6 acres

Most of this wetland is an excavated drainage way that flows from W11 into W9 and then into Lake Owasso. It widens out near the woodchip trail between this basin and W9 and at this location a mud flat having up to three feet of standing water was observed. Vegetation observed at this location is reed canary grass, bur-marigold, arrowhead, pale smartweed, nut sedge, cattail, water plantain, and heart-leaved tearthumb.

Community CP-W9
Shallow Marsh
Qualitative Rank: Medium
Area: 0.2 acres

This basin is a continuation of the drainage way into Lake Owasso. It receives hydrology from the two inlets from W8 and also street drainage from an 18-inch RCP. There is some sedimentation near the inlets. There is similar vegetation toW8 with the addition of jewelweed, duckweed, white water lily, barnyard grass, nettle, black willow, and red-osier dogwood.

Community CP-W10
Shallow Marsh/Shrub-carr/Wet Meadow
Qualitative Rank: Medium
Area: 10.0 acres (14.0 total)

This is a large wetland connected to the southern tip of Lake Owasso. A mix of shallow marsh and shrub-carr dominates the basin. This community is dominated by reed canary grass, sandbar, black, and Bebbs willow. Other vegetation includes: lake sedge, arrowhead, soft stem bulrush, pinkweed, duckweed, nut sedge, cattail, blue flag iris, boxelder, and purple loosestrife.

Community	Activity	Priority	Estimated Cost	Comments
CP-W10	Control purple loosestrife	Medium	$2,000.00	Spot treat to reduce purple loosestrife.

Community CP-W11
Shallow Marsh
Qualitative Rank: Medium/Low
Area: 0.6 acres

This is a small basin sandwiched in between Co. Rd. C, Dale Street, and railroad tracks. It receives the inlet from W4 and outlets to W10 and W8. There is much sedimentation coming from the large inlet. Dominant vegetation includes duckweed, reed canary grass, cattail, and sandbar willow.

Community	Activity	Priority	Estimated Cost	Comments
CP-W11	Control purple loosestrife	Medium	$400.00	Spot treat chemically

Community CP-W12
Shallow Open Water
Qualitative Rank: Medium
Area: 0.4 acres
Co. Rd. C, railroad tracks, and a gravel berm isolate this basin. It is primarily steep sided with a narrow fringe of vegetation including: reed canary grass, goldenrod, woolgrass, dogbane, red-osier dogwood, boxelder, cottonwood, elder, and jewelweed. The pond does contain a good diversity of macrophytes including: duckweed, elodea, coontail, grass-leaved arrowhead, and water plantain.

Community CP-W13
Shallow Open Water/Wet Meadow
Qualitative Rank: Medium
Area: 0.4 acres
Lexington Avenue, Co. Rd. C, railroad tracks, and a gravel berm isolate this basin. A 24-inch storm water inlet enters from the west and creates a deep sand bottomed ditch before entering the wetland. It is primarily steep sided with similar vegetation as W12.

Central Park Management Recommendation Summary Table

Community	Activity	Priority	Estimated Cost	Comments
CP-U1	Remove Buckthorn and other nonnative shrubs	High	Approximately $2,500, or 100-200 volunteer hours	Cut and treat all stumps with 25-50% solution of Roundup or Garlon. Stack and burn brush in winter. Cut before prescribed burning in any particular area. Also plant with native prairie/savanna flowers and grasses where bare soil exists.
CP-U1	Reintroduce Prescribed Fire	High	$1,000 - 2,000 per event	Highest priority burn is between trail and railroad, second priority is between trails and lake. Burning should not be conducted until brush clearing is completed. Burn 2-3 times in first ten years and every 5-10 years as community stabilizes. Conduct concurrently with seeding and cutting
CP-U1	Reintroduce native prairie and savanna species	High	$100 – 2,000 depending on number of species, plants, amount of seed.	Reintroduce appropriate local origin plant materials through planting of plugs or seed, particularly where bare ground is left from brush clearing. Dormant season seed and/or Broadcast during growing season An appendix of this report contains a list of recommended species for reintroducing into forest, savanna, and prairie areas.
CP-U4	Expand woodland garden	High	$1,000 – 2,000	This garden has the potential to provide a significant portion of the seed needed for savanna/forest restoration efforts in Roseville Parks. Collecting seed from here will substantially lower the cost of restoration efforts and shorten the amount of time for actively managed forests.
CP-U5	Collect seed	High	$500-1,000, or 10-60 volunteer hours per year	This prairie planting has the potential to provide a significant portion of the seed needed for prairie restoration efforts in Roseville Parks. Focus should be on collecting high-priced forb seed. Collecting seed from here for planting in other areas will substantially lower the cost of restoration efforts for prairie areas.
CP-W1	Review water quality treatment of compost site	High	$1,500.00	Review of treatment of runoff from compost site

Continued on next page

Central Park Management Recommendation Summary (continued)

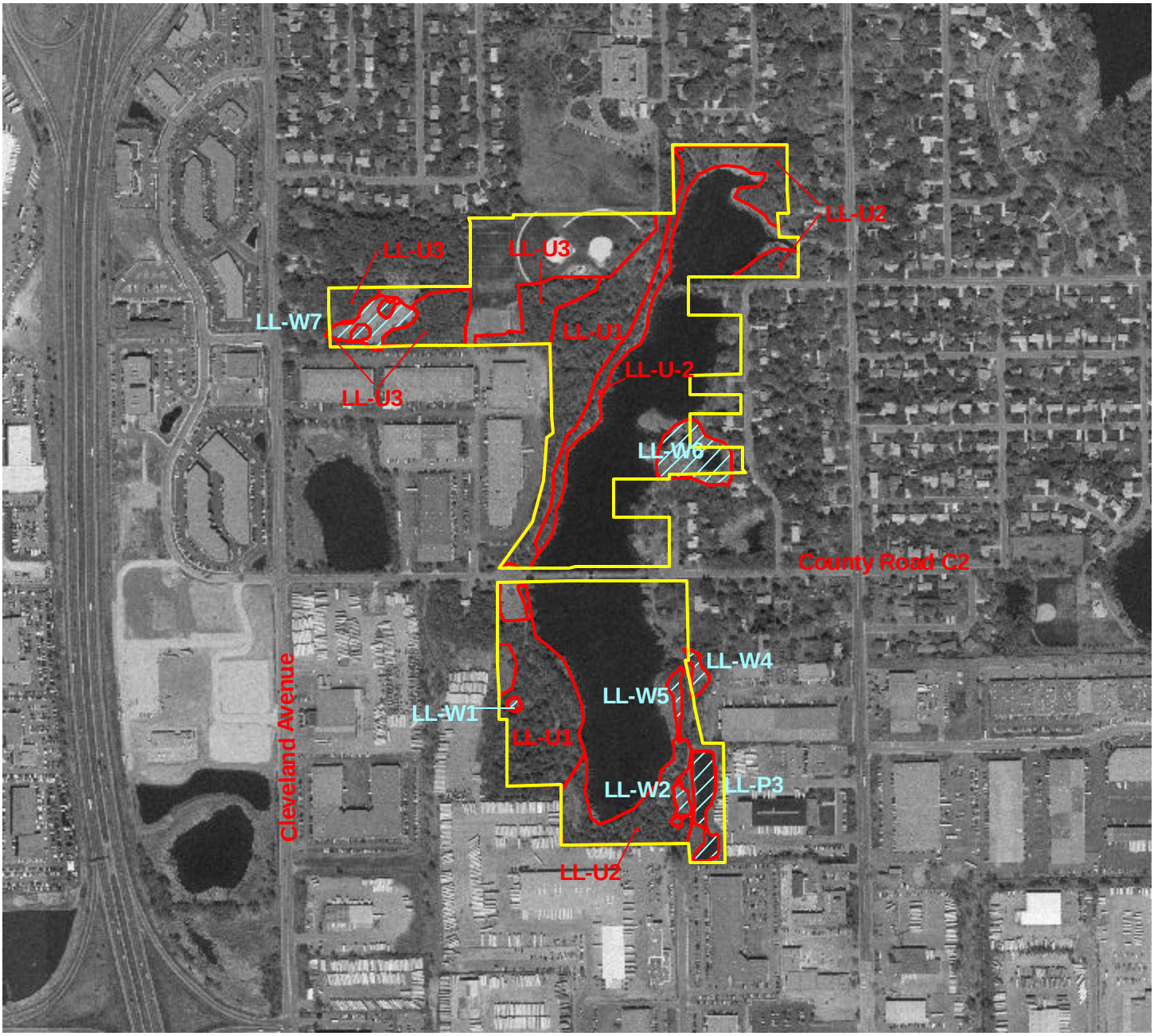
Community	Activity	Priority	Estimated Cost	Comments
CP-W2	Install educational signage	High	$500.00	Use in conjunction with buffer planting.
CP-W3	Control purple loosestrife	High	$800.00	Spot spray to prevent spread.
CP-W3	Shallow Marsh Plantings	High	$750.00	Shallow marsh plantings along the trail to improve the aesthetics and wildlife habitat values of the basin
CP-W4	Control purple loosestrife	High	$2,500.00	Spot spray to prevent spread.
CP-W4	Shallow Marsh Plantings	High	$1,500.00	Shallow marsh plantings along the trail will improve the aesthetics and wildlife habitat values of the basin
CP-W2	Outlet control structure	Medium	$3,500.00	Restore hydrology outside of main channel.
CP-W7	Restore wetland	Medium	$5,000.00	Construct a berm and spillway or trail crossing with culvert raised to historic outfall elevations
CP-W10	Control purple loosestrife	Medium	$2,000.00	Spot treat to reduce purple loosestrife.
CP-W11	Control purple loosestrife	Medium	$400.00	Spot treat chemically

Langton Lake Park

Langton Lake Park is approximately 54 acres and is found near Arthur Street and Brenner Avenue. It is one of the larger urban parks in Roseville.

Langton Lake Park supports a number of smaller wetlands in addition to the fine water resource of Langton Lake itself. Langton Lake is a nice quality shallow lake and deep wetland resource for an urbanized area and retains a remarkable diversity of aquatic plants. The inventory and management considerations for Langton Lake were discussed earlier in this report. With the exception of a treed area on the northwest side of the park that is dominated by the nonnative Siberian elm, the remainder of the upland areas are dominated by communities in moderate to good condition for an urban location, particularly oak forest.

Recreationally, Langton Lake features nearly one mile of scenic paved nature trails around Langton Lake, 2 ball fields, a soccer field, picnic areas, and two large play structures. Langton Lake also has an accessible fishing pier, has been stocked by the DNR in the past for fishing events, and is great for canoeing.



ROSEVILLE

City of Roseville
Natural Resources Inventory

Langton Lake Park

Figure 6.5

- Park Boundary
- Wetlands
- Upland Communities

Community ID	Community Type
LL-U-1	Dry Oak Forest
LL-U-2	Lowland Hardwood Forest
LL-U-3	Siberian Elm
LL-W1	Seasonally Flooded Basin
LL-W2	Wet Meadow
	Shallow Marsh
LL-P3	Storm Pond
LL-W4	Shallow Marsh
LL-W5	Wet Meadow
LL-W6	Deep Marsh
LL-W7	Shallow Marsh
	Wet Meadow
	Shallow Marsh

N

0 600 Feet

February, 2002

Bonestroo Rosene Anderlik & Associates

425\42501106\Cad\gis\mlccs\mlccs.apr

Upland Natural Community Descriptions and Management Recommendations

The upland areas of Langton Lake Park all appear to have been grazed in the past, although the major components of the oak communities have not been too drastically altered. There has been some invasion by nonnative shrubs, particularly European buckthorn, as well as dominance of one distinct area in the northwest portion of the park by Siberian elm. However, the vast majority of the natural areas are in moderately good condition and stand a good chance of improving in quality with some active management, including the cutting of nonnative shrubs, reintroduction of fire at proper intervals, and the planting of appropriate native grasses, sedges, and flowers. Below is a summary of upland community descriptions and associated management recommendations. An appendix of this report contains a list of recommended species for reintroducing into forest, savanna, and prairie areas.

Community LL-U1
Dry Oak Forest
Qualitative Rank: **C**
Nonnative Shrub Rank: **Southwest = 17**
Northwest = 19

This forest occurs on the west side of Langton Lake with the two parcels separated by County Road C2. The southwest parcel is somewhat better quality as a result of having fewer nonnative shrub problems and less past disturbance.

In general, the community has about 90 percent canopy closure and is characterized by bur, white and pin oak that average approximately 22 to 26 inches in diameter. In some places, these oaks have gaps between their canopies and in others have crowns that intermingle. Where canopy gaps occur, a number of tree species have grown into them. Some of these younger, second-growth trees include boxelder, American elm, quaking aspen, and black cherry. In addition, two nonnative tree species are found here. One of these is Siberian elm, found in larger numbers at the north edge of the community. The other is a white poplar clone near a bench and overlook on the southwest side of the lake.

The shrub layer varies from moderately sparse in portions of the south segment to very thick in the north. The most common shrub is the nonnative European buckthorn, which is found as mature shrubs, saplings, and as a carpet of seedlings in other areas. Natives found in the shrub layer at least occasionally include boxelder saplings, black raspberry, common elderberry, black cherry, and prickly gooseberry.

The ground layer is somewhat species poor, but is largely composed of native species. The most common of these include Pennsylvania sedge, Virginia creeper, white snakeroot, enchanter's nightshade, poison ivy, and false Solomon's seal. The most prominent nonnative forb here is deadly nightshade, which is found only occasionally.

Overall, this community is of moderate quality, but has good potential for recovery if actively managed. This is particularly true for the south segment.

Community	Activity	Priority	Estimated Cost	Comments
LL-U1	Remove small softwood/ pioneer trees, Buckthorn and other nonnative shrubs	High	$2,000 south end, $3,000 on north portion, or 150-300 volunteer hours total.	Cut and treat all stumps with 25-50% solution of Roundup or Garlon. Stack and burn brush in winter. Cut before burning in any particular burn unit. Re-plant with natives where bare soil exists. **Also, cut and treat white poplar near southwest lake overlook.**
LL-U1	Reintroduce Prescribed Fire	High	$1,000 - 2,000 per event	Critical for maintaining prairie and savanna communities. Burning should not be conducted until brush clearing is completed. Burn 2-4 times in first ten years and every 5-10 as community stabilizes. Conduct concurrently with seeding and cutting

(Table Continues)

Community	Activity	Priority	Estimated Cost	Comments
LL-U1	Reintroduce native woodland edge species	Medium-high	$100 – 2,000 depending on number of species, plants, amount of seed.	Reintroduce appropriate local origin plant materials through planting of plugs or seed, particularly where bare ground is left from brush clearing. Broadcast during growing season and/or dormant season seed (see appendix for spp. list)
LL-U1	Recut brush	Medium	$500-1,000 every 2-3 years or 20 hours volunteer time	Brush will likely continue to persist and resprouts or new stems over one inch in diameter should be cut.

Community LL-U2
Lowland Hardwood Forest
Qualitative Rank: C
Nonnative Shrub Rank: 15

This forest is found in low areas along the south and east side of Langton Lake. The canopy is patchy and composed of trees that appear to be two to four decades old. The most common of these are black willow and boxelder that average approximately 10 to 12 inches in diameter, as well as American elm and cottonwood. Less common are silver maple, hackberry, quaking aspen, and the nonnative weeping willow.

The shrub layer varies from moderate to heavy in thickness with the nonnatives European and glossy buckthorn the most common. Less frequently encountered were the native's common elderberry, black raspberry, and willow. The ground layer includes a mix of wetland edge species and those found in a wide variety of habitats. These include the native's white snakeroot, Canada goldenrod, white vervain, blue flag iris, and the nonnative reed canary grass. Overall, the quality of this forest is moderate.

Community	Activity	Priority	Estimated Cost	Comments
LL-U2	Remove nonnative shrubs	Medium	$500-1,000 per acre, 40-100 volunteer hours per acre	Cut and treat all stumps with 25-50% solution of Roundup or Garlon. Where brush is thick, stack and burn brush in winter, otherwise cut and let lay.
LL-U2	Recut brush	Medium	$500-1,000 every 5-10 years	Brush will likely continue to persist and resprouts or new stems over one inch in diameter should be cut.
LL-U2	Reintroduce Prescribed Fire	Low	$1,000 - 2,000 per event	Burning is not as important here as in the adjacent community (and it may not burn due to wetness). However, it would help to maintain a relatively open character.
LL-U2	Native grass and flower seeding, if necessary	Low	$100 – 2,000 depending on number of species, plants, amount of seed.	Inspect site and reintroduce appropriate local origin plant in bare ground areas. Seed/plant with species typical of Lowland Hardwood Forest (see natural communities of study area section).

Community LL-U3
Siberian elm monoculture
Qualitative Rank: NA
Nonnative Shrub Rank: 6

This community is found in two parcels in Langton Lake Park, both of which are on the northwest side adjacent to the ball fields. Although the native tree boxelder is found occasionally here, the vast majority of the canopy is dominated by the nonnative Siberian elm. Tree sizes for this nonnative range from a few inches to about 12 inches in diameter. The shrub layer has sometimes dense patches of European buckthorn, as well as some boxelder and gooseberry. The ground layer is dominated by bare ground and the nonnative pasture grass Kentucky bluegrass, with the native Virginia creeper less common.

Because of the dominance of this area by nonnative species and the lack of native plants, this plant assemblage does not meet the minimum characteristics necessary to classify or qualitatively rank it as a native plant community. Management recommendations include planting native hardwood species under the Siberian elm.

Community	Activity	Priority	Estimated Cost	Comments
LL-U3	Cut buckthorn and other nonnative shrubs	Low	$800-1,500 per acre. 40-80 volunteer hours per acre	This is a low priority site for management since it has fewer natural community characteristics than other areas in Langton Park.
LL-U3	Plant native hardwood trees	Low	$500-2,000, 80-200 volunteer hours	Plant native trees typical of dry forest, particularly species that are shade tolerant. See Appendix for suggested species.
LL-U3	Tree seedling release	Low	$1,000 - 1,000 per event	As native trees and shrubs mature, some cutting of Siberian elm may be undertaken to release the native trees from competition with Siberian elm. Stumps should be treated with Garlon, Krenite or equivalent to prevent resprouting.

Wetland Natural Community Descriptions and Management Recommendations

Most of the wetlands in Langton Lake Park have formed as a result of the overall increase in the size of Langton Lake from what was originally agriculture surrounding the area. The increases in impervious surface due to the many large parking lots and industrial areas have contributed a significant amount of stormwater to the lake. All of the wetlands, except W1, have connectivity to the lake and receive direct stormwater inputs. Locations of the improvements discussed in the following paragraphs are shown in figure 6.6

Community LL-W1
Seasonally Flooded Basin
Qualitative Rank: Medium
Area: 0.07 acres

This is a small isolated depression surrounded by upland forest on three sides and an upland old field to the north. Reed canary grass is the dominant vegetation. The presence of smartweed and duckweed indicates that this basin holds water during spring or significant rain events. This

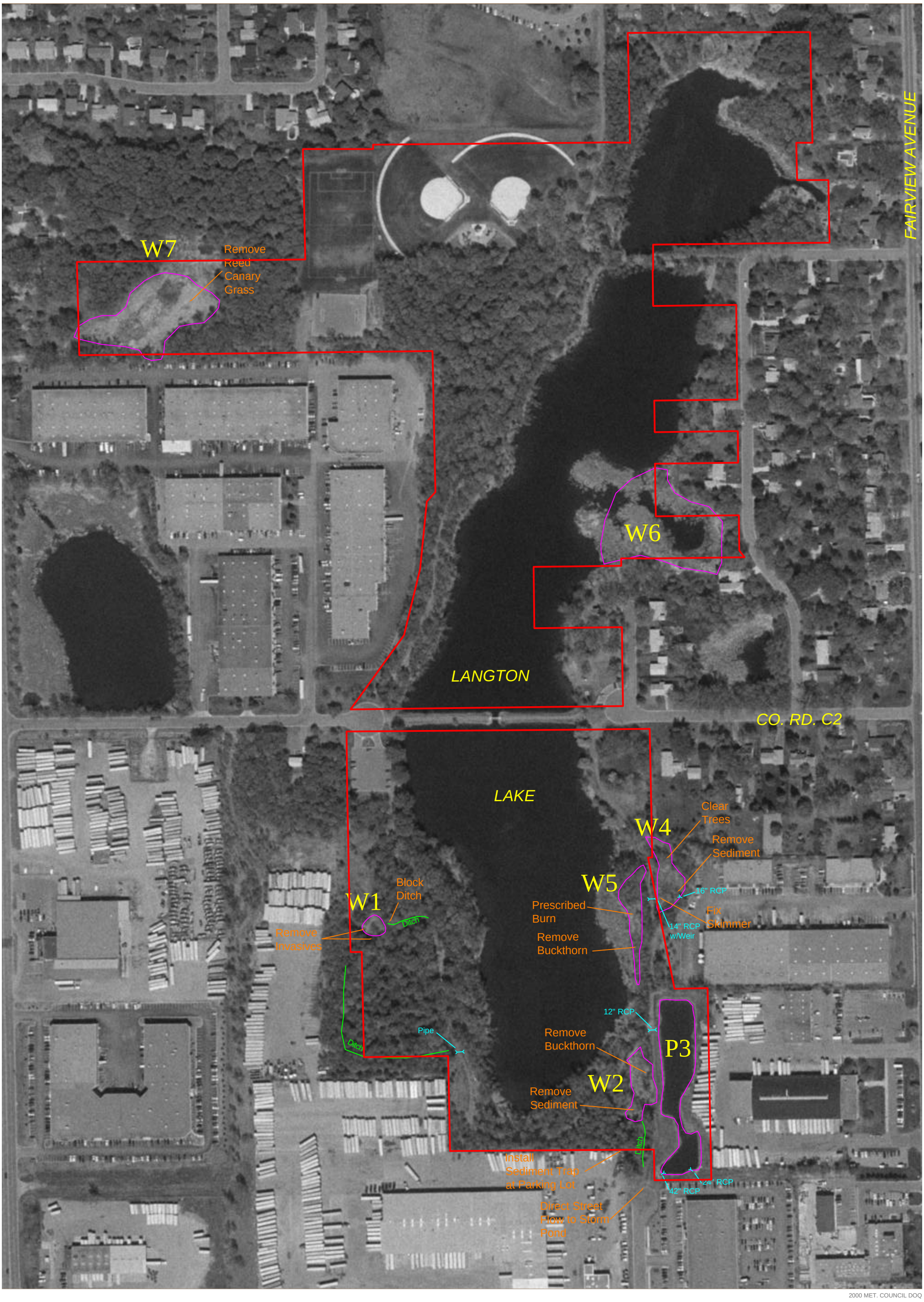
wetland has a ditched outlet that has substantially lowered the hydrology of the basin. The ditch is 12-feet wide and approximately 4-feet deep. Prior to the ditching the wetland was likely a shallow marsh. Ditching has caused this basin to be reduced in size and also has resulted in the hydrology being almost completely removed. The wetland could be restored with a berm 2.5 feet high and a spillway 1.5 feet above the bottom of the ditch. The basin is in danger of disappearing from lack of hydrology and invasive species. Boxelder, glossy and common buckthorn, elder, American elm, Tartarian honeysuckle, and aspen are encroaching on the edge.

Community	Activity	Priority	Estimated Cost	Comments
LL-W1	Block ditch outlet	Medium	$5,000.00	Create berm and spillway to restore hydrology
LL-W1	Remove invasive veg.	Medium	$500.00	Could be in conjunction with upland clearing.

Community LL-W2
Shallow Marsh/Wet Meadow
Qualitative Rank: High/Medium
Area: 0.3 acres

This basin is directly connected to the southern tip of the lake. A boardwalk crosses the wetland near the lake edge. A high berm separates this wetland from a storm pond to the east. The wetland vegetation is primarily cattails, with black willow, duckweed, and soft-stem bulrush. Buckthorn and sandbar willow are present in noticeable amounts. Reed canary grass has become more dominant in the southern portion of the wetland where sedimentation has occurred. This is a highly visible wetland with the boardwalk and a grass walking path from businesses to the south.

Historic sedimentation from parking lot located southwest of this wetland was observed. This has resulted in a conversion to reed canary grass and reduced the hydrology of approximately 3,400 square feet of this basin. Restoration of this basin would involve removal of 1 – 2 feet of accumulated sediment. Sediment traps at the discharge point of the parking lot would help to reduce sedimentation in the basin. Catch basin at the end of the cul-de-sac has a low curb that allows some drainage to be directed to W2 without treatment. Curb modifications or a berm should be placed to insure flows enter the catch basin and ultimately reach the storm water treatment pond.



2000 MET. COUNCIL DOQ

LANGTON LAKE PARK

FIGURE 6.6

LEGEND:

Management Recomendations
Existing Structures
Existing Features

N
W
E
S

0 125 250
Scale in feet

FEBRUARY 2002

K:\425\42501106\Cad\Dwg\DOQ3.dwg

Bonestroo
Rosene
Anderlik &
Associates
Engineers & Architects

Community	Activity	Priority	Estimated Cost	Comments
LL-W2	Remove sediment	Medium	$2,500.00	Removal of accumulated sediment should also remove reed canary grass and seed source for reed canary grass.
LL-W2	Install sediment trap at parking lot	Medium	$3,000.00	Needed to reduce sedimentation in wetland and could provide secondary benefit to reduce nutrients to Langton Lake.
LL-W2	Direct street flow to storm pond	Medium	$500.00	Berm to be constructed to direct flows to the storm pond and catch basin. Currently drainage from street is going over curb directly into wetlands.
LL-W2	Remove buckthorn	High	$500-1,000 per acre, 40-100 volunteer hours per acre	Cut and treat all stumps with 25-50% solution of Roundup or Garlon.

Community LL-W4
Shallow Marsh
Qualitative Rank: Low
Acres: 0.01 acres (0.3 total)

This basin does not appear on the National Wetland Inventory map and may have formed as a result of the trail forming a berm. This also could have been created as a storm pond and taken on wetland characteristics. It currently has a skimmer structure that does not function due to the lack of water in the basin.

The basin receives hydrology primarily from the 16-inch RCP stormwater inlet on the east side of the wetland. The dominant vegetation includes cattail, black willow, and an even age stand of small green ash. Invasive shrubs include glossy buckthorn and amur maple. Since this wetland is adjacent to the trail, cleaning it up could provide better aesthetics. Due to the connectivity to the lake, removal of sedimentation and small trees and shrubs could provide for better stormwater treatment.

Community	Activity	Priority	Estimated Cost	Comments
LL-W4	Fix skimmer structure	Medium	$2,000.00	This is more for water quality benefits to Langton Lake then the wetland. Skimming helps removes oils and other floating debris so it will not enter the downstream waterbody.
LL-W4	Remove sediment	Low	$10,000.00	Currently is wooded. Would only pursue to improve water quality to Langton Lake.

Community LL-W5
Wet Meadow
Qualitative Rank: Low
Area: 0.3 acres

This is a lacustrine fringe meadow. A shallow channel has formed from a 14-inch RCP inlet from W4. The basin is almost entirely reed canary grass with glossy buckthorn, aspen, and green ash along the edge. This site appears to be a candidate for vegetative restoration. Buckthorn should be removed and prescribed burns would help enhance the wetland basin.

Community	Activity	Priority	Estimated Cost	Comments
LL-W5	Remove buckthorn	High	$500-1,000 per acre, 40-100 hours per acre	Cut and treat all stumps with 25-50% solution of Roundup or Garlon.
LL-W5	Burn	High	$1,000.00	Prepare site for seeding help remove invasive.
LL-W5	Seeding	High	$1,000.00	Supplemental Seeding to enhance herbaceous layer after burn and buckthorn removal.

Community LL-W6
Deep Marsh
Qualitative Rank: Medium/Low
Area: 1.3 acres (1.7 total)

This is a small cattail bay of the lake. It appears to provide good wildlife habitat. A forest of reed canary grass, sumac, hazelnut, glossy buckthorn, white oak, boxelder, American elm, cottonwood, and aspen buffer the wetland from the street and houses.

Community LL-W7
Wet Meadow/Shallow Marsh
Qualitative Rank: Low
Area: 1.2 acres

This is primarily a reed canary grass monotype. The reed canary grass encroaches into the upland before giving way to forest. On the south side is a large business area and parking lot. A small, excavated hole near the center contains open water with water plantain and duckweed. The south end of the basin near the parking lot contains a couple areas of cattails.

Langton Park Management Recommendation Summary Table

Community	Activity	Priority	Estimated Cost	Comments
LL-U1	Remove small softwood/ pioneer trees, Buckthorn and other nonnative shrubs	High	$2,000 south end, $3,000 on north portion, or 150-300 volunteer hours total.	Cut and treat all stumps with 25-50% solution of Roundup or Garlon. Stack and burn brush in winter. Cut before burning in any particular burn unit. Re-plant with natives where bare soil exists. **Also, cut white poplar near southwest lake overlook.**
LL-W2	Remove buckthorn	High	$500-1,000 per acre, 40-100 volunteer hours per acre	Cut and treat all stumps with 25-50% solution of Roundup or Garlon.
LL-U1	Reintroduce Prescribed Fire	High	$1,000 - 2,000 per event	Critical for maintaining prairie and savanna communities. Burning should not be conducted until brush clearing is completed. Burn 2-4 times in first ten years and every 5-10 as community stabilizes. Conduct concurrently with seeding and cutting
LL-U1	Reintroduce native woodland edge species	Medium-high	$100 – 2,000 depending on number of species, plants, amount of seed.	Reintroduce appropriate local origin plant materials through planting of plugs or seed, particularly where bare ground is left from brush clearing. Broadcast during growing season and/or dormant season seed. See appendix for species list of recommended plants for reintroduction.
LL-W5	Remove buckthorn	High	$500-1,000 per acre, 40-100 volunteer hours per acre	Cut and treat all stumps with 25-50% solution of Roundup or Garlon.
LL-W5	Burn	High	$1,000.00	Prepare site for seeding help remove invasive.

(Table continues)

Community	Activity	Priority	Estimated Cost	Comments
LL-W5	Seeding	High	$1,000.00	Supplemental Seeding to enhance herbaceous layer after burn and buckthorn removal.
LL-W2	Install sediment trap at parking lot	Medium	$3,000.00	Needed to reduce sedimentation in wetland and could provide secondary benefit to reduce nutrients to Langton Lake.
LL-W2	Direct street flow to storm pond	Medium	$500.00	Berm to be constructed to direct flows to the storm pond and catch basin. Currently drainage from street is going over curb directly into wetlands.
LL-W4	Fix skimmer structure	Medium	$2,000.00	This is more for water quality benefits to Langton Lake then the wetland. Skimming helps removes oils and other floating debris so it will not enter the downstream waterbody.
LL-W4	Remove sediment	Low	$10,000.00	Currently is wooded. Would only pursue to improve water quality to Langton Lake.

Reservoir Woods

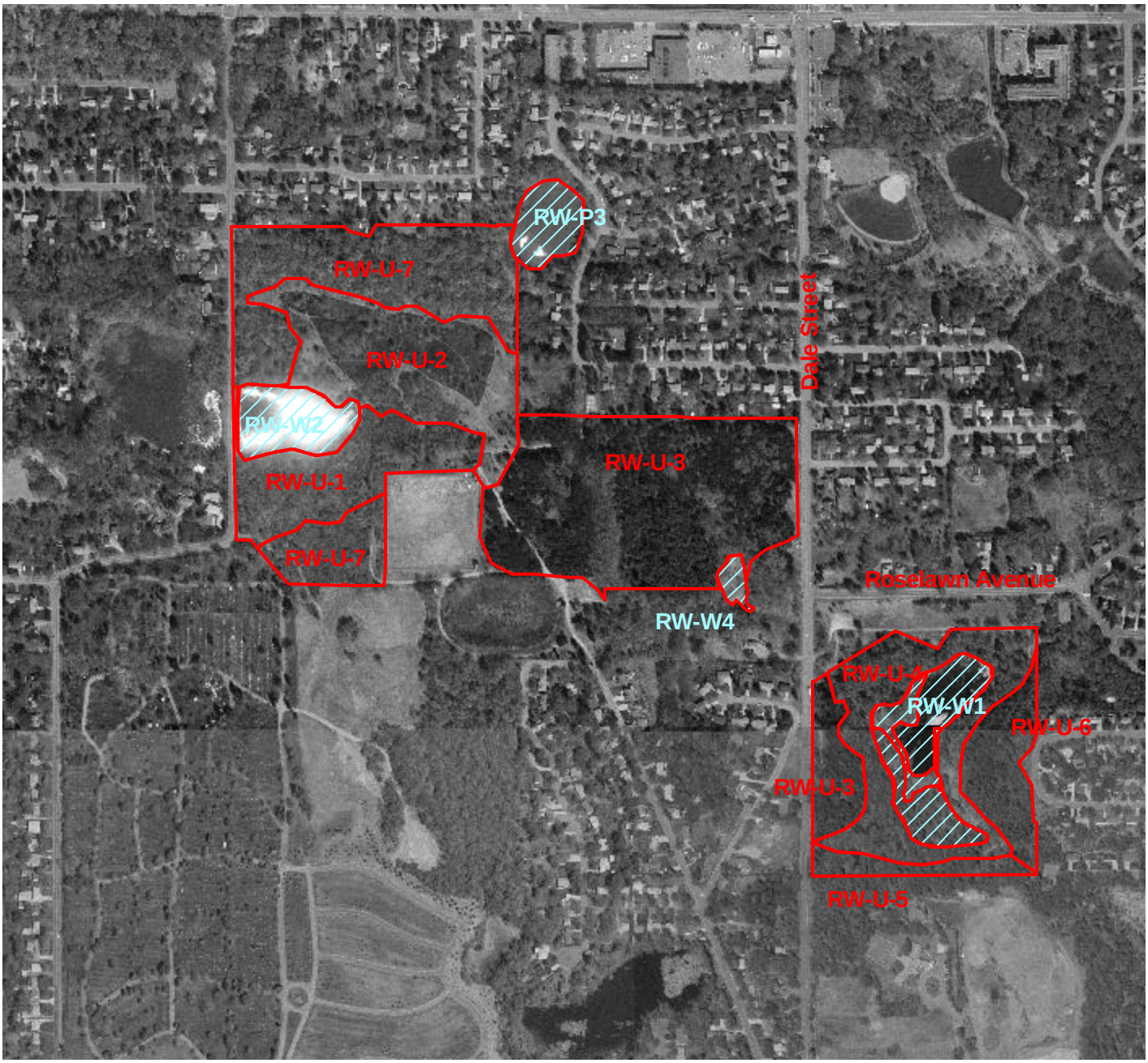
Reservoir Woods is approximately 115 acres between Victoria Street and Dale Street.
The site, which includes some of the highest ground in Roseville, is home to a 30-million gallon, underground water reservoir that for years had been operated by the City of St. Paul. When the reservoir became outdated, St. Paul sold the land to the City of Roseville in 1997. That land was added to 34 acres of land that the City leases from Roselawn Cemetery to create the park.

Neighborhood task forces and park and recreation planners expressed the wish that this new park remain pristine and forest like. Outside of adding a pathway, the only development the City has done is to restore eroding soft trails and eradicate invasive plants such as buckthorn and purple loosestrife.

Wetlands within the park include a number of small depressions of good quality, with a few wetlands on the southeast side of the park that have been impacted. The uplands contain an interesting mix of oak forest/woodland, dry prairie, and planted pine forest. The pine forest, although planted, is beginning to take on characteristics of a remnant pine-hardwood community. These pines are said to have been planted in the earliest years of the 1900's. The upland communities are in good to very good condition with excellent potential for improved quality with active management.

As the Roseville City Parks website notes - "You can walk for miles in this 120-acre Roseville park and see little sign of development… just hilly terrain with lots of pine trees, wetlands, prairie grass, and savanna. It is a place to enjoy natural, untamed beauty". It is a very unique place in such an urbanized setting. Recreation at Reservoir Woods is largely passive, there is no playground equipment, ball fields, or skating rinks.

The following pages includes community descriptions and management recommendations for both uplands and wetlands within the park.



ROSEVILLE

City of Roseville
Natural Resources Inventory

Reservoir Woods

Figure 6.7

Legend

- Park Boundary
- Wetlands
- Upland Communities

Community ID	Community Type
RW-U-1	Mesic Oak Forest
RW-U-2	Dry-Mesic Prairie
RW-U-3	Mixed Conifers & Hardwoods
RW-U-4	Floodplain Forest
RW-U-5	Dry Oak Forest
RW-U-6	Conifer Plantation
RW-U-7	Mesic Oak Forest
RW-W1	Wet Meadow
	Lowland Hardwood Forest
	Shallow Open Water
RW-W2	Open Bog
RW-P3	Storm Pond
RW-W4	Seasonally Flooded Basin

N

February, 2002

Bonestroo Rosene Anderlik & Associates
Engineers & Architects

425\42501106\Cad\gis\mlccs\mlccs.apr

Upland Natural Community Descriptions and Management Recommendations

The uplands in Reservoir Woods include oak woodland/forest, prairie, and some lowland hardwood forest. Also, because of a massive pine planting effort in the early 1900's, there is a nice pin-hardwood forest here. The earliest planted pines will soon approach 100 years of age. This curios pine forest, along with the quality oak and prairie communities make this park a natural gem, almost unheard of so close to the core of a densely populated urban area.

Community RW-U1
Mesic Oak Forest
Qualitative Rank: BC
Nonnative Shrub Rank: 13

This oak forest is on a slight to moderate north-facing hillside on the southwest side of Reservoir Woods. The canopy of this forest is generally closed with bur, white, red, and pin oaks being the most common trees. These average approximately 12-18 inches across the community. Other, smaller trees that have grown up under the oaks include black cherry, American elm, and green ash. Where canopy gaps occur between the oaks, these younger trees have, or will soon fill them in.

The shrub layer includes a moderately large number of species and includes both small trees and true shrubs. The most common shrub are the nonnatives European and glossy buckthorn. Other members of the shrub layer that were frequently encountered include boxelder, green ash, black raspberry, gooseberry and red-berried elder.

The ground layer composition is moderately poor in the south portion of this community but is better quality along the north portion. Here ferns and forbs characteristic of oak forest are more common and provide better overall community composition to the forest. Nonnative shrubs such as European and glossy buckthorn has also likely been a factor in delaying the establishment of woodland flowers and graminoids. The ground layer also indicates a history of grazing because of the fairly common thorny species.

Management Recommendations:

Community	Activity	Priority	Estimated Cost	Comments
RW-U1	Remove Buckthorn and other nonnative shrubs	High	$1,000 per acre, or approx. 40-60 volunteer hours per acre	Moderately Low Concentration here compared to other areas in park, but is hindering recovery of forest.
RW-U1	Reintroduce appropriate native species	Medium	$100 – 2,000 for plant materials, depending on number of species, plants, seed.	Reintroduce appropriate local origin plant materials through planting of plugs or seed, particularly where bare ground is left from brush clearing. Allow 10-20 hours for seeding if done by volunteers or city staff. An appendix of this report contains a list of recommended species for reintroducing into forest, savanna, and prairie areas.
RW-U1	Reintroduce Prescribed Fire	Medium	$1,500-2,000 per event.	This will help with maintaining oak component and keep shrub layer more open.
RW-U1	Recut brush	Medium	$500-1,000 every 2-3 years or 20-40 volunteer hours	Brush will likely continue to persist and should be treated regularly

Community RW-U2
Dry-mesic Prairie
Qualitative Rank: C
Nonnative Shrub Rank: 15

This prairie lies on the interior of the northwest portion of Reservoir Woods and is not readily visible from surrounding roads. The terrain here varies from gently rolling to a somewhat steep north-facing hillside in the southeast portion of the community. Soils vary from dry sand in the southeast portion to a richer sandy loam elsewhere

Flowers and grasses present here tend to be those that tolerate disturbance. Based on aerial photos from the 1940's and 1950's, as well as clues in the current plant community composition, it appears that this prairie has a history of moderate to intense long-term grazing. After release from grazing and in the absence of fire, the prairie was colonized by fast growing shrubs and

small trees. The majority of the brush and trees are concentrated in the lower portions of the prairie where the soils hold more moisture. The most common trees and shrubs include quaking aspen, blackberry, black raspberry, smooth sumac, black cherry, buckthorn, gray dogwood, and green ash.

Despite the large amount of tree and shrub cover, many of the grasses and a few flower species characteristic of dry-mesic prairie are still present here. The most common native grasses include big bluestem, little bluestem, Indian grass, purple lovegrass, Leiberg's panic grass, porcupine grass, and prairie cordgrass.

Some of the more common forbs include narrow-leaf pussytoes, bergamot, hoary vervain, prairie mugwort, tall anemone, wild strawberry, stiff and showy goldenrods, sky blue aster, and Virginia mountain mint. The driest soils of the prairie also include rough blazingstar, round-headed bushclover, golden aster, gray goldenrod, and wild four o'clock.

This prairie is exceptional, considering that it occurs within a fully developed suburb of a major metropolitan area, and is only four miles from downtown St. Paul. Due to the rarity of intact natural areas, and especially prairies in first ring suburbs of the Twin Cities, it is worthy of active management.

Community	Activity	Priority	Estimated Cost	Comments
RW-U2	Remove small trees, Buckthorn and other nonnative shrubs	High	$2,000 per acre or 100-200 volunteer hours per acre	Cut and treat all stumps with 25-50% solution of Roundup or Garlon. Stack and burn brush in winter. Cut before burning in any particular burn unit. Re-plant with natives where bare soil exists.
RW-U2	Reintroduce Prescribed Fire	High	$1,000 - 2,000 per event	Critical for maintaining prairie and savanna communities. Burning should not be conducted until brush clearing is completed in any given area.

(Table continues)

Community	Activity	Priority	Estimated Cost	Comments
RW-U2	Reintroduce appropriate native species	Medium	$100 – 2,000 depending on number of species, plants, seed.	Reintroduce appropriate local origin plant materials through planting of plugs or seed, particularly where bare ground is left from brush clearing. 10-40 hours of time if conducted by staff or volunteers. See appendix for species list to reintroduce.
RW-U2	Recut brush	Medium	$500-1,000 every 2-3 years	Brush will likely continue to persist and should be cut regularly

Community RW-U3
Mixed Coniferous-Hardwood Forest
Qualitative Rank: NA
Nonnative Shrub Rank: 11

This area consists of two separate conifer plantings, one that appears to have been done about 70 years ago, and the other perhaps 30-40 years ago. Canopy cover across this community varies from about 80 to 100 percent.

The younger planting is located at the top of the hill in an area that appears to have been dozed to flatten a hilltop. This area is dominated by red pine ranging in size from about 8 to 14 inches in diameter. Other planted pines include white, jack, and the nonnative scotch pine. A few large, somewhat open-grown bur, white and pin oak still persist on the west edge, but have been overtaken by the faster growing pines. Other trees found at least occasionally include fir, boxelder, green ash, and cottonwood. Also, there are several extraordinarily large butternuts on this hilltop that are estimated to have 35 to 45 inch trunk diameters. The shrub layer in this west area is thick to very thick and dominated by the nonnatives buckthorn, and honeysuckle, with the natives boxelder and red-berried elder less common. The ground layer here is sparse with plants tolerant of disturbance most common. Some of these include Virginia creeper, sweet cicely, and poison ivy. An area of generally similar character is located east of Dale Street and west of the wetland in the southeast segment of the park.

Because of the number of years since the trees were planted, the east-facing slope and lower elevations of this community are beginning to take on the character of a natural community rather than just being a planting of trees. This area includes trees that are much larger that the area on the west side of the community with some white and red pine that approach or exceed 20 inches in diameter. These form a nearly cathedral-like canopy with few subcanopy trees, or shrubs present. Other trees found here include a number of spruce and fir trees, as well.

The more frequently encountered shrubs and trees on the east portion of the community include brambles, highbush cranberry, green ash, chokecherry, red-berried elder and mountain ash. The mountain ash is presumably established from seed brought in from a residential planting somewhere in the area. The ground layer in the eastern portion of the community is sparse and includes Virginia creeper, false Solomon's seal, enchanter's nightshade and several species of ferns. Despite the fact that this community is largely defined by planted pine that would not have been native to this area at the time of settlement, the plantings are beginning to develop greater functionality and natural community characteristics as they "mature". This is particularly true of the east portion, with a winding trail under a canopy of enchanting cathedral-like white pines. Through time, and with some active management, this area has the potential to increase its ecological value and even further increase its currently good aesthetics.

Community	Activity	Priority	Estimated Cost	Comments
RW-3	Remove Buckthorn and other nonnative shrubs	Med-low	$1,000 per acre	Cut and treat all stumps with 25-50% solution of Roundup or Garlon. This community receives a lower priority than other communities due to the fact that it is a planting rather than a remnant natural community.
RW-U3	Thin pines	Low	$1,000 – 2,000 per event	Pines in the west side of the planting are growing too close to one another, these should be thinned to allow for better overall forest health.

(Table continues)

Community	Activity	Priority	Estimated Cost	Comments
RW-U3	Plant appropriate native species	Low	$100 – 2,000 depending on number of species, plants, seed.	Reintroduce appropriate plant materials for white pine-mixed hardwood forest by planting of plugs and/or seed across site. An appendix of this report contains a list of recommended species for reintroducing into forest, savanna, and prairie areas.

Community RW-U4
Floodplain Forest
Qualitative Rank: CD
Nonnative Shrub Rank: 10

This lowland hardwood forest lies along the fringes of the wetland in the southeast portion of Reservoir Woods. It is characterized by young boxelder, with occasional cottonwood, elm, and green ash. Butternut are also found here, but only rarely. The shrub layer is dominated by a mix of tree saplings, and nonnative and/or thorny shrubs. These include European and glossy buckthorn, green ash, prickly gooseberry, American elm, and common elder. The ground layer is dominated by a mix of species that are commonly found in disturbed areas. These include the nonnatives reed canary grass, motherwort, stinging nettle, and deadly nightshade, as well as the natives white snakeroot, wood nettle, Virginia stickseed, and Canada goldenrod.

Overall, this community is relatively young and is in the process of recovering from disturbance. It should recover to somewhat better quality in time on its own, although it would improve at a faster rate with active management.

Community	Activity	Priority	Estimated Cost	Comments
RW-U4	Remove Buckthorn and other nonnative shrubs	Low	$1,000 per acre	Cut and treat all stumps with 25-50% solution of Roundup or Garlon.

Community RW-U5
Dry Oak Forest
Qualitative Rank: CD
Nonnative Shrub Rank: 11

This disturbed oak forest is found on a dry, steep, north-facing slope between an asphalt trail and County maintenance facility. Although white and pin oak occur occasionally here, they are widely scattered. Other trees on the slope that are typical for this type of forest are white birch and ironwood. Between these trees, and under them is a collection of younger trees and shrubs. These include green ash, American elm, and the nonnatives European buckthorn and Tartarian honeysuckle. The ground layer includes some areas that are dominated by native forbs such as wild sarsparilla, Canada mayflower, lady fern, false Solomon's seal, yellow bellwort, and early meadow rue. However, the majority of the area is characterized by nonnatives, and native species adapted to disturbance. The most troubling species present in the ground layer is garlic mustard, a prolific colonizer of forest floors that is capable of displacing native plants.

In addition, there are some gullies that have formed due to excessive runoff from the hilltop to the south. Some of these appear to have stabilized, but some are still actively eroding and should be remedied. Although there are several pockets of good quality in this community, the overall amount of disturbance and nonnative species causes a somewhat lowered ranking for this community.

Community	Activity	Priority	Estimated Cost	Comments
RW-U5	Cut Buckthorn and other nonnative shrubs	High	$2,000 –3,000, or 100-200 volunteer hours	Cut and treat all stumps with 25-50% solution of Roundup or Garlon. Stack brush away from oak crowns and burn in winter. Cut before burning in any particular area. Re-plant with native seed/plants where bare soil exists.
RW-U5	Correct Erosion Areas	High	$2,000-5,000 for each area	Erosion occurs in several locations (old trails). Corrective bioengineering should be used to manage these

(Table continues)

Community	Activity	Priority	Estimated Cost	Comments
RW-U5	Treat garlic mustard	High	$300-800 per year for up to 10 years	Treat basal rosettes with Roundup, or other herbicide in fall. Ideally, should be treated every year
RW-U5	Reintroduce appropriate native species	High	$500 – 5,000+ depending on number of species, plants, seed.	Reintroduce appropriate local origin plant materials (see appendix) through planting of plugs or seed, particularly where bare ground is left from brush clearing. Along with burning, this will be an important step in long-term control of buckthorn and nonnative shrubs.
RW-U5	Apply Prescribed Fire	Low	$1,000 - 2,000 per event	Burning will help keep nonnative shrubs in-check and allow desirable native graminoids and forbs to better establish. However, burning may be difficult on this slope

Community RW-U6
Conifer Plantation
Qualitative Rank: NA
Nonnative Shrub Rank: 10

This community is found in the southeastern most area in Reservoir Woods. It consists of a mixed planting of conifers, with nonnative scotch pine being common. Other trees present include elm, quaking aspen, cottonwood, green ash and other fast growing trees. The shrub layer here is thick to very thick with small trees and nonnative shrubs common, including European buckthorn.

Similar to the tree and shrub composition, the ground layer shows signs of recent transition from a more open space to one that is well-shaded. Species found in the ground layer include white snakeroot, sweet cicely, enchanters nightshade, and nonnative pasture grasses. Because this community is dominated by nonnatives and a few native plant species tolerant of disturbance, it is of generally low overall quality.

Community	Activity	Priority	Estimated Cost	Comments
RW-U6	Cut Buckthorn and other nonnative shrubs	Med-low	$2,000 per acre	Cut and treat all stumps with 25-50% solution of Roundup or Garlon. Spread brush on ground here, stacking and burning is generally unsafe in conifer plantations.
RW-U6	Underplant native trees	Low	$1,000 - 2,000 per acre	Obtain seedling stock of appropriate shade tolerant native trees (see general management recommendations section) and plant under existing canopy. This will allow native trees to reach canopy as existing canopy trees die-off in the distant future

Community RW-U7
Mesic Oak Forest
Qualitative Rank: C
Nonnative Shrub Rank: 14

This oak forest is found in two areas, one is on a slightly rolling to moderately sloped south-facing hillside on the northwestern most segment of the park, while the other is just east of the intersection of Victoria Street and Roselawn Avenue. Similar to RW-U-1 the canopy of this forest is generally closed with a mix of tall, straight trees and those that are more open-grown. Bur, and pin oaks are most common and average approximately 12-18 inches across the community. White and red oak are also found here, but are less common than in the other oak forest parcel (RW-U-1). The canopy of this forest averages about 70 to 90 percent closure, with smaller trees growing up under the oaks in many places. These younger trees include black cherry, American elm, green ash, and less frequently boxelder. Where canopy gaps occur between the oaks, these younger trees have, or will soon fill them in.

The shrub layer is moderately thin to very thick and includes a moderately both small trees and true shrubs. The most common shrubs are the nonnatives European and glossy buckthorn. Efforts to control this shrub in the south portions of this community have been successful and

should allow native plants a better opportunity to establish here. Less common members of the shrub layer include boxelder, green ash, black raspberry, gooseberry and red-berried elder.

The ground layer composition reflects a recent, and relatively fast transition from a semi-open area to almost closed canopy. The prevalence of nonnative shrubs, along with the recent increase in shadiness and absence of natural disturbances such as fire have all likely been a factor in delaying the establishment of woodland flowers and graminoids. The ground layer also indicates a history of moderate to intense long-term grazing because of the amount of thorny species.

Community	Activity	Priority	Estimated Cost	Comments
RW-U7	Cut Buckthorn and other nonnative shrubs	High	$2,000 per acre, or about 40-60 hours volunteer labor per acre	Cut and treat all stumps with 25-50% solution of Roundup or Garlon. Stack brush away from oak crowns and burn in winter. Cut before burning in any particular area. Re-plant with native seed/plants where bare soil exists.
RW-U7	Reintroduce appropriate native species	High	$500 – 5,000+ depending on number of species, plants, seed. Allow 20-30 volunteer hours to plant	Reintroduce appropriate local origin plant materials through planting of plugs or seed, particularly where bare ground is left from brush clearing. Along with burning, this will be an important step in long-term control of buckthorn and nonnative shrubs.
RW-U7	Correct Erosion Areas	Medium	$2,000-5,000 for each area	Erosion occurs in several locations on hillsides. Corrective action such as bioengineering should be used to manage these
RW-U7	Apply Prescribed Fire	Medium	$1,000 - 2,000 per event	Burning will help keep nonnative shrubs in-check and allow desirable native graminoids and forbs to better establish

Wetland Natural Community Descriptions and Management Recommendations

The five wetlands in the park have all been altered by urbanization. W1 has most recently changed wetland type from a marsh to a shallow open water habitat through stormwater inputs. The floating vegetative mat of W2 has decreased in size and is being invaded by purple loosestrife. W3 has increased in size and has taken on the characteristics of a stormwater pond. Historically W4 was an open water wetland and has lost hydrology becoming a seasonal basin dominated by reed canary grass. Locations of the improvements discussed in the following paragraphs are shown in figure 6.8

Community RW-W1
Shallow Open Water/Wet Meadow/Lowland Hardwood Forest
Qualitative Rank: Medium
Acres: 5.7 acres

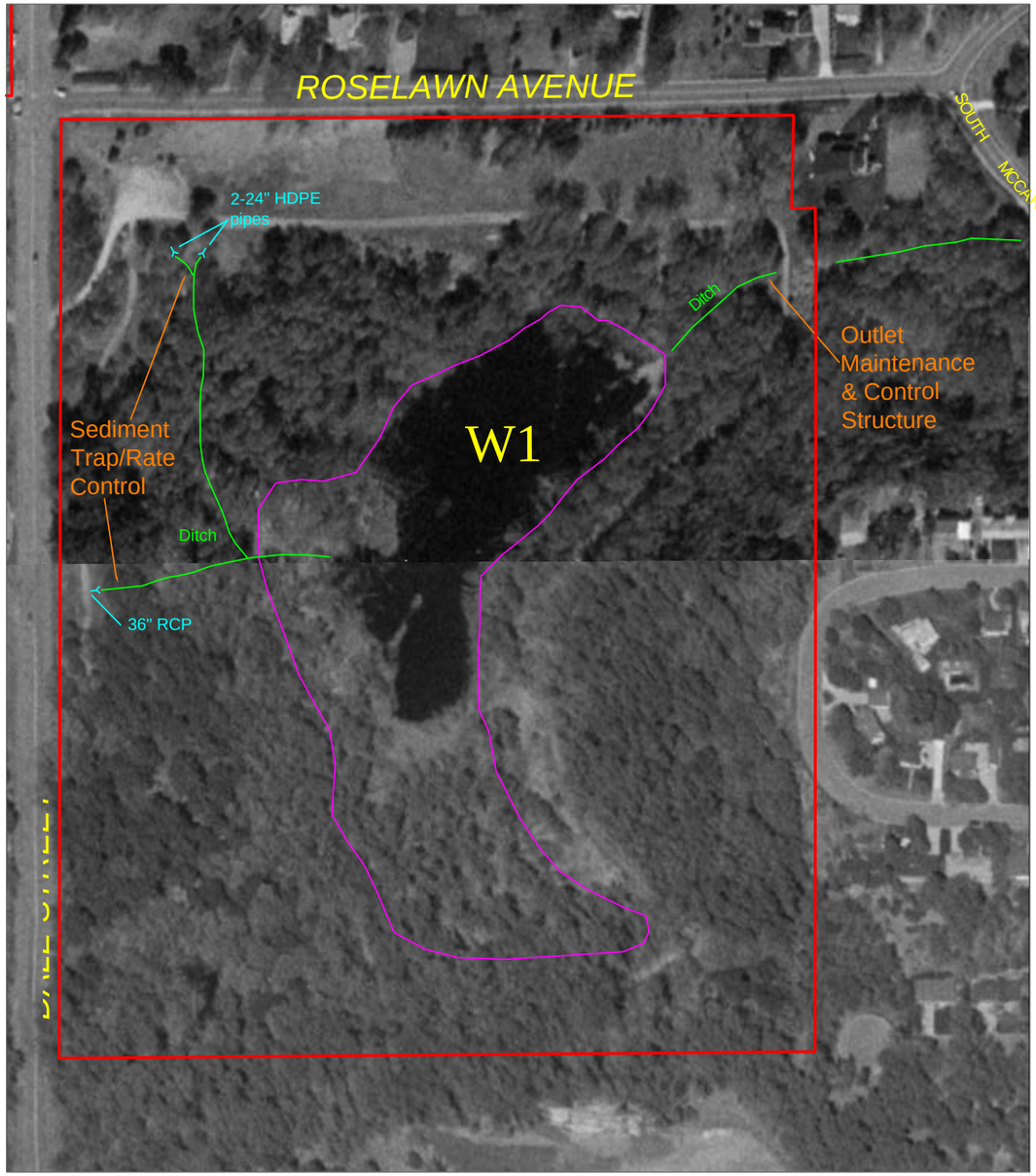
This wetland is a large depressional basin with fringes of wet meadow and a small forested wetland area on the south end. The open water habitat consists of predominantly duckweed and dead trees. The forested wetland and fringe are dominated by reed canary grass, touch-me-not, boxelder, silver maple, and buckthorn.

Several discharge points for storm water enter the basin. An increased water level is evident by the inundation and mortality of trees along the fringe of the basin. The National Wetland Inventory Map indicates this basin is Shallow Emergent Marsh. Recent inundation has converted this to open water, however emergents may encroach along the fringes.

The only observed potential outlet is a swale at the northeast end of the basin. With the increase drainage to this wetland and the current outlet, it has the potential to become a substantially larger open water area.

Currently this wetland has high waterfowl and wildlife values due to the snags and open water. This wetland should be monitored to determine additional expansion of water levels. The outlet elevation should be determined and referenced to the current open water to determine the potential expansion of the open water of this basin.

0 150 300
Scale in feet



2000 MET. COUNCIL DOQ

0 100 200
Scale in feet

RESERVOIR WOODS

FIGURE 6.8

LEGEND:

Management Recomendations
Existing Structures
Existing Features

Bonestroo Rosene Anderlik & Associates
Engineers & Architects

FEBRUARY 2002

K:\425\42501106\Cad\Dwg\DOQ3.dwg

If necessary, potential solutions to increased water levels includes maintenance of the outlet and installation of a control structure.

Community	Activity	Priority	Estimated Cost	Comments
RW-W1	Survey outlet elevations and water level and install staff gauge for future monitoring..	Medium	$500.00	Determine outlet elevation to determine potential expansion of open water. Install staff gauge to take water readings and determine if outlet maintenance is needed is needed in the future.
RW-W1	Maintenance outlet and install control structure	Med-Low	$2,000.00	Wetland has increased in stormwater storage, improving outlet may be necessary if water levels rise
RW-W1	2-Sediment traps with rate control outlets for each drainage ditch	Med-Low	$ 5,000.00	Would reduce erosion occurring in drainage ditches to wetland and reduce sedimentation in the wetland fringe.

Community RW-W2
Open Bog (Poor Fen)
Qualitative Rank: High/Medium
Area: 3.5 acres

This wetland is characteristic of a poor fen, shrub subtype. It is rare to find this plant community in southern Minnesota. Plant species included in this basin include steeplebush, purple loosestrife, marsh fern, violet, sphagnum moss, bog birch, reed canary grass, dogwood, cattail, leather leaf and blue flag iris.

Purple loosestrife has begun to become one of the dominant plants in portions of the wetland and buckthorn is common along the edge. Currently Victoria Street is a rural section along this portion of the basin with no curb and gravel shoulders. Untreated street drainage is likely impacting the plant community of this basin. Water quality improvements could be pursued adjacent to this road to improve drainage entering this basin.

Community	Activity	Priority	Estimated Cost	Comments
RW-W2	Remove purple loosestrife and/or begin beetle treatment	High	$ 600.00	Spot spray to remove purple loosestrife to allow other species native to bogs to establish.

(Table continues)

Community	Activity	Priority	Estimated Cost	Comments
RW-W2	Treat stormwater adjacent to each side of Victoria Street	High	$8,000.00	Currently street drainage flows directly into the wetland basins on either side of the road. Due to the sediment, road salts and other street chemical the runoff from the road should be treated prior to discharge to the basin. Grants from the Soil and Water Conservation District are potentially available for this work.
RW-W2	Remove Buckthorn	Medium	$500-1,000 per acre, 40-100 volunteer hours per acre	Cut and treat all stumps with 25-50% solution of Roundup or Garlon.

Community RW-W4
Seasonally Flooded Basin
Qualitative Rank: Medium/Low
Area: 0.4 acres (0.5 total)

This is a depressional area at the bottom of sloping swale. Hydrology primarily comes from a series of culverts that drain into a ravine further upslope. National Wetlands Inventory lists this basin as a PEM/SS1C, but currently it is more characteristic of a PEMA. The wetland is usually dry except during snow melt in the spring and after heavy rain events. Because of the slope in the wetland, hydrology is not sustained for a sufficient period of time for the wetland to be dominated by plant species typical of wetlands. It was observed that upland species are colonizing this basin due to the lack of hydrology. Dominant vegetation is mostly aggressive species such as reed canary grass, nettle, thistle, burdock, boxelder, elm, and cottonwood. The southern portion of the basin is off of park property, so building a berm to restore hydrology may be difficult.

Community	Activity	Priority	Estimated Cost	Comments
RW-W4	Restore hydrology with berm	Medium	$800.00	A small berm could create to restore the hydrology of this wetland.
RW-W4	Plant with native to restore wet meadow	Low	$500.00	Enhance wetland with plantings.

Reservoir Woods Management Recommendation Summary Table

Community	Activity	Priority	Estimated Cost	Comments
RW-U1	Remove Buckthorn and other nonnative shrubs	High	$1,000 per acre, or approx. 40-60 volunteer hours per acre	Moderately Low Concentration here compared to other areas in park, but is hindering recovery of forest.
RW-U2	Remove small trees, Buckthorn and other nonnative shrubs	High	$2,000 per acre or 100-200 volunteer hours per acre	Cut and treat all stumps with 25-50% solution of Roundup or Garlon. Stack and burn brush in winter. Cut before burning in any particular burn unit. Re-plant with natives where bare soil exists.
RW-U2	Reintroduce Prescribed Fire	High	$1,000 - 2,000 per event	Critical for maintaining prairie and savanna communities. Burning should not be conducted until brush clearing is completed in any given area.
RW-U5	Cut Buckthorn and other nonnative shrubs	High	$2,000 – 3,000, or 100-200 volunteer hours	Cut and treat all stumps with 25-50% solution of Roundup or Garlon. Stack brush away from oak crowns and burn in winter. Cut before burning in any particular area. Re-plant with native seed/plants where bare soil exists.
RW-U5	Correct Erosion Areas	High	$2,000-5,000 for each area	Erosion occurs in several locations (old trails). Corrective bioengineering should be used to manage these
RW-U5	Treat garlic mustard	High	$300-800 per year for up to 10 years	Treat basal rosettes with Roundup, or other herbicide in fall. Ideally, should be treated every year
RW-U5	Reintroduce appropriate native species	High	$500 – 5,000+ depending on number of species, plants, seed.	Reintroduce appropriate local origin plant materials (see appendix) through planting of plugs or seed, particularly where bare ground is left from brush clearing. Along with burning, this will be an important step in long-term control of buckthorn and nonnative shrubs.

(Table continues)

Community	Activity	Priority	Estimated Cost	Comments
RW-U7	Cut Buckthorn and other nonnative shrubs	High	)00 per acre, bout 40-60 rs volunteer r per acre	Cut and treat all stumps with 25-50% solution of Roundup or Garlon. Stack brush away from oak crowns and burn in winter. Cut before burning in any particular area. Re-plant with native seed/plants where bare soil exists.
RW-U7	Reintroduce appropriate native species	High	$500 – 5,000+ depending on number of species, plants, seed. Allow 20-30 volunteer hours to plant	Reintroduce appropriate local origin plant materials through planting of plugs or seed, particularly where bare ground is left from brush clearing. Along with burning, this will be an important step in long-term control of buckthorn and nonnative shrubs. See appendix for species list.
RW-W2	Remove purple loosestrife and/or begin beetle treatment	High	$ 600.00	Spot spray to remove purple loosestrife to allow other species native to bogs to establish.
RW-W2	Treat stormwater adjacent to each side of Victoria Street	High	$8,000.00	Currently street drainage flows directly into the wetland basins on either side of the road. Due to the sediment, road salts and other street chemical the runoff from the road should be treated prior to discharge to the basin. Grants from the Soil and Water Conservation District are potentially available for this work.
RW-W2	Remove Buckthorn	Medium	$500-1,000 per acre, 40-100 volunteer hours per acre	Cut and treat all stumps with 25-50% solution of Roundup or Garlon.
RW-U1	Reintroduce appropriate native species	Medium	$100 – 2,000 for plant materials, depending on number of species, plants, seed.	Reintroduce appropriate local origin plant materials through planting of plugs or seed, particularly where bare ground is left from brush clearing. Allow 10-20 hours for seeding if done by volunteers or city staff. An appendix of this report contains a list of recommended species for reintroducing into forest, savanna, and prairie areas.

(Table continues)

Community	Activity	Priority	Estimated Cost	Comments
RW-U1	Reintroduce Prescribed Fire	Medium	$1,500-2,000 per event.	This will help with maintaining oak component and keep shrub layer more open.
RW-U1	Recut brush	Medium	$500-1,000 every 2-3 years or 20-40 volunteer hours	Brush will likely continue to persist and should be treated regularly
RW-U2	Reintroduce appropriate native species	Medium	$100 – 2,000 depending on number of species, plants, seed.	Reintroduce appropriate local origin plant materials through planting of plugs or seed, particularly where bare ground is left from brush clearing. 10-40 hours of time if conducted by staff or volunteers.
RW-U2	Recut brush	Medium	$500-1,000 every 2-3 years	Brush will likely continue to persist and should be cut regularly
RW-U7	Correct Erosion Areas	Medium	$2,000-5,000 for each area	Erosion occurs in several locations on hillsides. Corrective action such as bioengineering should be used to manage these
RW-U7	Apply Prescribed Fire	Medium	$1,000 - 2,000 per event	Burning will help keep nonnative shrubs in-check and allow desirable native graminoids and forbs to better establish
RW-W1	Survey outlet elevations and water level and install staff gauge for future monitoring..	Medium	$500.00	Determine outlet elevation to determine potential expansion of open water. Install staff gauge to take water readings and determine if outlet maintenance is needed is needed in the future.
RW-W4	Restore hydrology with berm	Medium	$800.00	A small berm could create to restore the hydrology of this wetland.
RW-W1	Maintenance outlet and install control structure	Med-Low	$2,000.00	Wetland has increased in stormwater storage, improving outlet may be necessary if water levels rise
RW-W1	2-Sediment traps with rate control outlets for each drainage ditch	Med-Low	$ 5,000.00	Would reduce erosion occurring in drainage ditches to wetland and reduce sedimentation in the wetland fringe.
RW-W4	Plant with native to restore wet meadow	Low	$500.00	Enhance wetland with plantings.

(Table continues)

Community	Activity	Priority	Estimated Cost	Comments
RW-U3	Plant appropriate native species	Low	$100 – 2,000 depending on number of species, plants, seed.	Reintroduce appropriate plant materials for white pine-mixed hardwood forest by planting of plugs and/or seed across site.
RW-U4	Remove Buckthorn and other nonnative shrubs	Low	$1,000 per acre	Cut and treat all stumps with 25-50% solution of Roundup or Garlon.
RW-U5	Apply Prescribed Fire	Low	$1,000 - 2,000 per event	Burning will help keep nonnative shrubs in-check and allow desirable native graminoids and forbs to better establish. However, burning may be difficult on this slope
RW-U6	Underplant native trees	Low	$1,000 - 2,000 per acre	Obtain seedling stock of appropriate shade tolerant native trees (see general management recommendations section) and plant under existing canopy. This will allow native trees to reach canopy as existing canopy trees die-off in the distant future

Villa Park

Villa Park is approximately 41 acres and is located at Cohansey Boulevard and Crescent Lane. Set back amidst winding roads and rolling landscape just northwest of McCarron's Lake. Villa Park includes forest, grassland and marshland.

The wetlands in Villa Park are concentrated in the northwest-southeast trending valley that heads toward McCarron's Lake. These wetlands have been modified to reduce flooding and for other purposes in the past. The upland areas are largely dominated by lowland hardwood forest species that have colonized formerly open upland areas in the last 30 to 50 years. Upland and wetland communities here tend to be in moderate condition, and may require more intense management than some other city parks to realize substantial improvement.

Recreationally, Villa Park includes approximately one mile of paved pathway crossing wooded bridges through forests. Villa Park is the fifth largest park in Roseville. In addition to its the rural feeling, Villa Park offers Roseville residents a variety of recreational amenities including a ballfield, two play areas, a hockey rink, basketball court, and a small picnic shelters well as a bocce ball court in the western portion of the park near the B-Dale club.

ROSEVILLE

City of Roseville
Natural Resources Inventory

Villa Park

Figure 6.9

Legend

- **Park Boundary**
- **Wetlands**
- **Upland Communities**

Community ID	Community Type
VL-U-1	Floodplain Forest
VL-U-1	Floodplain Forest
VL-U-1	Floodplain Forest
VL-U-2	Old Field
VL-U-3	Lowland Hardwood
VL-P3	Storm Pond
VL-P7	Storm Pond
VL-W1	Shallow Marsh
VL-W1	Lowland Hardwood
VL-W2	Other
VL-W2	Wet Meadow
VL-W4	Shallow Open Water
VL-W4	Shallow Marsh
VL-W4	Shallow Open Water
VL-W5	Shallow Open Water
VL-W5	Shallow OPen Water
VL-W5	Shallow Marsh
VL-W6	Deep Marsh
VL-W8	Wet Meadow

N

0 400 Feet

February, 2002

Bonestroo Rosene Anderlik & Associates
Engineers & Architects

425\42501106\Cad\gis\mlccs\mlccs.apr

Upland Natural Community Descriptions and Management Recommendations

The majority of upland areas in Villa Park are mostly dominated by lowland hardwood forest trees that have colonized upland sites. Prior to the arrival of these lowland trees, the hillsides here appear to have been more open, with a few scattered groves of bur and pin oak. A few savanna and prairie species linger on the south side of the park, along an old fenceline in an open area. These are a reminder of the former openness of the park. Overall, the upland areas in Villa Park have potential to improve with active management, but may require a concerted, long-term effort.

Community VL-U1
Floodplain Forest
Qualitative Rank: D
Nonnative Shrub Rank: 14

This community is at the north end of the park on either side of a ponding area. It appears to be an area that was formerly more open and has been colonized by trees most commonly found in floodplain areas. The current canopy cover varies from about 75 percent to full closure. The most common trees here are cottonwood and boxelder that average about 18 and 10 inches, respectively. Other trees found here less often include American elm, quaking aspen, silver maple, green ash, black walnut, and a small planting of black locust.

The shrub layer varies from moderately thick to dense and includes a mix of young canopy trees, native and nonnative shrubs. The most common natives found in the shrub layer include green ash, boxelder, and black cherry saplings, as well as red-berried elder, red osier dogwood, and gooseberry. The nonnatives found here include European and glossy buckthorn, which are the most common shrubs, as well as Tartarian honeysuckle.

The ground layer includes an assemblage of natives and nonnatives, with most species being common in disturbed habitats. Natives species in the ground layer include white avens, Canada goldenrod, yellow wood sorrel, white snakeroot, clearweed, Virginia stickseed, and pale tough-

me-not in the lowest areas. Nonnatives encountered in this forest include poison nightshade, motherwort, catnip, motherwort, burdock, and stinging nettle. Also found here, along the edge of a trail intersection on the northeast side of the park was garlic mustard. Although the forests in the immediate area are only of moderate quality, garlic mustard has the potential to quickly expand its range within the park and beyond. It is known to displace native species by forming large single-species populations and outcompeting native species for available space.

During the fiend inventory for this park, a pair of broad-winged hawks was seen in this community and perhaps may be using the park for nesting. The prevalence of nonnative species, erosion on the northwest side, and other disturbances combine to cause a lowered rank for this community.

Community	Activity	Priority	Estimated Cost	Comments
VL-U1	Treat garlic mustard	High	$300-800 per year for up to 10 years	Treat basal rosettes with Roundup, or other herbicide in fall, treat a minimum of once every two years
VL-U1	Cut Buckthorn and other nonnative shrubs	Medium	$1,000 per acre	Cut and treat all stumps with 25-50% solution of Roundup or Garlon. Stack brush away from tree crowns and burn in winter.
VL-U1	Plant native tree and shrub seedlings	Medium	$500-2,000 per acre	Plant shade tolerant native hardwood trees that will one day replace the pioneer softwood trees currently dominating canopy. Suggested species listed in general management recommendations section of report
VL-U1	Reintroduce appropriate native species	Medium	$500 – 5,000+ depending on number of species, plants, seed.	Reintroduce appropriate native plant materials through planting of plugs or seed, particularly where bare ground is left from brush clearing. Along with burning, will be an important step in long-term control of buckthorn and nonnative shrubs.

Community VL-U2
Old Field
Qualitative Rank: NA
Nonnative Shrub Rank: 7

This area is classified as an old field, although it appears that its former use was as a pasture rather than as a crop field. It has approximately 15-25 percent brush and small tree cover. Some of which is native and some of which were planted. The most common native small trees and shrubs here include quaking aspen, red osier dogwood, New Jersey tea, bur and pin oak, and smooth sumac. The nonnatives planted around the site include caragana, Russian olive, various spruce and pine trees, and Amur maple. Other nonnatives that arrived at the site on their own include Siberian elm and European buckthorn.

The most common ground layer species are nonnative pasture grasses, including Kentucky bluegrass and smooth brome. Other nonnative grasses and forbs found in this community include yellow and white sweet clover, goatsbeard, red clover, birdfoot trefoil, and Canada thistle. The native grasses and flowers on the site include those that tend to be tolerant of disturbance. These include stiff goldenrod, yarrow, side-flowering aster, wild lettuce, Canada goldenrod, common milkweed, Virginia creeper, and hedge bindweed. Although this community contains some species normally found in prairies and savannas, past overuse for agriculture caused a dramatic shift away from any recognized native plant community type.

The management recommendations listed below assume that this area will be managed toward a native forest with an emphasis in planting appropriate native species. If a decision is made to manage this area for its open character (grassland), clearing of nonnative trees, grass, and shrubs should be conducted with prescribed burning and supplemental seeding of appropriate grasses and flowers. Maintaining the area as a grassland would be a more costly and maintenance-intensive path to choose for this area than planting native trees and shrubs. This path was chosen because the area has few native prairie and savanna species remaining.

Community	Activity	Priority	Estimated Cost	Comments
VL-2	Plant native tree and shrub seedlings	Medium	$500-2,000 per acre	Plant native hardwood trees (primarily bur and pin oak). Additional species listed in general management recommendations section of report and appendix
VL-U2	Cut nonnative shrubs and trees	Medium-low	$1,000	Cut and treat all stumps with 25-50% solution of Roundup or Garlon.
VL-U2	Reintroduce native ground cover species	Low	$500 – 5,000+ depending on number of species, plants, seed.	Reintroduce appropriate local origin plant materials through planting of plugs or seed. This can be done 10-30 years after native tree planting as canopy closure begins. See appendix for spp. list

Community VL-U3
Lowland Hardwood Forest
Qualitative Rank: CD
Nonnative Shrub Rank: 16

This community occurs on a generally northeast-facing slope adjacent to VL-U-2. This formerly open area was likely a pasture with widely scattered bur and pin oak in the first half of the 1900's. It is now a nearly closed forest composed of trees typical of lowland areas that are capable of establishing quickly. The most common of these include quaking aspen, cottonwood, boxelder and American elm. Most of these pioneer trees average between 10 and 18 inches in diameter. The pin and bur oaks that remain here are concentrated on the higher elevations near the south end. Most of these oaks have open-grown form and exceed 24 inches in diameter.

The shrub layer varies from moderately thick to nearly impenetrable in some places. It is largely dominated by nonnatives. These include European and glossy buckthorn, Tartarian honeysuckle, and only rarely white mulberry. The most common native members of the shrub layer are boxelder seedlings, as well as prickly gooseberry, red-berried elder, red osier dogwood, and black raspberry.

The ground layer here reflects past disturbance with a mix of nonnatives and natives that are generally capable of weathering disturbances. Nonnatives found here include creeping Charlie, deadly nightshade, motherwort, and burdock. Natives found here that are more typical of a woodland setting include lady fern, Pennsylvania sedge, enchanter's nightshade, wild geranium, and heart-leaved aster.

Overall, this forest is in moderately poor condition due to past disturbance by agriculture and the more recent transition to a forested setting, as well as erosion along some informal trails. Despite this, it has the potential to improve in quality in coming decades on its own, a process that could be expedited with active management.

Community	Activity	Priority	Estimated Cost	Comments
VL-U3	Cut Buckthorn and other nonnative shrubs	Medium-high	$1,000 per acre	Cut and treat all stumps with 25-50% solution of Roundup or Garlon. Stack brush away from tree crowns and burn in winter.
VL-U3	Plant native tree and shrub seedlings	Medium-high	$500-2,000 per acre	Plant shade tolerant native hardwood tree seedlings that will one day replace the pioneer softwood trees currently dominating canopy. Suggested species listed in general management recommendations section of report
VL-U-3	Reintroduce appropriate native species	Medium	$500 – 5,000+ depending on number of species, plants, seed.	Reintroduce appropriate local origin plant materials through planting of plugs or seed. This is particularly important where there is a lot of bare ground.

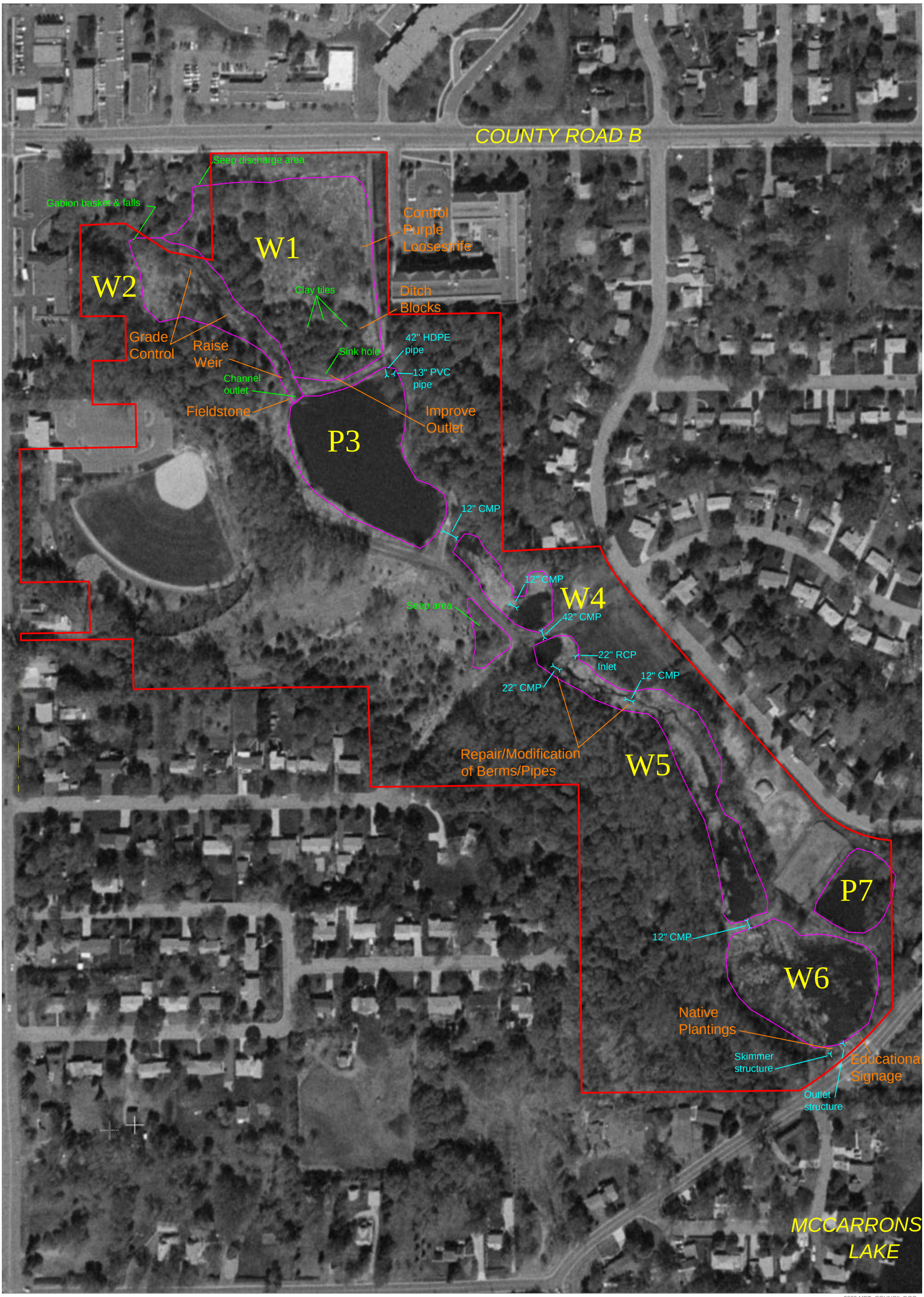
Wetland Natural Community Descriptions and Management Recommendations

A groundwater discharge area in the north part of the park has a significant influence these wetlands. Historically W1, which has the discharge area, was tiled and the tiles can still be seen today. The current system of wetlands follows a historic swale that once drained the northern area towards the south into McCarron's Lake. Hydrology also comes from stormwater inlets into W2 and W3. Purple loosestrife has not established a major population in the park yet. Locations of the improvements discussed in the following paragraphs are shown in figure 6.10

Community VL-W1
Shallow Marsh/Lowland Hardwood Forest
Qualitative Rank: Medium
Area: 3.4 acres

This basin receives hydrology from a groundwater discharge point near the edge of a yard in the northwestern portion of the park. At least two ditches provide drainage to this groundwater fed wetland. One of the ditches along the southern end of the wetland has ceramic tiles discharging into the ditch. The subsurface ceramic tiles appear to extend into the wetland from the northeast to the southeast. Three tiles were field located. Tiles are old ceramic tile and do not function as well as they use to as is apparent from the development of obligate wetland vegetation upstream of the tile. There was however flows coming from the tiles found. The ditch flows into a sinkhole (likely tile outlet) that flows into W3 under the trail. Ditch blocks would eliminate effectiveness of tile by inundation. The ditch blocks would also serve to reduce the scope and effect of the ditch on the adjacent wetland. The outlet of this ditch will likely need to be improved at some point. A riser could be placed on the outlet and a flexible, solid drain tile could be potentially installed within the existing tile to allow flows to reach the lake without further erosion and potential threat of the trail.

The northeastern portion of the wetland is dominated by a sloping marsh and shrub-carr containing elder, black willow, red-osier dogwood, cattail, and reed canary grass. There are a few individual plants of purple loosestrife along the edge of the wetland near the trail from Co. Rd. B. Along the western portion of the wetland a ditch has been created coming from the discharge area and flowing south and meeting up with the channel of W2. Along the ditch and



2000 MET. COUNCIL DOQ

VILLA PARK

FIGURE 6.10

LEGEND:

Management Recomendations
Existing Structures
Existing Features

N
W
E
S

0 100 200
Scale in feet

Bonestroo
Rosene
Anderlik &
Associates
Engineers & Architects

FEBRUARY 2002 K:\425\42501106\Cad\Dwg\DOQ3.dwg

into the southern portion of the wetland cottonwood, boxelder, and aspen are the dominant vegetation.

Community	Activity	Priority	Estimated Cost	Comments
VL-W1	Ditch blocks near tiles to restore hydrology	High	$1000.00	Used in conjunction with new outlet, will provide restored hydrology while preventing flooding to home and damage to trail.
VL-W1	Place riser and flexible drain tile to improve outlet structure	High	$1,000.00	May help to protect trail and will prevent erosion occurring at historic tile line.
VL-W1	Control of purple loosestrife	Medium	$200.00	Hand pulling or spot herbicide treating at this time.

Community VL-W2
Wet Meadow
Qualitative Rank: Medium/Low
Area: 1.0 acre

This wetland is associated with a stream channel that starts in the northwest portion of the park and flows into storm pond W3. The stream channel has severe down cutting, sedimentation, and permanent flows. During storm events the channel spills out into the surrounding wet meadow. The meadow is dominated by reed canary grass. Further from the channel are nettle, touch-me-not, red-osier dogwood, cottonwood, boxelder, willow, and buckthorn.

Down cutting of channels through wetland has artificially drained a portion of the direct basin and the adjacent wetland. Check dams to reduce down cutting have been installed at the downstream end at the bridge using metal honeycomb structure and the very upstream end using a gabion basket.

Community	Activity	Priority	Estimated Cost	Comments
VL-W2	Install up to two grade control structures or utilize other techniques to reduce down cutting and remove scope and affect of ditch.	High	$22,500.00	Needed to control down cutting and flow rates in channel to eliminate erosion and allow build up of sediment to restore wetland.
VL-W2	Raise weir under bridge	Medium	$500.00	Restore hydrology
VL-W2	Place fieldstone at outlet to cover up honeycomb structure	Low		Aesthetic

Community VL-W4
Shallow Marsh/Shallow Open Water
Qualitative Rank: Medium
Area: 0.5 acres

A 12-inch RCP enters this basin from the storm pond to the north. There is also a riprap swale under the footbridge on the north end of the basin. The north end of the basin is shallow open water. The center of the wetland is a cattail marsh. A 12-inch RCP through a reed canary grass berm separates these areas from the open water dominated by white water lily in the south portion of the basin. The outlet is through a 42-inch CMP under the paved trail to basin W5 to the south.

Community VL-W5
Shallow Marsh/Shallow Open Water
Qualitative Rank: High/Medium
Area: 1.4 acres

This basin is a long open water channel that follows the trail to the east. Most of the central channel is open water with fringes of reed canary grass and cattail. There are pockets of arrowhead, river bulrush, and lake-bank sedge. Sandbar willow, silver maple, boxelder, and large cottonwoods dominate the edges. A larger berm separates the basin from W6 to the south. The small 12-inch CMP outlet creates an open water area behind it that is dominated by white water

lily. The diversity of wetland communities enhance the habitat values of this linear wetland basin and likely the aesthetics of the basin for the users of the trail.

The basin is separated twice by low berms that create deep marsh communities. The north area has an inlet from W4 and a 22-inch RCP from the street to the east. The berm creates a shallow open water area dominated by white water lily and duckweed. A 22-inch CMP outlet through the berm controls the water level in the basin. Another berm with a 12-inch CMP is located further downstream. This pipe appears to be in disrepair and allows flows to over top the berm resulting in erosion lowering the outlet elevation of the basin. Restoration would involve restoring the berm and replacing the pipe. Appropriate elevations of the pipe will need to be determined at the time of the design.

Community	Activity	Priority	Estimated Cost	Comments
VL-W5	Repair/modification of berms and pipes	Medium	$3,000.00	Restoration of the berm and replacement of the pipe is necessary to prevent further reductions and restore the hydrology of this basin.

Community VL-W6
Deep Marsh
Qualitative Rank: High
Area: 1.7 acres
This is a deep marsh at the south end of the park. This wetland receives water form all of the other basins in the park and outlets to McCarron's Lake under the road to the south. There is a primary drop structure outlet under the overlook and an overflow skimmer to the west. The dominant vegetation is cattail, duckweed, and white water lily. Reed canary grass and sandbar willow are around the shoreline.

Community VL-W8
Wet Meadow
Qualitative Rank: Low
Area: 0.2 acres
This is a small seep area dominated by reed canary grass and sand bar willow.

Villa Park Management Recommendation Summary Table

Community	Activity	Priority	Estimated Cost	Comments
VL-U1	Treat garlic mustard	High	$300-800 per year for up to 10 years	Treat basal rosettes with Roundup, or other herbicide in fall, treat a minimum of once every two years
VL-W1	Ditch blocks near tiles to restore hydrology	High	$1000.00	Used in conjunction with new outlet, will provide restored hydrology while preventing flooding to home and damage to trail.
VL-W1	Place riser and flexible drain tile to improve outlet structure	High	$1,000.00	May help to protect trail and will prevent erosion occurring at historic tile line.
VL-W2	Install up to 2 grade control structures or utilize other techniques to reduce down cutting and disable ditch.	High	$22,500.00	Needed to control down cutting and flow rates in channel to eliminate erosion and allow build up of sediment to restore wetland.
VL-W5	Repair/modification of berms and pipes	Medium	$3,000.00	Restoration of the berm and replacement of the pipe is necessary to prevent further reductions and restore the hydrology of this basin.
VL-U2	Plant native tree and shrub seedlings	Medium	$500-2,000 per acre	Plant native hardwood trees (primarily bur and pin oak). Additional species listed in general management recommendations section of report
VL-U1	Reintroduce appropriate native species	Medium	$500 – 5,000+ depending on no. of species, plants, seed.	Reintroduce native plant materials through planting of plugs or seed. This is particularly important where there is a lot of bare ground.
VL-U2	Cut nonnative shrubs and trees	Medium-low	$1,000	Cut and treat all stumps with 25-50% solution of Roundup or Garlon.
VL-W2	Place fieldstone at outlet to cover up honeycomb structure	Low		Aesthetic
VL-U2	Reintroduce native ground cover species	Low	$500 – 5,000+ depending on number of species, plants, seed.	Reintroduce appropriate local origin plant materials through planting of plugs or seed. This can be done 10-30 years after native tree planting as canopy closure begins

7. STORM POND INVENTORY METHODOLOGY AND RESULTS

This section contains the Methodology utilized for Inventory of storm ponds in the Roseville Natural Resource Management.

EVALUATION OF STORM POND SITES

Preliminary Assessment

Data from the National Wetland Inventory (NWI) map was used for preliminary determination of wetland site locations in the study area. Black and white aerial photos were used to identify open water basins as potential storm ponds.

Field Assessment

Storm ponds were differentiated from wetlands primarily by the functionality of the basin. For the purpose of this field assessment, storm ponds are considered to be excavated areas either in uplands or historic wetlands that function to hold storm water runoff form streets and parking lots. In the parks of Roseville these storm ponds typically had steeply sloped sides with little to no emergent plant communities.

Sizes, types, and number of inlet and outlet structures where recorded for each pond. Obstructions, condition, and sedimentation where noted as well. Water quality, aesthetics and wildlife habitat was based on the following observances:

Evidence of dumping

High: No dumping evidence.

Medium: Decaying organic materials such as leaves and grass clipping that enter a water body can contaminate an aquatic system. Excessive organic material accumulating in a water body can cause increased phosphorus levels resulting in algal blooms.

Low: Evidence of construction or hazardous wastes such as paints and solvents are obvious contaminants.

Water color

High: Clear.

Medium: Faint brown or faint green.

Low: Bright green or dark brown. This can be due to amount of nutrients and suspended solids in a water body. Bright green water is the result of an increased level of nutrients within the system. Nutrients can be contributed by decaying organic material or excessive fertilizer use. Algae grow rapidly in a nutrient rich environment and green colored water is a result. Brown water, on the other hand, is the result of sediments being carried to the waterbody. Sediments can originate from eroding uplands and from excessive roadway sand.

Evidence of algal blooms

As previously discussed, algae grows rapidly in nutrient-rich aquatic environments. When algae decay in water, oxygen is consumed. This can be dangerous for aquatic organisms.

High: No algal colonies (0-25% cover)

Medium: Few colonies (25-75% cover)

Low: Dense algal colonies (75-100%)

Evidence of macrophytes (emergent or submerged pond vegetation)

Macrophytes improve pond-settling efficiency and utilize dissolved nutrients. They also provide cover for zooplankton that can help keep the algae population down.

High: Dense macrophytes (75-100% coverage)

Medium: Moderate (25-75% coverage)

Low: No macrophytes (0-25% coverage).

Evidence of amphibians and reptiles

Amphibians use water bodies for breeding, maturation, and over wintering. These organisms are extremely dependent on good water quality and their populations can be severely affected by toxins. Reptiles such as turtles rely on both a quality wetland for food foraging and hibernation and upland areas for laying eggs. Snakes will often be found in areas adjacent to wetlands that support amphibian life forms.

High: Number of individuals (3 or more)

Medium: (1-2)

Low: (0-1)

Evidence of Birds

Many types of birds can be found within and adjacent to wetlands. The reason for this is because of the abundance of food available and the nesting cover provided by wetland plants. A good diversity of bird species is supported by a diverse array of food and cover found and provides for better recreational bird watching opportunities.

High: Number of species (3 or more).

Medium: (2-3)

Low: (0-1)

Evidence of non-domestic mammals

Mammals, especially larger ones, need ample adjacent upland areas to search for food and raise their young. Aquatic systems that do not have mammalian life forms using them may have little to offer for food or cover or they may be isolated from other supportive systems.

High: Number of species (3 or more).

Medium: (2-3)

Low: (0-1)

Insects

High: Insects such as dragonflies, damselflies, mayflies and water bugs are found in higher value ponds. These insects are dependent on having aquatic and emergent vegetation for breeding and protection. They also provide food for small mammals, reptiles and amphibians, and birds.

Medium: These ponds provide habitat for a lower diversity of insects. Less desirable insects including mosquitoes and flies are found here.

Low: These ponds contain no signs of insects.

Storm Pond Qualitative Ranking

After field evaluation of each storm pond site, the next step was to assign a qualitative rank for each pond. The rank uses a Functional Value Index (FVI) based on the eight aesthetic criteria of High, Medium, or Low in each category. The eight criteria where evaluated separately and then the average was used to determine the ponds overall ranking. In general terms, the higher the ranking the healthier the pond is for water quality treatment, aesthetic viewing, and wildlife habitat.

STORM POND DESCRIPTIONS

Central Park

For a map of storm ponds within Central Park, please refer to Figure 6.4 in the previous section.

Community CP-P6
Storm Pond
Qualitative Rank: Medium
Area: 1.4 acres

This pond is located at the southeastern outlet of Bennett Lake. It receives water from the lake through a metal spillway. Other sources of hydrology inputs are from surface drainage of the parking lot and a 42-inch RCP stormwater inlet on the southwest corner of the pond. A 24-inch RCP acts as the outlet for the pond and extends east eventually draining into a roadside ditch, then into W4.

The pond has steep sloped banks with little emergent vegetation. A narrow fringe of cottonwood, willow, and aspen exist on the western edge. Some emergents on the south edge include: soft stem bulrush, spike rush, reed canary grass, and smartweed. The pond is visible from trails on all sides and the bridge over the channel from Bennett Lake.

The water had a dark green appearance and about 25-percent filamentous (floating) algal colonies. Low submerged vegetation was observed. Ducks, geese, and redwing blackbirds where observed using the pond. This could be due to the high presence of water bugs.

The National Wetland Inventory map indicates this basin was a shallow marsh with open pockets of water that at one time extended to Victoria Street to the east and near the houses to the south. A turf area along the east side of this basin historically was a shallow marsh. This area does not appear to be actively utilized and due to its elevation near the pond normal water level it would be relatively easy to restore to a shallow marsh with excavation or a wet meadow with seeding.

If excavation were proposed special consideration would need to be made for the storm pipe at a shallow elevation that extends to the east. This is the primary outlet for Lake Bennett that eventually flows into W4.

A defined channel has eroded a small 2-foot wide trench that extends from discharge at the parking lot to the storm pond. The pipe could remain, but turf should be replaced with a vegetated swale to minimize erosion. Human caused erosion is also happening on the northeast slope of the pond. This should be fixed to reduce sediment in the pond and increase safety.

This pond is located at a major trailhead and could offer some educational signage opportunities.

Management Recommendations:

Community	Activity	Priority	Estimated Cost	Comments
CP-P6	Restore adjacent wetland	High	$30,000	Restoration of this basin would involve excavation to the original soils along with planting and seeding. Due to its location at a major trailhead it could offer significant education opportunities.
CP-P6	Control erosion on north bank	Medium	$ 1,000	High traffic along slopes caused erosion. Create an access point with steps or woodchips to limit public use of adjacent slopes. Restore and re-vegetate adjacent slopes.
CP-P6	Educational Signage	Medium	$ 500-$1,000	A sign at this location could describe the wetland restoration and describe general wetland ecology.

Langton Lake

For a map of storm ponds within Central Park, please refer to Figure 6.6 in the previous section.

Community LL-P3
Storm Pond
Qualitative Rank: High
Area: 0.9 acres

This pond is located near the southeastern edge of Langton Lake. A 42-inch RCP and a 24-inch RCP, both on the south end of the pond, provide stormwater inputs. The large parking lot to the east contributes surface runoff to the pond. The outlet for the pond is through a 12-inch RCP with a wood weir, near the northwest end of the pond. Over the outlet pipe is a riprap spillway.

The pond has steep sloped banks but does have a narrow band of emergent vegetation. Some emergents on the edge include: river bulrush, soft stem bulrush, arrowhead, and cattail. There were also macrophytes such as coontail and duckweed. A border of sandbar willow, vervain, and swamp milkweed forms a buffer along the edge. The pond is visible from the boardwalk, walking path, and nearby businesses.

The water was relatively clear and only had a faint brown color. The clarity could be attributed to the fact it had not rained for four weeks prior to the field visit. Redwing blackbird, great blue heron, catbird, and other song birds where observed using the pond. The pond supports a good diversity of other animal life also. Small fish, frogs, aquatic insects (dragonflies, damselflies, pond skimmers), and deer and raccoon tracks where all observed. The diversity is probably due to the proximity to the lake and woods of the park.

The National Wetland Inventory map indicates this basin was excavated in an upland area. The pond appears to be functioning well for stormwater treatment and retention and providing habitat.

Reservoir Woods

For a map of storm ponds within Central Park, please refer to Figure 6.8 in the previous section.

Community RW-P3
Storm Pond
Qualitative Rank: Medium
Area: 0.8 acres (2.3 total)

This pond is located at the northeastern corner of the park west of Dale Street. The pond is visible from Alameda Street. The only source of hydrology inputs appears to be from street stormwater to the west. A concrete control structure on the east side acts as the only outlet. At the time of the field visit the water level was 1-inch below the lip of the structure. The structure was also partially blocked with debris.

The pond has very steep sloped banks with the upland forest growing to the edge. The pond has low visibility from the park or other public areas.

The water had a dark green appearance and only a small amount of duckweed. No emergent or submerged vegetation was observed. Possibly due to the pond's secluded location, cormorant, blue-wing teal, and wood duck were observed.

This storm pond has been excavated from a wetland and has increased in depth and storage volume.

Villa Park

For a map of storm ponds within Central Park, please refer to Figure 6.10 in the previous section.

Community VL-P3
Storm Pond
Qualitative Rank: Medium
Area: 2.0 acres

This pond is located south of W1 and W2. Two sources of hydrology constantly flow into the pond. Surface flow from a stream channel (W2) from the north flows into the pond on the

northwest side under the footbridge. Groundwater discharges from W1, flows into a sinkhole, then under the trail and enters under the edge of the pond. A 42-inch corrugated plastic pipe conveys stormwater from County Road B to the northeast side of the pond. A 12-inch PVC pipe also enters near the same place. On the west side a 46 x 35-inch RCP flows into a ditch under another footbridge.

The primary outlet is a 36 x 48-inch box skimmer that drops into a 12-inch CMP that goes under the trail on the south side. A riprap (gabion?) overflow is just to the east of the skimmer under a footbridge.

A sedimentation delta has formed at the large 42-inch inlet. The water had a dark green appearance, 25-percent covered with filamentous algae, and 30-percent covered by duckweed. Little emergent or submerged vegetation was observed. A steep, narrow vegetated fringe exists between the trail and the edge of the pond. Vegetation includes: reed canary grass, sandbar willow, bur dock, nettle, cottonwood, common and marsh milkweed, Canada thistle, Campion, and bulrush.

Many small fish and insects were observed. This abundance attracted such bird species as belted kingfisher, great blue heron, great egret, mallard, and green heron.

This storm pond has been excavated from a wetland and has increased in depth and storage volume.

Management Recommendations:

Community	Activity	Priority	Estimated Cost	Comments
VL-P3	Remove sediment delta at 42-inch inlet.	Medium	$1,000 - $8,000	Removing sediment delta will help preserve water quality functioning of pond.

Community VL-P7
Storm Pond
Qualitative Rank: Medium
Area: 0.5 acres

This pond is located east of W6 and south of the hockey rink. The primary inlet is a 27-inch RCP, which conveys stormwater from Cohansey Boulevard. The grate on the flared end is damaged and filled with debris and trash. There is moderate sedimentation near the inlet. The pond appears to outlet over a low berm into W6 to the southwest.

The pond has steep dirt banks with little emergent vegetation. At the time of the field visit, wood chips from a lot clearing to the east had encroached into the edge of the pond. The surface of the pond was completely coved with duckweed. This allowed for little observance of water color or other pondweeds.

The edge of the pond is a dense coverage of sandbar willow and silver maple. There was evidence that raccoon and woodchuck use the fringe area of the pond. The water is stagnant and the dense tree cover makes the air still, thus providing for an abundance of mosquitoes.

Management Recommendations:

Community	Activity	Priority	Estimated Cost	Comments
VL-P7	Replace damaged grate at inlet and remove debris. Provide appropriate gap at bottom.	Medium	$600.00 (material cost only)	Debris build-up in the grate allows water to back up in the pipe and creates conditions were sediments drop out in the pipe rather than the pond. An appropriate gap (3-4”) between the grate and pipe invert will limit debris build-up.

APPENDIX A

Modeling Data/Lake Survey Results//Lake Inventory Information

Table 1 – Water Quality Data for Langton Lake

DATE	SECCHI	Chlorophyll a	Total Nitrogen (TN)	Total Kjehdahl Nitrogen (TkjN)	Total Phosphorous (TP)	Soluble Reactive Phosphorous (SRP)	Total Suspended Solids (TSS)	Total Volatile Solida (TVS)	TN/TP
	meters	ug/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	
6/7/2001	3.00	32	0.81		0.07	0.01	3.00	48.00	12.46
7/17/2001	2.00	19	1.6	1.6	0.11	nd	8.20	nd	14.55
8/23/2001	2.50	23	1.2	1.2	0.07	nd	9.70	5.20	18.46
Mean	**2.50**	**24.67**	**1.20**	**1.40**	**0.08**	**0.01**	**6.97**	**26.60**	**15.16**
Min	**2.00**	**19.00**	**0.81**	**1.20**	**0.07**	**0.01**	**3.00**	**5.20**	
Max	**3**	**32**	**1.6**	**1.6**	**0.11**	**0.01**	**9.70**	**48.00**	

Table 2 – Water Quality Data for Bennett Lake

DATE	SECCHI	Chlorophyll a	Total Phosphorous (TP)	Soluble Reactive Phosphorous (SRP)
	(meters)	(ug/l)	(mg/l)	(mg/l)
7-May-01		34.36	0.08	0.01
29-May-01	1.90	63.51	0.08	0.04
15-Jun-01	1.40	16.74	0.10	0.02
5-Jul-01	0.80	33.48	0.15	0.06
26-Jul-01	0.70	54.01	0.23	0.04
15-Aug-01	0.70	37.99	0.25	0.02
6-Sep-01	1.00	17.32	0.12	0.04
27-Sep-01	1.30	23.35	0.09	0.03
Growing Season Overall Mean	**1.11**	**35.20**	**0.14**	**0.03**
Min	**0.70**	**16.74**	**0.08**	**0.02**
Max	**1.90**	**63.51**	**0.25**	**0.06**

Source: Ramsey County

TABLE 3 - PHOSPHORUS LOADING RATES FOR STUDY AREA (EXISTING AND ULTIMATE LAND USE/COVER)

Land Use/Cover	Density (Units/ac.)	Impervious Fraction	Runoff (TP) (ug/l)	Dissolved/Total Phosphorus Fraction	Runoff Coefficient	Loading Rate (lbs./ac./yr.)[1]
Woodlands	N/A	N/A	200	.6	.08	.1
Non-ponded wetland	N/A	N/A	200	.6	.08	.1
Undeveloped open land[2]	N/A	N/A	400	.6	.15	.4
Agricultural cropland	N/A	N/A	650	.2	.24	1.0
Golf course	N/A	<5%	550	.7	.12	.4
LA-Rural	1 unit/20 ac.	<5%	300	.5	.11	.2
LA-1	3 units/ac.	30%	450	.3	.21	.6
LA-2	6 units/ac.	52%	450	.3	.35	1.0
LA-3	12 units/ac.	70%	500	.3	.61	2.0
LA-4	20 units/ac. (stacked)	75%	500	.3	.68	2.2
Commercial	N/A	75%	600	.3	.68	2.6
Industrial	N/A	68%	600	.3	.55	2.1

[1]Based on annual precipitation of 28.3 inches
[2]Values for parks/open space and grass hay equivalent to those for undeveloped open land

Table 5 - Results for Langton Lake from the Wisconsin Lake Model Spreadsheet (WiLMS) model

Phosphorus Prediction and Uncertainty Analysis Module
Date: 1/10/2002 Scenario: 78
Observed spring overturn total phosphorus (SPO): 0.0 mg/m^3
Observed growing season mean phosphorus (GSM): 80.0 mg/m^3
Back calculation for SPO total phosphorus: 0.0 mg/m^3
Back calculation GSM phosphorus: 0.0 mg/m^3
% Confidence Range: 70%
Nurenberg Model Input - Est. Gross Int. Loading: 0 kg

Lake Phosphorus Model	Low Total P (mg/m^3)	Most Likely Total P (mg/m^3)	High Total P (mg/m^3)	Predicted -Observed (mg/m^3)	% Dif.
Walker, 1987 Reservoir	N/A	N/A	N/A	N/A	N/A
Canfield-Bachmann, 1981 Natural Lake	N/A	N/A	N/A	N/A	N/A
Canfield-Bachmann, 1981 Artificial Lake	N/A	N/A	N/A	N/A	N/A
Rechow, 1979 General	66	74	86	-6	-8
Rechow, 1977 Anoxic	307	346	402	266	333
Rechow, 1977 water load<50m/year	221	249	290	169	211
Rechow, 1977 water load>50m/year	N/A	N/A	N/A	N/A	N/A
Walker, 1977 General	N/A	N/A	N/A	N/A	N/A
Vollenweider, 1982 Combined OECD	134	148	167	108	270
Dillon-Rigler-Kirchner	N/A	N/A	N/A	N/A	N/A
Vollenweider, 1982 Shallow Lake/Res.	122	136	155	96	240
Larsen-Mercier, 1976	N/A	N/A	N/A	N/A	N/A
Nurnberg, 1984 Oxic	100	113	131	33	41

Lake Phosphorus Model	Confidence Lower Bound	Confidence Upper Bound	Parameter Fit?	Back Calculation (kg/year)	Model Type
Walker, 1987 Reservoir	N/A	N/A	N/A	N/A	N/A
Canfield-Bachmann, 1981 Natural Lake	N/A	N/A	N/A	N/A	N/A
Canfield-Bachmann, 1981 Artificial Lake	N/A	N/A	N/A	N/A	N/A
Rechow, 1979 General	50	106	FIT	0	GSM
Rechow, 1977 Anoxic	252	466	FIT	0	GSM
Rechow, 1977 water load<50m/year	172	351	P Pin	0	GSM
Rechow, 1977 water load>50m/year	N/A	N/A	N/A	N/A	N/A
Walker, 1977 General	N/A	N/A	N/A	N/A	N/A
Vollenweider, 1982 Combined OECD	83	249	FIT	0	ANN
Dillon-Rigler-Kirchner	N/A	N/A	N/A	N/A	N/A
Vollenweider, 1982 Shallow Lake/Res.	78	225	FIT	0	ANN
Larsen-Mercier, 1976	N/A	N/A	N/A	N/A	N/A
Nurnberg, 1984 Oxic	71	173	P	0	ANN

Table 6 - Results for Bennett Lake from the (Wisconsin Lake Model Spreadsheet) WiLMS model

Phosphorus Prediction and Uncertainty Analysis Module
Date: 1/10/2002 Scenario: 69
Observed spring overturn total phosphorus (SPO): 0.0 mg/m^3
Observed growing season mean phosphorus (GSM): 140.0 mg/m^3
Back calculation for SPO total phosphorus: 0.0 mg/m^3
Back calculation GSM phosphorus: 0.0 mg/m^3
% Confidence Range: 70%
Nurenberg Model Input - Est. Gross Int. Loading: 0 kg

Lake Phosphorus Model	Low Total P (mg/m^3)	Most Likely Total P (mg/m^3)	High Total P (mg/m^3)	Predicted -Observed (mg/m^3)	% Dif.
Walker, 1987 Reservoir	N/A	N/A	N/A	N/A	N/A
Canfield-Bachmann, 1981 Natural Lake	N/A	N/A	N/A	N/A	N/A
Canfield-Bachmann, 1981 Artificial Lake	N/A	N/A	N/A	N/A	N/A
Rechow, 1979 General	100	111	126	-29	-21
Rechow, 1977 Anoxic	227	254	287	114	81
Rechow, 1977 water load<50m/year	182	203	229	63	45
Rechow, 1977 water load>50m/year	N/A	N/A	N/A	N/A	N/A
Walker, 1977 General	N/A	N/A	N/A	N/A	N/A
Vollenweider, 1982 Combined OECD	112	122	135	52	74
Dillon-Rigler-Kirchner	N/A	N/A	N/A	N/A	N/A
Vollenweider, 1982 Shallow Lake/Res.	100	111	123	41	59
Larsen-Mercier, 1976	N/A	N/A	N/A	N/A	N/A
Nurnberg, 1984 Oxic	112	125	141	-15	-11

Lake Phosphorus Model	Confidence Lower Bound	Confidence Upper Bound	Parameter Fit?	Back Calculation (kg/year)	Model Type
Walker, 1987 Reservoir	N/A	N/A	N/A	N/A	N/A
Canfield-Bachmann, 1981 Natural Lake	N/A	N/A	N/A	N/A	N/A
Canfield-Bachmann, 1981 Artificial Lake	N/A	N/A	N/A	N/A	N/A
Rechow, 1979 General	76	158	FIT	0	GSM
Rechow, 1977 Anoxic	186	341	FIT	0	GSM
Rechow, 1977 water load<50m/year	141	285	P	0	GSM
Rechow, 1977 water load>50m/year	N/A	N/A	N/A	N/A	N/A
Walker, 1977 General	N/A	N/A	N/A	N/A	N/A
Vollenweider, 1982 Combined OECD	69	205	FIT	0	ANN
Dillon-Rigler-Kirchner	N/A	N/A	N/A	N/A	N/A
Vollenweider, 1982 Shallow Lake/Res.	64	183	FIT	0	ANN
Larsen-Mercier, 1976	N/A	N/A	N/A	N/A	N/A
Nurnberg, 1984 Oxic	79	191	P	0	ANN

APPENDIX B

Summary of Wetland Functional Values Ranking

Summary of MnRAM Wetland Data

Wetid	*Hydrologic_Val*	*Wildlife_Value*	*Aesthetic_rec_V*	*Quality*	*comid*
AC-W1	*Medium/High*	*Medium/Low*	*Medium*		
				Low	Shrub-Carr
AC-W10	*Low*	*Low*	*Low*		
				Low	Seasonally Floode
AC-W11					
				Low	Wet Meadow
AC-W2	*Medium/High*	*Medium/Low*	*Medium*		
				Medium	Shallow Marsh
				Medium/Low	Wet Meadow
AC-W3	*Medium*	*Medium/Low*	*Medium*		
				Medium/Low	Shallow Marsh
AC-W4	*Medium*	*Medium/Low*	*Medium/High*		
				Low	Shallow Open Wa
AC-W5	*Medium*	*High*	*High*		
				Medium	Shrub-Carr
AC-W6	*Low*	*Low*	*Medium/Low*		
				Low	Seasonally Floode
AC-W7	*Medium*	*Medium/Low*	*Low*		
				Low	Seasonally Floode
AC-W8	*Low*	*Low*	*Medium/Low*		
				Low	Seasonally Floode
AC-W9	*High*	*Medium/High*	*Medium*		
				Medium	Shallow Marsh
				Medium/Low	Wet Meadow
CP-W1	*Medium*	*Medium*	*Medium*		
				Low	Shallow Marsh
				Low	Shallow Open Wa
				Medium/Low	Shrub-Carr
CP-W10	*Medium/High*	*High*	*High*		
				Medium	Shrub-Carr
				Medium	Shallow Marsh

Wetid	Hydrologic_Val	Wildlife_Value	Aesthetic_rec_V	Quality	comid
				Medium/Low	Wet Meadow
CP-W11	Medium	Medium/Low	Medium/Low		
				Medium/Low	Shallow Marsh
CP-W12	Medium/High	Medium	Medium/Low		
				Medium	Shallow Open Wa
CP-W13	Low	Medium/Low	Medium/Low		
				High/Medium	Shallow Open Wa
				Medium/Low	Wet Meadow
CP-W2	Medium/High	Medium	Medium		
				Medium	Shallow Marsh
CP-W3	Medium	Medium	Medium		
				Medium	Shrub-Carr
				Medium/Low	Shallow Marsh
				Medium/Low	Shallow Open Wa
CP-W4	Medium/High	Medium	Medium/High		
				Medium	Deep Marsh
				Medium/Low	Wet Meadow
				Medium/Low	Shallow Marsh
CP-W5	Medium/High	Medium	Medium		
				High/Medium	Wet Meadow
				Medium	Shallow Marsh
CP-W7	Low	Medium/Low	Medium/Low		
				Low	Seasonally Floode
CP-W8	Medium/Low	Medium	Medium		
				Medium/Low	Wet Meadow
CP-W9	Medium	Medium/High	Medium		
				Medium	Shallow Marsh
LL-W1	Medium/Low	Medium	Medium/Low		
				Medium	Seasonally Floode
LL-W2	High	Medium/High	High		
				High/Medium	Shallow Marsh
				Medium/Low	Wet Meadow
LL-W4	Medium	Medium/Low	Low		
				Low	Shallow Marsh

Wetid	Hydrologic_Val	Wildlife_Value	Aesthetic_rec_V	Quality	comid
LL-W5	High	Medium	Medium		
				Low	Wet Meadow
LL-W6	High	Medium	Medium/High		
				Medium/Low	Deep Marsh
LL-W7	Medium	Medium	Medium		
				Low	Wet Meadow
				Medium/Low	Shallow Marsh
RW-W1	Medium/High	High	Medium/High		
				Medium	Shallow Open Wa
				Medium	Other
				Medium	Wet Meadow
RW-W2	Medium/High	High	Medium/High		
				High/Medium	Open Bog
RW-W4	Medium/Low	Medium/Low	Low		
				Medium/Low	Seasonally Floode
VL-W1	Medium/High	Medium/High	Medium/High		
				Medium	Shallow Marsh
				Medium	Other
VL-W2	Medium/Low	Medium/High	Medium		
					Other
				Medium/Low	Wet Meadow
VL-W4	Medium/High	Medium/High	Medium/High		
				Medium	Shallow Marsh
				Medium	Shallow Open Wa
VL-W5	High	Medium/High	Medium/High		
				High/Medium	Shallow Marsh
				High/Medium	Shallow Open Wa
VL-W6	Medium/High	Medium/High	High		
				High	Deep Marsh
VL-W8					
				Low	Wet Meadow

APPENDIX C

Upland Natural Communities Species Lists

Roseville Natural Resource Management

Appendix C: Upland Natural Community Summary

Area AC-U2

Oak Woodland-Brushland **RANK** D **STATUS**

Canopy

Quercus alba	White oak	Common
Quercus ellipsoidalis	Northern pin oak	Common
Populus tremuloides	Quaking aspen	Common
Acer negundo	Box elder	Occassional
Fraxinus pennsylvanica	Green ash	Occassional
Prunus serotina	Black cherry	Rare
Pinus banksiana	Jack pine	Rare
Populus deltoides	Cottonwood	
Acer saccharinum	Silver maple; Soft maple	Rare

Shrub

Rhamnus frangula	Alder buckthorn	Common
Prunus serotina	Black cherry	Occassional
Rubus occidentalis	Black raspberry	Occassional
Acer negundo	Box elder	Occassional
Sambucus pubens	Red-berried elder	Common
Caragana arborescens	Siberian pea-shrub	Occassional
Cornus alternifolia	Pagoda dogwood	Rare
Rhamnus cathartica	Common buckthorn	Common
Ribes missouriense	Missouri gooseberry	Rare
Prunus serotina	Black cherry	Occassional
Cornus	Dogwood; Cornel	Rare
Rubus	Bramble	Rare
Rubus occidentalis	Black raspberry	Rare
Juglans cinerea	Butternut	Rare
Acer saccharinum	Silver maple; Soft maple	Rare
Rhus glabra	Smooth sumac	Rare
Populus tremuloides	Quaking aspen	Rare
Acer spicatum	Mountain maple	Rare

Forbs

Solanum dulcamara	Bittersweet nightshade	Occassional
Eupatorium purpureum	Sweet Joe-pye weed	Rare
Aster lateriflorus	Side-flowering aster	Rare
Eupatorium rugosum	Common snakeroot	Rare
Asclepias syriaca	Common milkweed	Occassional
Solidago canadensis	Canada goldenrod	Occassional
Lactuca	Lettuce	Occassional
Linaria vulgaris	Butter-and-eggs	Occassional
Geum canadense	White avens	Occassional
Potentilla	Cinquefoil	Occassional
Circaea lutetiana	Enchanter's nightshade	Occassional
Achillea millefolium	Yarrow	Rare
Rudbeckia hirta	Black-eyed Susan	Rare
Rumex crispus	Curly dock	Rare

Graminoids

Poa pratensis	Kentucky bluegrass	
Phleum pratense	Timothy	
Bromus inermis	Smooth brome	
Muhlenbergia	Satin-grass; Muhly gra	Rare
Carex pensylvanica	pensylvania sedge	Rare
Lolium perenne	English rye grass	Rare
Dichanthelium	Panic Grass	Rare

Appendix C: Upland Natural Community Summary

Area AC-U3

Oak Forest, Dry **RANK** CD **STATUS**

Canopy			Shrub			Forbs		Graminoids
Quercus alba	White oak	Common	*Rhamnus frangula*	Alder buckthorn	Common	*Smilacina stellata*	Starry false Solomon's-seal	
Quercus ellipsoidalis	Northern pin oak	Common	*Prunus serotina*	Black cherry	Occassional			
Populus tremuloides	Quaking aspen	Common	*Rubus occidentalis*	Black raspberry	Occassional			
Acer negundo	Box elder	Occassional	*Acer negundo*	Box elder	Occassional			
Fraxinus pennsylvanica	Green ash	Occassional	*Sambucus pubens*	Red-berried elder	Common			
Prunus serotina	Black cherry	Rare	*Cornus alternifolia*	Pagoda dogwood	Rare			
Populus deltoides	Cottonwood							

Appendix C: Upland Natural Community Summary

Area CP-U1

Oak Woodland-Brushland **RANK** D **STATUS**

Canopy

Ulmus americana	American elm	Occassional
Robinia pseudoacacia	Black locust	
Ulmus pumila	Siberian elm	
Acer negundo	Box elder	Common
Populus deltoides	Cottonwood	
Acer saccharinum	Silver maple; Soft maple	
Quercus macrocarpa	Bur oak	
Salix	Willow	Rare
Populus tremuloides	Quaking aspen	
Pinus resinosa	Red pine; Norway pine	Rare
Betula nigra	River birch; Red birch	Rare
Pinus sylvestris	Scotch pine	Rare

Shrub

Fraxinus pennsylvanica	Green ash	Common
Acer negundo	Box elder	Common
Robinia pseudoacacia	Black locust	Rare
Ulmus pumila	Siberian elm	Occassional
Rhamnus cathartica	Common buckthorn	Occassional
Sambucus canadensis	Common elder	Rare
Lonicera tatarica	Tartarian honeysuckle	Occassional
Elaeagnus angustifolia	Russian-olive	Rare
Rhamnus frangula	Alder buckthorn	Rare
Amelanchier	Juneberry; Serviceberry; Saska	Rare
Morus alba	White mulberry	Rare

Forbs

Apocynum cannabinum	Indian hemp	
Smilacina racemosa	False Solomon's-seal	
Acalypha rhomboidea	Three-seeded mercury	Rare
Artemisia ludoviciana	Western mugwort; White sage	
Galium boreale	Northern bedstraw	
Parthenocissus inserta	Virginia creeper	
Solidago canadensis	Canada goldenrod	
Eupatorium rugosum	Common snakeroot	
Euphorbia cyparissias	Cypress spurge	Rare
Solanum dulcamara	Bittersweet nightshade	
Polygonum pensylvanicum	Pennsylvania smartweed	
Aster lateriflorus	Side-flowering aster	
Aster oolentangiensis	Sky-blue aster	
Helianthus strumosus	Woodland sunflower	
Solidago missouriensis	Missouri goldenrod	
Campanula aparinoides	Marsh bellflower	
Monarda fistulosa	Wild bergamot	
Achillea millefolium	Yarrow	
Anemone cylindrica	Thimbleweed	

Graminoids

Bromus inermis	Smooth brome	
Phalaris arundinacea	Reed canary grass	
Poa pratensis	Kentucky bluegrass	
Andropogon gerardii	Big bluestem	Rare
Panicum lanuginosum	Hairy panic grass	Rare
Schizachyrium scoparium	Little bluestem	Rare
Carex pensylvanica	pensylvania sedge	Occassional
Spartina pectinata	Prairie cordgrass	Rare

Appendix C: Upland Natural Community Summary

Area CP-U2

Floodplain Forest **RANK** CD **STATUS**

Canopy

Populus deltoides	Cottonwood	Common
Acer negundo	Box elder	Common
Ulmus americana	American elm	Occassional
Quercus macrocarpa	Bur oak	Rare
Salix nigra	Black willow	Occassional
Acer saccharinum	Silver maple; Soft maple	Rare
Salix	Willow	Rare

Shrub

Rhamnus cathartica	Common buckthorn	Occassional
Acer negundo	Box elder	Common
Prunus virginiana	Chokecherry	Occassional
Sambucus canadensis	Common elder	Occassional
Fraxinus pennsylvanica	Green ash	Occassional
Ulmus	Elm	Rare
Ribes americanum	Wild black currant	Occassional
Lonicera tatarica	Tartarian honeysuckle	Occassional
Cornus stolonifera	Red-osier dogwood	Common
Vitis riparia	Wild grape	Occassional

Forbs

Glechoma hederacea	Creeping charlie	Common
Parthenocissus inserta	Virginia creeper	Common
Viola	Violet	Occassional
Solanum dulcamara	Bittersweet nightshade	Occassional

Graminoids

Bromus inermis	Smooth brome	Rare
Phalaris arundinacea	Reed canary grass	Rare
Carex blanda	woodland sedge	Rare

Appendix C: Upland Natural Community Summary

Area CP-U3

Floodplain Forest **RANK** CD **STATUS**

Canopy

Ulmus pumila	Siberian elm	Occassional
Populus tremuloides	Quaking aspen	Rare
Populus deltoides	Cottonwood	Common
Acer negundo	Box elder	Common
Ulmus americana	American elm	Occassional
Quercus macrocarpa	Bur oak	Rare
Salix nigra	Black willow	Occassional
Acer saccharinum	Silver maple; Soft maple	Rare
Salix	Willow	Rare

Shrub

Cornus amomum	Silky dogwood	Common
Juglans cinerea	Butternut	Rare
Morus alba	White mulberry	Rare
Rhamnus cathartica	Common buckthorn	Occassional
Acer negundo	Box elder	Common
Prunus virginiana	Chokecherry	Occassional
Sambucus canadensis	Common elder	Occassional
Fraxinus pennsylvanica	Green ash	Occassional
Ulmus	Elm	Rare
Ribes americanum	Wild black currant	Occassional
Lonicera tatarica	Tartarian honeysuckle	Occassional
Cornus stolonifera	Red-osier dogwood	Common

Forbs

Eupatorium perfoliatum	Common boneset	Rare
Verbena hastata	Blue vervain	Rare
Viola	Violet	
Glechoma hederacea	Creeping charlie	
Parthenocissus inserta	Virginia creeper	
Solanum dulcamara	Bittersweet nightshade	

Graminoids

Appendix C: Upland Natural Community Summary

Area CP-U4

Lowland Hardwood Forest **RANK** CD **STATUS**

Canopy

Acer negundo	Box elder	Common
Fraxinus pennsylvanica	Green ash	Occassional
Ulmus pumila	Siberian elm	Rare
Acer saccharinum	Silver maple; Soft maple	Rare
Pinus resinosa	Red pine; Norway pine	Rare
Populus tremuloides	Quaking aspen	Common
Pinus sylvestris	Scotch pine	Rare
Betula papyrifera	Paper birch	Rare
Juglans cinerea	Butternut	Occassional
Populus deltoides	Cottonwood	
Quercus rubra	Northern red oak; Common red oak	
Tilia americana	Basswood	Occassional
Quercus ellipsoidalis	Northern pin oak	Rare
Quercus macrocarpa	Bur oak	Rare
Prunus serotina	Black cherry	
Ulmus americana	American elm	
Juglans nigra	Black walnut	Rare

Shrub

Acer negundo	Box elder	Occassional
Fraxinus pennsylvanica	Green ash	Occassional
Ribes americanum	Wild black currant	Occassional
Rhamnus cathartica	Common buckthorn	Common
Ulmus pumila	Siberian elm	Rare
Morus alba	White mulberry	Rare
Viburnum trilobum	High-bush cranberry	Rare
Sambucus canadensis	Common elder	Occassional
Lonicera tatarica	Tartarian honeysuckle	Occassional
Cornus amomum	Silky dogwood	Common
Prunus virginiana	Chokecherry	Rare
Populus tremuloides	Quaking aspen	Occassional
Rubus occidentalis	Black raspberry	Occassional
Juglans cinerea	Butternut	Rare
Rhus glabra	Smooth sumac	Occassional
Acer ginnala	Amur maple	Occassional
Ulmus americana	American elm	Occassional
Robinia pseudoacacia	Black locust	Rare
Juglans nigra	Black walnut	Rare

Forbs

Eupatorium rugosum	Common snakeroot	Occassional
Arctium minus	Common burdock	Occassional
Glechoma hederacea	Creeping charlie	Occassional
Solanum dulcamara	Bittersweet nightshade	Occassional
Parthenocissus inserta	Virginia creeper	Occassional
Helianthus strumosus	Woodland sunflower	Rare
Monarda fistulosa	Wild bergamot	Rare
Solidago canadensis	Canada goldenrod	pilea pumi
Pilea pumila	Clearweed	Rare
Hackelia virginiana	Virginia stickseed	smilacina rac
Smilacina racemosa	False Solomon's-seal	Rare

Graminoids

Phalaris arundinacea	Reed canary grass

Appendix C: Upland Natural Community Summary

Area CP-U5

RANK NA **STATUS**

Canopy

Shrub

Rhamnus cathartica	Common buckthorn	Rare
Rhus typhina	Staghorn sumac	Rare
Acer negundo	Box elder	Occassional
Rhamnus frangula	Alder buckthorn	Rare

Forbs

Menispermum canadense	Canada moonseed
Solidago rigida	Stiff goldenrod
Helianthus laetiflorus	Showy sunflower
Asclepias syriaca	Common milkweed
Dalea candida	White prairie-clover
Petalostemon purpureum	Purple prairie-clover
Agastache foeniculum	Blue giant-hyssop
Baptisia	False indigo
Ratibida pinnata	Gray-headed coneflower
Monarda fistulosa	Wild bergamot
Aster lateriflorus	Side-flowering aster
Aster ericoides	Heath aster
Veronicastrum virginicum	Culver's root
Heliopsis helianthoides	Ox-eye
Echinacea	Purple coneflower
Solidago canadensis	Canada goldenrod
Artemisia ludoviciana	Western mugwort; White sage
Mirabilis nyctaginea	Heart-leaved four-o'clock
Asclepias tuberosa	Butterfly-weed
Vicia	Vetch

Graminoids

Schizachyrium scoparium	Little bluestem	Common
Sorghastrum nutans	Indian grass	Common
Andropogon gerardii	Big bluestem	Common
Poa pratensis	Kentucky bluegrass	Occassional
Bromus inermis	Smooth brome	Common
Panicum lanuginosum	Hairy panic grass	
Bouteloua curtipendula	Side-oats grama	

Appendix C: Upland Natural Community Summary

Area LL-U1

Oak Forest, Dry **RANK** C **STATUS**

Canopy

Ulmus americana	American elm	Common
Quercus ellipsoidalis	Northern pin oak	Common
Acer negundo	Box elder	Occassional
Quercus alba	White oak	Common
Quercus macrocarpa	Bur oak	Occassional
Populus tremuloides	Quaking aspen	Occassional
Prunus serotina	Black cherry	Occassional
Ulmus pumila	Siberian elm	Rare

Shrub

Morus alba	White mulberry	Rare
Ribes cynosbati	Prickly gooseberry; Dogberry	Occassional
Acer negundo	Box elder	Occassional
Rubus occidentalis	Black raspberry	Occassional
Sambucus canadensis	Common elder	Occassional
Rhamnus cathartica	Common buckthorn	Common
Prunus serotina	Black cherry	Occassional
Lonicera tatarica	Tartarian honeysuckle	Rare
Rhus glabra	Smooth sumac	Rare
Viburnum trilobum	High-bush cranberry	Rare

Forbs

Solanum dulcamara	Bittersweet nightshade	Occassional
Parthenocissus inserta	Virginia creeper	Common
Rhus radicans	Poison ivy	Occassional
Eupatorium rugosum	Common snakeroot	Occassional
Aster simplex	Marsh aster	Rare
Circaea lutetiana	Enchanter's nightshade	Occassional
Smilacina racemosa	False Solomon's-seal	Occassional
Hackelia virginiana	Virginia stickseed	Rare
Verbena urticifolia	White vervain	Rare
Rhus radicans	Poison ivy	Rare
Oxalis stricta	Yellow wood-sorrel	
Vitis riparia	Wild grape	Occassional
Menispermum canadense	Canada moonseed	Occassional

Graminoids

Carex pensylvanica	pensylvania sedge	Occassional
Carex intumescens	bladder sedge	Rare

Appendix C: Upland Natural Community Summary

Area LL-U2

Lowland Hardwood Forest **RANK** C **STATUS**

Canopy

Populus deltoides	Cottonwood	Occassional
Salix nigra	Black willow	Common
Ulmus americana	American elm	Occassional
Acer negundo	Box elder	Common
Celtis occidentalis	Hackberry	Rare
Acer saccharinum	Silver maple; Soft maple	Rare
Populus tremuloides	Quaking aspen	
Salix babylonica	Weeping Willow	Rare

Shrub

Rhamnus cathartica	Common buckthorn	Common
Sambucus canadensis	Common elder	Occassional
Rhamnus frangula	Alder buckthorn	Rare
Rubus occidentalis	Black raspberry	Rare
Salix	Willow	Occassional

Forbs

Eupatorium rugosum	Common snakeroot	
Verbena urticifolia	White vervain	Rare
Solidago canadensis	Canada goldenrod	Rare
Veronicastrum virginicum	Culver's root	Rare
Asclepias syriaca	Common milkweed	Rare
Smilacina racemosa	False Solomon's-seal	Rare
Iris virginica	Southern blue flag	Rare

Graminoids

Phalaris arundinacea	Reed canary grass	

Area LL-U3

Other **RANK** **STATUS** na

Canopy

Ulmus pumila	Siberian elm	Common
Acer negundo	Box elder	Occassional

Shrub

Rhamnus cathartica	Common buckthorn	Common
Acer negundo	Box elder	Occassional
Ribes	Currant; Gooseberry	Occassional

Forbs

Parthenocissus inserta	Virginia creeper	Common

Graminoids

Poa pratensis	Kentucky bluegrass	Occassional

Appendix C: Upland Natural Community Summary

Area RW-U1

Oak Forest, Mesic **RANK** BC **STATUS**

Canopy

Quercus macrocarpa	Bur oak	
Quercus ellipsoidalis	Northern pin oak	Occassional
Quercus rubra	Northern red oak; Common red oak	Occassional
Quercus alba	White oak	Occassional
Populus tremuloides	Quaking aspen	Occassional
Prunus serotina	Black cherry	
Ulmus americana	American elm	
Fraxinus pennsylvanica	Green ash	Rare

Shrub

Rhamnus cathartica	Common buckthorn	Common
Acer negundo	Box elder	
Ulmus americana	American elm	Common
Fraxinus pennsylvanica	Green ash	
Rhamnus frangula	Alder buckthorn	rubus occiden
Rubus occidentalis	Black raspberry	
Quercus	Oak	
Sambucus pubens	Red-berried elder	
Ribes cynosbati	Prickly gooseberry; Dogberry	
Prunus serotina	Black cherry	
Amelanchier	Juneberry; Serviceberry; Saska	Rare
Lonicera tatarica	Tartarian honeysuckle	Rare
Rhus glabra	Smooth sumac	Rare
Acer ginnala	Amur maple	Rare
Cornus foemina	Gray dogwood	Rare
Corylus americana	American hazelnut	
Sorbus	Mountain-ash	Rare
Viburnum trilobum	High-bush cranberry	Rare
Cornus amomum	Silky dogwood	Rare
Prunus virginiana	Chokecherry	Rare
Tsuga canadensis	Hemlock	Rare

Forbs

Viola	Violet	Rare
Pilea pumila	Clearweed	Rare
Eupatorium rugosum	Common snakeroot	Rare
Veronicastrum virginicum	Culver's root	Rare
Smilacina racemosa	False Solomon's-seal	Rare
Thalictrum dioicum	Early meadow rue	Rare
Osmunda claytoniana	Interrupted fern	Occassional
Circaea lutetiana	Enchanter's nightshade	
Arctium minus	Common burdock	
Geranium maculatum	Wild geranium	Rare
Campanula aparinoides	Marsh bellflower	Rare
Aster cordifolius	Heart-leaved aster	Rare
Erigeron strigosus	Daisy fleabane	Rare
Solidago canadensis	Canada goldenrod	Rare
Helianthus strumosus	Woodland sunflower	Rare
Monarda fistulosa	Wild bergamot	Rare
Smilax ecirrata	Carrion-flower	Rare
Solanum dulcamara	Bittersweet nightshade	Occassional
Oxalis stricta	Yellow wood-sorrel	Rare
Athyrium angustum	Lady fern	Rare
Aster ontarionis	Ontario aster	Rare

Graminoids

Poa pratensis	Kentucky bluegrass	Rare
Carex pensylvanica	pensylvania sedge	

Appendix C: Upland Natural Community Summary

Area RW-U2

Dry Prairie **RANK** C **STATUS**

Canopy		
Populus tremuloides	Quaking aspen	Occassional
Quercus macrocarpa	Bur oak	Rare

Shrub		
Rubus allegheniensis	Common blackberry	Occassional
Rubus occidentalis	Black raspberry	Occassional
Prunus serotina	Black cherry	Occassional
Rhus glabra	Smooth sumac	
Cornus foemina	Gray dogwood	
Fraxinus pennsylvanica	Green ash	Occassional
Juniperus virginiana	Red cedar	Occassional
Acer ginnala	Amur maple	
Rhamnus	Buckthorn	Occassional
Prunus americana	Wild plum	Rare
Rhus typhina	Staghorn sumac	

Forbs		
Solidago canadensis	Canada goldenrod	Common
Solidago speciosa	Showy goldenrod	Common
Solidago rigida	Stiff goldenrod	Common
Aster simplex	Marsh aster	Rare
Achillea millefolium	Yarrow	
Aster oolentangiensis	Sky-blue aster	
Pycnanthemum virginianum	Virginia mountain-mint	
Fragaria virginiana	Common strawberry	Common
Euphorbia corollata	Flowering spurge	
Trifolium pratense	Red clover	Rare
Anemone virginiana	Thimbleweed	Occassional
Aster ericoides	Heath aster	Rare
Mirabilis nyctaginea	Heart-leaved four-o'clock	
Rumex acetosa	Green sorrel	Rare
Antennaria neglecta	Pussytoes	Occassional
Physalis heterophylla	Clammy ground-cherry	Rare
Helianthemum canadense	Frostweed	Rare
Liatris aspera	Rough blazing star	Rare
Lespedeza capitata	Round-headed bush-clover	Rare
Heterotheca villosa	Prairie golden aster	Rare
Solidago nemoralis	Gray goldenrod	Rare
Verbena stricta	Hairy blue vervain	
Monarda fistulosa	Wild bergamot	Occassional
Ambrosia coronopifolia	Western ragweed	Occassional

Graminoids		
Andropogon gerardii	Big bluestem	
Sorghastrum nutans	Indian grass	
Poa pratensis	Kentucky bluegrass	
Bromus inermis	Smooth brome	
Agrostis stolonifera	Redtop	Occassional
Eragrostis spectabilis	Purple love grass	Rare
Dicanthelium	Panic Grass	
Schizachyrium scoparium	Little bluestem	Occassional
Stipa spartea	Porcupine grass	Occassional
Spartina pectinata	Prairie cordgrass	Rare

Appendix C: Upland Natural Community Summary

Area RW-U3

Mixed Pine Hardwood Forest **RANK** NA **STATUS**

Canopy

Pinus banksiana	Jack pine	Occassional
Pinus resinosa	Red pine; Norway pine	Common
Pinus strobus	White pine	Occassional
Populus deltoides	Cottonwood	Rare
Quercus alba	White oak	Rare
Quercus rubra	Northern red oak; Common red oak	Rare
Quercus macrocarpa	Bur oak	Rare
Pinus sylvestris	Scotch pine	Occassional
Juglans cinerea	Butternut	Occassional
Picea	Spruce	Occassional
Acer negundo	Box elder	Occassional
Fraxinus pennsylvanica	Green ash	Rare
Thuja occidentalis	White cedar; Arbor vitae	Rare

Shrub

Acer negundo	Box elder	Occassional
Celtis occidentalis	Hackberry	Rare
Sambucus pubens	Red-berried elder	Occassional
Prunus virginiana	Chokecherry	Rare
Rhamnus cathartica	Common buckthorn	Common
Ribes cynosbati	Prickly gooseberry; Dogberry	
Viburnum trilobum	High-bush cranberry	Rare
Prunus serotina	Black cherry	Rare
Fraxinus pennsylvanica	Green ash	Rare
Rubus occidentalis	Black raspberry	Rare
Sorbus	Mountain-ash	Rare
Rubus allegheniensis	Common blackberry	Rare
Rhamnus frangula	Alder buckthorn	Rare

Forbs

Smilacina racemosa	False Solomon's-seal	Rare
Parthenocissus inserta	Virginia creeper	Common
Circaea lutetiana	Enchanter's nightshade	Occassional
Osmorhiza claytonii	Sweet Cicely	Rare
Athyrium angustum	Lady fern	Occassional
Osmunda claytoniana	Interrupted fern	Occassional
Rhus radicans	Poison ivy	Rare
Cystopteris fragilis	Fragile fern	Rare
Menispermum canadense	Canada moonseed	
Vitis riparia	Wild grape	Occassional

Graminoids

Appendix C: Upland Natural Community Summary

Area RW-U-3

Lowland Hardwood Forest **RANK** CD **STATUS**

Canopy

Acer negundo	Box elder	Common
Fraxinus nigra	Black ash	Common
Prunus serotina	Black cherry	Rare
Quercus ellipsoidalis	Northern pin oak	Rare
Quercus alba	White oak	Rare
Populus tremuloides	Quaking aspen	Occassional

Shrub

Sambucus pubens	Red-berried elder	Occassional
Ribes americanum	Wild black currant	Occassional
Rhamnus cathartica	Common buckthorn	Common
Quercus ellipsoidalis	Northern pin oak	Rare
Prunus virginiana	Chokecherry	Rare
Rhamnus frangula	Alder buckthorn	Common
Lonicera tatarica	Tartarian honeysuckle	Rare
Acer ginnala	Amur maple	Occassional
Rubus occidentalis	Black raspberry	Occassional

Forbs

Eupatorium rugosum	Common snakeroot	
Solanum dulcamara	Bittersweet nightshade	
Circaea lutetiana	Enchanter's nightshade	
Osmorhiza claytonii	Sweet Cicely	
Vitis riparia	Wild grape	
Parthenocissus inserta	Virginia creeper	

Graminoids

Poa pratensis	Kentucky bluegrass	Rare
Alopecurus	Foxtail	

Appendix C: Upland Natural Community Summary

Area RW-U4

Floodplain Forest **RANK** CD **STATUS**

Canopy

Acer negundo	Box elder	Common
Populus deltoides	Cottonwood	Occassional
Ulmus americana	American elm	Occassional
Fraxinus pennsylvanica	Green ash	Occassional
Juglans cinerea	Butternut	Rare

Shrub

Rhamnus cathartica	Common buckthorn
Rhamnus frangula	Alder buckthorn
Fraxinus pennsylvanica	Green ash
Ribes cynosbati	Prickly gooseberry; Dogberry
Ulmus americana	American elm
Sambucus canadensis	Common elder

Forbs

Eupatorium rugosum	Common snakeroot
Leonurus cardiaca	Motherwort
Impatiens capensis	Spotted touch-me-not; Jewel-weed
Hackelia virginiana	Virginia stickseed
Solanum dulcamara	Bittersweet nightshade
Parthenocissus inserta	Virginia creeper
Urtica dioica	Stinging nettle
Solidago canadensis	Canada goldenrod

Graminoids

Phalaris arundinacea	Reed canary grass
Muhlenbergia	Satin-grass; Muhly gra

Appendix C: Upland Natural Community Summary

Area RW-U5

Oak Forest, Dry **RANK** CD **STATUS**

Canopy		Shrub		Forbs		Graminoids
Quercus alba	White oak	*Sambucus canadensis*	Common elder	*Thalictrum dioicum*	Early meadow rue	
Fraxinus pennsylvanica	Green ash	*Rhamnus cathartica*	Common buckthorn	*Smilacina racemosa*	False Solomon's-seal	
Ostrya virginiana	Ironwood; Hop hornbeam	*Ribes cynosbati*	Prickly gooseberry; Dogberry	*Athyrium angustum*	Lady fern	
Quercus ellipsoidalis	Northern pin oak			*Solanum dulcamara*	Bittersweet nightshade	
Betula papyrifera	Paper birch	*Ulmus americana*	American elm	*Leonurus cardiaca*	Motherwort	
		Rubus allegheniensis	Common blackberry	*Maianthemum canadense*	Canada mayflower	
		Lonicera tatarica	Tartarian honeysuckle	*Parthenocissus inserta*	Virginia creeper	
		Prunus virginiana	Chokecherry	*Circaea lutetiana*	Enchanter's nightshade	
		Viburnum trilobum	High-bush cranberry	*Aralia nudicaulis*	Wild sarsaparilla	
				Uvularia sessilifolia	Pale bellwort	
				Alliaria petiolata	Garlic-mustard	
				Rhus radicans	Poison ivy	
				Osmorhiza claytonii	Sweet Cicely	
				Eupatorium rugosum	Common snakeroot	

Appendix C: Upland Natural Community Summary

Area RW-U6

Conifer Plantation **RANK** NA **STATUS**

Canopy		
Pinus sylvestris	Scotch pine	Common
Ulmus	Elm	
Populus tremuloides	Quaking aspen	
Populus deltoides	Cottonwood	
Fraxinus pennsylvanica	Green ash	
Acer negundo	Box elder	

Shrub	
Rhamnus cathartica	Common buckthorn
Acer negundo	Box elder
Fraxinus pennsylvanica	Green ash

Forbs	
Eupatorium rugosum	Common snakeroot
Osmorhiza claytonii	Sweet Cicely
Circaea lutetiana	Enchanter's nightshade

Graminoids		
Poa pratensis	Kentucky bluegrass	Common
Bromus inermis	Smooth brome	

Appendix C: Upland Natural Community Summary

Area RW-U7

Oak Forest, Mesic **RANK** BC **STATUS**

Canopy

Quercus macrocarpa	Bur oak	
Quercus ellipsoidalis	Northern pin oak	Occassional
Quercus rubra	Northern red oak; Common red oak	Occassional
Populus tremuloides	Quaking aspen	Occassional
Prunus serotina	Black cherry	
Ulmus americana	American elm	
Fraxinus pennsylvanica	Green ash	

Shrub

Rhamnus cathartica	Common buckthorn	Common
Acer negundo	Box elder	
Ulmus americana	American elm	
Fraxinus pennsylvanica	Green ash	
Rhamnus frangula	Alder buckthorn	
Rubus occidentalis	Black raspberry	
Quercus	Oak	
Sambucus pubens	Red-berried elder	
Ribes cynosbati	Prickly gooseberry; Dogberry	
Prunus serotina	Black cherry	
Amelanchier	Juneberry; Serviceberry; Saska	Rare
Lonicera tatarica	Tartarian honeysuckle	Rare
Rhus glabra	Smooth sumac	Rare
Acer ginnala	Amur maple	Rare
Cornus foemina	Gray dogwood	Rare
Corylus americana	American hazelnut	
Sorbus	Mountain-ash	Rare
Viburnum trilobum	High-bush cranberry	Rare
Cornus amomum	Silky dogwood	Rare
Tsuga canadensis	Hemlock	Rare
Prunus virginiana	Chokecherry	

Forbs

Viola	Violet	Rare
Circaea lutetiana	Enchanter's nightshade	
Arctium minus	Common burdock	
Geranium maculatum	Wild geranium	Rare
Campanula aparinoides	Marsh bellflower	Rare
Aster cordifolius	Heart-leaved aster	r5
Erigeron strigosus	Daisy fleabane	Rare
Solidago canadensis	Canada goldenrod	Rare
Helianthus strumosus	Woodland sunflower	Rare
Monarda fistulosa	Wild bergamot	Rare
Smilax ecirrata	Carrion-flower	Rare
Solanum dulcamara	Bittersweet nightshade	Occassional
Oxalis stricta	Yellow wood-sorrel	Rare
Athyrium angustum	Lady fern	Rare
Aster ontarionis	Ontario aster	Rare
Pilea pumila	Clearweed	Rare
Eupatorium rugosum	Common snakeroot	Rare
Veronicastrum virginicum	Culver's root	Rare
Smilacina racemosa	False Solomon's-seal	Rare
Thalictrum dioicum	Early meadow rue	Rare
Osmunda claytoniana	Interrupted fern	Occassional

Graminoids

Poa pratensis	Kentucky bluegrass	Rare
Carex pensylvanica	pensylvania sedge	

Appendix C: Upland Natural Community Summary

Area VL-U1

Floodplain Forest **RANK** D **STATUS**

Canopy		
Ulmus americana	American elm	Occassional
Populus deltoides	Cottonwood	Common
Populus tremuloides	Quaking aspen	Occassional
Acer saccharinum	Silver maple; Soft maple	Rare
Acer negundo	Box elder	Common
Fraxinus pennsylvanica	Green ash	Occassional
Juglans nigra	Black walnut	Rare
Robinia pseudoacacia	Black locust	Rare

Shrub		
Ceanothus americanus	New Jersey tea	Rare
Quercus macrocarpa	Bur oak	Rare
Caragana	Caragana, Pea-Tree	Rare
Elaeagnus angustifolia	Russian-olive	
Acer negundo	Box elder	Occassional
Fraxinus pennsylvanica	Green ash	Occassional
Rhamnus cathartica	Common buckthorn	Common
Cornus stolonifera	Red-osier dogwood	Occassional
Populus tremuloides	Quaking aspen	Rare
Sambucus pubens	Red-berried elder	Occassional
Rhamnus frangula	Alder buckthorn	Occassional
Lonicera tatarica	Tartarian honeysuckle	Occassional
Prunus serotina	Black cherry	Occassional
Ribes missouriense	Missouri gooseberry	Occassional
Rubus occidentalis	Black raspberry	Rare
Prunus virginiana	Chokecherry	Rare
Viburnum trilobum	High-bush cranberry	Rare

Forbs		
Geum canadense	White avens	Occassional
Solanum dulcamara	Bittersweet nightshade	Common
Solidago canadensis	Canada goldenrod	Occassional
Oxalis stricta	Yellow wood-sorrel	Occassional
Circaea lutetiana	Enchanter's nightshade	Occassional
Nepeta cataria	Catnip	Occassional
Leonurus cardiaca	Motherwort	Occassional
Urtica dioica	Stinging nettle	Occassional
Urtica dioica	Stinging nettle	Occassional
Alliaria petiolata	Garlic-mustard	Rare
Impatiens capensis	Spotted touch-me-not; Jewel-weed	Rare
Pilea pumila	Clearweed	Rare
Arctium minus	Common burdock	Occassional
Eupatorium rugosum	Common snakeroot	Rare
Hackelia virginiana	Virginia stickseed	Rare
Lotus corniculatus	Bird's-foot trefoil	
Cirsium arvense	Canada thistle	
Solidago speciosa	Showy goldenrod	
Parthenocissus inserta	Virginia creeper	Common
Vitis riparia	Wild grape	Occassional
Convolvulus sepium	Hedge bindweed	Occassional
Apios americana	Groundnut	

Graminoids

Appendix C: Upland Natural Community Summary

Area VL-U2

Old Field **RANK** NA **STATUS**

Canopy

Shrub

Picea	Spruce	Rare
Cornus stolonifera	Red-osier dogwood	Occassional
Pinus resinosa	Red pine; Norway pine	Rare
Ulmus pumila	Siberian elm	Occassional
Fraxinus	Ash	Rare
Acer ginnala	Amur maple	Rare
Pinus strobus	White pine	Rare
Rhus glabra	Smooth sumac	Occassional
Populus tremuloides	Quaking aspen	
Rhamnus cathartica	Common buckthorn	Rare

Forbs

Solidago canadensis	Canada goldenrod	Common
Melilotus alba	White sweet-clover	Occassional
Melilotus officinalis	Yellow sweet-clover	Occassional
Solidago rigida	Stiff goldenrod	Occassional
Tragopogon dubius	Yellow goat's-beard	Occassional
Lactuca	Lettuce	Rare
Lathyrus venosus	Veiny pea	Occassional
Trifolium pratense	Red clover	Occassional
Achillea millefolium	Yarrow	Occassional
Aster lateriflorus	Side-flowering aster	Rare
Cirsium discolor	Field thistle	Rare
Solidago missouriensis	Missouri goldenrod	Rare
Asclepias syriaca	Common milkweed	

Graminoids

Bromus inermis	Smooth brome	Common
Poa pratensis	Kentucky bluegrass	Common
Phalaris arundinacea	Reed canary grass	Occassional

Appendix C: Upland Natural Community Summary

Area VL-U3

Lowland Hardwood Forest **RANK** CD **STATUS**

Canopy

Populus tremuloides	Quaking aspen	Occassional
Populus tremuloides	Quaking aspen	Common
Acer negundo	Box elder	Common
Prunus serotina	Black cherry	Rare
Ulmus americana	American elm	Occassional
Acer saccharinum	Silver maple; Soft maple	Rare
Quercus ellipsoidalis	Northern pin oak	Rare
Quercus macrocarpa	Bur oak	Rare

Shrub

Rhamnus cathartica	Common buckthorn	
Acer negundo	Box elder	
Lonicera tatarica	Tartarian honeysuckle	
Cornus stolonifera	Red-osier dogwood	
Ribes americanum	Wild black currant	
Sambucus	Elder	
Rubus occidentalis	Black raspberry	
Rhamnus frangula	Alder buckthorn	Common
Prunus americana	Wild plum	Rare
Rubus allegheniensis	Common blackberry	Rare
Morus alba	White mulberry	Rare

Forbs

Solanum dulcamara	Bittersweet nightshade	Occassional
Glechoma hederacea	Creeping charlie	
Erigeron strigosus	Daisy fleabane	Rare
Urtica dioica	Stinging nettle	
Athyrium	Lady-fern; Spleenwort	
Circaea lutetiana	Enchanter's nightshade	
Carex pensylvanica	pensylvania sedge	
Geum aleppicum	Yellow avens	Occassional
Oxalis stricta	Yellow wood-sorrel	Rare
Eupatorium rugosum	Common snakeroot	Occassional
Hackelia virginiana	Virginia stickseed	Rare
Phryma leptostachya	Lopseed	
Viola sororia	Common blue violet	Rare
Leonurus cardiaca	Motherwort	Occassional
Geranium maculatum	Wild geranium	Rare
Pilea pumila	Clearweed	Rare
Arctium minus	Common burdock	
Matteuccia struthiopteris	Ostrich fern	Rare
Aster cordifolius	Heart-leaved aster	Rare

Graminoids

Carex pensylvanica	pensylvania sedge	Rare
Poa pratensis	Kentucky bluegrass	Rare

APPENDIX D

Potential Species for Upland Restorations

Appendix: Potential Species for Dry Prairie and Woodland Restoration

Species	COMNAME	Habitat	Sun	Comments
Agastache foeniculum	Blue giant-hyssop	Upland	Full Sun/Part Shade	licorice smell to plant
Agastache scrophulariaefolia	Purple giant-hyssop	Upland	Full Sun/Part Shade	tall, fragrant
Agropyron trachycaulum	Wheatgrass	Upland	Full Sun/Part Shade	interseeding
Allium stellatum	Prairie wild onion	Upland	Full Sun/Part Shade	best on sand/gravel south-facing slopes
Allium tricoccum	Wild leek	Upland	Part Shade/Full Shad	rich soil in protected areas
Andropogon gerardii	Big bluestem	Upland	Full Sun/Part Shade	better in open areas
Anemone virginiana	Thimbleweed	Upland	Full Sun/Part Shade	versatile plant
Anemonella thalictroides	Rue-anemone	Upland	Part Shade/Full Shad	rich soils in full shade
Aquilegia canadensis	Columbine	Upland	Part Shade	medium to dry soils in part sun
Aralia racemosa	American spikenard	Upland	Part Shade/Full Shad	dry oak forest
Artemisia ludoviciana	Western mugwort; White sag	Upland	Full Sun	can be aggressive, weedy
Asclepias exaltata	Poke milkweed	Upland	Part Shade	medium to dry soils in part sun
Asclepias incarnata	Swamp milkweed	Wetland	Full Sun	medium to dry soils in part sun
Asclepias tuberosa	Butterfly-weed	Upland	Full Sun/Part Shade	prairie, full sun

Species	COMNAME	Habitat	Sun	Comments
Aster cordifolius	Heart-leaved aster	Upland	Full Sun/Part Shade	does well in dappled sunlight
Aster ericoides	Heath aster	Upland	Full Sun	can be aggressive in some situations
Aster laevis	Smooth blue aster	Upland	Full Sun/Part Shade	prairie areas
Aster novae-angliae	New England aster	Wetland	Full Sun	full sunlight on mesic to wet-mesic soils
Aster oolentangiensis	Sky-blue aster	Upland	Full Sun	nice fall color, prefers dry openings
Astragalus canadensis	Canada milk-vetch	Upland	Full Sun/Part Shade	prairie
Blephilia hirsuta	Wood-mint	Upland	Part Shade	dry woodland edge, prairie
Bromus kalmii	Kalm's brome	Upland	Full Sun/Part Shade	interseeding
Bromus pubescens		Upland	Full Sun/Part Shade	dappled sunlight
Campanula rotundifolia	Harebell	Upland	Full Sun/Part Shade	dry, sparse areas
Carex comosa	bottlebrush sedge	Wetland	Full Sun	fringe
Cinna arundinacea	Wood reedgrass	Upland	Part Shade	savanna and open oak forest grass
Coreopsis palmata	Stiff tickseed	Upland	Full Sun/Part Shade	prairie
Dalea candida	White prairie-clover	Upland	Full Sun/Part Shade	prairie
Desmodium canadense	Tick-trefoil	Upland	Full Sun/Part Shade	prairie
Elymus canadensis	Nodding wild-rye	Upland	Full Sun	nodding seedhead, short-lived

Species	COMNAME	Habitat	Sun	Comments
Elymus hystrix	Bottlebrush grass	Upland	Part Shade	bottlebrush seedhead; dappled sunlight
Elymus villosus	silky wildrye	Upland	Full Sun/Part Shade	graceful seedhead, oak openings
Erigeron pulchellus	Fleabane	Upland	Part Shade	dry savanna
Eupatorium altissimum	Tall boneset	Upland	Full Sun/Part Shade	prairie and savanna
Eupatorium purpureum	Sweet Joe-pye weed	Upland	Part Shade/Full Shad	dappled sunlight and medium soils
Euphorbia corollata	Flowering spurge	Upland	Full Sun	prairie
Euthamia graminifolia	Grass-leaved goldenrod	Upland	Full Sun/Part Shade	aggressive
Galium boreale	Northern bedstraw	Upland	Full Sun/Part Shade	prairie or savanna
Gentiana alba	Cream gentian	Upland	Full Sun/Part Shade	needs at least a few hours of full sun per day
Geum triflorum	Prairie smoke	Upland	Full Sun/Part Shade	prairie
Helianthus strumosus	Woodland sunflower	Upland	Part Shade	dappled sunlight
Heuchera richardsonii	Alum-root	Upland	Full Sun/Part Shade	hand broadcast or frost seed
Hypericum pyramidatum	Great St. John's-wort	Upland	Full Sun/Part Shade	openings of oak forest and mesic prairie
Hypoxis hirsuta	Yellow star-grass	Upland	Full Sun/Part Shade	very small relative of daffodil, striking yellow flower
Kuhnia eupatorioides	False boneset	Upland	Full Sun	dry areas

Species	COMNAME	Habitat	Sun	Comments
Lespedeza capitata	Round-headed bush-clover	Upland	Full Sun	versatile in open areas
Liatris aspera	Rough blazing star	Upland	Full Sun	exists on site
Liatris pycnostachya	Gay-feather	Wetland	Full Sun	wet meadow edge
Lilium michiganense	Michigan lily	Wetland	Full Sun	wet swales/meadow
Lithospermum canescens	Hoary puccoon	Upland	Full Sun	dry, sandy soils
Lobelia siphilitica	Great lobelia	Wetland	Full Sun	edge of wetland
Lobelia siphilitica	Great lobelia	Upland	Full Sun	small and short-lived
Muhlenbergia mexicana	Mexican satin grass	Upland	Full Sun/Part Shade	attractive grass in all seasons
Oxalis violacea	Violet wood-sorrel	Upland	Full Sun/Part Shade	dry prairie and savanna
Panicum virgatum	Switchgrass	Upland	Full Sun	plant sparingly, if used at all
Pedicularis canadensis	Wood-betony	Upland	Full Sun/Part Shade	showy spike of light yellow flowers in May/June
Petalostemon purpureum	Purple prairie-clover	Upland	Full Sun	prairie
Phlox pilosa	Prairie phlox; Downy phlox	Upland	Full Sun/Part Shade	prairie
Potentilla arguta	Tall cinquefoil	Upland	Full Sun	will tolerate some shade
Prenanthes alba	White rattlesnake-root	Upland	Part Shade	prariie and savanna
Pycnanthemum virginianum	Virginia mountain-mint	Upland	Full Sun/Part Shade	will tolerate some shade, and wide variety of soils

Species	COMNAME	Habitat	Sun	Comments
Sisyrinchium campestre	Blue-eyed-grass	Upland	Full Sun/Part Shade	small relative of iris, prariie and dry savanna
Smilacina racemosa	False Solomon's-seal	Upland	Full Sun/Part Shade	versatile
Smilacina stellata	Starry false Solomon's-seal	Upland	Full Sun/Part Shade	versatile
Solidago flexicaulis	Zig-zag goldenrod	Upland	Part Shade	showy woodland goldenrod
Solidago speciosa	Showy goldenrod	Upland	Full Sun/Part Shade	aggressive
Sorghastrum nutans	Indian grass	Upland	Full Sun/Part Shade	interseeding
Spartina pectinata	Prairie cordgrass	Wetland	Full Sun	wet soils
Sporobolus heterolepis	Prairie dropseed	Upland	Full Sun	long-lived and characteristic of healthy prairie
Stipa spartea	Porcupine grass	Upland	Full Sun	easy to establish from seed
Uvularia grandiflora	Yellow bellwort	Upland	Part Shade/Full Shad	does better in shadier sites with rich soils
Veronicastrum virginicum	Culver's root	Upland	Full Sun/Part Shade	seed on surface of soil
Viola pedata	Bird-foot violet	Upland	Full Sun/Part Shade	savanna and wet-mesic prairie
Zizia aptera	Heart-leaved alexanders	Upland	Full Sun/Part Shade	attractive foliage and flowers
Zizia aurea	Golden alexanders	Upland	Full Sun/Part Shade	also wetland fringe

Appendix: Potential Species for Woodland/Forest Restoration

Species	*Habitat*	*Sun*	*Comments*
Agastache scrophulariaefolia	Upland	Full Sun/Part Shade	violet to pink flowers
Allium tricoccum	Upland	Part Shade/Full Shade	onion-like smell to foliage
Amelanchier	Upland	Part Shade	tall shrub, small tree, blueberry-like fruits
Anemonella thalictroides	Upland	Part Shade/Full Shade	mesic forest
Aquilegia canadensis	Upland	Part Shade	spring bloomer
Aralia nudicaulis	Upland	Part Shade	dry to mesic forest
Aralia racemosa	Upland	Part Shade/Full Shade	large plant
Asarum canadense	Upland	Full Shade	forms colonies
Asclepias exaltata	Upland	Part Shade	does well in dry woods with patchy sunlight
Aster cordifolius	Upland	Part Shade	early fall bloomer in part sun and wood edge
Bromus pubescens	Upland	Full Sun/Part Shade	frost seeding
Campanula americana	Upland	Full Sun/Part Shade	colorful flower
Caulophyllum thalictroides	Upland	Part Shade/Full Shade	blue berries
Celtis occidentalis	Upland	Part Shade	part shade tolerant
Cinna arundinacea	Upland	Part Shade	attractive savanna and open forest grass
Cornus alternifolia	Upland	Part Shade	fragrant and attractive
Cornus amomum	Upland	Part Shade	olive-yellow twigs
Desmodium glutinosum	Upland	Part Shade	small pink flowers, sticky seed pods
Elymus hystrix	Upland	Part Shade	seedhead looks like bottle brush

Species	*Habitat*	*Sun*	*Comments*
Elymus villosus	Upland	Full Sun/Part Shade	graceful seedhead
Eupatorium purpureum	Upland	Part Shade/Full Shade	dappled sunlight
Euthamia graminifolia	Upland	Full Sun/Part Shade	aggressive
Galium boreale	Upland	Full Sun/Part Shade	spreads by rhizomes
Geranium maculatum	Upland	Part Shade/Full Shade	pink to violet flowers in May
Helianthus hirsutus	Upland	Part Shade	dappled sunlight
Muhlenbergia mexicana	Upland	Full Sun/Part Shade	gracefully arching grass
Osmunda claytoniana	Upland	Part Shade/Full Shade	nice colony forming fern
Panicum virgatum	Upland	Full Sun/Part Shade	use sparingly in buffer
Phlox divaricata	Upland	Full Sun/Part Shade	bright blue flowers in spring
Polemonium reptans	Upland	Part Shade	low, purple flowers
Quercus alba	Upland	Part Shade	somewhat shade tolerant seedlings
Quercus macrocarpa	Upland	Part Shade	needs canopy openings to recruit seedlings
Ranunculus fascicularis	Upland	Part Shade	early blooming, small glossy yellow flower
Sanguinaria canadensis	Upland	Full Shade	early bloomer
Smilacina racemosa	Upland	Full Sun/Part Shade	small white flowers and red berries
Solidago flexicaulis	Upland	Part Shade	attractive foliage and flowers
Solidago ulmifolia	Upland	Part Shade	arching flower stalks in vase-like pattern
Thalictrum dioicum	Upland	Part Shade/Full Shade	spring bloomer
Trillium cernuum	Upland	Part Shade/Full Shade	only buy from reputable suppliers, if used at all
Uvularia grandiflora	Upland	Part Shade/Full Shade	drooping yellow flower

Species	*Habitat*	*Sun*	*Comments*
Veronicastrum virginicum	Upland	Full Sun/Part Shade	seed on surface of soil
Viburnum lentago	Upland	Part Shade	good wildlife value
Viburnum rafinesquianum	Upland	Part Shade	does well on sandy, slightly acid soils
Viburnum trilobum	Upland	Part Shade	red fruit produced if enough sunlight

APPENDIX E

Problem Species Control Fact Sheets

APPENDIX F

Glossary of Technical Terms

APPENDIX E

[1]Glossary 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.
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.

[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.

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 [1]flooding 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 that 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.

---

[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.

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.
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 oligotrophiclakes.
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.

[1]**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.

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.

[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.

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 that 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.
[1]**Talus** 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

[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.

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 form 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 along, 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.

Woody plant A perennial plant with a secondarily thickened, lignified stem.

Zooplankton Microscopic animals.